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**Agenda**

1. Background
2. Relevance to insurance professionals
3. Advanced technologies & crowdsourcing
4. Implementation using "Pixelation"
5. Concluding remarks



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**CAS Anti-Trust Slide**

- The Casualty Actuarial Society is committed to adhering strictly to the letter and spirit of the antitrust laws. Seminars conducted under the auspices of the CAS are designed solely to provide a forum for the expression of various points of view on topics described in the programs or agendas for such meetings.
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**Background**

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**Polling Question 1**

**How would you respond to this question?**

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

a) True  
b) False

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

a) True  
b) False

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**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%

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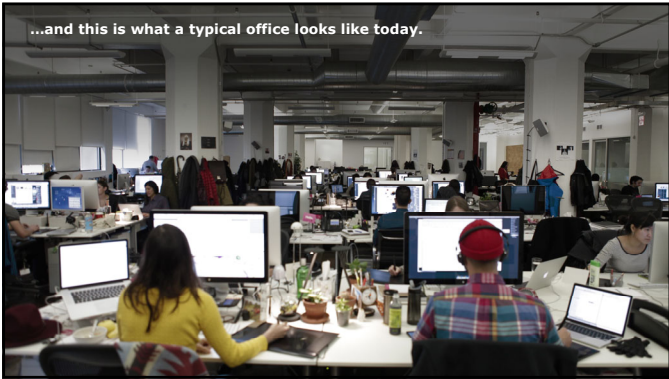
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**Replication vs. Innovation**

"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!**

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By the numbers

25%

Productivity improvement in the late 1800s due to steam power<sup>1</sup>

80%

Impact on Model T production time from the assembly line<sup>2</sup>

-1.1%

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

<sup>1</sup> Steam Power, Establishment Size, and Labor Productivity Growth in Nineteenth-Century American Manufacturing, National Bureau of Economic Research, January 2005, <http://www.nber.org>

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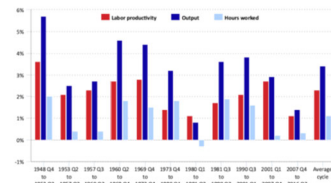
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Productivity in US

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, 1949-2016



"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

Click legend items to change data display. Please note that in some data, Source: U.S. Bureau of Labor Statistics.

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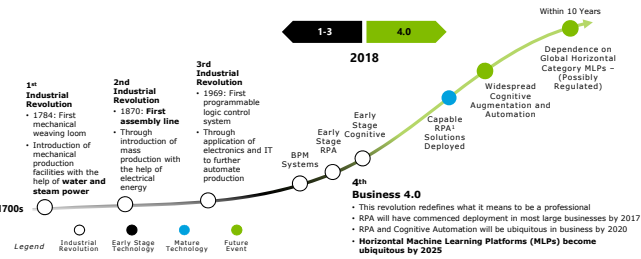
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We are on the cusp of "Business 4.0"



Source: Process Automation  
Source: Industry 4.0: Challenges and Solutions for the Digital Transformation of Experimental Technologies, Deloitte AG, 2015 and Deloitte proprietary research  
<sup>1</sup> Steam Power, Establishment Size, and Labor Productivity Growth in Nineteenth-Century American Manufacturing, National Bureau of Economic Research, January 2005, <http://www.nber.org>

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

Technology is everywhere  
6.0 billion+ smartphones in the world by 2020<sup>1</sup>

Tsunami of data  
9x more in last 2 years<sup>2</sup>  
Major enabler of machine learning

Diversity and generational change  
Millennials 50%<sup>3</sup>  
25% global pop in Africa by 2050<sup>4</sup>  
Longevity Dividend- 50 year careers<sup>5</sup>



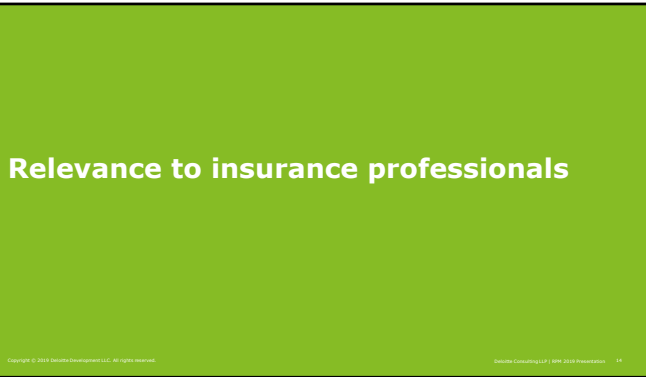
Change in nature of a career  
2.5 - 5 years: Half-life of skills  
4.3 years: Average tenure in a job<sup>6</sup>

AI, Cognitive Computing, Robotics  
\$500,000 in 2008  
\$22,000 today<sup>7</sup>

