CUTTER Business Technology Journal

Management, Innovation, Transformation

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Business Technology Trends & Predictions 2019

CUTTER Business Technology Journal

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CUTTER CONSORTIUM
Access to the Experts

Opening Statement

by the *Cutter Business Technology Journal* Team

With 2019 upon us, it is clearer than ever that this is a time of perpetual technological innovation. We not only welcome *the new*, we take what *was new* only recently and make it even better. This year, a plethora of technologies will continue to evolve, improve, and become more widely adopted, with a growing set of new applications strategically applied across industries.

As has been our tradition over the past few years, we have gathered a group of Cutter Consortium experts to weigh in on the strategies, technologies, and business models that will impact business transformation efforts in 2019. We hope the articles in this issue of *Cutter Business Technology Journal* help you prioritize your business technology objectives and chart your journey forward in today's digitally competitive world.

In This Issue

First up, Cutter Fellow Steve Andriole describes some trends around "technologies, technologists, and technoligarchs." He starts with a look at the technologies with the highest momentum and a growing number of associated applications. Andriole then examines the role of, and demand for, the digital business technology leader. He asserts that this leader can achieve success through his or her understanding of technology as an enabler, belonging to everyone, with the ability to transform business processes. Andriole rounds out his discussion by addressing the technoligarchs, the companies that have a commanding share of the market in their industries.

In our second article, Cutter Consortium Senior Consultants Rick Eagar, Gregory Pankert, Raf Postepski, and Sean Sullivan discuss how the role of a CEO in 2019 is very different from that of a decade ago, primarily because traditional business boundaries are blurring while the pace of business continues to accelerate. The authors explore the changes in the CEO role and propose a new framework to help CEOs map the right strategic direction for their organizations.

While Cutter Consortium Senior Consultant Whynde Kuehn believes that enterprise architecture (EA) has come a long way in providing enterprise perspective and structured thinking to business-critical activities, she posits in the next article that it still faces an up-hill battle in delivering its intended value proposition. But the potential of EA is vast, and Kuehn outlines the eight key business priorities that EA teams should consider in 2019 and describes how EA can add value to each priority. She also briefly discusses a few practices demonstrated by successful EA teams.

As has been our tradition, we have gathered a group of Cutter Consortium experts to weigh in on the strategies, technologies, and business models that will impact business transformation efforts this year.

In the past decade, failures in risk management have resulted in numerous catastrophes that could have been minimized, or even completely avoided, if the proper risk-monitoring mechanisms were in place. Hence, in our fourth article, Cutter Consortium Senior Consultant Tom Teixeira, along with his peers George Simpson and Immanuel Kemp, discuss how the use of key risk indicators to drive proactive executive behavior can reduce unnecessary risk exposure and minimize the potential for disastrous events. This discussion includes a series of steps executives should take to improve risk monitoring.

Next, Cutter Fellow Vince Kellen outlines the six new rules for managing 21st-century data and analytics that organizations should embrace in 2019. He discusses the technologies that enable the rules and stresses the need to organize IT teams very differently around key data activities. According to Kellen, "In this environment, analytics is a team sport, not an individual one…. Thus, the organizational culture needs to shift to ensure that

data and information are communal assets, not individual assets."

Cutter Consortium Senior Consultant Curt Hall then addresses the compelling topic of customer experience (CX) management, also commonly referred to as the "customer journey." Using preliminary results from an ongoing Cutter Consortium CX management survey,[1] Hall outlines some of the important trends and developments influencing the adoption of CX management practices and technologies. Included in this discussion are the top leading technologies under consideration or already adopted by organizations, and the benefits and goals CX practices can help them achieve. The ability to remain competitive as organizations are confronted with new, more agile upstarts in their respective industries is high on the priority list.

In our next article, Cutter Consortium Senior Consultant Helen Pukszta discusses the growing use of drones, aka unmanned aircraft systems (UAS), and the already countless enterprise and professional applications of drone-based technologies. Although drone delivery of products is not yet possible due to regulatory delays, the technology is still making significant advancements. In 2019, drones will be increasingly integrated into business workflows and American airspace, and UAS technology will exhibit even more innovation.

"An ontology is coming to your business soon," assert Cutter Consortium Senior Consultants Claude Baudoin and Cory Casanave in our eighth contribution to this issue. Modeling perfection, however, has not yet been achieved, and the current movement is from system-specific data models to business-wide information models. In their article, Baudoin and Casanave discuss the challenges this movement presents but are optimistic that adoption of a complete semantic model of businesses in more and more industry sectors is on its way.

In our concluding piece, Cutter Consortium Senior Consultant Paul Clermont weighs in on the relentless privacy and security issues resulting from technological advancement. He emphasizes social networks' misuse of private data and the need to address privacy-related basics, along the lines of the European Union's General Data Protection Regulation. Clermont predicts that, in 2019, attention will be paid to the real and present threats posed by artificial intelligence (AI), such as AI replacing large numbers of the current workforce, the overuse of AI algorithms and associated ethical considerations, and the malicious use of AI by authoritarian governments.

We hope the insight our experts provide in this issue will help shape your strategic direction in 2019 and aid in navigating the open waters and ever-present shoals of the current environment's new and emerging digital business models and technologies.

We would love to hear your thoughts on the articles in this issue and welcome any trends and predictions of your own that you would like to share with our community. Please leave your observations in the comments section on our website: https://www.cutter.com/article/business-technology-trends-predictions-2019-opening-statement-502336.

Endnote

[1]The survey looks to see how organizations are adopting, or planning to adopt, CX management practices and technologies and hopes to show the possible impacts on businesses and the issues organizations are encountering in their efforts. We welcome your participation in this survey; please visit https://www.surveymonkey.com/r/7T3HQ3R.

Upcoming Topics

Automation: The Next Frontier
San Murugesan

Cutting-Edge Agile
Alistair Cockburn

Decision Support Systems, AI & ML
Karen Neville

WHAT WILL DEFINE LIFE?

Technology, Technologists, and Technoligarchs in 2019

by Steve Andriole

This article describes some trends about technologies, technologists, and technoligarchs. First, we'll look at the *technologies* with the most momentum. Next, we'll examine the *technologists* escaping from data centers. Finally, we'll round out the discussion by addressing the *technoligarchs* who control much of the digital landscape.

Technologies

Here's a list of seven technologies to watch in 2019:

1. Augmented reality (AR), virtual reality (VR), and mixed reality
2. Wearables
3. Artificial intelligence (AI)/machine learning
4. Blockchain
5. Application architectures
6. Platforms as a service
7. 5G

None of these technologies is new. They've all been evolving for years. Nevertheless, it's important to track momentum and the appearance of applications that demonstrate the value of the technologies. These seven technologies are on the 2019 list because momentum is high and because the number of applications in these areas is rapidly growing.

AR, VR, and Mixed Reality

Measured by investments in the technology alone, momentum around augmented, virtual, and mixed reality is staggering. Digi-Capital reported that US $1.5 billion was invested in AR and VR in Q4 2017, with an overall investment of $3 billion for that year.[1] Applications are growing as fast as the headsets in this realm, while other access devices are shrinking in size and cost. Gaming, education, and training are the leading application targets. Applications in additional domains, such as travel, will grow in 2019 and beyond.

These seven technologies are on the 2019 list because momentum is high and because the number of applications in these areas is rapidly growing.

Wearables

The number of applications in wearables is also growing, especially in healthcare and sports performance. While the debate about implanted wearables continues, sensor technology is evolving rapidly — regardless of where it sits on/in humans. The appeal is on the analytics side: what data sensors collect and present for analysis. In healthcare, for example, monitoring leads to diagnosis and diagnosis leads to intervention. Prospects of expanding medical care through monitoring and virtual consultations will fuel additional investments. Relatedly, applications designed to prevent sports injuries are also appearing, especially in contact sports like American football.[2]

AI/Machine Learning

AI services, platforms, frameworks, and infrastructure as enablers of applications across domains continue to explode. AI will augment autonomous vehicles, analytics, and application development, among scores of other activities and platforms. The most notable trends to watch in 2019 will be AI's continued displacement effect on knowledge workers. Knowledge-based automation is coming for accountants, lawyers, and diagnosticians, among other knowledge workers — while lower/no knowledge task automation also continues to grow. The driver here is cost: applications

in AI have shifted from fun to cost reduction. A quick look at Amazon's automation strategy[3] proves the point — and offsets employees earning $15 an hour.

Blockchain

Blockchain platform growth, standardization, and use across industries in 2019 is a safe bet. While the financial industry will lead the way, healthcare will follow quickly. Blockchain will completely free itself of its singular cryptocurrency identity, which it began to shed in 2018. It will become a legitimate transaction platform that mainstream technology vendors and vertical industry leaders deploy. The broader fintech revolution will accelerate the use of blockchain and all distributed ledger technologies, though there will be some resistance among financial transaction incumbents.

> *Today there are calls everywhere for digital business technology leaders who understand they're enablers, and that "technology" belongs to everyone, not just an enterprise office — and certainly not one or two C-suite executives.*

Application Architectures

Monolithic architectures are yielding to microservice architectures.[4] Big, monolithic software applications — the ones that still dominate many large enterprises — will continue to be replaced by architectures far more flexible, distributed, and scalable than older ones. This is an important trend that should be optimized, especially when it's time to upgrade a monster monolithic application or rearchitect enterprise distributed computing. More container vendors will enter the market in 2019.

Platforms as a Service

Another trend is the "platformitization" of emerging technologies; that is, the exploding of "as a service" offerings. Blockchain as a service, VR/AR as a service, analytics as a service, Internet of Things (IoT) as a service, and AI as a service will grow in 2019. The important trend here is the evolution of cloud-provided services well beyond desktop as a service, storage as a service, and security as a service. Cloud providers are trends enablers, prototypers, innovation labs, and more. A trend to watch is the number and depth of new services cloud providers offer.

5G

The explosion of data; the interconnectivity of devices, people, and places; and the integration of intelligent applications into expanding ecosystems all require faster communications — from 5G. This trend is just around the corner: 2019 is a safe bet; 2020 is a lock. Companies should be tracking this trend monthly and defining (and launching) multiple pilots in 2019.

Technologists

Chief *infrastructure* officers will always be necessary, but today there are calls everywhere for digital business technology leaders who understand they're enablers, and that "technology" belongs to everyone, not just an enterprise office — and certainly not one or two C-suite executives. With digital transformation constantly on their minds, leaders who understand that success begins with the acknowledgement that technology enables and transforms business processes and whole business models will succeed, while leaders who define technology solely as data, applications, and networks will fail. The number of "digital business officers" — for lack of a better title — immersed in and around the business will grow in 2019. Technology governance will be shared across the enterprise to include business units and their delivery partners, especially cloud providers.

Technoligarchs

Amazon owns around 50% of the e-commerce market, followed by eBay (6.6%), Apple (3.9%), Walmart (3.7%), and Home Depot (1.5%).[5] It's projected that by 2020, the cloud computing market will be overwhelmingly dominated by Amazon, Google, and Microsoft (at over 90%), with Amazon Web Services continuing its relative dominance.[6] Apple cracked the worldwide smartphone 50% market share threshold in 2018.[7] Google owns

over 90% of the Internet search market.[8] Facebook continues to dominate social media, followed by YouTube (Google), WhatsApp (Facebook), Facebook Messenger (Facebook), WeChat (Tencent), and Instagram (Facebook).[9] Microsoft owns 36% of the worldwide operating system market, behind Android at 42% (Google and the Open Handset Alliance).[10] The same market trends are seen in other industries, like ridesharing, where Uber and Lyft own more than 70% of the market.[11] AT&T, Time Warner, Disney, Verizon, and Comcast own huge chunks of "media" but are under constant attack from Amazon, Netflix, Apple, Facebook, and Google for media market share.

