



State of the Practice of Enterprise AI
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Strategic Directions for Enterprise Artificial Intelligence

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Strategic Directions for Enterprise Artificial Intelligence

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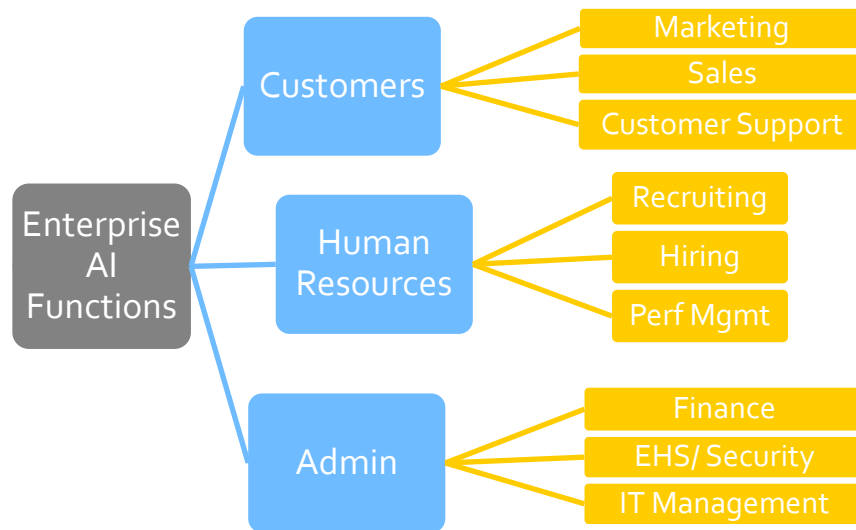


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Executive Summary

For most of its existence, the field of artificial intelligence (AI) was confined to academic and highly technical pursuits, but in 2016, AI became the next business imperative. Thanks to the rise of a non-technical AI community, software and services bringing AI to enterprise needs, and enterprise software vendors shifting to “AI-first” from “mobile first” strategies, corporate users now have real offerings to choose from and real decisions to make, like:

- **Which vendor should I choose, for what enterprise needs?** Enterprise AI vendors are bringing techniques like machine learning, predictive analytics, and machine vision to bear on business problems that all firms face: selling to customers, recruiting talent, and keeping in compliance with regulations. In each area, a dozen or more specialist startups has arisen, and enterprise software giants like Salesforce.com and SAP are launching new offerings.
- **How will my industry be affected?** In addition to functional offerings, industry-specific AI solutions are emerging. Health care and banking, in particular, have administrative and skill-based jobs that AI can complement or replace.
- **What should my company’s strategy be?** Past waves of enterprise IT, from MES to ERP, have transformed industries by eliminating human work and extending corporate scope – and that will happen this time, too. As AI gets better at analytical work, it will enter creative roles and fields like design and strategy itself.



2016 was the year AI entered the enterprise

For most of its existence, the field of artificial intelligence (AI) was confined to academic and highly technical pursuits, such as winning strategy board games like Go, or assisting radiologists in analyzing medical images. This year, however, was full of signs that AI became the next business imperative (see the presentation "[Beyond Buzzwords: Capitalizing on the Digital Transformation of the Enterprise](#)"):

- **The rise of a non-technical AI community.** The AI World Expo in San Francisco, which we co-chaired, was one of the first major conferences to focus on enterprise applications of AI (see the [November 22, 2016 LRIBDAJ](#)). Among the well over 1,000 participants, computer scientists and technology investors mingled with call center managers, human resources strategists, and CFOs.
- **Software and services bringing AI to enterprise needs.** Management consulting firm [Deloitte claimed](#) that "by end-2016, more than 80 of the world's 100 largest enterprise software companies will have integrated cognitive technologies into their products." AI is a logical extension of these companies' big data and analytics offerings, which in turn were fed by the copious amounts of information collected via mobile devices and Internet-of-Things machines, and stored in cloud data centers (see the report "[Information Meets Matter: Devising Big Data Strategies for Real-World Industries](#)"). Those datasets were finally large enough for AI algorithms (machine learning and neural networks) to be trained on.
- **"AI-first" eclipsing "mobile first" strategy.** As much as cloud-based big data for training machine learning was important, powerful chips at the network edge (smartphones and internet of things [IoT]) mattered too. AI opened the gates for companies like Nvidia to enter enterprise computing, and new startups to tackle enterprise computing tasks. Google has now declared it will "move from a mobile-first world to an [AI-first](#) world." Others on the AI-first bandwagon include [Salesforce](#), [CIO Magazine](#), and [tech bloggers](#):

"The AI-First enterprise (will) incorporate AI as a first class citizen of the vast majority of business processes and software solutions in the enterprise."

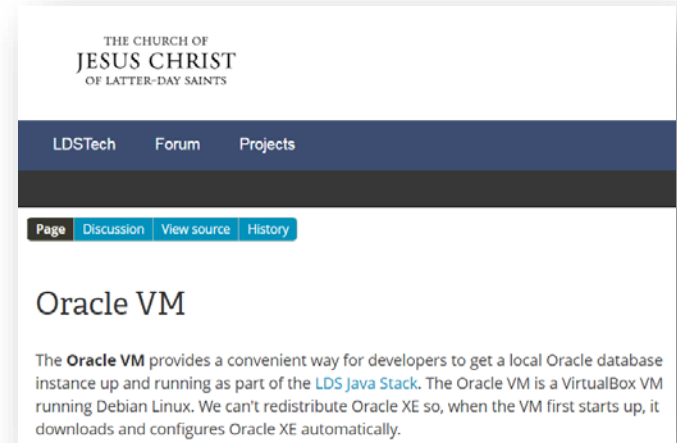
Enterprise: A synonym for organization

Enterprise is a synonym for organization, especially commercial, but also government, educational, or even religious organizations.

Enterprise software manages administrative functions that are not specific to a user, but **address organizational needs that are common to most businesses**, regardless of industry or size: managing customers, keeping human resources records, and other administrative tasks. There are also industry-specific modules, adaptations, and vendors that focus on, such as health care recordkeeping for regulatory compliance.

