Deloitte.

Technology and Disruption

Leveraging Innovation to Enhance Productivity

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Casualty Loss Reserving Seminar
Anaheim, CA
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Agenda

1. Background
2. Relevance to actuaries
3. Advanced technologies
4. Implementation using “Pixelation”
5. Concluding remarks

CAS Anti-Trust Slide

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Background

Polling Question 1

How would you respond to this question?

The actuarial function at my company has done a good job at finding ways to leverage technology to improve productivity.

a) True

b) False

Polling Question 2

What portion of your usual day-to-day job do you believe could be impacted by new technologies in the next 3 years?

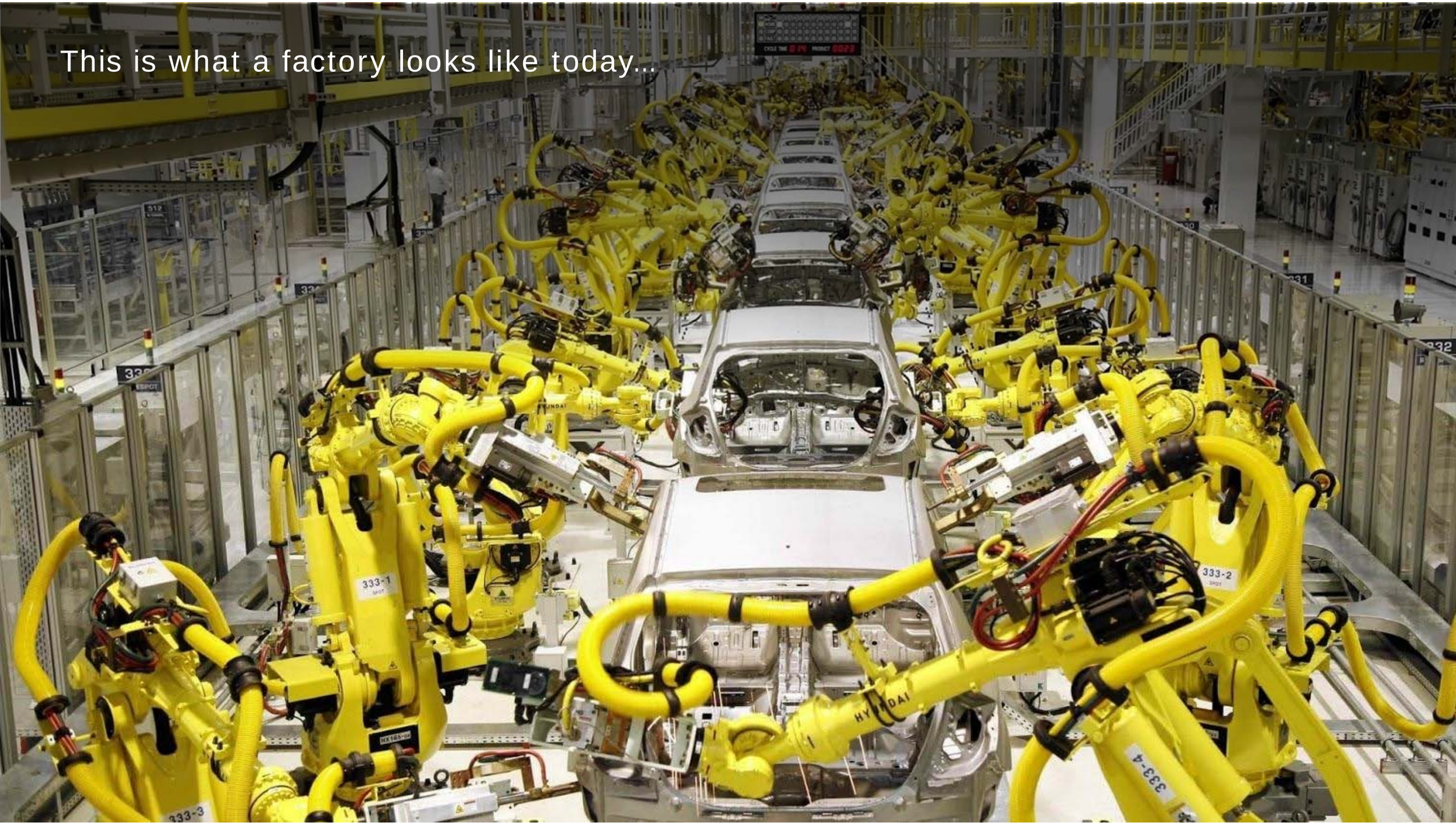
a) None

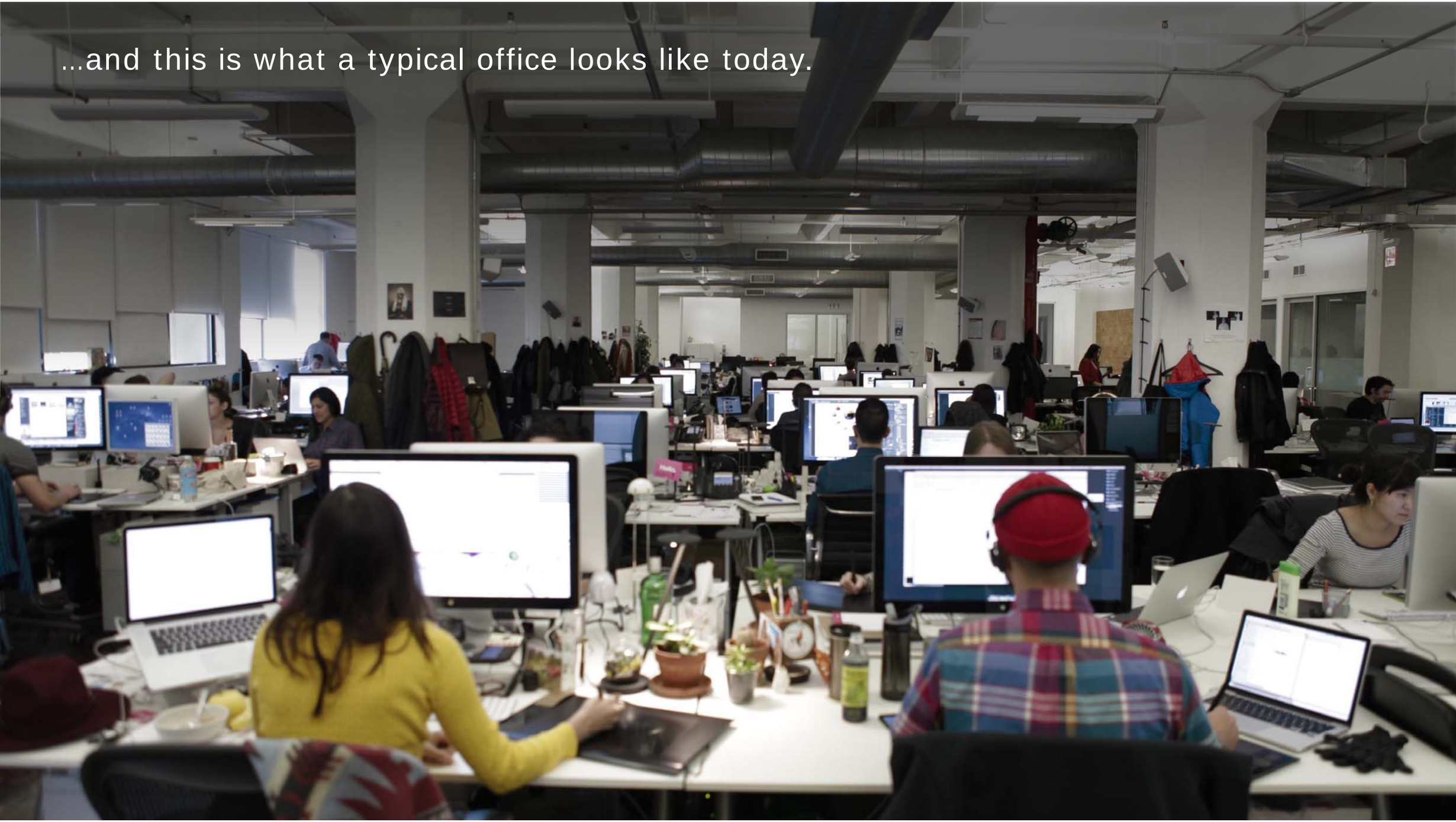
b) <25%

c) 25-50%

d) 50-75%

e) >75%


This is what a factory looks like today...
333-1
333-2
333-3
333-4
HYUNDAI


...and this is what a typical office looks like today.