Jobs vulnerable to automation  
35% UK  
47% US  
77% China<sup>8</sup>

Explosion in contingent work  
US Contingent workers  
40% by 2020<sup>9</sup>

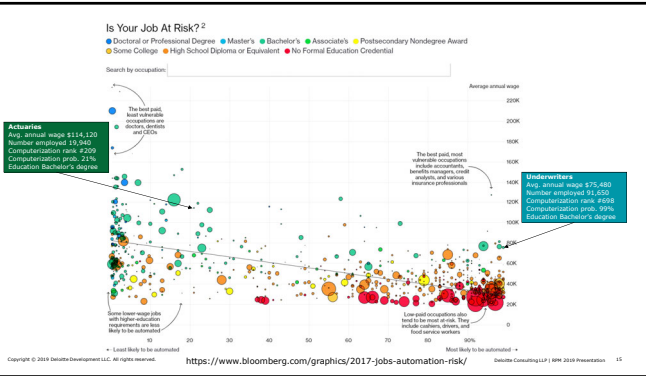
1 IBM, China 2016-2020 (1/11/16) 2016-2020 (1/11/16) 2016-2020 (1/11/16) 3 Statista 4 UN 5 IBM 6 IBM 7 IBM 8 IBM 9 IBM



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Horizontal lines for handwritten notes.

Horizontal lines for handwritten notes.



Horizontal lines for handwritten notes.

### The insurance professional of today

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

#### Representative Pain Points

- Excessively large and complex spreadsheets** utilized to perform annual / quarterly rate reviews
- 10,000 unique tools** and spreadsheets required for monthly actuarial financial reporting processes
- Company demands more filings, but mandates that **headcount cannot grow with the business**
- 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
- Underwriters miss opportunities** because of manual submission review processes
- Decentralized business model has **inconsistencies and redundancy** in roles, tools, and approach

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

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### 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

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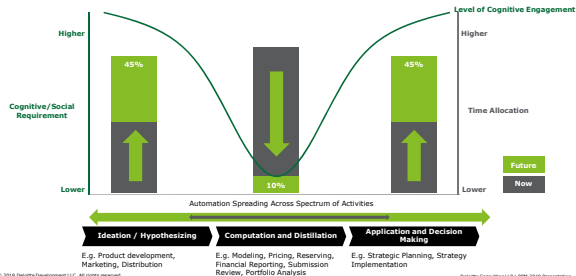
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### Current and future state of actuarial and underwriting functions

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



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**As the industry progresses, organizations will evolve...**

Imagine A World Where...

<p><b>5:00 AM</b></p> <p>An <b>bot</b> completes the portfolio analysis. <b>Natural language processing</b> extracts relevant data for the underwriting process. Output is sent to its analytics engine.</p>	<p><b>7:00am</b></p> <p>The <b>natural language generator</b> adds in narratives to the dashboard.</p>	<p><b>8:10am</b></p> <p>The profession interacts with the <b>chatbot in natural language</b> to drill down into splits by channel/product, and knows where underwriting information is missing.</p>
<p><b>6:00 AM</b></p> <p>The data from the modeling engine is staged on a <b>Tableau server</b> and dashboards are refreshed.</p>	<p><b>8:00am</b></p> <p>The professionals have access to the updated reports and narratives as soon as he/she arrives in the office.</p>	<p><b>8:15am</b></p> <p>The professional further drills down into variance analyses for products /services with dropping margins, and directs underwriters to focus on high-priority submissions.</p>

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

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## Advanced Technologies and Crowdsourcing