The implications of all this concentration of power are obvious, even ominous, though few of us seem worried about even 90% market shares of anything. Concentration will continue this year. The technology delivery options space will shrink, not grow, in 2019.

Acceleration, Integration, Reorganization, and Consolidation!

2019 will be an interesting year in technology. There will be acceleration, integration, reorganization, and consolidation. Technologies, like IoT, wearables, analytics, and AI, are accelerating. Integration across platforms will accelerate, too. "IT departments" will continue to fade as business technologists come to the fore. The consolidation of the technology industry itself, however, will increase in 2019, redefining choice in technology acquisition, deployment, and optimization. The real challenge is not predicting what might happen in 2019, but what "all things digital" will look like in 2030. While year-to-year predictions are important, we should also step back from time to time to discuss the macro trends that will literally define life as we move further and further into the 21st century. Maybe next year.

Endnotes

[1]Merel, Tim. "Digi-Capital: 2017 Saw $3 Billion Invested in AR/VR, Half in Q4 Alone." VentureBeat, 8 January 2018.

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SHIFT YOUR PARADIGM

The CEO: Lost in Space and Time

by Rick Eagar, Gregory Pankert, Raf Postepski, and Sean Sullivan

The average tenure of CEOs has been falling steadily, down from nine years in 2000 to five years in 2017. Simultaneously, there has been a revolution in the nature of business itself: today only two of the world's top 10 global companies by market capitalization — Exxon and Microsoft — are the same as about 10 years ago,[1] while the business space leading companies occupy has radically changed. Being a CEO today is a very different experience from a decade ago. In the past, the new CEO would have known definitively the space that his or her business occupied and would be given at least a few years' time to effect change. For today's CEO, however, space has expanded while time has contracted. In this new "extended space, accelerated time" universe, the CEO's role has become significantly more challenging; how can CEOs in 2019 navigate the right path for their organization and avoid getting "lost"? This article explores the changes and proposes a new framework to help CEOs map the right course.

The challenges of leading a large organization in an uncertain environment have always existed in the business world. However, it was not until the 1990s that these challenges began to attract attention in terms of leadership tools and approaches. The acronym VUCA, borrowed from the US military, characterized the issues: volatility, uncertainty, complexity, and ambiguity.[2] Since then, CEOs have been urged to develop better resilience in their organizations to cope with VUCA (e.g., building in float or slack to cope with volatility, developing better intelligence to mitigate uncertainty, restructuring or bringing in special resources to address complexity, and using more experimentation to reduce ambiguity).

Until recently, even taking VUCA into account, businesses were mostly managed with similar goals and assumptions, such as:

- A clear business vision and strategy, often with a five- to 10-year time frame, with an accompanying strategic plan cascading in a logical way down through the company to set multiyear priorities at business unit and operational levels
- Continuity of a company's core business, even when a degree of diversification was part of the strategy
- A path to success achieved through aligning processes, resources, and organization with the strategy, and driving productivity and efficiency in a disciplined and systematic way

Additionally, there were well-established expectations of a new CEO, such as the following:

- **First year.** Conduct a strategic review to develop the vision and strategy and deliver enough visible, quick wins to pass the "first 100 days" test.
- **Next two to three years.** Implement the strategy, including top-line growth, productivity, and efficiency initiatives; improve business alignment; and take measures to adapt culture.
- **Following years.** Reach performance and shareholder value goals.

In today's business world, these traditional strategic approaches are increasingly inadequate due to significant changes in two basic dimensions in which companies operate: (1) there is an unparalleled requirement to consider potential extensions to the scope of the business (space); and (2) there is a huge acceleration in the required pace of the business (time). So what's behind space extension and time acceleration? Figure 1 identifies some key trends driving these changes, which we address further below.

Space Extension

As standard products are replaced by experience and services, and new technologies are becoming increasingly ubiquitous, industries are converging and traditional business boundaries are blurring. This has led to a new *ecosystem emergence* in which previously unheard-of parties are jointly experimenting and collaborating to innovate and match customer and consumer appetites and imaginations. Moreover, the millennial generation is driving a sea change in

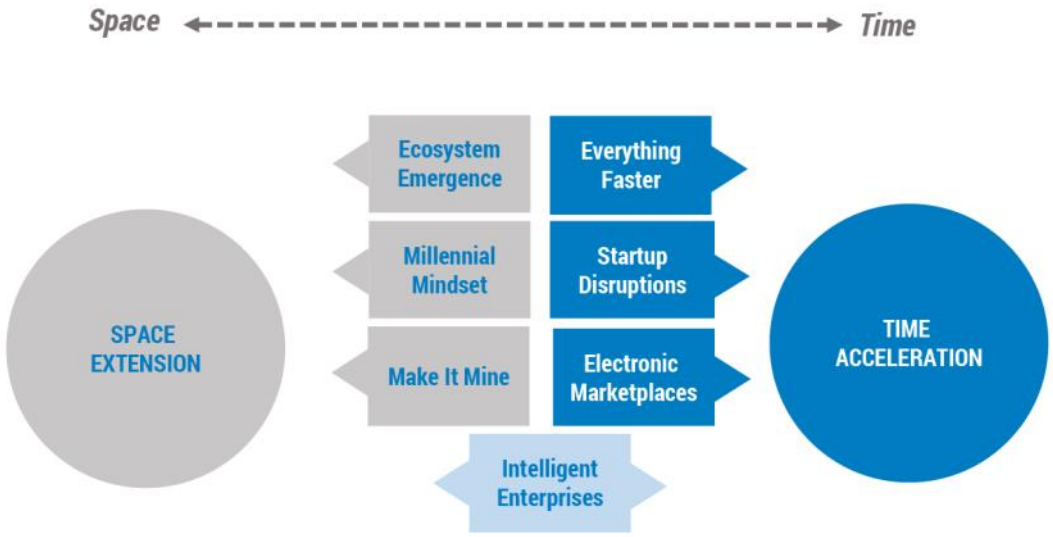

Figure 1 — Key trends driving space extension and time acceleration.

consumer mindsets. The *millennial mindset* places a high value on the authenticity of a company's long-term purpose, while simultaneously demanding responsiveness and adaptability to change. Many millennials seem comfortable without permanent employment and do not feel the same need to own the assets they make use of — whether houses, cars, bicycles, or technology. This has major implications for the business scope of companies that produce assets. Millennials also want to *"make it mine"* (although not in the sense of ownership) — but to stand out, make a statement, have an opinion, and trust in themselves to "do it their way." In meeting the expectations mapped out by the space extension elements, today's digital technologies can (*and should*) enable full personalization of products and services.

Time Acceleration

There are many drivers accelerating the pace of business. First, there is the underlying trend of *"everything faster,"* driven by technology, globalization, social norms, and economics. For business, this implies expectations of quicker decision making and time to market, continuous and accelerated innovation, and shorter ownership and/or alternatives to ownership.

Second, we are seeing *startup disruptions* to an extent never seen before — the examples of Uber, Airbnb, Amazon, and Netflix need no explanation in terms of their effects on the global taxi, hotel, bookstore, and premium content markets. What is new, however, is how technology allows startups to gain scale and achieve global reach within weeks or months instead of, for example, the decades it took McDonald's to disrupt the restaurant business in the 1950s.

Third, the advent of *electronic marketplaces* (and platforms) has substantially accelerated the dynamics of business for consumers and producers alike. Electronic marketplaces impact how we buy and source, how we create and consume, and, ultimately, how we engage and choose, leveraging global and technology-based interactions between parties and peers.

And, finally, the digitalization of our society and economy is generating a more-than-exponential increase in the volume of data, profoundly affecting both the scope and the dynamics of business. The leveraging of artificial intelligence, robotic process automation, blockchain, and analytics by *intelligent enterprises* has led to both rapid and disruptive competitive advantage.

The Challenges for Today's CEO

This business environment poses some tough challenges for today's CEO, including:

- **Determining a dynamic and adaptive strategy.** Determining a strategic direction is a core responsibility of the CEO. However, designing a strategy with a three- to five-year planning cycle is unrealistic. Today's CEO still needs to create a strategy with a clear direction, but one that is more dynamic, is adaptive to change, and produces results quicker than was expected in the past.

- **Deciding what new business spaces to focus on.** Conventional diversification around a stable core is not feasible if the core is vulnerable to disruption. To create value, today's CEO must adopt a broader

perspective of the company's business models and the overall scope of the business portfolio, while simultaneously maintaining control of the core business to ensure short-term performance and license to operate. The CEO should be able to take the necessary steps and explore noncore initiatives (different stuff to what the business is currently doing) while at the same time get enough buy-in from the executive team and the board to allow for freedom to see it through.

- **Aligning resources to meet rapidly changing needs**. Maintaining competitive advantage by having unique competencies is key for any company. CEOs today must decide, despite VUCA, what competencies the organization will need — both in-house and from the partner ecosystem — in the future.
- **Organizing the business to drive creativity and maintain control.** The CEO needs to design an organization with enough explicit or implicit hierarchy to maintain control while empowering staff, breaking down silos, and removing barriers to creativity. Finding the right structures and models to support both objectives is often challenging.
- **Leading in an effort to create an Agile culture.** Cultures that encourage experimentation, are tolerant of early failure, and support "fail fast, learn fast" have proven to be successful in the current business environment. Today's CEO needs the right leadership style to encourage an Agile culture. Some CEOs rose to the top through being great entrepreneurs, and others through being great controllers, but the qualities needed for leading the organization today may be different.

The New CEO Space and Time Paradigm

To meet today's challenges, the CEO needs a new paradigm to bridge effectively across control and creativity and to be able to meet the challenges of space extension and time acceleration. As Figure 2 illustrates, the key is to focus on five leadership priorities covering the *why*, *what*, *who*, and *how*:

1. Sense of purpose
2. Dynamic portfolio
3. Rich ecosystem
4. Ambidextrous organization
5. Cultural, process, and strategic agility

Let's look at how each leadership priority can meet the challenges of extending space and accelerating time.

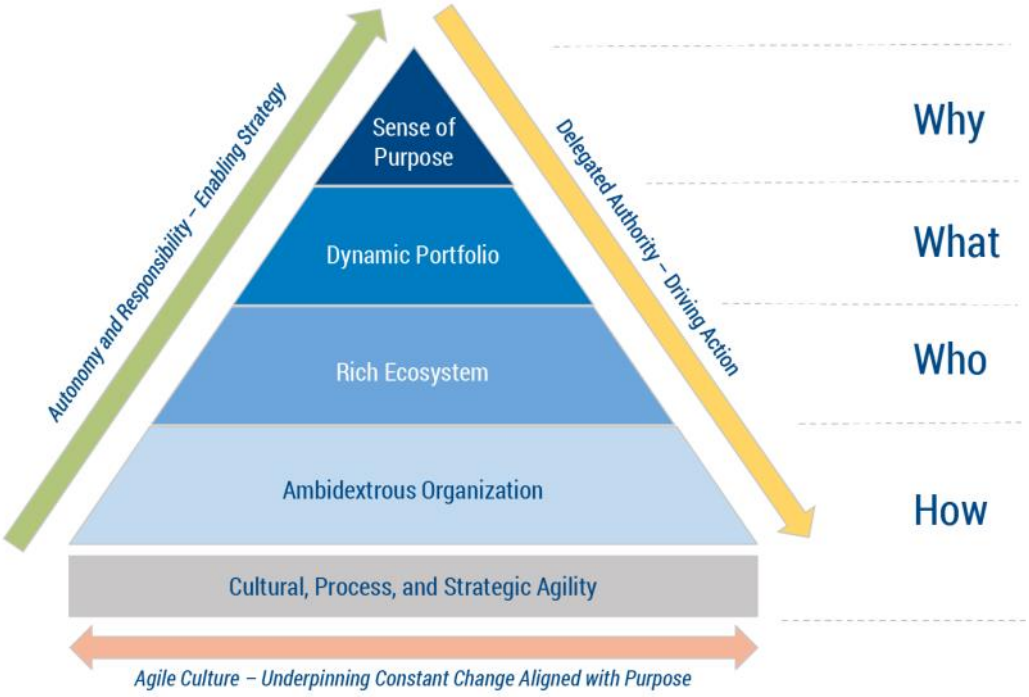

Figure 2 — Five leadership priorities covering the why, what, who, and how.