The field of enterprise software pre-dates even the world wide web, and is structured roughly in three segments:

- **Giant vendors** in enterprise resource planning (ERP) like SAP and Oracle; or in sales force automation (SFA) and customer relationship management (CRM) like Salesforce.com
 - ERP and CRM have been converging, and players in the two spaces now complement and compete with one another
- **Adjacent, mid-sized specialists** in business intelligence (BI), supply-chain management (SCM), etc
- **Startups** scrambling to grab a niche – and get acquired



Not only corporations: the Mormon church is an avid customer of enterprise software like [Oracle's ERP system](#) and [Google's Search engine optimization \(SEO\)](#) marketing tools



"This idea of CRM and SFA – that's dead; everybody has got that ... intelligent applications will fundamentally change the way you do work in the enterprise." – [SAP CEO Bill McDermott](#)

AI applications target the enterprise's customer-facing, employee, and administrative functions

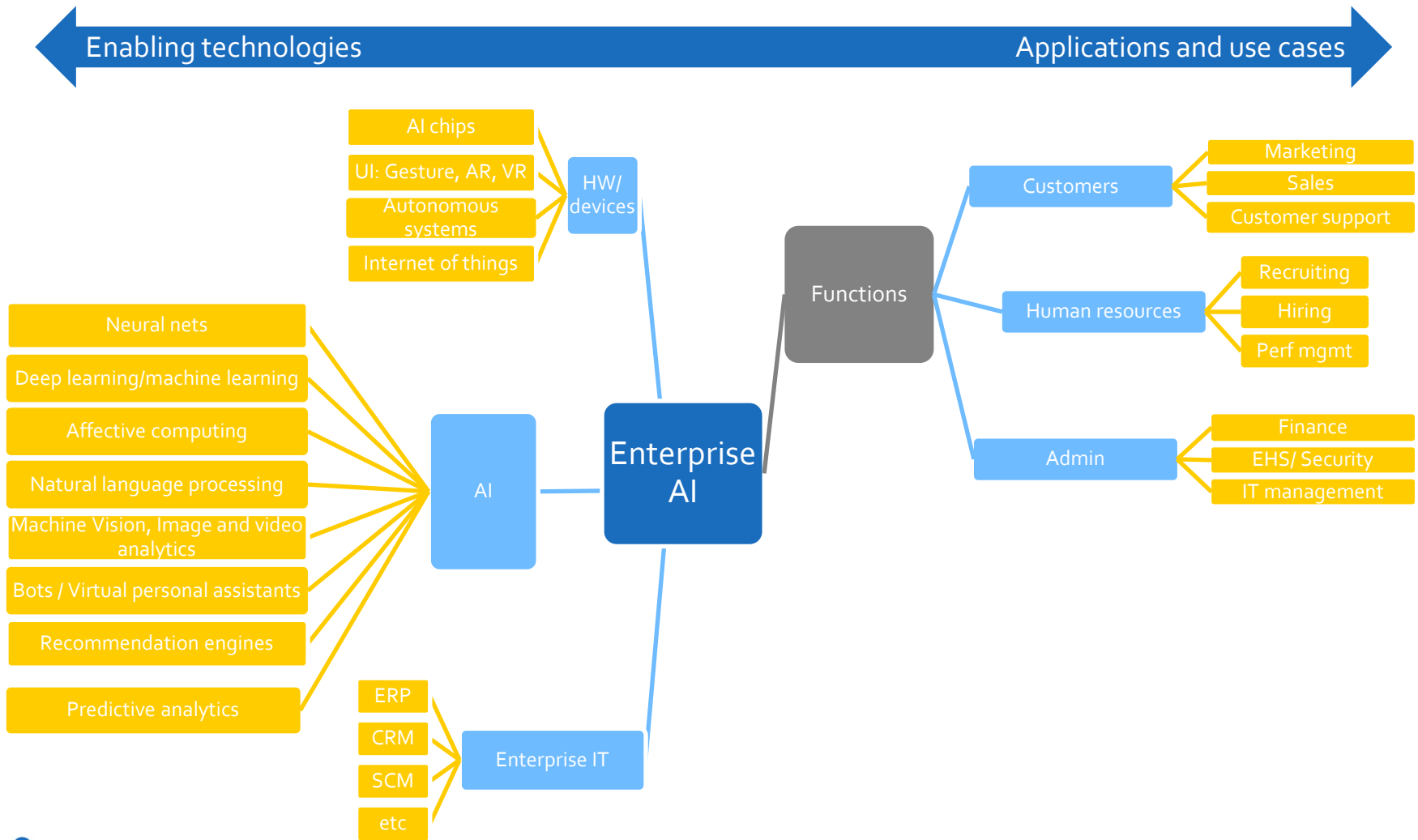
Based on our interactions with clients, startups, and at events like the [AI World Expo \(AIWE\)](#) and [Robobusiness](#), there is a clear relationship between AI, big data, and enterprise applications (see the report "[Information Meets Matter: Devising Big Data Strategies for Real-World Industries](#)").

- [Sentient Technologies](#) (which has raised \$150 million to date) is one of the larger startups in the field. At AIWE, Sentient advocated for "measuring digital transformation by the number and importance of the decisions that have been impacted," and that "**artificial intelligence is the key missing ingredient to bridge the gap**" between big data and decisions. The company focuses on functions like marketing, eCommerce, and finance that cross industry boundaries.
- [Insidesales](#) (whose \$100 million round makes it a [tech unicorn](#)) claims its predictive algorithms can help salespeople close more deals. The [company argues that it's "the data, not the algorithm"](#) that makes AI "the evolution of enterprise software."

Across the board, we see vendors primarily targeting three core business functions – managing customers, employees, and administrative tasks (see next slide). Most of those tasks are the same as the ones big data wants to address, since AI (especially ML) applied to big data is the basis of most enterprise AI today.