Replication vs. Innovation

"With only replication and *without innovation*, output will increase in proportion to capital and labor inputs." …

"By contrast the successful introduction of new products and new or altered processes, organization structures, systems, and business models **generates growth of output that exceeds the growth of capital and labor inputs.**"

– *Long-term Estimates of U.S. Productivity and Growth*, May 2014

There are three options to increase overall output:

Work more hours

Hire more people

Innovate!

By the numbers

25%

Productivity improvement in the late 1800s due to steam power[1]

-1.1%

2008-2016 labor productivity growth rate deviation from the 70-year average

80%

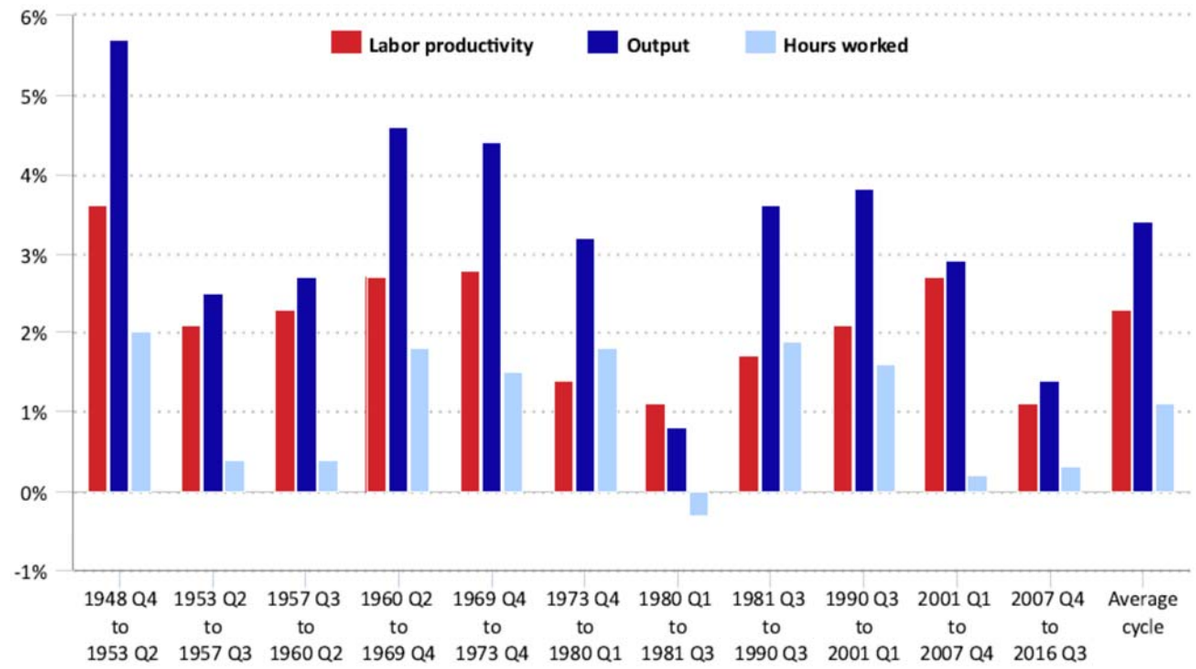
Impact on Model T production time from the assembly line[2]

[1] "Steam Power, Establishment Size, and Labor Productivity Growth in Nineteenth Century American Manufacturing", National Bureau of Economic Research, January 2006
[2] History.com

Productivity in US

Since the Great Recession, productivity increases in US have stagnated to the lowest levels since the 1980s.

Chart 1. Labor productivity, output, and hours worked: average annual growth rates during business cycles, nonfarm business sector, 1948–2016

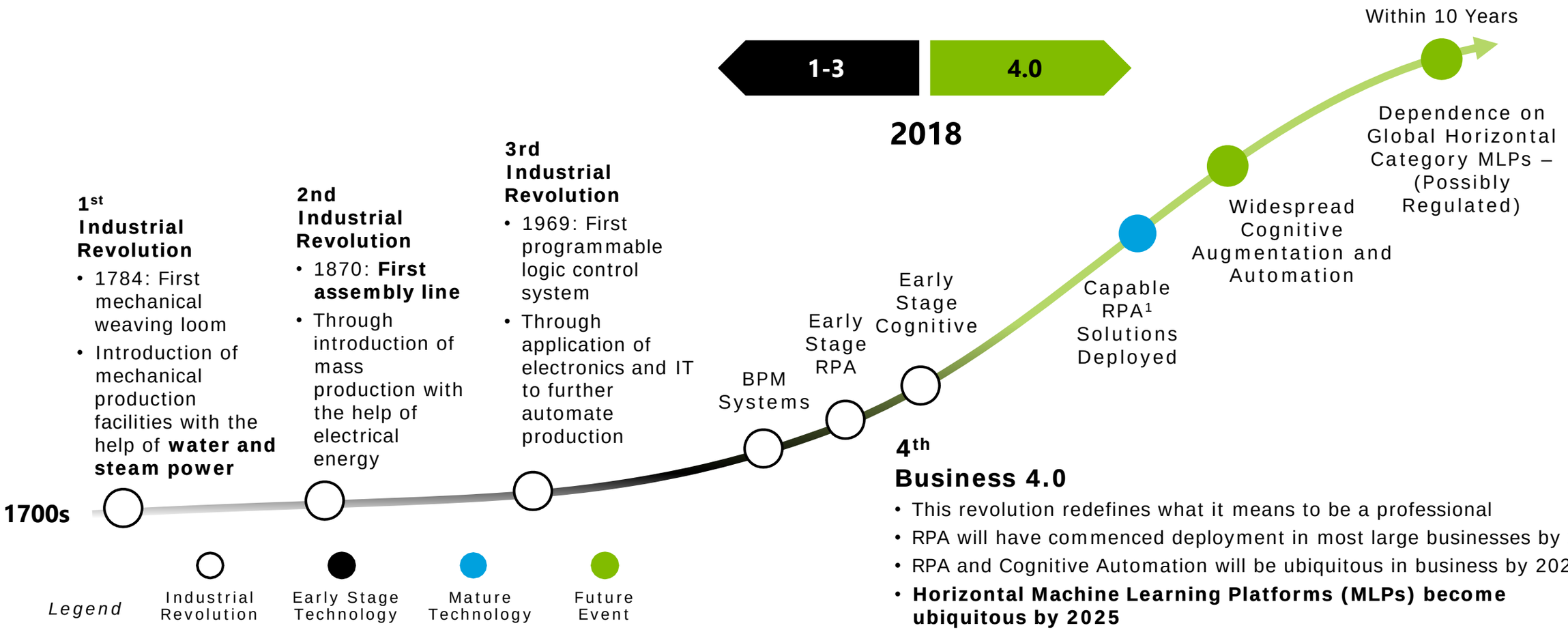


Click legend items to change data display. Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics.