1. **Sense of purpose:**
    - *Extending space.* Redefine the playground, starting from the company's overarching purpose and how it creates a unique competitive advantage that it can leverage and apply across converging industries.
    - *Accelerating time.* Take back control over the time dimension by clearly defining the immutable long-term purpose of the company and its implications on decision making, thereby enabling strategy to focus on the short-term decision cycle.
2. **Dynamic portfolio:**
    - *Extending space.* Align the portfolio with a sense of purpose that goes beyond product. Consider new, step-out business as a key part of business portfolio management.
    - *Accelerating time.* Use Agile approaches for new product/service development, maintain multiple pilots, and consider design before technology.
3. **Rich ecosystem:**
    - *Extending space.* Create an ecosystem of delivery partners in which the combined competencies drive competitive advantage greater than the sum of the parts. Unlock new, value-creation opportunities with nonobvious collaborations.
    - *Accelerating time.* Nurture mutual trust in your resource ecosystem and use new collaboration tools to rapidly deploy and engage the best resources from a wide network.
4. **Ambidextrous organization;** that is, blending productivity organization systems and creativity organization systems in order to simultaneously manage existing business lines
    - *Extending space.* Expand the portfolio with disruptive initiatives.
    - *Accelerating time.* Rapidly launch and scale new businesses.
5. **Cultural, process, and strategic agility:**
    - *Extending space.* Lead a culture that accepts complexity and expects constant change and realignment, including strategy and portfolio, to enable achievement of your sense of purpose and vision through alternative paths.
    - *Accelerating time.* Delegate authority, empower the organization, and encourage autonomy to enable rapid decision making — but stay within the guiding principles of the sense of purpose and vision.

Insight for the Executive

Today's environment of extended space and contracted time is significantly different from that of yesterday. New CEOs taking over the leadership of companies, as well as existing CEOs interested in effecting major transformations, should carefully reflect on how their organizations measure up to the five priorities of sense of purpose; dynamic portfolio; diverse ecosystem; ambidextrous organization; and cultural, process, and strategic agility.

In practice, this means reviewing the current status of the organization, identifying required changes, and taking the right approach to bring about transformation. Some actions and questions today's CEO should consider:

- **Review the current status of the organization versus the space and time paradigm:**
    - Is there a clear, enduring, and inspiring purpose for the company, above and beyond its products and services — and is this purpose activated in practice, both internally and externally?
    - Does the company take a truly dynamic approach to business portfolio review, and does it effectively address noncore growth?
    - Has the company leveraged the full potential of the innovation ecosystem?
    - Does the company operate both productivity- and creativity-based organizational models ambidextrously?
    - Is there a culture of agility, in which the business embraces complexity, encourages autonomy, and accepts constant change across strategy, processes, and ways of behaving?
- **Identify gaps and leverage points across each of the five priorities:**

- Where gaps exist, hold further discussions to understand the root causes, including the "unwritten rules" as well as more explicit factors.
- Identify points of leverage that could be harnessed to bring about change, such as distinctive and unique aspects of vision and mission, examples of successful diversification, fruitful external partnerships, pockets of creativity for use as exemplars, and potential champions in terms of Agile thinking.

- **Engage and empower the organization for change:**
  - Lead the implementation of a program of rapid transformational change, adopting Agile principles and working simultaneously across all five priorities.
  - Spend some time personally ensuring that a sense of purpose is clearly articulated and actuated in practice.
  - Engage the organization in the change and empower key individuals to take it forward.
  - Focus on rapid experiments to test feasibility and demonstrate progress and be prepared to change direction quickly as progress develops over time.

Many decades ago Einstein discovered that the previously held Newtonian certainties about space and time were no longer valid, transforming the way scientists thought about the cosmos. At the more prosaic level of business in the 21st century, CEOs should also have a rethink.

Endnotes

[1]Johnston, Stephen. "Largest Companies 2008 vs. 2018, a Lot Has Changed." Milford Asset Management Limited.

[2]Bennett, Nathan, and G. James Lemoine. "What VUCA Really Means for You." *Harvard Business Review*, January–February 2014.

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MAKING THE LEAP

Enterprise Architecture: Key Business Priorities and Success Factors for 2019

by Whynde Kuehn

As we begin a new year and the world accelerates and shifts around us, it is important to take an honest look at where we are with enterprise architecture (EA) today and where we are — or should be — going.

EA Now

Where are we now, *really*? Perhaps "seasoned and leveraged" is the most honest and fair way to characterize the current state of the EA practice globally — but a seasoned and leveraged state that is yet to be fully realized. Yes, increasingly, EA practitioners' unique contributions of enterprise perspective and structured thinking to business-critical activities like transformation are being recognized. The practice has continually advanced and evolved in its focus, methods, and progress toward becoming a profession. Indeed, the recent growth in business architecture has increased focus on the importance of a common business language and lens for everything an organization does.

Yet as far as we have come, we still have our challenges. EA disciplines do not always work together cohesively; teams struggle with organizational adoption and being perceived as theoretical. And the reality is that while many organizations practice EA, they do not do it at scale, or as strategically as possible. The truth is that organizations do not always practice EA as its intended discipline. Consequently, the practice can fall short on delivering its fully intended value proposition.

However, the potential of enterprise architecture is vast and still relatively untapped. Today's business climate is an opportune time to help organizations grow, transform, and thrive. Indeed, the time is now for EA to prove itself as the strategic, valuable discipline that enterprise architects have always envisioned.

8 Key Business Priorities

There are eight key business priorities that EA teams should consider in 2019 (see Figure 1). In other words, these are the business scenarios on which enterprise architects should focus their time, talent, and discipline. These recommended priorities are based on both the current focus areas of the practice globally as well as

Figure 1 — Key business priorities for EA in 2019.

the focus areas of tomorrow. Through each of these business priorities, EA teams can provide relevant business value based on today's trends and needs.

Some top areas of focus for EA teams currently include *business transformation*, *strategic planning*, and *customer experience*. More and more teams today assist in enabling *Agile execution* by providing the big-picture view and priorities up front to ensure that execution focuses on doing the right things. More recently, Agile execution has even become an impetus for the introduction of business architecture to organizations.

Certainly, the category of emerging technologies is very much a segment of the bigger context of business transformation, but we're calling it out separately here to bring more focus to the crucial role that EA plays in helping organizations understand, assess, and implement emerging technologies.

Resource optimization is a broad category representing continued focus on activities that help to reduce cost, waste, and complexity. While typically an ongoing activity for organizations, this area helps position enterprise architecture as a key part of the solution to enable efficiency — so that when times are tight, the organization still perceives the EA discipline as valuable, not extra overhead. *Regulatory compliance and changes* reflect the increasing amount of change necessary to respond to and comply with the shifting regulatory environment, especially due to our globally connected world and political changes.

Certainly, the category of *emerging technologies* is very much a segment of the bigger context of business transformation, but we're calling it out separately here to bring more focus to the crucial role that EA plays in helping organizations understand, assess, and implement emerging technologies — and in shifting the conversation to occur through a business lens. Finally, *cross-organization coordination* is another area where the role of architecture is increasing and necessary as organizations pursue mergers, acquisitions, joint ventures, and other cross-ecosystem initiatives. Table 1 briefly summarizes the value EA teams can bring to each key business priority.

Practices of Successful EA Teams

Not only is *what* EA teams focus on important (as described above in the key priorities), but *how* they perform their role is crucial, too. Below are a few practices demonstrated by successful EA teams:

- **Unify the EA disciplines.** Surprisingly, there are still cases within many organizations where the EA disciplines work fairly independently of each other or do not leverage the full power of working cohesively. Successful teams integrate the business and IT architecture disciplines from a knowledgebase, role, and practice perspective, and then work together to deliver business value and outcomes.

- **Position EA strategically.** Regardless of reporting lines, successful teams position the role of EA strategically within the strategy realization path (i.e., after strategy and upstream of planning). While this may not initially be possible for some organizations, many are on a deliberate journey to "shift left" within the strategy realization path. Successful teams also build relationships with the ecosystem of teams across the strategy realization path and integrate with other methodologies (e.g., Agile) to provide a seamless experience to the business.

- **Focus on the business.** Successful teams are laser-focused on delivering business value and outcomes, using the discipline as the means to achieve them. Regardless of the specific architectural role, teams partner closely with the business and are fluent in strategy, business models, the organization's business architecture, and the world of the business. Of course, the architecture is at the heart of being able to actually deliver on the value for the key business priorities, but the raison d'etre for an EA team should be the business, not the architecture.

The individuals and teams that can make these leaps both in terms of business priorities and practices will become more relevant, and, most important, will deliver more value to their organizations *and* to our societies, especially at a time when we most need such forward-thinking individuals and teams.

Key Business Priority	Enterprise Architecture Value
Business transformation	Assert business goals, redesign business models, assess impacts, design and communicate future, prioritize and plan changes, and accelerate requirements.
Strategic planning	Provide a business and enterprise framework for objectively prioritizing investments within and across portfolios based on strategic alignment and rationalization.
Customer experience	Provide root-cause analysis for experience results, inform experience decision making (e.g., priorities, available capabilities), assess impacts bidirectionally (i.e., experience and business/technology environment), and translate experience into action.
Agile execution	Provide big-picture direction and common language, focus execution teams on the right enterprise priorities, and accelerate requirements.
Resource optimization	Provide a business and enterprise lens for optimizing resources (e.g., processes, system applications) for cost/simplification reasons and assist efforts of related disciplines (e.g., business process management and operational excellence).
Regulatory compliance and changes	Provide a business and enterprise framework for assessing, addressing, and communicating regulatory impacts and risks; and demonstrate compliance with end-to-end traceability from policy to business and IT assets.
Emerging technologies	Assert business goals, redesign business models, identify key applications for emerging technology, assess impacts, design and communicate future, prioritize and plan changes, and accelerate requirements.
Cross-organization coordination	Provide a business and enterprise framework for assessing, designing, planning, and executing mergers, acquisitions, joint ventures, joint initiatives, and startups.

Table 1 — EA value for key business priorities.

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RED LIGHT AHEAD?

Key Risk Indicators as a Value Driver

by Tom Teixeira, George Simpson, and Immanuel Kemp

The risk landscape of the modern business environment is constantly evolving, and companies need to maintain continuous oversight to deal with the key risks that may threaten their businesses. Over the past decade, a number of high-profile corporate crises, many directly attributed to failures in risk management, have highlighted the extent of the problem and the danger posing many organizations. Notable recent examples include the collapse of UK construction giant Carillion (with contract risk as a key driver) and the cyberattack on shipping and energy company A.P. Moller–Maersk. Corporate boards are increasingly demanding the ability to continuously monitor risk exposure, using metrics to assess, validate, and verify whether risk is increasing or decreasing.