- Customer-facing functions
 - Customer support
 - Sales
 - Marketing
- Human resources
 - Recruiting
 - Hiring
 - Performance management
- Administrative functions
 - Finance
 - EHS/ Security
 - IT

The landscape of enterprise AI's enabling technologies and functional applications



AI in marketing – persuading as many prospective customers, as efficiently as possible



- Marketing is tasked with **external interactions with prospective customers** via advertising, promotions, public relations (PR), and other activities and channels
- Marketing theoretically precedes sales (turning prospects into customers), which in turn precedes customer care. In reality, **these activities overlap** (marketing to prospective customers sometimes reaches current ones, for example) so software vendors' solutions often tackle more than one step
- In marketing specifically, vendors use AI techniques to better **identify prospects, predict their behaviors, and deploy tactics** (such as the classic [marketing mix](#) of “four Ps,” product, price, placement, and promotion) that will be most effective at persuading them to become customers

AirPR	Public relations (PR) analytics and recommendations based on media analysis
Bloomreach	NLP and ML for understanding shopper intent
BrightFunnel	Machine Learning for marketing analytics
Cognicor	AI chatbot for product queries, on-boarding, and other customer support activities
CommandIQ (acquired by Publishers Clearing House)	
Drawbridge	Customer tracking and analytics across multiple devices
Freshplum (acquired by TellApart)	
Liftigniter	ML and recommendation engine for personalization of eCommerce sites
Mintigo	Predictive analytics for customer discovery, targeting, and engagement
Motiva	ML-based marketing automation
Msg.ai	AI chatbot for customer support and marketing
Optimove	Predictive analytics for marketing management
Persado	NLP and ML for machine-generated marketing text and visual content
Radius	Predictive analytics for prioritizing inbound leads and open opportunities
Retention Science	Automated analysis of customer behavior and proactive messaging
TellApart	Data enrichment and predictive analytics for customer scoring and marketing optimization

AI in sales – improving conversion of prospects into customers



- Sales takes information about specific prospects from marketing, or that it gathers on its own, and **prioritizes how to spend time and resources converting those prospects** to paying customers
- Typical AI tasks are managing customer lists (by removing duplicates and unlikely buyers) or **adding missing data (called “data enrichment”)** which several vendors offer
- Potential customers are often ranked and scored, so **salespeople know which ones to prioritize, and which actions to take** (uncovering needs or negotiating contracts), which AI can help do
- Current customers are an important base for tomorrow’s revenue, so **sales analytics platforms also track and analyze customer interactions, and use them to predict future sales**

6sense	Data enrichment and analysis for predictive lead scoring
Aviso	Sales forecasting and analytics
Clari	Sales pipeline analysis and forecasting
Collective[i]	Aggregates collective experience of sellers across multiple enterprises to understand and predict buying behavior
Fuse machines	Deep learning and NLP for automation of lead generation and outreach
Gainsight	Predictive customer scoring
InContact	NLP for analysis of call center transcripts, for customer management and security
Infer	Data enrichment, ML, and PA to score potential customers for sales and marketing
Init.ai	Chatbot platform for sales and customer support staff
Lattice Engines	Analyzes customer behavior data to improve acquisition, onboarding, and churn
NGData	Customer analytics for finance, media, and telecom
NICE	Customer analytics and security/fraud prevention
PeoplePattern	Supervised machine learning techniques and NLP on unstructured social data for market research and planning
Preact	Analyzes customer behavior data to improve acquisition, onboarding, and churn
Prism	Analysis of video data to predict sales and manage inventory
SalesforceIQ	Analyzes e-mail, calendar and smartphone-call data for sales management; formerly RelateIQ (bought by Salesforce.com for \$340 million)
SalesPredict (acquired by eBay)	ML, PA, and NLP plus data enrichment to analyze sales win/loss data and score customers
Sentient	AI platform targeting digital marketing, e-commerce, and financial applications
Vidora	Analyzes user behavior to predict, understand, and decrease user churn
Zensight	Uses NLP to analyze content of email and CRM for sales forecasting and optimization

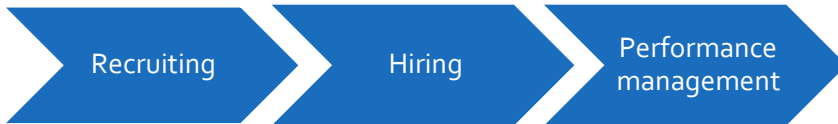
AI in customer care – reducing the cost of managing existing customers, while increasing satisfaction



- Customer care processes include managing problems like returns and defects; providing training, user support, and additional services; and encouraging customers to buy more, better, and different versions of company offerings
- A very common application of AI is chatbots that converse with customers about basic product features, or fulfill back-office requests (such as returns). These are low-complexity interactions that bots can perform more cheaply than humans, and are sometimes little more than online versions of phone-based menus (“press 1 to hear your current balance...”)
- AI also used to support or train human agents, by gathering data from the customer before the live interaction, or predicting which action the agent can take to achieve the best customer outcome
- Intelligent systems learn from previous resolutions, and can take on more complex tasks over time

ActionIQ	Web-based responsive user experience (UX)
Clarabridge	NLP for analysis of customer feedback
CogniCor	“Cognitive resolution agent (CIRA)” uses NLP for customer self-service and support of human agents
DigitalGenius	Marketing automation via email, social media, mobile messaging, and chat
Eloquent	AI chatbot for customer service
Framed (acquired by Square)	
Inbenta	NLP and ML to replace customer email conversations with chatbots
Kasisto	AI chatbot with focus on banking customers
Luminoso	Examines unstructured data from customer interactions to develop customer insights
Quantifind	Analytics of competitive, customer, and marketing (promotion and sponsorship) activity
Verve.ai	Customer analytics across internal and external (e.g. social media) channels
Wise.io	PA for customer service agents
WorkFusion	Chatbots to automate customer service
Zendesk	ML for customer service agent support

AI in HR offers end-to-end employee management



- › The process of employee management bears striking resemblance to customer care: in both cases, companies must find and assess many unknown candidates (recruiting); invest in bringing some of them onboard (hiring), and tracking, predicting, and influencing the course of the relationships (performance management)
- › Several companies use NLP to scour social media like LinkedIn and industry blogs to identify job candidates, and enrich data about those in the pipeline (aka “social sourcing”), and chatbots for pre-interview screens
- › Performance management is no longer about annual reviews. Slack analytics measure employee engagement in company culture, while chatbot-based surveys assess employees’ preference for monetary compensation versus soft benefits like gym memberships. For example, Engazify captures peer feedback from team chats for use in personal evaluations