"Productivity is the most important determinant of the growth in living standards over the long run…"

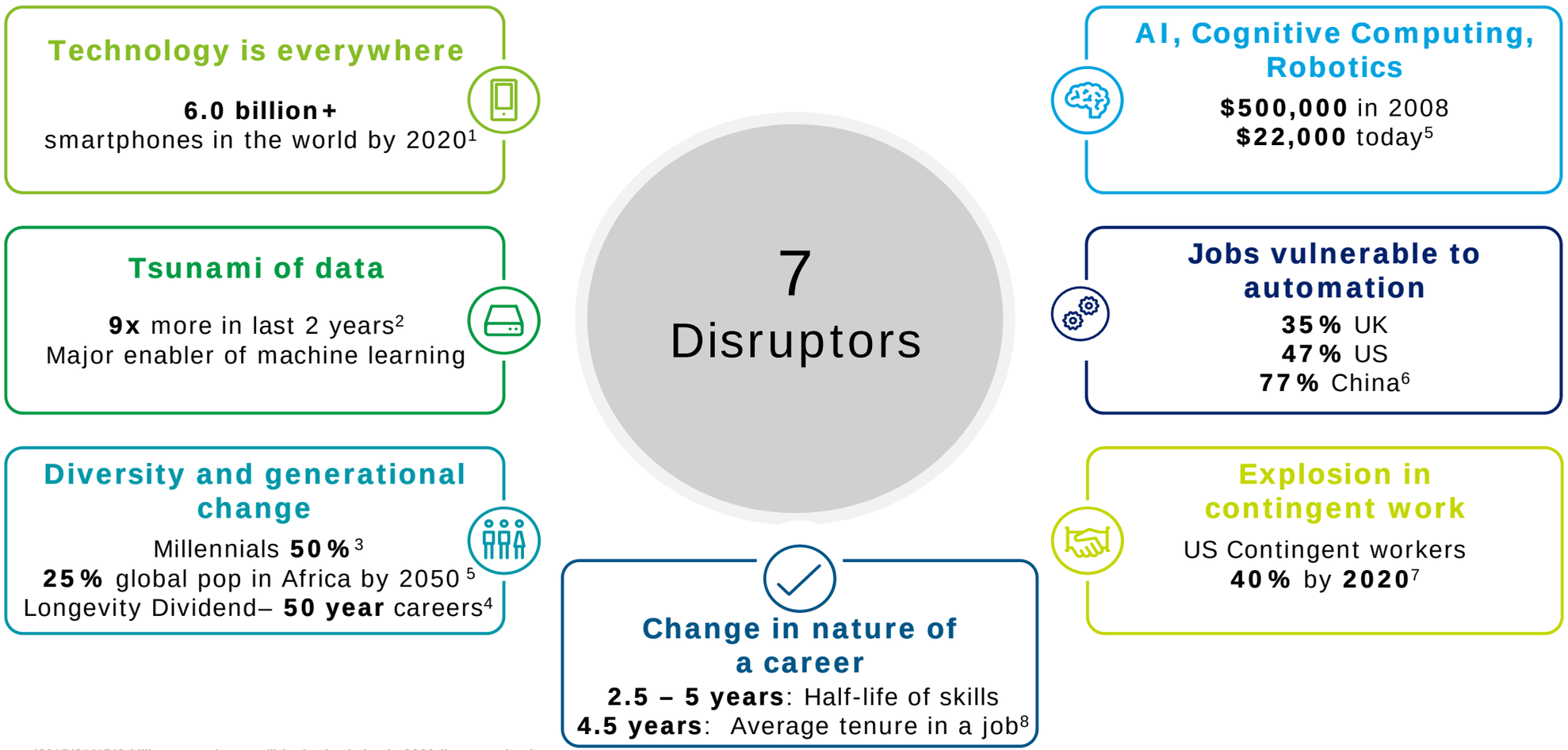
– *Why is US Productive Growth So Slow; Possible Explanations and Policy Responses*, The Brookings Institution, September 2016

We are on the cusp of “Business 4.0”



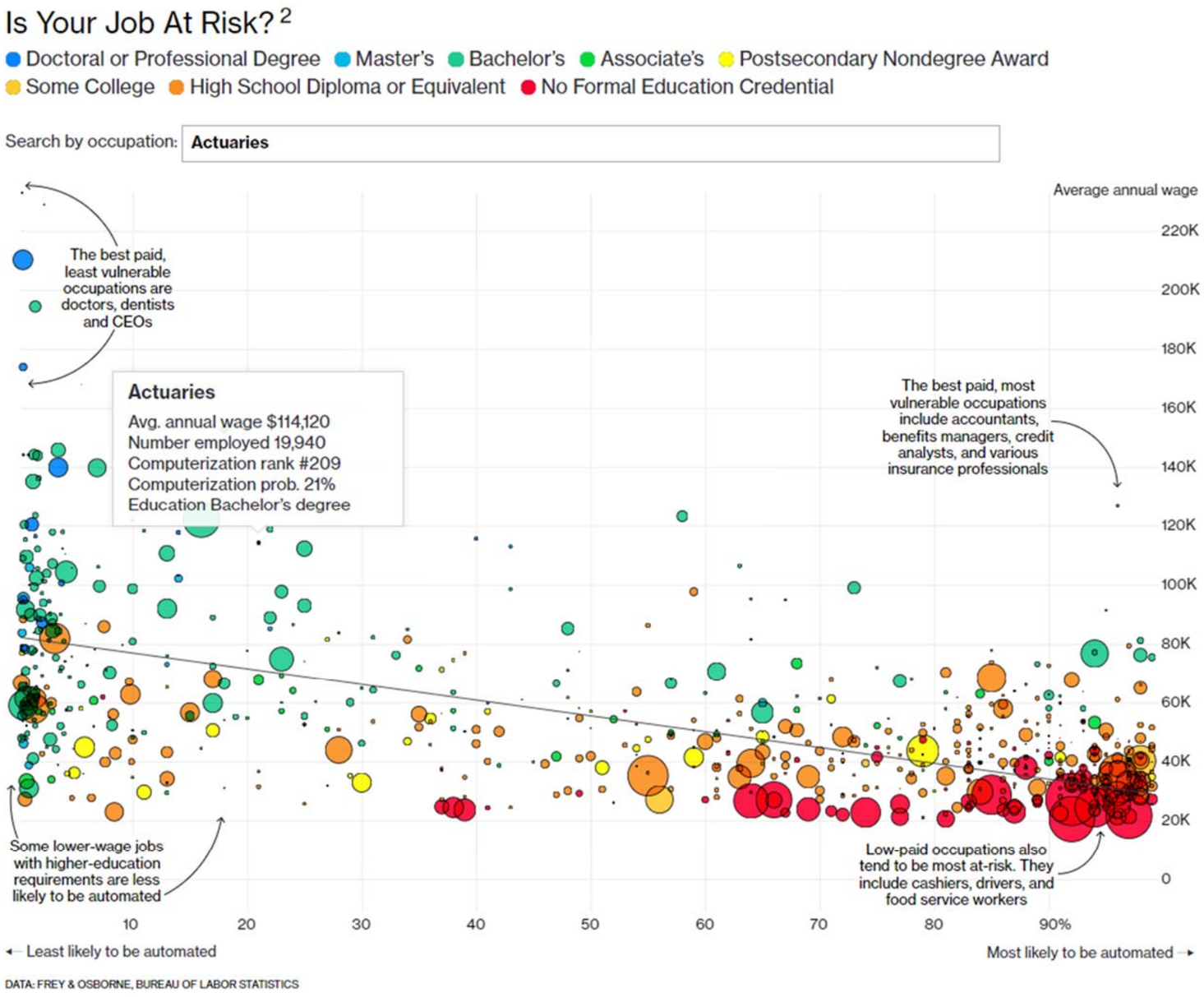
[1]Robotic Process Automation
Source: Industry 4.0: Challenges and Solutions for the Digital Transformation of Exponential Technologies, Deloitte AG, 2015 and Deloitte proprietary research
[2] “Steam Power, Establishment Size, and Labor Productivity Growth in Nineteenth Century American Manufacturing”, National Bureau of Economic Research, January 2006
[3] History.com