Meanwhile, executives and other stakeholders need the ability to respond rapidly to emerging threats before they crystallize into serious financial and reputational impact. This is of particular concern to executives, such as CFOs, general counsel, and company secretaries, who in many cases are responsible for ensuring that adequate risk governance is in place. In addition, companies stand to benefit financially by reducing their total cost of risk (TCOR) through reduced insurance premiums, reduced insurance losses, and improved credit ratings. According to the "2017 Aon Risk Maturity Index Insight Report," companies with the best risk management maturity outperformed those with the poorest maturity financially, with up to 15% better stock-price performance and up to 25% lower stock price volatility. [1] Studies by other organizations, including the Federation of European Risk Management Associations (FERMA),[2] have established similar links between risk management maturity and financial performance.

This article explores some of the ways in which effective risk management approaches, in particular the use of key risk indicators (KRIs) to drive proactive executive behavior, can reduce unnecessary risk exposure and minimize the potential for catastrophic events. We discuss the current state of risk-monitoring maturity in the business world, considerations for the selection of appropriate leading and lagging KRIs and their effective implementation, and then present insight for executives on what steps to take to improve risk monitoring. While the concepts we discuss are well established, evidence shows that management teams are still consistently poor at addressing the process and technical challenges necessary to produce fully operational solutions that deliver business value.

Risk Monitoring and Proactive Correction Are Still Immature

Risk management is a growing priority for companies across all sectors, not just those in highly regulated environments. Senior leadership needs to better monitor risk to support improved decision making as well as minimize the likelihood of catastrophic events that may cripple their businesses financially and reputationally. This is not a task that individual functions, such as a dedicated risk team, can manage independently. A cross-functional approach at the executive level is required for it to be effective. Additionally, there is a growing regulatory obligation for companies to make statutory disclosures on financial viability, solvency, and liquidity in light of the key risks they face. There is also pressure exerted by more active investors demanding evidence that risk management is reducing uncertainty and volatility, while improving confidence in financial forecasts.

Shortfalls in the risk management approaches many companies currently take can leave them dangerously exposed. These companies either have no corporate-level mechanisms for monitoring and acting on risk exposure or gather potentially relevant data but fail to develop appropriate metrics to support effective monitoring, control, and timely remediation. These metrics can take the form of KRIs, which all levels of management can use to provide evidence of the effectiveness of the implemented risk management strategies. Even when companies do employ KRIs, they frequently select inappropriate ones; for example, relying too heavily on lagging indicators rather than leading indicators. Alternatively, they struggle to implement effective monitoring environments that

Figure 1 — KRI maturity model.

will provide early warnings that their risk management strategies are off track, and thus do not enable timely corrective actions.

The maturity in approach can vary enormously, even though this methodology has existed for some time. Indeed, many organizations operate in the first two boxes of the simple maturity model illustrated in Figure 1. Although insufficient KRI-related maturity assessments have been conducted to develop a robust universal benchmark, our experience assessing maturity suggests that most companies, even those conforming to *Fortune* 500 best practices, lie toward the lower end of the maturity scale, and usually lower than assumed by senior management.

Selecting KRIs

KRIs selection is neither a trivial nor simple process. Figure 2 shows the characteristics required of effective KRIs. For example, cyber risk might be monitored via 20-25 KRIs within each business unit, while only a few metrics are reported at the board level. The challenge lies in developing board-level KRIs that appropriately capture multiple business unit–level KRIs to give an overall indication of a key risk area, such as data governance or cybersecurity awareness.

The distinction between leading and lagging indicators is, in our experience, often misunderstood. A *lagging indicator* is a measurable outcome that informs us about what has already happened (e.g., accident rates). A *leading indicator* is a predictor of future outcomes (e.g., the extent of employee compliance with a company's safety standards may correlate with future accident trends). An effective set of KRIs requires the balanced use of both leading and lagging indicators, as they have complementary characteristics (see Figure 3).

The distinction between leading and lagging indicators is not a sharp one, but rather a continuum between two extremes based on how close the indicator is to the adverse event in its chain of causation. For example, the frequency of a known precursor to an accident may be used as a risk indicator. This is a leading indicator compared with accident frequency itself, but a lagging indicator compared with compliance with safety procedures that aim to prevent both the precursor and the accident. Leading indicators must causally link to the risks they are measuring (i.e., when an indicator

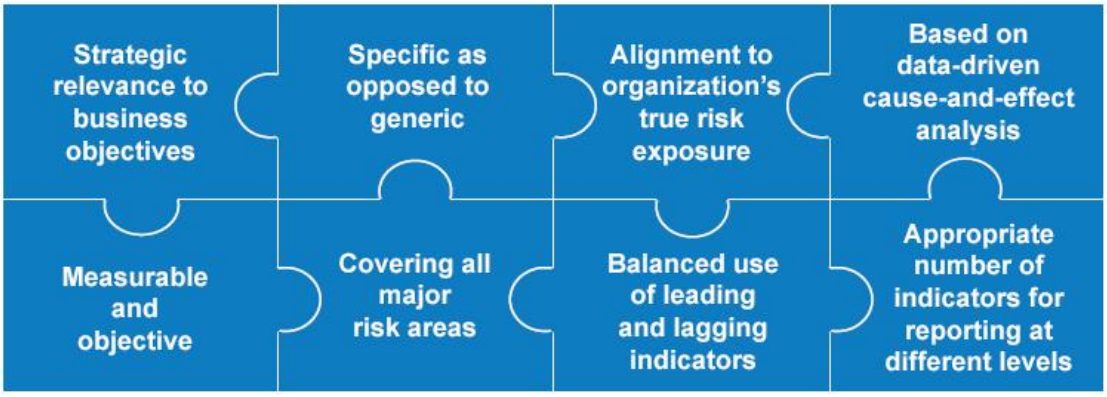

Figure 2 — Characteristics of effective KRIs.

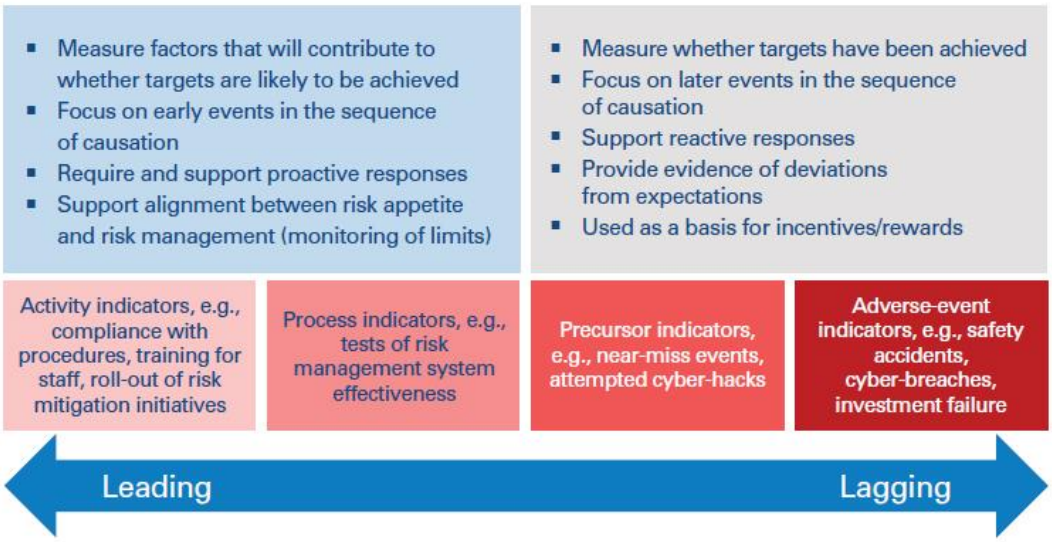

Figure 3 —Leading and lagging indicators.

improves, the likelihood of an eventual outcome also improves).

Lack of Leading Indicators: The Hatfield Rail Crash

The impact of the failure to recognize appropriate leading indicators is further demonstrated in the case of a 2000 Hatfield, UK, rail crash. On 17 October 2000, a train derailed at Hatfield, Hertfordshire, UK, killing four people and injuring more than 70. The accident was caused by metal fatigue of the rails, resulting from poor maintenance oversight by the private railway infrastructure company, Railtrack. Subsequently, the company was replaced by publicly owned Network Rail. From a KRI perspective, we can observe that:

1. Safety improvements following previous rail accidents at Southall and Paddington had led to *complacency* around the potential for train accidents, making this a "black swan" event.

2. Railtrack had failed to recognize the *causal link* between track defects and a fatal derailment event.

3. Railtrack had not been adequately monitoring track defects, which would have served as a *leading KRI* for derailment risk.

The Hatfield crash could be attributed in part to failure to use appropriate KRIs, which allowed Railtrack to be caught unaware by a major accident that ended the company through financial and reputational consequences.

Implementing KRIs

Another major reason why companies fail to make effective use of KRIs is that while they may select relevant and useful indicators to monitor, and in many cases already possess most of the relevant data, they fall short of implementing systems to monitor and manage them proactively. Implementation is often more of a challenge to get right than the process of identifying and selecting the correct KRIs. This is something many boards overlook in favor of simply deciding on a KRI profile and leaving it to the subdivisions of the organization to measure them and report back.

Many organizations also fail to commit to full implementation once they understand the complexities and effort required to deploy an effective monitoring environment, citing lack of resources and capital. As mentioned, most of the data required to be monitored and interpreted already exists, and organizations need to answer the questions shown in Figure 4.

Features of effective KRI implementation should therefore include the following:

- **Appropriate limits and monitoring** for when there are breaches.

- **Traffic lights** for assessing the severity of breaches, with differentiation between "amber" levels, which require closer monitoring, and "red" levels, for which senior leadership intervention becomes essential (see Figure 5).

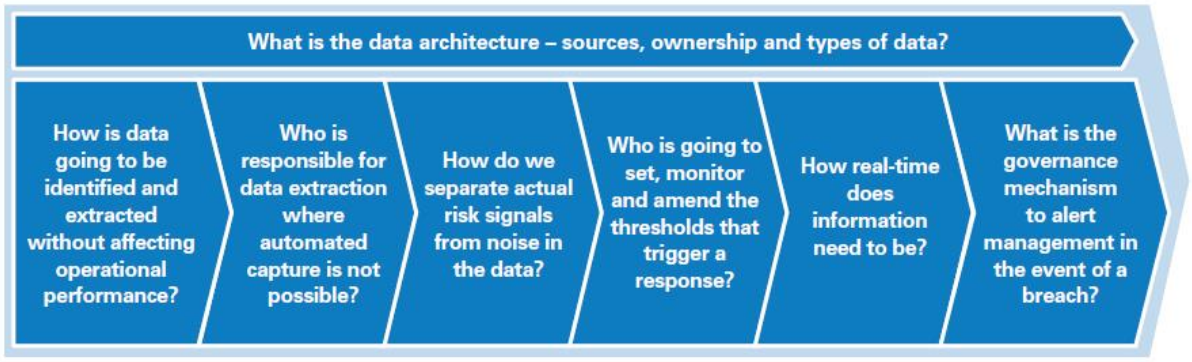

Figure 4 — Considerations for designing an appropriate platform for KRI implementation.

Figure 5 — KRI profile, where yellow lines represent risk appetite and red lines represent danger level, with amber and red traffic alerts, respectively.

- **A data-driven approach** to determine KRI thresholds and limits, relying on actuarial data as much as possible rather than pure estimation and a "finger in the air. Any "red" limits should represent genuinely high-probability risk (i.e., close to impacting, with significant consequences requiring immediate attention and action) so as to avoid excessively frequent alarms — a situation that tends to breed complacency toward future, more serious breaches. Where robust data is not available (e.g., for various cyber-related scenarios), judgment using subject-matter expertise remains integral in determining appropriate limits.
- **Effective communication processes** for ensuring the right information gets to the right level of management at the right time once a limit has been breached.
- **Selective focus** to avoid the situation where senior leadership becomes accustomed to excessive "alarms" and begins to disregard them.