Arya	Uses ML to scan internal and external sources for job candidates, and creates proactive contact to send to top choices
ConceptNode (failed)	
Connectifier (acquired by LinkedIn)	Social sourcing of job candidates
Engazify	Tracks appreciation emojis in Slack chats to assess employee performance
Entelo	Uses ML to scan social media and other candidate sources for recruiting
Gigster	Analyzes project activity data (Github, Trello, Slack, etc) to match software freelancers with projects
Gild (acquired by Citadel)	
Glint	Electronic surveys and analytics to measure organizational cultural health, and propose actions
HiQ	Data and analytics for employee retention, recruiting, and other HR tasks
HireVue	Predictive analytics and ML for recruiting and employee coaching
Ideal	Data enrichment and AI for candidate screening
Predikt (failed)	
Pymetrics	Gamification of job screening
SpringRole	Uses machine learning to qualify candidates against 100 data points
TalentBin (acquired by Monster)	Social sourcing aggregates job candidate profiles from more than 100 websites
Textio	ML and NLP for improving writing in job listings and recruiting e-mails
Unitive	Automation, analytics, and best practices for hiring
Wade & Wendy	AI chatbot-based hiring and interviewing

AI in admin targets many kinds of cost and risk, from compliance to fighting finance fraud and bad code

AI has great potential to automate mundane administrative tasks like regulatory reporting and inventory forecasting, or predicting IT repair needs. At the same time, doing this admin correctly has expanded the definition of security, to include safety for many stakeholders even outside the firm:

- As mentioned earlier, SAP's HR offering [Success Factors](#) watches out for bias in hiring (a societal hazard and a regulatory risk). It also integrates with travel and expense apps like Concur (which SAP owns) to find expense padding and save time in mundane invoice matching
- [Amazon offers AI-based APIs](#) that companies can use with ML-based image analytics (called AWS Rekognition), such as facial recognition for fast customer service, and biometric verification in financial transactions
- In addition to these giants' offerings, there are dozens of startups addressing administrative safety and risk mitigation needs. For example, Brainspace and x examine legal documents for indications of financial fraud and patent breaches (see the [June 7, 2016 LRIBDAJ](#)).
- Cybersecurity is a critical IT function where AI is being deployed, especially as mobile devices, IoT, and now chatbots increase the number of weak attack surfaces (see the report "[Cybersecurity Venture Investment in Pervasive Computing and the IoT](#)"). One startup to watch is [StackPath](#) which uses ML to monitor real time activity patterns in machines, networks, and systems to see deviations that indicate an attack
- The lines between data ownership and privacy are poorly-defined, but startups like bot-maker [Snips](#) are integrating privacy into AI (see the [May 24, 2016](#))
- Beyond, security, there are many everyday IT management needs that AI can take on, as [CIO Magazine pointed out](#). For example, [Grok](#) monitors systems to detect when a new code push has hurt performance, while [Apcera](#) helps deploy, orchestrate, and govern containers and legacy code

AI in admin – security, fraud, and other risk management startups to watch

AppZen	Uses pattern recognition to identify phishing campaigns and other cyberattacks
Area1	Analyzes attack data to rate security providers for vendor selection and risk insurance
Bitsight	"AI-as-a-service" for fraud detection, anti-money laundering compliance, and other business risks
Brighterion	Blocks endpoint breaches to prevent cyberattacks
Bromium	Identity and trust management for enterprise security
Conjur	Composite biometric security
Crossmatch	Real-time web server traffic analytics via "self-learning" software
Cyberlytic	AI for antivirus, updates, and other cybersecurity applications
Cylance	ML for detection and response to cyberthreats
DarkTrace	Deep learning for mobile and endpoint cybersecurity
DeepInstinct	AI for cybersecurity and IT management via chatbots
Demisto	Biometric security based on measurements of eye features, focused on finance
Eyeverify	ML for fraud detection and prevention
Feedzai	Behavior analytics to identify internal security threats
Fortscale	Combines human and machine intelligence for cybersecurity
F-Secure	Visual presentation of complex datasets for security analysis and other assessments
Graphistry	Identifies changes in user behavior, network activity, and other indicators of cyberattacks
Harvest.ai	Uses pattern recognition to identify phishing campaigns and other cyberattacks

IBM	Integrates multiple threat intelligence sources to more accurately identify cyberattacks
Intersect	Behavioral analytics and ML to identify surface threats
Jask	PA to detect cyberattacks, while avoiding false alarms
Massive Alliance	Cybersecurity and reputation management via monitoring of over 100 million channels
MIT	Analyst-in-the-loop cybersecurity system based on supervised ML and behavioral analytics
Neokami	Scans data and images to identify risk and comply with regulations like US's HIPAA and EU's GDPR
Nymi	Personal authentication based on electrocardiogram (ECG) via wearable band
PatternEx	AI-human collaboration for cybersecurity
PreIert	Unsupervised ML for anomaly detection
SentinelOne	Behavioral analytics for detection of malware, exploit, and insider attacks
Sift science	ML for fraud and abuse of payments, promotions, and other risks
SignalSense	Records endpoint interactions to detect risk candidates for deeper study
Secure	ML on biometrics, email, phone, and other channels for secure finance
StatusToday	Behavioral analysis of employee activity to detect security threats
ThreatMetrix	Tracks individuals across devices, locations, accounts, and behavior for authentication, fraud prevention, and cybersec
Vectra	ML and behavioral traffic analysis for network security
Verafin	Cross-institutional financial fraud and money laundering detection
Zimmerium	ML for mobile threat detection