Several disruptors will enable the next big wave of change and opportunity



1 https://www.cnbc.com/2017/01/17/6-billion-smartphones-will-be-in-circulation-in-2020-ihs-report.html
2 https://www-01.ibm.com/software/data/bigdata/what-is-big-data.html
3 Annual Global Millennial Study, https://www2.Deloitte.com/uk/en/pages/about-Deloitte-uk/articles/millennial-survey.html
4 https://www.newscientist.com/article/mg23130810-800-the-100year-life-how-should-we-fund-our-lengthening-lives/
5 https://www2.deloitte.com/content/dam/Deloitte/il/Documents/human-capital/Thriving_in_times_of_digita_disruption.pdf
6 http://www.oxfordmartin.ox.ac.uk/downloads/reports/Citi_GPS_Technology_Work_2.pdf
7 Intuit 2020 Report: Twenty Trends that will Shape the next Decade https://http-download.intuit.com/http.intuit/CMO/intuit/futureofsmallbusiness/intuit_2020_report.pdf
8 https://www2.deloitte.com/content/dam/Deloitte/global/Documents/HumanCapital/dttl-hc-english-opentalenteconomy.pdf

Relevance to actuaries



https://www.bloomberg.com/graphics/2017-jobs-automation-risk/

The actuary of today

The opportunity for actuaries to provide deep business insight is limited by tight timelines, process inefficiencies, and fewer resources just to name few.

Representative Actuarial Pain Points

- **500+ spreadsheets** utilized to perform quarterly loss reserve reviews
- **10,000 unique tools** and spreadsheets required for monthly actuarial financial reporting processes
- **90 people** involved in **a 6 month** process of updating regulatory memos and reports
- 1,500 hours spent annually **drafting 500** actuarial reports after analysis has been completed
- 1,000 model output files **manually copied** and aggregated to refresh Actuarial results
- Data limitations **restrict ability to understand** profitability at granular levels
- Users wake up at **2:00 a.m.** to confirm models have successfully completed and to kick-off next job
- **300 plus Actuarial** models all need to be maintained, updated, and launched manually and reconciled
- Company produces **150 product filings** every year
- Decentralized business model has **inconsistencies and redundancy** in roles, tools, and approach

The role of the actuary can be redefined and refocused on more value added and strategic activities – with a new focus on productivity, business insights, and performance

Polling Question 3

With respect to common drains on productivity, which of these resonate most with you?

a) Too many spreadsheets!

b) Disparate data sources!

c) Time-consuming, manual processes!

d) Something else…

e) All of the above

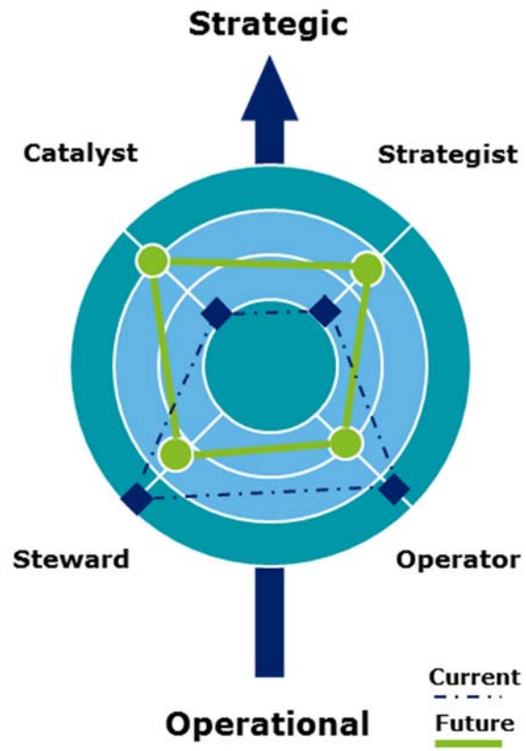
So what are insurers doing?

There are numerous challenges across the Insurance industry driving the need for Actuarial Modernization.

Insurers are trying to address similar pain points in the management of financial results, reserving, pricing and ERM …

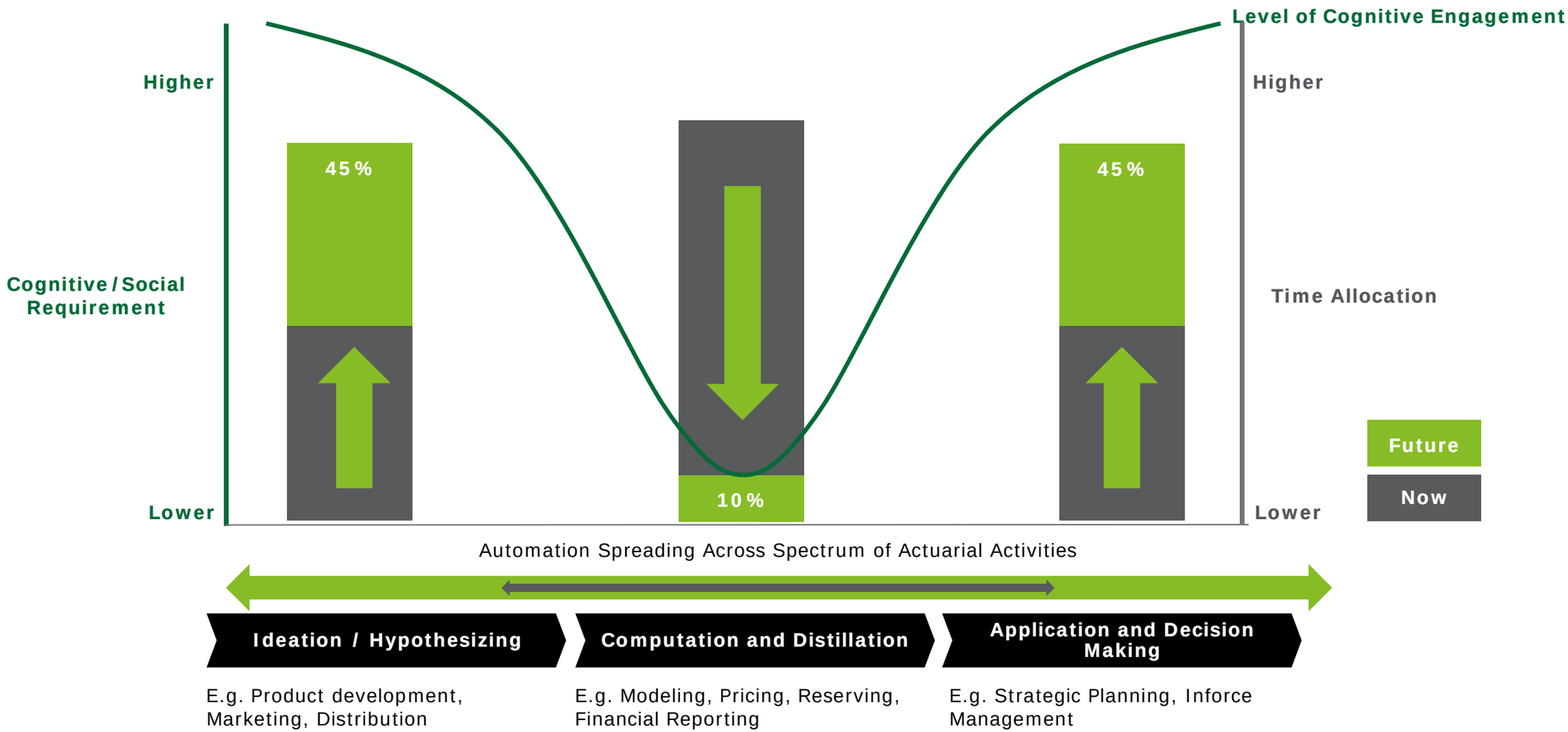
Productivity Drains	Opportunity
Patchwork of Outdated Systems	Leading Actuarial Systems
Disconnected Operations	Integrated and Connected Services
Constrained by Process and Data	Focus on Value Add Activities
Actuaries Performing IT Roles	Automate IT Tasks
Reactive Operations	Proactively Analyze Results
Limitations in Governance	Embedded Governance
Emerging Regulations	Readiness for New Regulations