The following two case studies further illustrate the importance of senior management performing proper oversight.

Robust KRI Implementation: BP Texas City

On 23 March 2005, an explosion occurred at the BP-owned Texas City Refinery, killing 15 workers and injuring more than 180 others. The independent "Baker Report" identified a variety of causal factors:[3]

- BP had been effectively managing personal safety risk, employing KRIs such as accident rate. However, BP's management of process safety risk (risk of releases, explosions, etc.) was poor, and due to overreliance on personal safety KRIs, managers were unaware of process safety risks.
- BP had a poor culture of reporting risks upwards within the company, with bad news from safety audits often not reaching senior management.
- Cost-cutting decisions by senior management had led to deficiencies in safety management on site, due to lack of awareness of the potential safety risk impact.

This incident illustrates the importance of ensuring causal linkage between the KRIs monitored and the risks requiring management, as well as the implications of senior management making decisions in the absence

of appropriate risk information. Following the "Baker Report," BP undertook a program of improvements to safety management across its five US refineries.

Poor Reporting Culture: Northern Rock

In 2012, the British financial services provider Northern Rock was forced to nationalize following the first run on a UK bank in over 150 years. This happened after a liquidity crisis in wholesale markets due to the large volume of mortgage defaults in the US, as 70% of Northern Rock's funding came from these markets.

We make the following observations from this incident:

- Northern Rock had failed to adequately "stress test" its business model.
- A poor reporting culture was found to have been widespread, with staff tending to underreport mortgage arrears and not challenging management approaches. This poor culture would have been symptomatic of, and contributory to, shortcomings in management's risk awareness, creating a vicious cycle of risk-blindness leading up to the event.

This case illustrates the importance of management proactively encouraging appropriate risk reporting to ensure it receives an accurate picture of risk exposure.

Capturing the Right Data

Crises such as those affecting BP and Northern Rock are, in part, unpredictable, but the risk can be managed if the right data and events are effectively captured across the organization, stored, processed, and visualized to support decision making and timely correction. To consolidate this data into a form that is usable for this purpose, management should consider using digital patterns such as event-driven architectures that:

- Are designed to create insight from data that is locked into existing systems and was previously costly/very difficult to access
- Are visualized through a near-real-time dashboard in a time frame that enables the management team to make a difference to the outcome
- Use consumer commodity and open source technology, which can be implemented faster and significantly more cost-effectively than traditional enterprise integration approaches

Figure 6 illustrates a typical corporate arrangement that demonstrates how the complexity of a full set of company-wide data necessitates the use of a technology-based platform to process it and issue alerts as close to real time as possible.

Executive Insight

The effective implementation and adoption of KRIs to support improved decision making and performance improvement can be an involved and complex task for any organization. In order to view risk management as an effective mechanism for achieving business objectives and delivering the overall corporate strategy, organizations should adopt a pragmatic approach that balances simplicity with innovative, technology-led

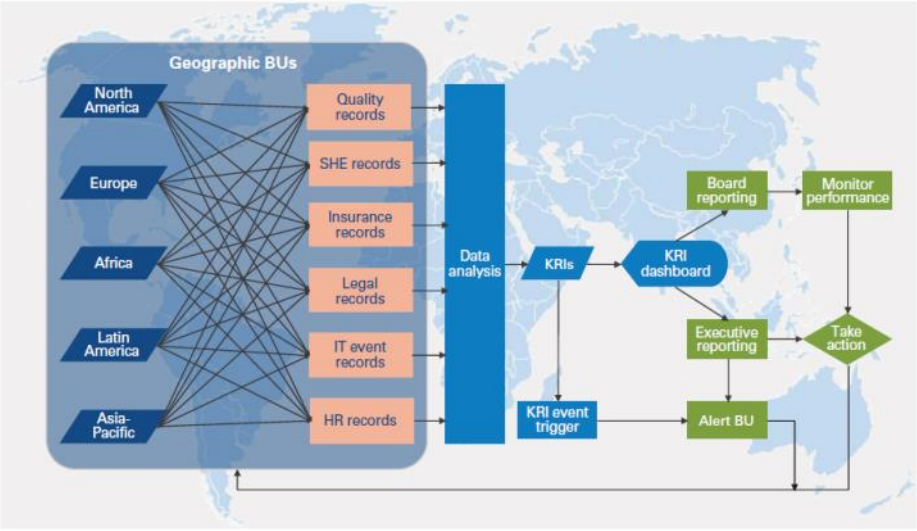

Figure 6 — Complexity related to company-wide collation of KRIs from across business units.

solutions. Executives committed to improving risk reporting, getting better understanding of the effectiveness of controls across various operations, and addressing emerging threats early in the process should consider adopting the following steps:

1. **Develop (or redevelop) an appropriate, balanced set of KRIs,** ensuring proper alignment to the needs and strategic goals of the business, ease of measurement, and the ability to provide objective evidence of whether key exposures are being effectively dealt with on a timely basis.

2. **Determine appropriate, data-driven limits for these KRIs.** Where KRI monitoring has not been implemented previously, a simpler approach with a single limit for each KRI could be considered, with a view to developing a traffic-light system in the longer term.

3. **Implement a proof of solution for a number of selected KRIs** to demonstrate the technology solution, define the route to scale across the organization, explore adoption techniques to ensure take-up, and identify benefits resulting from the reporting output.

4. **Be prepared to commit time and resources to the development of an effective KRI monitoring environment.** Do not underestimate the scale of this task; ROI is soon achieved through reduced insurance premiums, reduced uninsured losses, reduced risk management costs, and improved credit ratings.

5. **Consider the level of detail and format of reporting that will enable effective decision making,** ensuring the inclusion of critical information while not burdening senior management with excessive detail.

6. **Be prepared to use KRI information to inform all levels of management** to ensure that these indicators are used to drive appropriate action. This should prompt timely investigation and intervention at appropriate levels when a risk limit is breached, avoiding adverse financial and reputational impact.

Organizations need a proactive approach for KRI development and implementation with clear sponsorship and commitment at the executive level in order to prevent reversion to a passive risk management approach. It should act as an enabler to drive decisive action to preemptively manage risks, reduce TCOR, improve financial performance, and provide the right level of board assurance that risk is being taken on a "controlled and informed" basis.

Endnotes

[1]"2017 Aon Risk Maturity Index Insight Report." Aon/Wharton School of the University of Pennsylvania, October 2017.

[2]Federation of European Risk Management Associations (https://www.ferma.eu/).

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INFORMATION SHARING IS POWER

6 New Rules for Managing 21st-Century Analytics

by Vince Kellen

With 2019 here and 2020 around the corner, it is time to recognize there are new rules in analytics and data management. These rules have created a wildly different analytics environment from the past. It's time for organizations to embrace these new rules. But first, let's look at the technologies behind these changes.

Five technologies have done the most, in my mind, to enable this transformation. These technologies are:

1. **Improvements in scale-out, low-cost, near-real-time streaming technologies.** While usually associated with Internet of Things (IoT) applications, streaming technology is poised to take over the synchronization of data for analytics. These technologies include Apache's Kafka, NiFi, and Storm and Amazon's Kinesis Data Firehose. These tools support real time and near real time and can scale-out to handle big data movement at usually extremely low costs. When data movement moves to streaming, the real-time nature of the tools hardens the environment because errors get rooted out quickly and enable real-time analytics as data moves through the stream.

2. **High-speed, in-memory analytics.** These tools, like SAP HANA, sport scale-out, parallel designs that make mincemeat out of billion-row data sets. These environments also heavily compress the data, maximizing use of higher-speed memory. Very large data sets can be analyzed in these environments, which resemble that of supercomputers.

3. **Low-cost, big data environments.** Tools like Hadoop, Amazon Redshift, and Google's serverless BigQuery let organizations store petabytes of data cost-effectively. The high-speed tools referred to above can now federate their queries with these environments, providing companies with a two-tier approach. Tier 1 is very fast, but more expensive. Tier 2 is super big and slower, but super cheap. Petabytes of data can be modeled in one, synoptic architecture.

4. **Artificial neural network resurgence.** After enduring an impossibly long and cold winter of a couple decades, artificial intelligence (AI) has undergone a renaissance, partly enabled by improvements a decade ago in computer hardware such as CPUs and memory, but also due to software improvements represented by the various forms of new neural networks available today.

5. **Hyperscale cloud providers.** These cloud providers, dominated by Amazon Web Services, but with Microsoft Azure and Google Cloud Platform following close behind, are enabling all the technologies above to run in very dynamic and elastic environments. Analytics data processing can ebb and flow in a pattern of big bursts punctuated by dry spells, and the resource consumption and pricing can also ebb and flow.

The 6 New Rules

These five technologies conspire to subvert the dominant paradigm of data and analytics and beg for a new set of rules. These rules are an inversion of sorts of the old rules. Let's take a closer look at this set of six rules.

Rule 1: Everything Is a Verb

In my own work, my team in a university setting has found that the old focus on nouns and their relationships to each other (entity-relationship modeling, among other approaches) is much less important. Relational modeling grew originally out of the need to divorce logical hierarchies (relationships) from physical data structures, providing great flexibility. In time, relational modeling also had to genuflect before the performance altar, and today, most data warehouse designers cut out of this cloth cannot stop themselves from trying to conserve performance and hence adjust their designs.

With the five technologies highlighted earlier, we can now put verbs first. For each noun, we work out all the events that can change the noun. Each of those events come from one or more source systems in tiny batches of data creations, updates, or deletions. Rather than try

to ensure we have all the additional fields that describe the noun perfectly confirmed, we instead work on ensuring the stream of changes regarding the noun are suitably captured. In short, we are essentially replicating a transaction log that describes all updates. We call this a "replayable log," meaning we have the time history of changes captured in the stream of events.

All these events, or verbs, are placed into one very long table. Specifically, the table is one that has a variable record length, with different uses of columns, but all placed in one big, fat, wide table. While this is raising the hair on the back of the neck of old-school data warehousing folk, with these new tools, these are actually mostly benign manipulations. For example, while the developer sees a single wide table, in-memory columnar database tools store that activity log in an entirely different internal structure.

These large activity tables then serve as a data lake in a very simple, very big, and often very wide data structure. This simplicity enables all sorts of extensibility since it relaxes so many rules of data design. And as you may suspect, the streaming technologies let us more easily ingest data — IoT-style — from a variety of differing systems.

Rule 2: Express Maximum Semantic Complexity

With the old way of doing things, analytics developers often include only data that matches the need required. My team does the opposite. We try to bring in all data we can find in any given stream, *whether we think we will use the data or not*. This is just like in home construction, where it is much easier to put in electrical cabling before the walls go up, not after.

A second aspect of this rule is that we also bring in data at the lowest level of granularity possible. While this can often explode the number of rows of data within our models, the new technologies come to our aid with all sorts of tiering between high-cost and low-cost storage and several automatic compression methods.

Bringing in as many attributes as possible and all data at the lowest level of granularity also ensures that we will be able to answer any question that the business may ask. The only unanswerable questions are those for which there are no data or for which the source system did not capture at that level of granularity.

We have found that the in-memory, parallel columnar analytics environment also means that we do not have to handcraft the preaggregation of data. All our models can rely on the lowest level of detail at all times. If we do any preaggregation work in our designs, it is for the convenience of the analyst. Sometimes a preaggregated number is much easier to work with in visualization tools. Thus, we aggregate data for convenience only, not for speed.