Enterprise AI's industry applications stem from big data and analytics, too

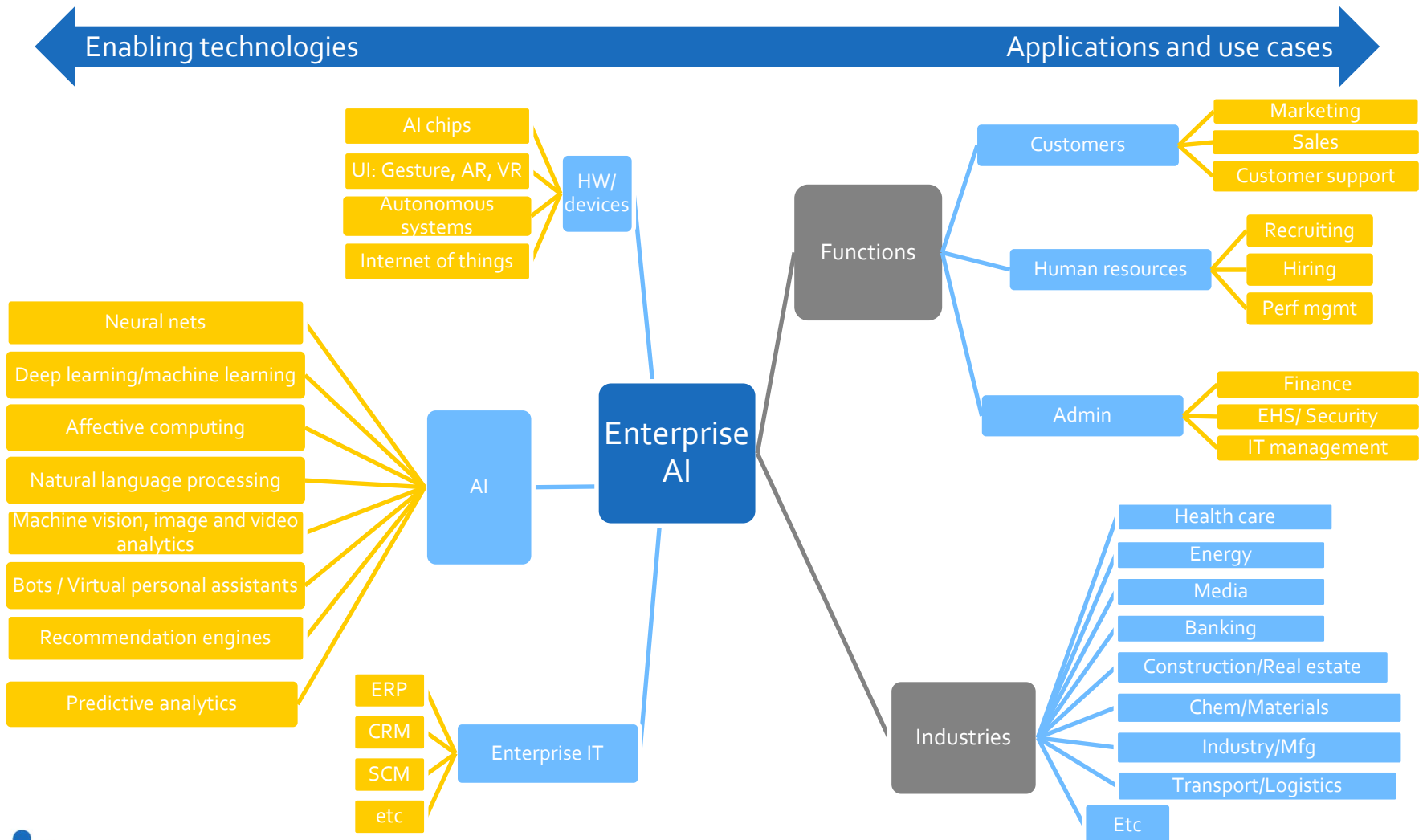
Forecasters have tried in vain to quantify AI's impact in dollar and industry terms:

- Tractica forecasts cumulative revenue for the sector will [total \\$43.5 billion worldwide during the entire period](#) from 2015 through 2024 (primarily from **advertising and media, financial services, manufacturing, oil and gas, and retail**).
- At the same time, a report in Market Research Store predicts it will be [\\$40 billion in the single year of 2022](#) with "key drivers of market growth include increased usage in 3D printers and adoption of digital assistance system in **health care and transportation** (and) gaming applications such as puzzle and chess games."
- One on Reports and Reports believes the [advertising and media, finance, and retail](#) sectors will be the drivers (and the market size will be \$5.05 billion in 2020).
- Frost and Sullivan estimates that the AI market [in health care alone will be \\$6,662.2 billion \(sic\)](#) in 2021.
- These and other market researchers have estimated the AI market's compound annual growth rate between 25% and 56% over the next 10 years, assumptions that lead to a tenfold difference in the high and low market sizes.

Clearly it's too early to expect credible industry size assessments (3D printing, really?) – a bit like estimating [the size of "the internet industry" in 1998](#). At the same time, it's clear there will be impacts; those impacts will vary by industry, and depend on the specific use cases and vendors (see next slide).

- Health care
- Energy
- Media
- Banking
- Construction/Real estate
- Chem/Materials
- Industry/Mfg
- Transport/Logistics
- Etc.

The landscape of enterprise AI's enabling technologies and functional and industry applications



Forecasts are meaningless without industry-specific use cases for AI

Also at AIWE, [Kogentix](#) CEO Boyd Davis talked about how his system's foundation in Cloudera Enterprise data hub, Hadoop and other open source technologies "enables companies to deliver machine learning on an enterprise scale" (see the [August 2, 2016 LRIBDAJ](#)). Its applications address functional needs like customer analytics, but also ones specific to an industry like **Energy**, with "Outage Forensics" to measure and foresee equipment failure, and "Guzzler Behavior Analysis" to examine wasteful energy consumption patterns.

The need to apply AI to industry-specific tasks (and challenges in doing so) is evident in other examples, like:

- **Construction and Real Estate.** Architecture was an early adopter of informatics-driven design, and the field of building information modeling (BIM) has embraced AI (see the report "[Beyond Material Innovations: How Construction Technologies for Digitization and Automation Will Compete and Influence the Industry](#)").
- **Chemicals and Materials.** AI's impact in materials will not be much in manufacturing, but large in R&D (see the reports "[Digital DNA: Accelerating Innovation with Information, Automation, and Open Source](#)" and "[Big Data and Analytics in Chemicals: From Cheminformatics and LIMS to Launch](#)"). Materials informatics is an area of intense interest, with efforts like the [Materials Genome Initiative](#) and companies like [IBM](#), [Nutonian](#), [Enterra Solutions](#), and [Citrine Informatics](#) all touting AI (see the [May 31, 2016 LRAMJ](#)).
- **Transportation/logistics.** Automotive is one of the industries feeling (or at least fearing) disruption via AI, as most strategists predict that autonomy will reduce the need for individually-owned vehicles. Shipping and warehousing will also be hit as AI improves demand forecasts, reducing the need for bulk storage (see the reports "[Towards Intelligent Intermodal Trade: Industrial Big Data and Analytics in Transportation and Logistics](#)" and "[Warehouse Robotics: Assistive Tools, or Replacements for Humans?](#)" and the [August 17, 2016 LRASJ](#)). Retailers will also feel the pinch as AI-enabled stores and supply chains combine, as they are with the Amazon Go store (see the [December 8, 2016 LRIBJ](#)).