…and are making targeted investments to shift the focus of Actuaries into more strategic activities

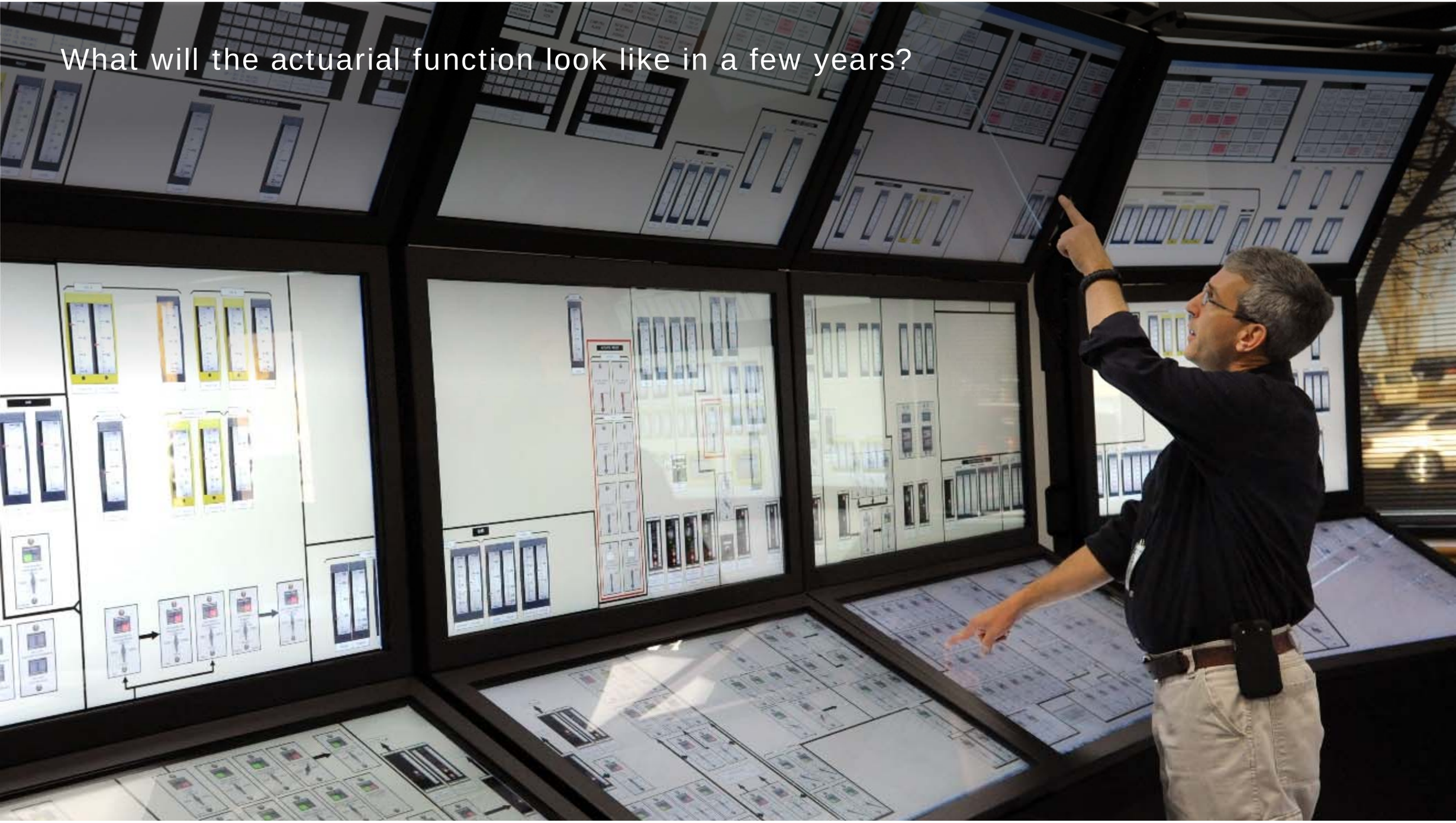


Current and future state of actuarial functions

The nature of the Actuarial Profession is being disrupted by technological and talent/operating innovation. This will shift human work towards higher cognitive and value-added Actuarial activities.

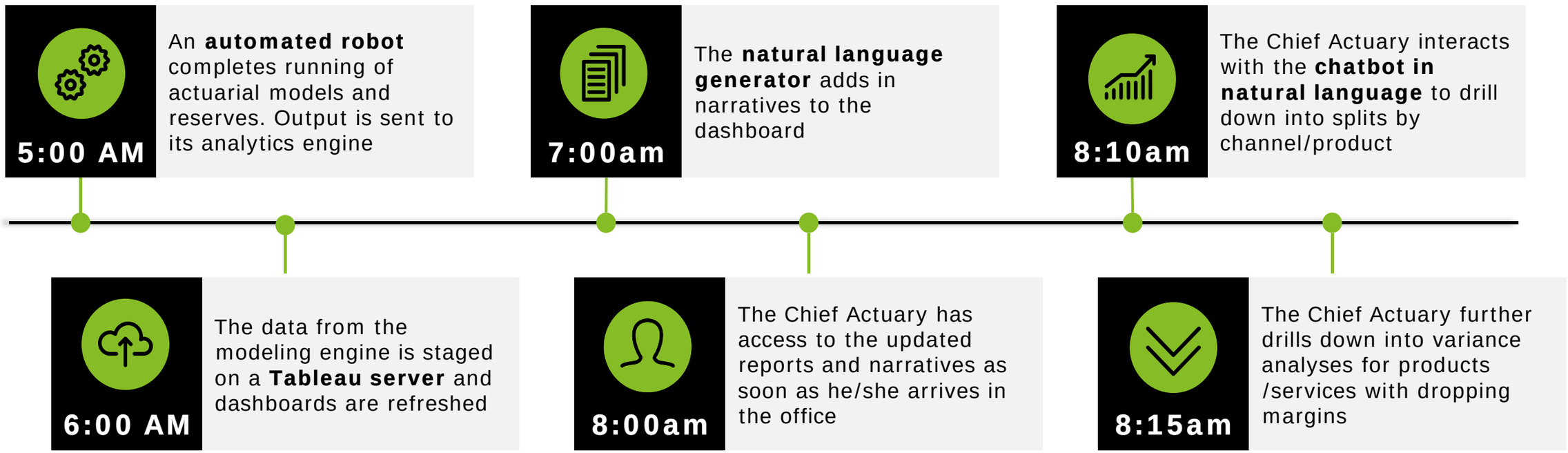


What will the actuarial function look like in a few years?



As the industry progresses, actuarial organizations will evolve…

Imagine A World Where…



All of the technologies required to realize this vision of the future exist today

Advanced Technologies

Modernization and exponential technologies

Several technologies have growing relevance within the actuarial workflow.