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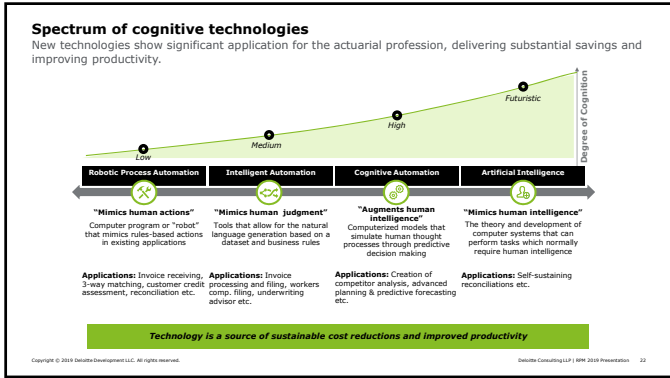
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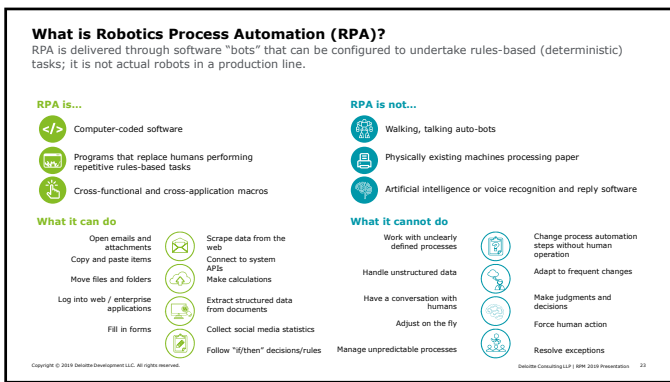
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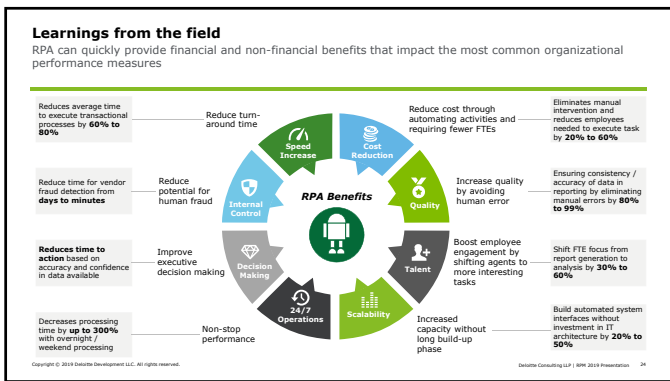
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### What is Cognitive Automation?

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.**

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### 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
<b>Structured Data</b> Deterministic Outcomes "Mimics Human Actions"	<b>Unstructured Data</b> Probabilistic Outcomes "Augments Human Intelligence"
<b>RPA Realm:</b> <ul style="list-style-type: none"> <li>Rules-based tasks</li> <li>Operational processes</li> </ul> <b>RPA Technologies:</b> <ul style="list-style-type: none"> <li>Robotic Process Automation</li> <li>Rules engines</li> <li>Event stream / complex event processing</li> <li>Human-in-the-loop process automation</li> </ul>	<b>Cognitive Realm:</b> <ul style="list-style-type: none"> <li>Cognitive analytics</li> <li>Decision making</li> </ul> <b>Cognitive Technologies:</b> <ul style="list-style-type: none"> <li>Deep learning</li> <li>Supervised machine learning</li> <li>Integrated Cognitive Computing Platforms (e.g. IBM Watson)</li> </ul>
<b>Potential RPA Applications:</b> <ul style="list-style-type: none"> <li>Reporter – Automated story writing</li> <li>Back Office – All "twivel chair" clerical tasks</li> <li>Customer service – Mass customization of automated CRM</li> <li>Data reconciliations and report generation</li> </ul>	<b>Potential Cognitive Applications:</b> <ul style="list-style-type: none"> <li>Pharma – Cognitive creation of new drugs</li> <li>Hedge Fund – Algorithmic trading</li> <li>Banking – Financial crime detection</li> <li>Actuarial – advanced modeling techniques</li> </ul>

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### 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.

Line Item	2017	2018	2019
1. Current Actuarial Liability	100,000	105,000	110,000
2. Reserve Analysis	50,000	55,000	60,000
3. Business Line	50,000	50,000	50,000

**INPUT**

**OUTPUT**

Based on the provided input, we identify that the current actuarial liability and reserve analysis for the business line are as follows:

Category	2017	2018	2019
Current Actuarial Liability	100,000	105,000	110,000
Reserve Analysis	50,000	55,000	60,000
Business Line	50,000	50,000	50,000

**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

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### Natural Language Processing (NLP) vs. Natural Language Generation

Natural Language Processing reads and Natural Language Generation writes.

#### Natural Language Processing

**Unstructured Text:**

- 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

**Structured Data:**

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

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### Crowdsourcing delivers a new way to access on-demand talent

Crowdsourcing refers to the practice of obtaining needed services, ideas, or content by soliciting contributions from a large group of people rather than from traditional employees or suppliers

**ANYONE**  
*Access to a variety of specialized resources*

**ANY TIME**  
*On-demand, dynamic ramp up (or down) capabilities based on workloads*

**ANYWHERE**  
*Global geographic coverage*

**AT SCALE**  
*Execute and deliver multiple projects in parallel without scaling dedicated resources proportionally*

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### Enterprise Crowdsourcing provides access to exponentially larger pools of talent and expertise

**Your team as a crowd**

Social and professional pressure to participate make this the easiest crowd to work with; however their value is inherently limited by size and experience.

**Your company as a crowd**

The hardest crowd to work with. Rigid compensation structures can result in misaligned incentives, low participation, and poor value.

**3.4 Billion in 2015**

**The internet-connected population as a crowd**

External crowds are often the scariest, but also can be the most impactful. They are scalable, motivated by outcomes, and enable you to target exactly the right mix of people with the right skills - only when you need them.