Rule 3: Build Provisionally

I have found this rule to be the hardest for data warehouse developers to swallow. These developers, historically, build fact tables and dimensions that must stand the test of time, which they do. But these models also end up requiring additional data structures on top of them to support analysts.

In our environment, my team employs activity tables to serve as a data lake, which by itself is not really usable. We must build something on top of that, which would not only endure the test of time but also be considered ephemeral. We have used the term *curated view* to capture two opposing intents here. The first intent is to ensure a view of the data is appropriate for a specific use case. We call these *analytics vignettes*. Analysts use data for specific purposes, so we build the curated view specifically to serve a specific, and, perhaps narrow, but evolving purpose. The second intent is to ensure the curated view has as much structure as possible contained within it. Thus, the structure of hierarchies associated with any given data element, the exact data type and formatting, and so on, are carefully worked out. While the curated view may be provisional, the deep structures within it often are not.

Curated views can be redundant and overlapping. Several curated views can be combined and also built on top of each other. Our curated view designs typically have three or four levels of hierarchy so that we can reuse code (SQL for us) when constructing curated views. Thus, what the user sees is a single, flat file with often a few hundred attributes (columns) that an analyst can easily use. We take any joining away from the analysis. All our curated views are designed just so with all needed joins made.

While our data lake may carry with it lots of unstructured data (i.e., data not adequately described in terms of attributes and relationship), unstructured data will continually be desperately seeking structure and now chiefly through advanced algorithms, including AI and machine learning (ML) ones. While I have been focusing the argument here on structured data, as unstructured data grows exponentially, so does the

need to structure it. Hence, over time, structure will be added.

Normally this sounds hideously wasteful of computational resources. While that may be, the five technologies outlined in this article have made this approach eminently feasible and cost-effective. Because our curated views are built on top of highly reusable components and are themselves reusable in other curated views, we can have as much model overlap or outright redundancy as our analysts need while still keeping the views quickly changeable. By merging the data lake (the activity logs) and the curated views into one environment, we can ingest very complex and unstructured data in the activity tables right away and then incrementally add structure to the data and include it in existing or new curated views.

Rule 4: Design for the Speed of Thought

I often get asked, why the need for speed? Many decisions in business are not made against real-time or near-real-time data. My answer is two-fold. Designing with speed from the start is far cheaper than trying to add it back in later. Second, speed is important for analysts and data developers and data scientists. A fast environment lets analysts work at the speed of thought with sub-second responses for all clicks in an analytics tool, regardless of whether the task is to aggregate a single column across 500 million rows or to drill into 500 rows of fine detail. A fast environment lets data scientists build and deploy models that much faster.

Designing for the speed of thought also requires moving as much of the complexity the analyst has to contend with as possible to the infrastructure. For example, in our environments, we will handle filtering logic (sometimes complex Boolean and set logic) normally expressed in the front-end visualization tool in the back end, relieving the analyst of that work. This means our curated views will contain what look like redundant fields (permutations of a single field, such as last name and first name combined into one field in that order and first name and last name in that order, side by side). While a downstream analyst can easily do that, we found that providing these small details increases analyst usage and throughput.

In addition, designing for speed of thought requires a robust and flexible framework for handling many different analytics tools, including traditional statistics, neural networks, older and newer ML algorithms, and graphing algorithms, alongside different deployment options. In the near future, many organizations will need to be able to manage dozens, or hundreds, of AI or ML models, all running in real time, acting on the stream of data as it flows in. These models need to be placed into service and taken out of service much more dynamically and frequently than analytics of yore.

These new analytics models will be handling alerting, nudging, personalization, system communication, and control of the activities frequently connected to human beings. This new analytics environment must be capable of delivering timely information that fits within the cognitive time frame of each person's task at hand.

Rule 5: Waste Is Good

While this rule is implied or directly called out in the prior four, it is worthwhile touching on it further. In working with developers from traditional environments who make the transition to the new environment, all of them spend at least a few months struggling to accept what was so ingrained in them — the need to conserve computing resources. This is where younger and perhaps less experienced developers and data scientists may have an advantage. We are constantly reminding them that all this supposed waste enables agile, flexible, super-fast, and super-rich analytics environments at a lower price that was unheard of 10 years ago.

In this environment, we routinely take what would be a parsimonious data set and explode it, often to enormous sizes. Why? In a nutshell, we are trading off a larger data structure for a simpler algorithm. For example, in a typical large university, a class schedule for all courses offered can fit in a decently sized spreadsheet. Exploding that data set to show each room's usage for each minute of the data, for every day in a year for 20 years, results in 2.3 billion rows. Why would anyone do such a thing? Because visualizing an "exploded" data set is trivial and allows the analyst an incredible level of granularity — either with a visual or an analytics algorithm.

Thus, we can throw away the old rules for normalizing databases. But this is not a free-for-all environment. Quite the contrary. A new strict set of construction rules replaces the old rules, yes, but now it comes with an inverted set of assumptions regarding space, size, and performance. For example, our methods for handling activity tables and curated views are as rigorous as any of the old rules for dimensional modeling. It's just that we don't care about the growth or explosion of data. We embrace it.

Rule 6: Democratize It

Data democratization means providing equal access to everyone — leveling the playing field between parts of the organization so that all parties can get access to the data. Today's economy is an information economy, filled with information workers — and information workers need information. If these key staff members in your organization end up in an environment not suitable for their intellectual skills, they will opt to leave. So, when considering access to data more broadly, it's not just about the data itself, it's about recognizing the information-oriented nature of today's work and recognizing the complexity of organizations.

Organizations that invest in decentralized decision making and make the necessary investments in technology and organizational practices perform much better than their peers.[1] We must free data from silos and transcend traditional hierarchies, making data hoarders a thing of the past.

Organizational Change

The implications here are manifold. We will need to organize our IT teams very differently around the following activities:

- Data movement design
- Data movement orchestration and monitoring
- Data architecture and data design
- Data science modeling
- Data science orchestration and monitoring
- Data democratization community development and management

When thinking about these skills, we need to recognize that they are a repackaging of older skills now wrapped around dynamic cloud technologies, a sort of data science design and operations group. With software as a service growing by leaps and bounds, many IT shops no longer develop software. Instead, with a coterie of various systems in the cloud originating data, a new DevOps team called *DataOps* — which I try to think of as "data and data science ops" — is being born.

With these new technologies, of course, we have more legal and ethical concerns. Privacy law and policies are growing rapidly and differentially across multiple regions of the globe. Moreover, new AI and ML approaches can introduce new forms of legal liabilities not previously imagined. While data democratization is both important and helpful, ensuring a highly secure environment takes on greater importance.

How humans react to and handle information needs to change. In this environment, analytics is a team sport, not an individual one. Whatever one person creates in these tools, it is likely another person can replicate it. Thus, the organizational culture needs to shift to ensure that data and information are communal assets, not individual assets.

Other implications abound. We need to ponder them, but we don't have the luxury of time. These are the new rules of the big data world. Read them, contemplate them, and adopt them, but ignore them at your own peril. Analytics of the 21st century aren't merely coming, they have arrived.

Endnote

[1]Brynjolfsson, Erik, Lorin M. Hitt, and Shinkyu Yang. "Intangible Assets: Computers and Organizational Capital." Center for eBusiness, Massachusetts Institute of Technology, Paper 138, October 2002.

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THE CUSTOMER IS EVEN MORE RIGHT

Customer Experience Management: Trends and Developments

by Curt Hall

Customer expectations have never been higher, and they are driving organizations across almost every industry to rethink their approaches to commerce, marketing, sales, and, in particular, customer engagement, service, and support. Consequently, organizations are expressing intense interest in all things pertaining to the experience customers encounter when dealing with their business.

In short, more than ever, customer experience (CX) management is the order of the day, and organizations are examining their dealings with the customer from the perspective of what they must do to make the experience more appealing, satisfying, and engaging — as opposed to just completing another transaction as efficiently as possible.

Using preliminary results from an ongoing Cutter Consortium CX management survey,[1] along with my additional research for Cutter Consortium's Data Analytics & Digital Technologies practice, I've identified several trends and developments that organizations may want to consider when assessing their own CX management journey, including:

- CX interest is expanding considerably.
- Organizations are seeking a surprisingly broad range of benefits from their CX initiatives.
- Technologies for implementing CX management are evolving and organizations are investing considerably in solutions to help with their CX initiatives.
- Organizational interest in adopting artificial intelligence (AI) and machine learning (ML) for CX is huge.

CX Management on the Rise

To meet increasingly elevated customer expectations, more organizations are implementing detailed strategies for distributing and standardizing CX practices and technologies across their various lines of business. Preliminary results from the Cutter Consortium survey show that approximately 71% of organizations have, are planning to develop (within the next 12 months), or are seriously investigating detailed strategies for deploying CX practices and technologies.

According to the findings, the main benefits organizations seek from their CX strategies and practices (ranked by importance) include:

1. Better customer satisfaction
2. Optimized customer engagement across all channels
3. Increased customer loyalty/customer lifetime value
4. Lower customer service costs
5. Strengthened brand/reputation
6. Better use of customer feedback

Organizations are also turning to CX practices to try and remain competitive as they are confronted with new, more agile upstarts in their respective industries. This is most apparent with the rise of the new, platform-based companies that seek to upset traditional industries by offering consumers a very compelling user experience (e.g., to buy insurance, sell/buy real estate, or manage and transfer funds).

Growing Interest in Adopting CX Management Technologies

Organizations are investing in various technologies to help enhance the customer experience, regardless of which channels customers use to engage with them. These range from leading technologies like enhanced mobile, video, and social messaging systems to chatbots and other solutions designed to support customer

self-service applications and tools for analyzing customer interactions across the organization.

Top Leading CX Technologies

The main leading CX technologies organizations are interested in applying (in ranked order) include:

1. **Customer analytics and behavioral modeling** — for analyzing customer interactions, identifying patterns, and building detailed customer profiles
2. **Chatbots and digital assistants** — for mobile, voice, and chat-driven sales and customer self-service systems
3. **Personalization** — for delivering targeted content and promotions to selected audiences
4. **Omni-channel customer engagement hubs and marketing platforms** — includes customer data management platforms, multichannel (e.g., mobile, social, messaging) marketing and loyalty platforms, and real-time customer interaction systems
5. **Customer intent/journey mapping and analysis tools** — for visualizing and analyzing the journey customers take and the experience(s) they encounter across an organization's channels in order to effect better (and standardized) CX and customer satisfaction
6. **Social video and messaging** — video chat-based systems that allow customer service representatives to interact with customers across popular social platforms in real time

AI, ML, and Other Advanced CX Technologies

Organizations also want to adopt more cutting-edge technologies that provide advanced capabilities for supporting their CX management initiatives. This includes AI, ML, and the Internet of Things (IoT), among other technologies.

The top advanced technologies organizations want to adopt for CX (in ranked order) include:

1. **AI and ML** — for automating a range of business processes and operations
2. **Speech recognition and natural language processing (NLP)** — for implementing conversational computing and conversational commerce systems
3. **AI-powered bots (i.e., smartbots) and intelligent virtual assistants** — for mobile, voice, and chat-driven sales and customer self-service systems that offer advanced capabilities for understanding user wants and needs that go beyond standard keyword-based solutions
4. **Predictive analytics** — for predicting future events, customer actions, or intent using historical data analysis
5. **Natural language interactive voice response systems** — interpreting and understanding more comprehensive customer dialogues using NLP techniques
6. **IoT** — predictive maintenance systems utilizing ML to support the monitoring of connected products for proactive customer service and real-time incident management to heighten customer satisfaction/loyalty and increase sales

> *CX management is the order of the day, and organizations are examining their dealings with the customer from the perspective of what they must do to make the experience more appealing, satisfying, and engaging.*

General Trends Using AI for CX Management

Interest expressed by organizations for using AI for CX management is considerable. According to additional Cutter Consortium survey-based research, "better CX" is right at the top when it comes to the most important benefits organizations hope to obtain from adopting AI.[2] Organizational goals sought from applying AI to CX and customer engagement include greater levels of automation for customer-service operations. This encompasses encouraging customers to take a self-service approach to issue resolution and the ability to deliver innovative and unified experiences to the customer across all digital channels — ranging from chat and text to video, social media, and voice.