Core Modernization

Here Now

Cloud

Visualization

In-Memory Computing

Process Robotics

Exponentials

Emerging Quickly

Advanced Analytics

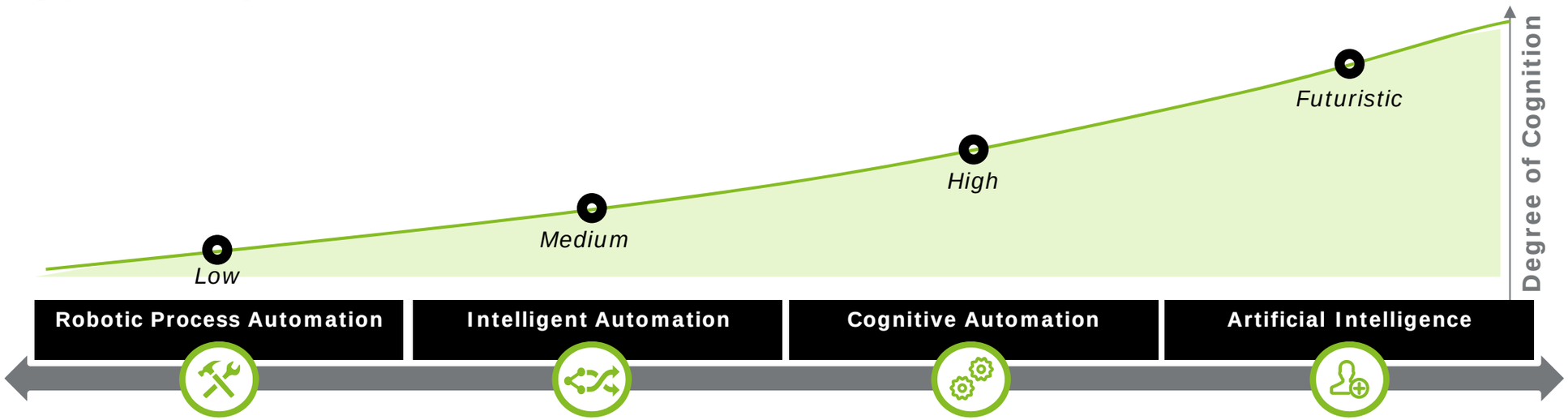
Crowd Sourcing & Competitions

Cognitive Computing

Focus Today

Spectrum of cognitive technologies

New technologies show significant application for the actuarial profession, delivering substantial savings and improving productivity.



"Mimics human actions"

Computer program or "robot" that mimics rules-based actions in existing applications

Applications: Invoice receiving, 3-way matching, customer credit assessment, reconciliation etc.

"Mimics human judgment"

Tools that allow for the natural language generation based on a dataset and business rules

Applications: Invoice processing and filing, workers comp. filing, underwriting advisor etc.

"Augments human intelligence"

Computerized models that simulate human thought processes through predictive decision making

Applications: Creation of competitor analysis, advanced planning & predictive forecasting etc.

"Mimics human intelligence"

The theory and development of computer systems that can perform tasks which normally require human intelligence

Applications: Self-sustaining reconciliations etc.

Technology is a source of sustainable cost reductions and improved productivity

What is Robotics Process Automation (RPA)?

RPA is delivered through software “bots” that can be configured to undertake rules-based (deterministic) tasks; it is not actual robots in a production line.

RPA is…

- Computer-coded software
- Programs that replace humans performing repetitive rules-based tasks
- Cross-functional and cross-application macros

RPA is not…

- Walking, talking auto-bots
- Physically existing machines processing paper
- Artificial intelligence or voice recognition and reply software

What it can do

- Open emails and attachments
- Copy and paste items
- Move files and folders
- Log into web / enterprise applications
- Fill in forms
- Scrape data from the web
- Connect to system APIs
- Make calculations
- Extract structured data from documents
- Collect social media statistics
- Follow “if/then” decisions/rules

What it cannot do

- Work with unclearly defined processes
- Handle unstructured data
- Have a conversation with humans
- Adjust on the fly
- Manage unpredictable processes
- Change process automation steps without human operation
- Adapt to frequent changes
- Make judgments and decisions
- Force human action
- Resolve exceptions

Benefits of RPA

RPA can be executed with low costs, high accuracy, and high scalability, with the potential to produce transformative change and benefits.

Key Benefits	
Efficiency & Quality	• Robots perform tasks with a **high degree of accuracy** and operate 24x7 leading to **high-throughput** • Robots can work up to 15x faster than humans in some cases, **dramatically reducing time spent on process execution** • RPA streamlines, standardizes and optimizes the processes, **improving quality and reducing costs**
Scalability & Expertise	• A process can be automated quickly, **reducing reliance on recruitment to handle workload spikes** • RPA helps engage talent by **freeing time to work on strategic roles** and develop new competencies / expertise
Insource & Control	• RPA opens new doors for insourcing processes by providing **greater control** over service delivery model
Governance & Compliance	• Robotic platforms are **secure, audited and managed** within an IT corridor of governance • RPA **improves data quality / consistency** that can result in **better analytics, insights and increased revenue**
Competitive Advantages	• RPA has a **short payback period** since robots drive existing applications with low integration costs • RPA provides **high potential ROI** which can be leveraged to drive critical initiatives

Re-engineer core processes while automating the function

Revenue and profit generated becomes less dependent on the ability to scale labor; automation enhances the abilities of current resources

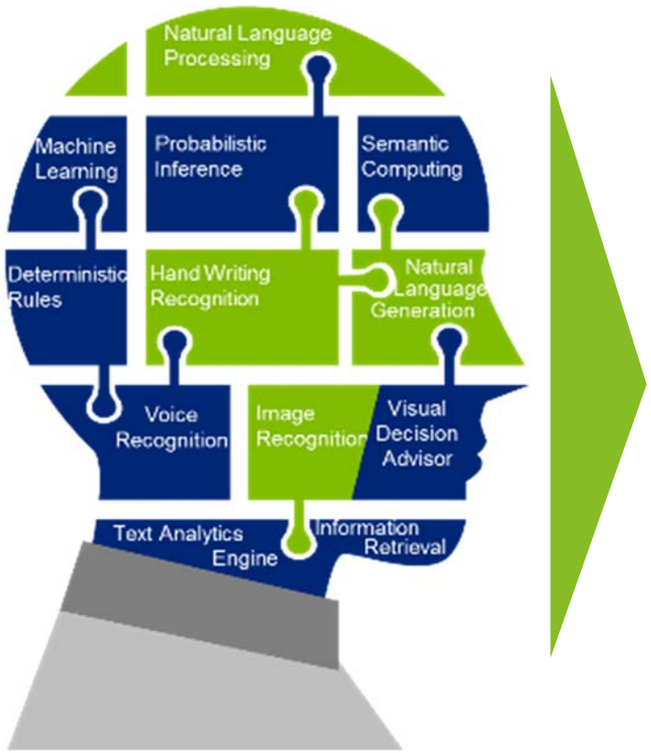
Rapidly scale up or down depending on the nature of the business issue

Process owners elevated to process transformation leaders and robot designers as production becomes more automated

15 – 90% cost reduction opportunity depending upon the characteristics of the functions selected for automation

What is Cognitive Automation?

Cognitive systems employ technology and algorithms to automatically extract concepts and relationships from data and “understand” their meaning, learn independently from data patterns and prior experience and extend what either humans or machines could do on their own.



- Emulates strengths of the human brain, including parallel processing & associative memory
- Enables natural language processing of structured and unstructured data.
- Understand/leverage big data in real time
- Use machine learning to develop context-based hypotheses
- Convert text, images, and voice data into meaningful concepts and relationships
- Make reasonable predictions and recommendations based on learned concepts and relationships
- Understand environment and present contextually relevant information
- Ability to automatically process, filter, and extract key information from a vast amount of data
- Interact with humans in natural language, voice, and text

Cognitive computing can push past the limitations of human cognition and connect the dots between big data, enabling more informed decisions.