AI offers abundant help to make health care better

Health care, from drug discovery to end-of-life care, is rife with opportunities for improvement that AI perfectly fits (see the report “[Industrial Big Data and Analytics in Digital Health](#)”). From a technical point of view, anyway. But in reality, the industry is technologically conservative, rigidly regulated, and economically fragmented, so it can take decades to adopt even obviously-needed, technically straightforward fixes.

Diving more deeply into some of the use cases where AI can help, we have found:

- **Image analysis.** AI can help balance workloads of the specialists trained to analyze medical images, while also enhancing their skill at seeing problems. [Arterys](#) provides a cloud platform to gather, process, analyze, and report on medical images from anywhere in the world.
- **Predictive, personalized recommendations.** Companies like [Deep Genomics](#) are using AI to see complex disease relationships and predict where cures might be found (see the [June 21, 2016 LRIBDAJ](#)).
- **Better diagnostics, based on years of stored data.** Using about 20,000 pediatric intensive care unit (ICU) encounters and 60,000 regular floor encounters, Children’s Hospital in Los Angeles is training neural nets to diagnose cancer earlier (see the [November 22, 2016 LRIBDAJ](#)).

AiCure	Artificial Intelligence platform for medication adherence tracking
Aira	Smart glass-based visual interpreter for the blind
AirStrip	Health care data analytics and integration
BioBeats	Artificial intelligence-based personal and corporate wellness solutions
Catalia Health	Health care robot for patient engagement
CloudMedX	Artificial intelligence-based analytics for health care
Genospace	Cloud-based data management and analytics for health care
Lumiata	Predictive analytics for patient care management
Molecular Match	Data analytics for treatment selection
Niesm	Remote epilepsy seizure monitoring
Palo Alto Scientific	Pressure-sensing insoles
PhysIQ	Personalized physiology analytics
Potbotics	EEG-analysis software for medical marijuana strain prescription
Quvium	Wearable cough monitor
ResultCare	Artificial intelligence solution for evidence-based medicine
Salu	Blood-pressure-measuring wearables
Secure-NOK	Cyber security for the oil and gas market
Vecna	Robotic and information technologies for health care

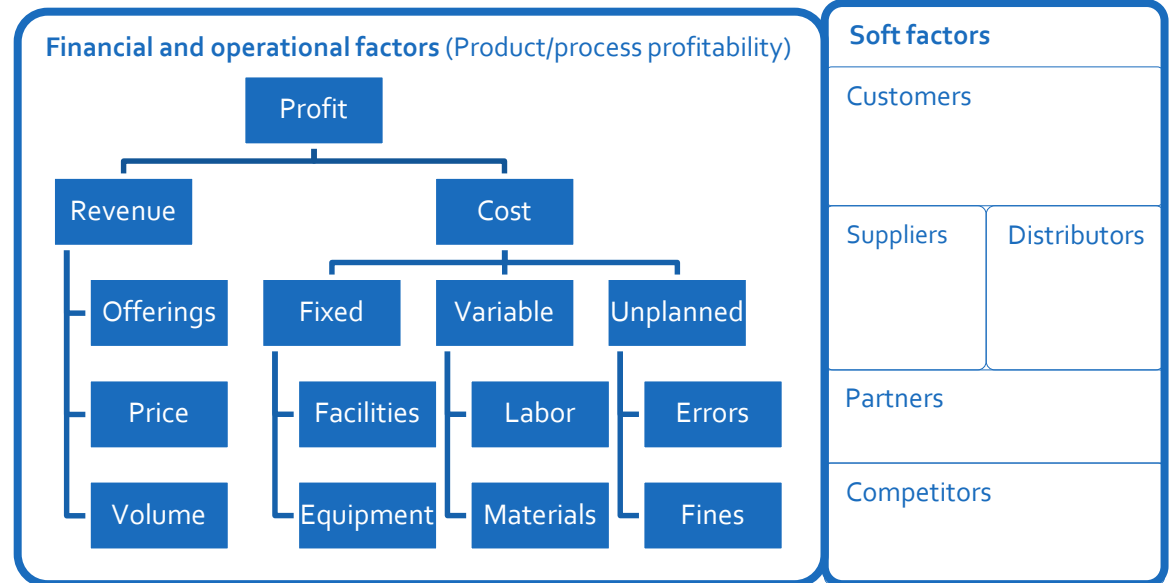
Incorporating enterprise artificial intelligence into corporate strategic directions

If 2016 was the year AI entered the enterprise, 2017 and 2018 will be when it moves from trials and pilots to delivering operational and financial results. But those results won't just show up magically – achieving them at a pace and scale greater than competitors will require management focus and planning. Corporate strategists need to set goals and take actions for implementing AI and dealing with its impacts on three levels:

- **Tactical.** Based on their promise for automating simple human tasks, CIO Magazine declared enterprise bots [“poised to disrupt the enterprise”](#) – a sure sign that the space is currently overhyped. But as fast as bots blew up in 2016, we expect them to become useful tools quickly, too. Avoid them as equity investments, but start to tinker with small-scale deployment in 2017. The examples described earlier in this report are the best places to start using AI for cutting costs initially, and driving new revenue later.
- **Strategic.** As noted earlier, each new wave of enterprise connectivity has changed the definition of what a firm is, expanding its boundaries and the scope of activities under its control – with massive implications obvious to logic and to history. In the context of open innovation, the boundary for what's considered “internal” and what's outside keeps spreading outward.
- **Societal.** The idea that machines are coming to take our jobs is an old one, but it happens to be largely true. It's not too early to start examining which occupations and industries will be most greatly impacted by enterprise AI, and to start taking precautions and using foresight to plan for the impacts.

Tactical steps: Break down the use cases into business cases for AI

- Building the business case for AI is not rocket science. Like any investment, its payback will come from reducing costs, increasing revenues, and unquantifiable “soft factors” – improvements in relationships and interactions with customers, suppliers, competitors, and other organizations adjacent to the company.
- For any purported benefit an AI vendor promises, clients should calculate the business case by looking at real costs to be saved or revenues to be gained. For example, in assessing the benefit of an AI chatbot for customer support, clients should look at the current costs of call center personnel, and how much time they spend on specific kinds of customer inquiries that could be automated: checking the status of the return, or answering a question about product features.
- By estimating what fraction of those calls could be handled by the AI chatbot, clients can estimate the benefit of the AI on the bottom line.
- Clients should also estimate the unquantifiable acts, such as the increase or decrease in customer frustration by dealing with a bot instantaneously, instead of a human after a five-minute phone wait.