As a general trend, AI for optimizing CX management and customer engagement will become dominant applications for applying the technology over the next three to five years. During this period, expect a

significant uptake in organizations using AI technologies, in particular ML, NLP, speech recognition, and conversational interfaces to make customer interaction with their organizations more engaging, intuitive, and satisfying. These developments will correspond with the use of connected products and other IoT applications, where AI technologies like ML, NLP, intelligent search, visual search, and predictive analytics will run on the back-end cloud platforms and, in more limited forms, on various edge computing layers and endpoint devices. Increasingly, endpoint devices themselves will feature on-device AI to help soothe customer concerns around data breaches and privacy issues, which can arise from shipping user data to the cloud for processing.

Further down the road, organizations will start to adopt applications combining ML and emotion recognition algorithms for interpreting, and adapting to, customer emotions to allow real-time decision making and support. One example includes monitoring telephone interactions with customers (e.g., selling and service interactions) in order to perform QA, compliance, and other analysis on the nature and quality of the CX and employee interaction.

Smartbots and Intelligent Digital Assistants Forecast

One of the biggest potentials for AI to impact CX is in the form of smartbots and intelligent digital assistants. Organizations have expressed considerable interest in employing such solutions to add capabilities to mobile apps and popular messaging systems to enable customers to conduct common interactions via speech and natural language text-powered interfaces. This includes both standalone mobile apps and those that function within Facebook Messenger, WeChat, and other popular social messaging platforms.

Consumer voice-driven intelligent assistants like Apple Siri, Google Assistant, and Microsoft Cortana as well as so-called smart speakers like Amazon Alexa, Google Home, and Apple HomePod are increasingly becoming customer engagement channels for companies. Consumer adoption of smart speakers is high. Interestingly, we are now seeing more organizations developing applications for sales, support, and customer service designed to run on these platforms.

Conclusion

These are some of the important trends and developments influencing the adoption of CX management practices and technologies. The bottom line is that interest in CX is increasing, with the majority of the Cutter Consortium survey participants being in some stage of implementing, or planning to implement, CX practices. There's no reason for this trend to change.

Additionally, organizations are looking for a number of benefits from their CX initiatives, and they are keenly interested in utilizing a plethora of technologies to help them meet their goals. This includes various technologies that fall under the "AI umbrella," ranging from ML and NLP to smartbots and intelligent digital assistants.

Endnotes

[1]The data comes from Cutter Consortium's CX management survey on how organizations are adopting, or planning to adopt, CX management practices and technologies and what they see as the possible impacts on their businesses and the issues they are encountering in their efforts. We welcome your participation in this survey; please visit https://www.surveymonkey.com/r/7T3HQ3R.

[2]Hall, Curt. "AI & Machine Learning in the Enterprise, Part III: Benefits Sought from AI Adoption." Cutter Consortium Data Analytics & Digital Technologies *Executive Update*, Vol. 18, No. 8, 2018.

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UP, UP, AND AWAY

Growing Drone Usage in Business in 2019

by Helen Pukszta

Civilian drones have opened up the vertical dimension for personal, commercial, and public use — and the exploration of the low-altitude space immediately above us has only just begun. There are already countless enterprise and professional applications of drone-based technologies (or UAS — unmanned aircraft systems), and some winning ones have surely yet to be conceived. It's a good bet that the future will include our coexistence with drones in the sky similar to that of motor vehicles on land. We don't yet know exactly what the future will look like, but the transformative potential of UAS will ensure we get there.

What's in store for 2019? Continued integration of drones into business workflows and the national airspace, along with more innovations coming to market in UAS technologies.

More Drones in the Skies

In 2012, the US Federal Aviation Administration (FAA) estimated there would be as many as 30,000 drones flying in the US by 2020.[1] After the introduction of mandatory drone registration in 2016, more than 1 million drones were registered by January 2018; out of those, some 122,000 were registered for commercial and public use.[2] (The registration requirement is now on hold, following a successful legal challenge by a noncommercial hobbyist, and no one knows for sure how many drones are in civilian hands today.) The FAA's latest prediction is that there will be 7 million drones in the skies by 2020.[3] As drones ease their way into our lives, there will be an increased public tolerance for them, but we can expect occasional public outcry and anti-drone movements, too.

This past summer I came across a passerby on a Chicago residential street with a small drone hovering slightly ahead, a couple of feet above the shoulder. The drone was well behaved and looked like an innocuous assistant or novelty toy. Before I had time to take in the scene and gape, both drone and pilot were gone past the corner. I doubt personal companion drones will become *de rigueur* in 2019, but don't be surprised when you see drones where you least expect them.

No Drone Deliveries at Your Doorstep Just Yet

Unless you are located within a small group of 10 regional participants of the UAS Integration Pilot Program (IPP)[4] — an initiative started in 2018 under the US Department of Transportation and the FAA — it's unlikely you will see drone deliveries in 2019, and certainly not on a commercial scale.

What's in store for 2019? Continued integration of drones into business workflows and the national airspace, along with more innovations coming to market.

The IPP tests a variety of applications that relax current FAA drone restrictions, experimenting with flying at night, at airports, over people, beyond visual line of site, and autonomously. The applications cover operations from search-and-rescue to delivery of food and medical supplies. Amazon is conspicuously missing from this testing group (submissions that included Amazon were not selected), but Amazon Prime Air will continue perfecting its autonomous operation, inching closer to launch, whether in the US or abroad.

The IPP is a step in the right direction. Having state, local, and tribal governments volunteer their participation — in partnership with enabling technology firms and on projects that they select and manage and that improve the quality of life in their area — is the right approach for integrating drones in national airspace and informing broader drone adoption processes. There should be more locally managed and assertively pursued initiatives like this one. Expect this limited program to go through its paces throughout 2019 and 2020.

Current regulatory roadblocks aside, deliveries by drones are unlikely to be profitable until they reach

scale. And they won't reach scale until standards and technologies like UAS traffic management — to prevent drones on arbitrary routes from colliding with each other, other aircraft at low altitudes, or anything else on the ground — are in place. That will not happen in 2019.

VTOL (vertical takeoff and landing) drone taxis are even further away from broad use than package delivery. FAA certifications that would give the green light for passengers to board a drone will take a long time to secure. And, even more so than with drone deliveries, the infrastructure and traffic control to support air taxis — both in air and for takeoff and landing — are yet to be implemented.

There is a learning curve to developing an internal capability to use UAS — although services are also available — and to wring out as much value as they can bring.

Business and Public Sector UAS Adoption Gains Momentum

Applications of drone technologies other than air taxis and delivery of goods over public spaces garner less media attention, yet they open up new paths to efficiency, safety, and accuracy, and are being implemented and producing tangible benefits. Insurance, agriculture, construction, and oil and gas are some of the industries that have experimented with UAS and have started fine-tuning, operationalizing, and turning their use of drone-based technologies into a competitive advantage. Public sector use, such as for infrastructure inspections and public safety, is also increasing and will continue to grow in 2019.

There is a learning curve to developing an internal capability to use UAS — although services are also available — and to wring out as much value as they can bring. It's a fast-moving technology, and there tends to be a gap between what is available and a vision for how to apply it effectively. Competitive pressures are already pushing for widespread adoption in entertainment, real estate, surveys, and insurance. That competitive urgency will increase in 2019 in other sectors where UAS can bring immediate value within the current regulatory framework (with or without FAA waivers).

The operation of drones within the confines of a business or a professional service tends to face fewer barriers and restrictions than anything involving the public, and adoption in those contexts will continue to make good strides in 2019.

More Innovation on the Horizon

UAS technology will continue to make significant advancements in 2019, with smaller enterprise-grade drones capable of longer flights as well as smaller, more accurate and precise sensors, such as RGB (red, green, and blue), multispectral, and infrared cameras. Smaller means less payload, and that means more time in the air. Also expect the introduction of some larger, industrial-grade drones capable of higher payloads (used, for example, for moving objects at a construction site) and longer flights.

Technologies like real-time kinematic GPS correction are becoming available with an increasing number of aircraft, providing centimeter-level accuracy for georeferenced images and any maps and models derived from them. This is survey-grade accuracy, and it will continue to improve, speeding up old processes with results that meet or exceed current professional standards. These technologies also help with precision positioning of aircraft in close-up or challenging conditions.

The ecosystem of post-processing and analytics software for UAS will also see more innovation, integrating artificial intelligence and machine learning. This will help in more precise automatic assessment of hail damage to a roof and more accurate identification of anomalies in asset inspections, for example. There are already good options for fleet and operations management systems, and their features and offerings will continue to expand.

Collision avoidance and autonomous capabilities will not become standard for enterprise UAS in 2019. Current regulatory restrictions (for example, automated flight paths are fine, but autonomous flights without a pilot and those beyond visual line of sight are not) lessen the industry incentive for autonomous drones for business and curtail innovation in that area. Those areas are crucial to fully unlocking drones' ability to disrupt and improve business models and processes. This will change in tandem with regulations as pioneer operators push the envelope and demonstrate on a repeated basis the safety and efficacy of autonomous UAS.

Overall, Exciting but Incremental Changes in 2019

For 2019, expect some significant milestones but no dramatic, large-scale breakthroughs in the commercial use of drones or in the UAS industry. Steady incrementalism will continue, but the technology is firmly on the path leading to a convergence of increasingly capable, safe, and autonomous UAS with improved standards and infra-structures for drone operations and with progressively accommodating attitudes, laws, and regulations. This convergence is where the transformative power of drone-based technologies will thrive. Use 2019 to get ready for it. Don't get left behind.

Endnotes

[1]Johnson, Robert. "FAA: Look for 30,000 Drones to Fill American Skies by the End of the Decade." Business Insider, 8 February 2012.

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IT'S JUST SEMANTICS

From Information Modeling to Ontology

by Claude Baudoin and Cory Casanave

We're going to make some business people cringe right off the bat with this claim: *there is an ontology in your near future*. In this article, we will explain what that means and why we assert it.

Over the last 25 years, we've developed and perfected ways to model information — objects, classes, attributes, and relations — as well as activities and behaviors. There's all this and more in the the Unified Modeling Language (UML) or, for complex systems, in the Systems Modeling Language (SysML), which might make you think we've reached modeling perfection. Sorry — but we're going to disappoint you.

The system of systems that powers the modern enterprise has become increasingly complex and interdependent. Each system has its own requirements, designs, and implementations. Each design has purpose-specific data architectures and schemata, reflecting the unique perspectives of the system's stakeholders and unique implementation demands. As a result, the models developed to specify "system A" rarely contain the same definitions, relationships, constraints on data values, and so on, of various data objects as the models describing "system B."

It doesn't help that models rely on the ambiguous meanings of words in natural languages. In an oil company, for example, what a production engineer calls a "well" could be multiple "wells" to a driller. Similarly, different units of a bank may use the word "loan" or "transaction" to mean different things. In this system-of-systems scenario, we end up with application silos not just because people work separately in different parts of the organization, but because it is onerous or impossible to integrate systems that assume different semantics for a loan, a transaction, or an oil well. Data quality suffers, too. If systems A and B have different rules for entity E, what's acceptable to A may be garbage when received by B.