Robotics vs. Cognitive Automation

Technology is evolving rapidly, opportunity exists to exploit disruptive technologies to increase the value and pace of change of information assets across service, process, and workforce transformation.

Realm of Process Robotics (RPA)

Realm of Cognitive Automation

"Mimics Human Actions"

RPA Realm:
- Rules-based tasks
- Operational processes

RPA Technologies:
- Robotic Process Automation
- Rules engines
- Event stream / complex event processing
- Human-in-the-loop process automation

Potential RPA Applications:
- Reporter – Automated story writing
- Back Office – All "swivel chair" clerical tasks
- Customer service – Mass customization of automated CRM
- Data reconciliations and report generation

"Augments Human Intelligence"

Cognitive Realm:
- Cognitive analytics
- Decision making

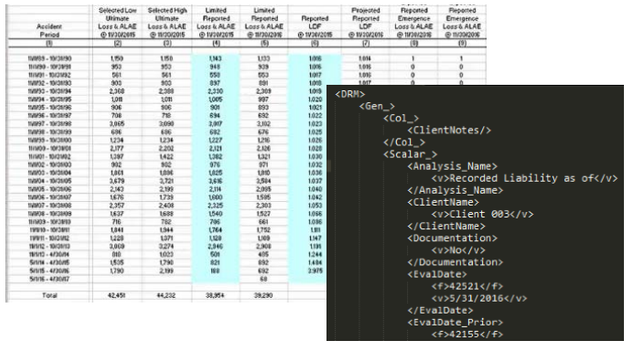
Cognitive Technologies:
- Deep learning
- Supervised machine learning
- Integrated Cognitive Computing Platforms (e.g. IBM Watson)

Potential Cognitive Applications:
- Pharma – Cognitive creation of new drugs
- Hedge Fund – Algorithmic trading
- Banking – Financial crime detection
- Actuarial – advanced modeling techniques

What is Natural Language Generation (NLG)?

Auto-generate parts of actuarial memorandums with the goal of reducing manual reporting, improving time-to-market, improving consistency of communication.

INPUT



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Ingests the following components:

- Current Actuarial Liability data such as reserve analysis for each line of business
- Past-year data/analysis to perform retrospective analysis
- Data structure, which can be visualized in Excel workpaper via macro

OUTPUT

Based on our procedures performed, we conclude that the external actuarial specialist used appropriate actuarial methods, and the results produced by its assumptions and selections are a reasonable provision for the Actuarial Liabilities in the aggregate. We therefore conclude that the estimates provided by the external actuarial specialist are reasonable.

Summary of Actuarial Liabilities (000's) as of December 31, 2016 on an Undiscounted Basis — Net of Anticipated Insurance Recoverables

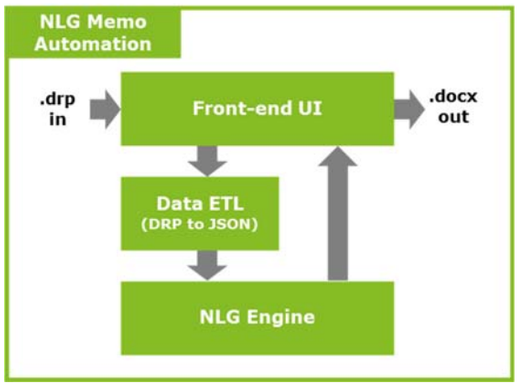
	Low	High
Deloitte Estimated Actuarial Liabilities	$4,565	$6,266
Entity Recorded Actuarial Liabilities	$6,012	
Difference — Redundancy/(Deficiency)	**$1,447**	**$(254)**

Our procedures performed resulted in a range of reasonable Estimated Actuarial Liabilities net of Anticipated Insurance Recoverables on an undiscounted basis of $4.6 million to $6.3 million as o December 31, 2016. The Entity's Recorded Actuarial Liabilities as of December 31, 2016 are $6.(million. Therefore, we conclude that the Entity's Recorded Actuarial Liabilities net of Anticipated Insurance Recoverables on an undiscounted basis are reasonable.

Automated parts of the memo, including:

- Substantiation to the summary table (produce variable narratives for financial items selected though human analysis)
- Substantiation to the Retrospective Procedures analysis (such actual vs expected, year over year changes, etc.)
- Templated/boilerplate descriptions

IMPACT



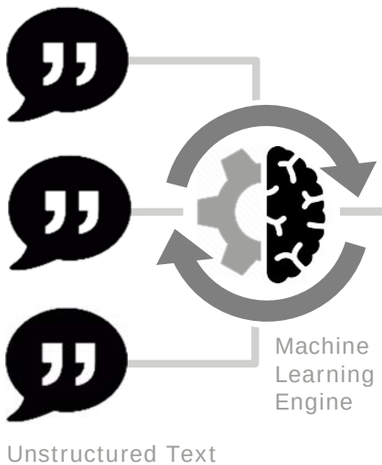
The solution enables company to:

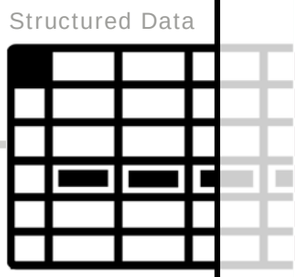
- Reduce time spent on manual reporting
- Reinvest hours to more value-added opportunities
- Improve quality and consistency of communication
- Improve delivery from data to actionable insights

Natural Language Processing (NLP) vs. Natural Language Generation

Natural Language Processing reads and Natural Language Generation writes.

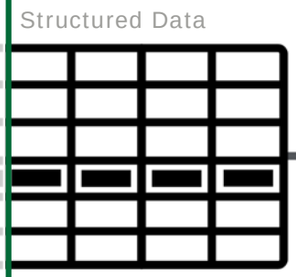
Natural Language Processing

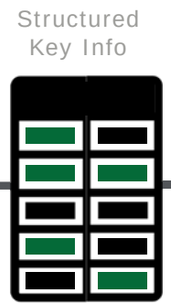


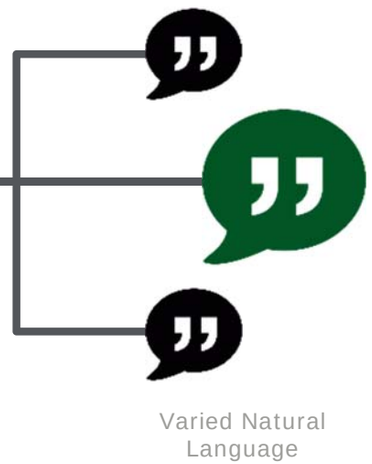


- Ingests unstructured data (emails, tweets)
- Output designed for machine consumption
- Cognitive capacity lies in ability to disambiguate variations in speech
- Driven by machine learning

Natural Language Generation







- Ingests structured data (spreadsheets)
- Output designed for human consumption
- Cognitive capacity lies in ability to imitate natural variability in human speech
- Driven by rulesets

Key Takeaways

The **high volume** of data sources and inputs make actuarial processes good candidates to be augmented with robotic automation

Interactions with internal and external crowds should be designed differently. Each crowd is **incentivized and motivated** in their own unique way

Cognitive learning software can be used to identify trends in actuarial data and learn from **human-provided corrective feedback** to become smarter and more effective

Natural language generation and processing could simplify the process taken to develop opinion memos, actuarial reports and documentation that are frequently **hundreds of pages long**

Surges in demand for actuarial services has led to a potential opportunity to incorporate crowdsourcing to address specific tasks

Robotic automation and crowdsourcing **cannot replicate the breadth of work** done by an actuary. Instead, it can be leveraged to make the actuary more effective and efficient

Polling Question 4

Which technology resonates most with you?

a) Robotics Process Automation

b) Cognitive Automation

c) Natural Language Processing

d) Natural Language Generation

Implementation using “Pixelation”

Pixelation comes from the world of digitized images

When an image is broken down into its component pixels such that you can better identify its building blocks

Pixelation deconstructs a task/project to break it down to its core components (pixels)

Identify the components of a project in order to architect the right approach and leverage the best mix of technologies, people and crowds to deliver results.