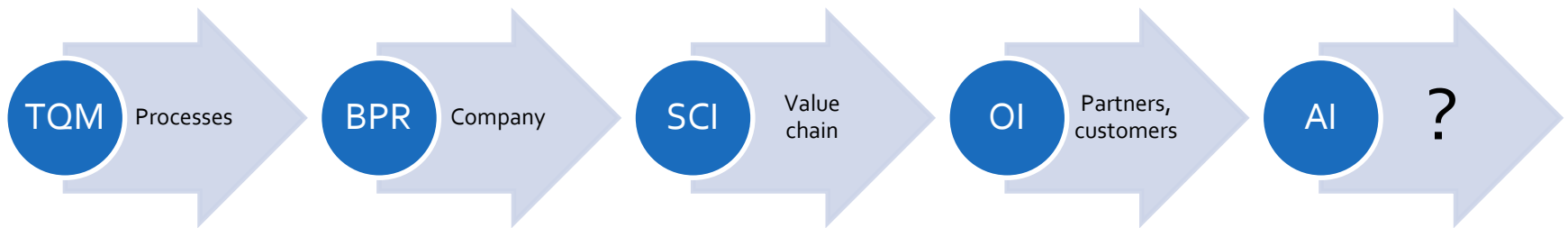
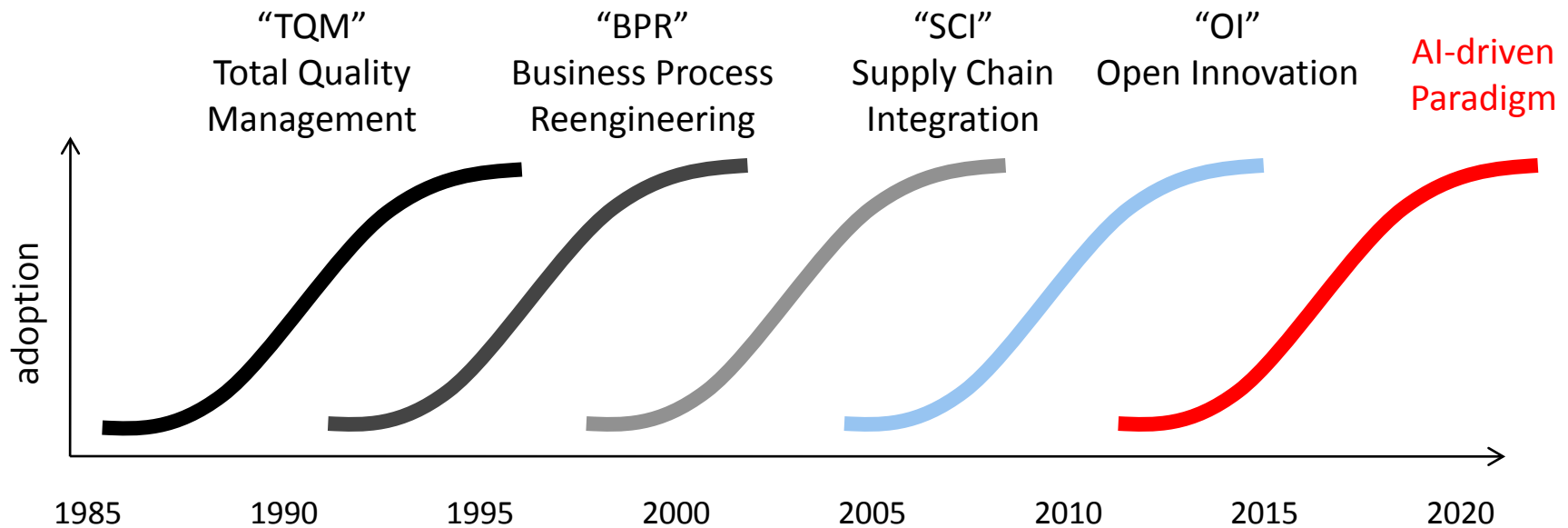


AI's impact on strategy: AI is extending the bounds of "enterprise" – again

ERP systems initially arose in the early 1990s to integrate what had, until then, been disparate, department-specific IT systems. Before ERP, there had been neither ability nor motivation for accounting systems to talk with factory-floor planning, for example; sales and HR were still using rolodexes and manila folders. In some cases, interdepartmental communication was a fireable offense akin to treason (indeed, in many company cultures, these silos still exist). Since then, our concept of an "organization" has continuously expanded (see following slide), as:

- **1980s – Factory and management automation.** Early enterprise computing was only about accounting, but by the 1980s, manufacturing resource planning (MRP) and management information systems (MIS) helped give a unified view of all the steps in a process, or activities in a department. **Total quality management (TQM)** was the buzz.
- **1990s – Personal computers arose.** Personal computers (PCs) and company-wide local area networks (LANs) were the impetus and enablers of what was called **business process reengineering (BPR) – the first time a company-wide view** was possible. Recognizing IT's strategic importance, MIS managers were elevated to the strategy-level Chief Information Officer (CIO), first in information-centric industries like banking, but eventually every field (see the [October 6, 2016 LRASJ](#)).
- **2000s – Global networks spread.** Soon thereafter, the world-wide web expanded IT's tendrils to suppliers' and buyers' systems, which had been accessible only via relatively expensive and narrowband, industry-specific networks like [AMADEUS](#) in airlines, or the [ODETTE Electronic Data Interchange \(EDI\) system](#) in automotive. SCM became part of enterprise software suites, enabling the "extended enterprise," as eCommerce and cloud computing accelerated the network-centric view of computing architecture. **Suppliers were integrated** into the organization's horizons.
- **2010s – Mobile devices proliferated.** The next wave was mobile devices and Web 2.0, bringing social media into the marketing mix, followed most recently by the internet of things and augmented and virtual reality – which ERP leaders like SAP are promoting (see the [April 12, 2016 LRIBDAJ](#)). **Customers are now** included in "enterprise," too, contributing ideas (in "open innovation") alongside outside partners and other adjacent organizations.
- **Now – AI is here.** But what, exactly, can AI bring to bear on enterprise, and who is poised to do it? More interestingly, **will AI expand the boundary of the organization yet again – and if so, how?**

AI's impact on strategy: Even more open innovation



Corporate strategy in an AI-first world

If AI-first is the new strategic game, what are its goals? How is it played, and who will be its winners and losers? Looking at past waves of digital transformation, it's clear that integration has facilitated consolidation, allowing the players get it right to take a dominant space in the market. And that's certainly not just IT vendors, although obviously Microsoft's position in PCs, and Google's in mobile operating system android are nothing to scoff at.