So we need an approach to integrate these systems and designs, to provide a common vocabulary and common semantics for what our data means across the system of systems. We're not going to resolve fragmented data architectures by superimposing another data architecture on top! To federate designs and integrate data, we need a set of concepts that lasts, that reflects what the enterprise really does and what it is about — the concepts of the business, regardless how we implement them.

We need to capture precisely the deeper meaning of "things" (customers, orders, assets, missions — whatever is the focus of the enterprise) in a machine-processable model, complete with relations, properties, constraints, rules, derivation formulas, and so on. This, in short, is what an ontology is.

This model of the business is not a data model but rather a reference (in business terms) for what data means to the business. Any particular stakeholder can take this common understanding and pivot to understand or design the data and messages that power specific systems. With a common, coherent model, data can be more easily integrated, shared, and federated. The information that supports processes, services, and business rules can be understood and traced through the system of systems in support of governance, integration, sharing, machine learning, and analytics.

Ontologies are more complete, powerful, and complex than taxonomies because they add all this semantic knowledge, couched in formal logic terms. In the ANSI definition of "controlled vocabularies,"[1] you find lists (i.e., glossaries), taxonomies (glossaries plus synonyms and hierarchical relationships), and thesauri (taxonomies plus relationships other than "is a kind of"). Ontologies go further: they also tell you complex relationships (such as "a person can only be a car renter if his or her age is 25 or above"), which a taxonomy cannot represent.

Thinking in terms of a layered enterprise architecture framework, with the business strategy at the top and the computing infrastructure at the bottom, an ontology is close to the top level; it models the business capabilities and business processes across the entire organization. A UML model of a system, by contrast, lives at the lower level of individual applications and the data they manipulate. Once you have created an ontology for your business, there are semantic tools that you can use

to automate many functions or derive additional logical consequences. And, as mentioned earlier, you can also use the ontology to derive consistent application-specific models.

This movement from system-specific data models to business-wide information models presents some challenges:

- **Ontologies require understanding formal logic concepts.** These include concepts such as intersection, union, implication, transitive relationships, existential qualifiers, and so forth. This comes more naturally to people who have had a good dose of math education — from the high school level and up.
- **Some of the ways in which ontologies are expressed, such as the Web Ontology Language (OWL),[2] are not easy for business users to understand.** OWL looks like code. But ontologies can also be expressed in relatively simple graphical notations like UML, using a conceptual modeling profile. For those who are inclined to use OWL, massive open online courses offered by Coursera, Udemy, and others have made the training quite accessible.
- **Ontology specialists are a bit like a secret society.** They have special handshakes and speak in their own language. They tend to assume that the need for an ontology is going to be obvious to a business person, but the casual mention of the "O" word in the first conversation may send their client running away.

The good news is we are starting to see some real movement toward adoption. A multiyear collaboration between the Object Management Group (OMG) and the Enterprise Data Management (EDM) Council has produced the Financial Industry Business Ontology (FIBO),[3] an expanding collection of standards that define financial instruments and concretely help financial institutions implement compliance with regulations such as the US Dodd–Frank Wall Street Reform and Consumer Protection Act. The number of vertical industry conferences, working groups, and standards committees that have the word "ontology" in their title is still small, but it is no longer zero. As a result, this work is very doable, even if it does take a reorientation of thinking from modeling data for a specific solution to modeling the business as a reference. The benefits will include integration, analytics, governance, and inference.

In the next few years, more industry sectors will discover the need for, and benefits of, a complete semantic model of their businesses. (And you know a concept promoted by IT people is important when it is mentioned in a prominent business journal like *Forbes*.[4]) So, fear not, but learn what an ontology (or "business information model," if you prefer) is and how to benefit from developing one before the lack of one becomes a disadvantage.

Endnotes

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UNINTENDED CONSEQUENCES?

Privacy Issues and AI Forecast

by Paul Clermont

Predictions about IT have typically focused on new offerings and what they can do for us, along with improvements in infrastructure that will make even better things possible. Over the past few years, I have avoided predicting specific technologies and focused instead on issues around privacy and security, suggesting they would become more prominent. Last year[1] I called out the following points:

- **IT's long honeymoon with the public, the press, and government has been threatened.** Indeed, too many revelations of inadequately protected and inappropriately distributed and misused personal data have surfaced. The general public is wising up to the fact that companies like Google and Facebook's delightful "free services" come at a cost — our privacy. The cavalier attitudes and tone-deaf responses from some tech executives have not aided their cause.
- **Rapid developments in artificial intelligence (AI) will take concerns about privacy and security to a whole new level.**

Now, you can view these simultaneous events as either fortunate or unfortunate, depending on your viewpoint. Why? Because people widely perceive AI in its totality — algorithms, machine learning, robots — as a potential threat to society far greater than any earlier forms of IT. So at a time when the industry critically needs people to view it as a credible force for good (or at least not for evil), its once-good reputation has been severely tarnished.

It has become clear that most new technologies have serious downsides. Examples of unintended, unforeseen, and undesirable consequences — all of which could have been foreseen and even were foreseen (just not by the people who mattered) — include:

- Social networks that only a few years ago seemed to empower people against despots have become tools of repression used by despots (e.g., fomenting genocide in Myanmar).
- Democratizing the ability to mass distribute content worldwide over the Internet so that anyone's voice can be heard provides an unprecedented megaphone for cranks, bigots, mischief makers, and certifiable lunatics to spread not just fake news but even bizarre conspiracy theories and poisonous lies.
- Algorithms that help connect people to music and fashions they like also help seal them inside informational echo chambers about current affairs, amplifying political divisiveness.
- The amazingly handy access to online information is also access to time wasters, and for large numbers of people, screens seem to be addictive.
- Access to educational material for children also means access to junk programming that ultimately turns kids into passive couch potatoes and, worse yet, offers them the opportunity to buy junk[2] that they can order on the spot. The news that many tech executives are strictly limiting their children's access and screen time should be instructive.
- Social networks that help people enrich their connections have, in the hands of adolescents, hugely amplified the voices of the nasty bullies we all remember from our own school years who have harassed their prey even to the point of suicide.

The Front Lines of Privacy

The poster child for exhibiting a cavalier attitude is Facebook, whose largely unpublicized privacy-related issues with the US Federal Trade Commission go back to 2007, with promises to change largely ignored,[3] and whose recent attempts to discredit their critics have backfired.[4] The once-plausible notion that the tech industry could and would effectively regulate itself now seems hopelessly naive.

The European Union (EU) is leading the way on the privacy front with its implementation of the General Data Protection Requirements (GDPR) last year. EU governments have also levied massive (10-figure) fines

on much of Big Tech and beefed up their scrutiny of business models and practices. If and when the US joins in is a big question; public outcry will bump up against the pro-business slant of most parts of its government. Unfortunately, the lack of an even basic understanding that lawmakers (not just the octogenarians!) have exhibited in hearings about today's technologies does not bode well for effective legislation.

It would be easy but wrong to think that most Big Tech companies are in the same boat; for example, Apple and Microsoft are not in the business of gathering and selling data about their users; in fact, their leaders have spoken out on privacy. Apple CEO Tim Cook warned attendees at a conference in Brussels via the image of a "data-industrial complex" in a call for comprehensive US privacy laws, adding that "our own information is being weaponized against us with military efficiency."[5]

Just days later, Microsoft CEO Satya Nadella characterized privacy as a human right in a similar London speech.[6] This month, Shoshana Zuboff of the Harvard Business School published "The Age of Surveillance Capitalism," which paints both Google's and Facebook's hoovering up and packaging of our data crumbs for lucrative sale as threats to a free society.[7] Moreover, the World Economic Forum's annual meeting in Davos, Switzerland, included speeches from several national leaders, including German Chancellor Angela Merkel and Japanese Prime Minister Shinzō Abe, calling for increase governmental scrutiny and regulation of IT innovations.[8] This drumbeat will only get louder, but it would be foolish to predict serious regulatory action in the US in 2019, though one could hope for a bipartisan push to address at least a few privacy-related basics, including:

- Requiring opting into anything that might send unwanted advertising our way
- Making it easy to drop out of a social network without leaving a trace
- Making it easy to shield subsets of personal information with substantial penalties for releasing it, some of which are already part of GDPR

Companies that conceived of their platforms as common carriers with no responsibility for the content they carried — a model appropriate for a phone conversation between two people but not for a medium that broadcasts any individual's musings to the whole world — have had to scramble to weed out misinformation, outright lies, and hate-mongering. Facebook has corralled thousands of employees and contractors around the world to try to screen out bad and inappropriate material, but not surprisingly, it has proven difficult to promulgate effective guidelines.[9] Substantial progress in getting rid of most of the chaff while only losing a minimum of wheat will need to be demonstrated, or governments, particularly in Europe, may take drastic action. I will go out on a limb and suggest that before the year is out, some thought leaders or institutions may start questioning whether social networks need to fundamentally change their business (and profitability) models.

Coming to Terms with AI

2019 developments in AI are more likely to be debates about its threats than about specific technical innovations, though we should expect lots of push from Amazon and Google to extend the use of their intelligent assistants into the Internet of Things. Rather than killer robots and mind control, attention in 2019 will be paid to AI's real and present threats:

- AI *will replace* a large share of the current workforce if and when it can do the jobs better than people, or at least as well, if it's cheaper. To suggest otherwise is a fantasy, a belief confirmed by private conversations with business leaders at Davos who look forward to massive staff reductions.[10] Clearly, some form of lifelong education is called for, but 2019 may not bring much more than further admiration of the problem.
- AI algorithms can be (and are already) overused where nuanced human judgment would add real value. AI can do very well informing decisions but making them is a different matter when those decisions can have a huge impact on people's lives, such as hiring and extending loans for homes and small businesses. Recent attention to ethics is appropriate; it is extremely difficult to create algorithms that don't reflect the personal, institutional, and cultural biases of their designers. We should expect to see broader acknowledgement of ethical issues[11] and early efforts to address them (e.g., Google's AI principles and possibly laws and regulations demanding transparency[12]).
- AI offers rich opportunities for malicious use;[13] for example, by authoritarian governments analyzing the copious data we generate without even thinking about it, such as our location.[14] It is chilling to think of

what the East German Stasi would have done with that type of data, and as more information exists only in electronic form, *1984* scenarios[15] of governments literally rewriting inconvenient history and creating "deep fake" photos as "proof" become practical. However, possible 2019 developments in this area, other than awareness raising, would probably not go beyond restricting import and export of specific technologies, if that.

In sum, AI amplifies the demand for something much different from the laissez-faire approach that governments, particularly in the US, have taken to date.

One final thought: 2019 is likely to shape up as a year in which the news is less about what technology can do *for* us than about what it can do *to* us.

Endnotes

[1]Clermont, Paul. "Public Policy Coming in from the Sidelines?" *Cutter Business Technology Journal*, Vol. 31, No. 1, 2018.

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[11]New York University is the home of the AI Now Institute, which examines social implications. The Massachusetts Institute of Technology offers a course entitled "The Ethics and Governance of Artificial Intelligence,"and its Media Lab spawned the delightfully named Algorithmic Justice League.

[12]Zeynep Tufekci, a University of North Carolina professor and *New York Times* op-ed columnist, has an excellent TED talk on this topic: "We're Building a Dystopia Just to Make People Click on Ads."

[13]An international consortium of institutions, including Oxford and Cambridge Universities, issued a comprehensive report in February 2018 entitled "The Malicious Use of Artificial Intelligence: Forecasting, Prevention, and Mitigation."

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