A common place where Pixelation is used is with Crowdsourcing

Crowdsourcing can be used for design, development, and testing activities that require a reliable source of skill or technique. The power and flexibility of crowdsourcing allows you to use the community for individual project components to facilitate an end-to-end solution.

How it works

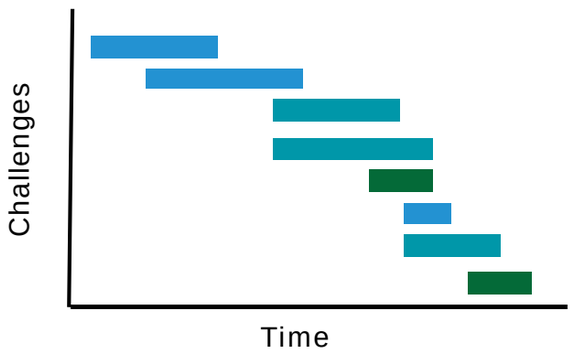
1.Requirements

Design and development projects can start with a rough idea or a full requirements document.

Whiteboard Mockup or **Scope survey** or **Detailed requirements documents**

2.Gameplan Creation

A gameplan breaks the project into small, open competitions that attract hyper-specialized competitors. Deliverables iterate and build on each other until the final product is complete.



3. Challenge Execution

Design Challenge	Crowd submits checkpoint designs	Sponsor provides direction & feedback	Crowd incorporates feedback	Sponsor selects winners & requests final fixes
Development Challenge	Crowd submits code or algorithm	High ranking crowd members review and score submissions	Scorecards determine challenge winners	
Testing Challenge	Crowd tests and finds bugs	Bugs are reviewed & prioritized	Crowd submits bug fixes	Co-pilot tests and deploys fixes

Why it works

Statistics

The scale and specialization of the crowd increases the probability of extreme value outcomes

Structure

Competition drives creativity and quality
The raw nature of competition forces participates to think out side the box and outperform their competition

Sponsor feedback sets direction & forum posts answer questions Sponsor manages the feedback processes and the challenge forum where the crowd gets their questions answered

Incentives

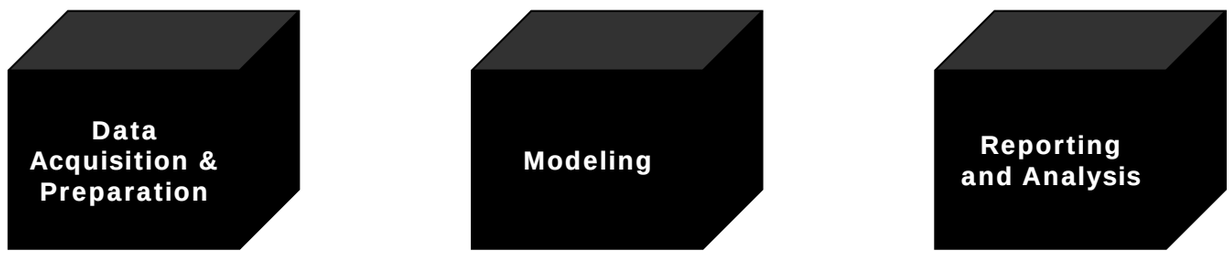
Why does the crowd want to participate?

Prize money **Status in community** **Educational Opportunities**

Application to the actuarial workflow

Various segments of the Actuarial process can be automated and enhanced

End-to-End Actuarial Process



Automation Spreading Across Spectrum of Actuarial Activities

Use Cases

Using rules-based processes and data automation to mimic human actions

Using cognitive automation to enhance the actuarial processes

Using enterprise content management and natural language generation to augment memorandum and report generation

What might a pixelated actuarial process look like?

The goal is to understand what tasks require humans and what can be disrupted

Loss Reserving

Data Management

Extract data from source systems and organize for analysis

Data Extraction

- Identify Data Needs
- Query Source Systems
- Define Requirements
- Load Data Warehouse

Transformation & Aggregation

- Load Transactions
- Summarize Data
- Make Adjustments
- Merge Data
- Create Triangles
- Populate Models

Validation & Reconciliations

- Control Reports
- Ledger Reconciliation
- Metadata Management
- Source Reconciliation

Diagnostic Analysis

Identify trends or anomalies in the data that may impact models and assumptions

Calculate Diagnostics

- Identify Metrics
- Calculate Statistics
- Perform Calculations
- Populate Templates

Review Diagnostics

- Identify Trends
- Cross Reference
- Adjust Data
- Identify Anomalies
- Validate Understanding
- Prioritize Reviews

Model and Assumption Selection

Identify, select, and test several models and assumptions to estimate unpaid claims

Calculate Ultimates

- Select LDFs
- Calculate Development
- Run Alternate Models
- Select IELRs
- Make Adjustments
- Make Selections

Reviews and Benchmarks

- Review LRs, PPs, Severity
- Change Analysis
- Final Reviews
- Compile Industry Info
- Validate with Business
- Finalize Selections

Ad Hoc Analysis

- Discount Reserves
- Run Stochastic
- Alternative Splits
- Prepare Ranges
- Claim Deep Dive Analysis
- Calculate Risk Margins

Aggregation and Communication

Summarize and communicate results to various stakeholders

Financial Close

- Compile Results
- Perform Allocations
- Validation
- Manual Adjustments
- Run Close Process
- Resolve Issues

Internal Reporting

- Prepare Mgmt. Repts.
- Respond to Inquiries
- Conduct Meetings

External Reporting

- Prepare Certifications
- GAAP Reporting
- Solvency II Reporting
- Prepare Schedule P
- Rating Agency Reporting
- Fulfill Audit Requests

Concluding Remarks

How do you get started?

ESTABLISH A DIGITAL ACTUARY LEADERSHIP TEAM

Identify a visionary program leader and assemble a team to accelerate your digital goals. Determine a governance model and understand policies that might need to be adapted to execute successful change management and ensure the solution is absorbed into the business fabric

THINK BIG

Immerse Yourself in Innovation

Join an immersive experience (e.g., Exponential Actuary™ Lab) to explore the "art of the possible" and determine a future state vision, goals, and benefits

Build Your Ecosystem

Evolve your Actuarial organization by collaborating with other business functions, BPO providers, and digital vendors

START SMALL

Scaling the Edges

Disconnect from the core business and set up a digital actuary leadership team to assess disruptive opportunities within the organization

Pick One or Two Plays

Prioritize your desired tactics and pick just one or two to get started in order to establish proof of concept

ACT FAST

Prove it Works (Quickly)

Use an agile, iterative piloting approach to move from strategy to prototyping as quickly as possible – "fail fast" and achieve rapid results

Market Your Own Success

Seek opportunities to share digital experiences with other functions – knowledge share

Key Takeaways

Disruption will impact Actuaries and other white-collar professionals, in addition to those blue collar professions that we typically associate with disruption (e.g. Uber/Taxis)

Examples of change / disruption are manifold and include technology enablers such as robotics and cognitive automation

Pixelating the opportunity set is important, which requires breaking the spectrum of work and entire end-to-end process into bite sized chunks

Professionals need to continue to meet **professional standards** and how these are met will evolve as processes change

There are **significant implications for professional operating and talent models**, such as the change in how we source talent and design organizations – encompassing an array of resources, both internally and externally

Training and education of actuaries will dramatically change as the role moves away from performing mathematics and towards business decisions and insights using the results of automated processes and results

The **outlook for the future is bright** and will enable professionals with the right skillsets to add more value to organizations through more strategic activities

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