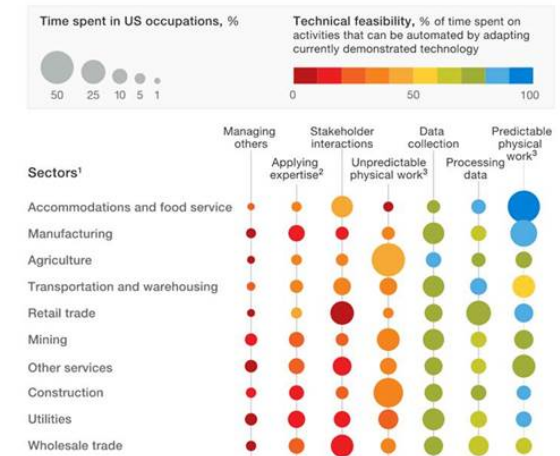
For buyers of enterprise technology, AI could have impacts like **PCs in banking, letting any bank go global, and ultimately leading to a cashless society**. Personal computing in the 1990s cut back-office costs for banks – a tactical benefit. But strategically, PCs led to the explosive global growth of automated teller machines (ATMs) that not only led to branch closures, but let any bank be global.

*In spite of innovations in modular manufacturing and an associated increase in reliability and reduction in service costs, the operation of ATMs remained expensive. The need for dedicated telephone lines limited them mainly to bank branches or very high volume non-bank locations such as busy train stations and big airports. **This was to change with the advent of digital telephony and the introduction of Microsoft Windows as the core of the operating system.** The ATM then effectively became a terminal of the bank's central computer, enabling functions such as remote diagnostics and integration with credit card clearing networks.... Thanks to integration, we can travel almost anywhere in the world with just a plastic card in our wallet, confident of access to our bank accounts and the ability to obtain local currency. ([ATM Marketplace, March 15, 2013](#))*

Thanks to PCs, the rise of ATMs led to the widespread use of ATM cards, which in turn led to commonplace use of credit, debit, and other cards for retail payments 15 years later. Today, 10 years after that, cards are used to pay online and via mobile devices, thanks to add-ons like Square readers. While it would have been nearly impossible to envision this outcome in the early 1990s, it's equally obvious that only by applying the technology early to find out how it works, could companies be positioned to see the step that would follow next.

Where AI strategy meets society: Destroying and recreating jobs

- **Yes, AI will take your job (or somebody else's).** Another lesson from past waves of enterprise technology adoption is that the AI will eliminate many jobs: in the past it was secretaries, bank tellers, journalists, and travel agents, and with AI will be call center employees, machine inspectors, retail employees, and HR recruiters. A [2013 Oxford University study](#) guessed that AI could take over nearly half of all U.S. jobs, and more recently [McKinsey presented a similar take \(45%\) at AIWE](#) (see right).
- **New jobs will be designed around AI.** Of course, new jobs generally arise to take their place. What often happens is that the opportunity to automate a task shifts the task so it is organized for automation. In other words, we might reorganize the way items are packaged and stored specifically so they will be more robot-friendly, or change the way we speak and write – as we all have learned to type and text and use a mouse – in order to better communicate with AI agents, systems, and interfaces (see the report [“AIUX: The Artificial Intelligence User Experience”](#)).
- **Examples are already evident.** A good example is shipping containers – we now design ports to use containers, whereas initially we used to design containers to fit the needs of ports. Music changed to suit record players (packaged into albums that would fill a standard record), FM radio, music videos, and now streaming. Food packages change to suit convenience stores or big-box retailers, and AI is already happening in downstream logistics, with Amazon and Beam's human-free stores (see the [December 8, 2016 LRIBJ](#) and the report [“Warehouse Robotics: Assistive Tools, or Replacements for Humans?”](#)).



McKinsey predicts that “as many as 45% of the activities individuals are paid to perform can be automated by adapting currently demonstrated technologies”

Recommendations for technology vendors for today to 2018

As mentioned earlier, AI is rapidly becoming a feature of large-scale enterprise software offerings. It's far too early to call winners and losers, but through acquisitions, internal work, and market traction, we already see:

- **Leaders emerging with initial product and customer wins.** SAP has also staked out key advantages by integrating ML and PA with Hana, and in HR with SuccessFactors. Salesforce is deeply invested in [AI for its core enterprise offerings, salesforce automation \(SFA\) and customer relationship management \(CRM\)](#). Even as the leader by far in the space, it sees AI as a potential competitive threat, which a startup could use to obliterate [it the way it used cloud and SaaS to obliterate then-leader Siebel](#).
- **Surprise entrants surpassing napping incumbents.** Speaking of Siebel, Oracle acquired its post-Salesforce remains, but Oracle only recently jumped on the AI bandwagon. It announced cloud and data-centric "[Adaptive Intelligent Applications](#)" in September 2016, studiously avoiding calling anything "AI," although it is using ML. Nvidia and Softbank have stepped in to an opportunity that rightly should have been Intel's alone. Baidu, Amazon, and Facebook are using AI to creep up on Microsoft, Google, and Apple.
- **The window of opportunity for start-ups will close.** Data science and integration experts like Dataiku, Dato, and [Skytree](#) will need to find a corporate parent, as their ability to stay afloat and sell a product independently will diminish as the ERP enterprise suites expand. Increasingly, AI will be a feature of their products, as opposed to a standalone product in its own right. As that happens, startups should look to be acquired by incumbents outside of enterprise software that are looking to use data, analytics, and AI to enter the enterprise software space, like GE is doing with Predix and Monsanto did with Climate Corp. Another strategy is to become an "AI middleware" layer, unifying what are likely to be disparate systems for at least five or more years to come.

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