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**Enterprise Crowdsourcing is the application of crowd concepts to large companies, paying particular attention to legal, risk, and more complex crowd-based solutions**

 <b>Ideation &amp; Co-Creation</b>	 <b>Knowledge &amp; Expertise</b>	 <b>Technology &amp; Data Science</b>	 <b>Labor &amp; Process</b>
<i>need a new concept or idea</i>	<i>need to know something</i>	<i>need to build something</i>	<i>need to optimize a process</i>
<ul style="list-style-type: none"> <li>Idea generation</li> <li>Concept development and testing</li> <li>Content, image, and video curation</li> </ul>	<ul style="list-style-type: none"> <li>Custom benchmarking</li> <li>Horizon scanning and scenario planning</li> <li>Hard-to-reach experts / insights</li> <li>Country/market analysis</li> <li>Real-time, on-location data capture</li> </ul>	<ul style="list-style-type: none"> <li>UI mockups and rapid prototyping</li> <li>App / web / platform design and build</li> <li>Functional, UI, and vulnerability testing</li> <li>Algorithm optimization</li> <li>Predictive Analytics</li> </ul>	<ul style="list-style-type: none"> <li>Data collection and enhancement</li> <li>Master data management cleanup</li> <li>Language translation</li> <li>Machine learning &amp; A.I.</li> </ul>

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**Key Takeaways**



-  The **high volume** of data sources and inputs make actuarial and underwriting processes good candidates to be augmented with robotic and cognitive 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 data and learn from **human-provided corrective feedback** to become smarter and more effective
  -  Natural language generation could simplify the process taken to develop memos and reports often hundreds of pages long; natural language processing could streamline the underwriter's job and **improve speed to market**
  -  **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 the professional. Instead, it can be leveraged to make the professional more effective and efficient
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**Polling Question 4**

- Which technology resonates most with you?**
- a) Robotics Process Automation
  - b) Cognitive Automation
  - c) Natural Language Processing
  - d) Natural Language Generation

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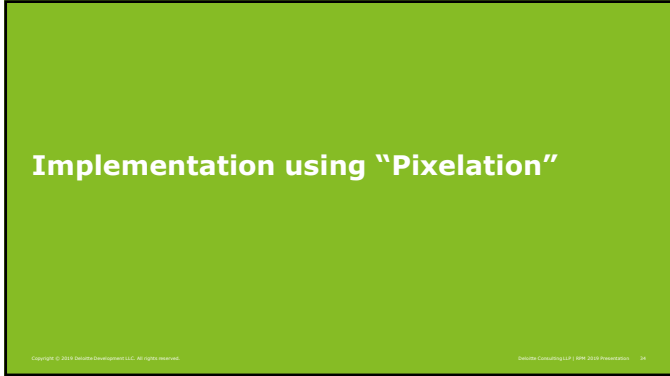
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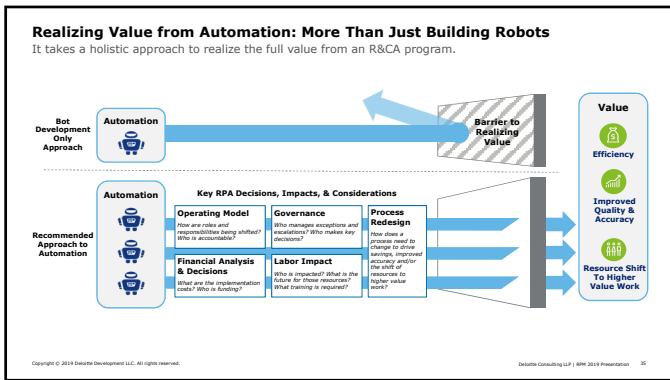
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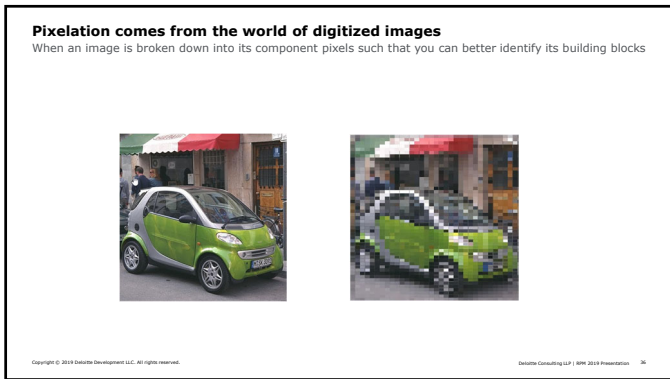
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**Pixelation deconstructs a task to break it down to its core components**  
 Identify the components of a project in order to architect the right approach and leverage the best mix of technologies, people and crowds to deliver results.



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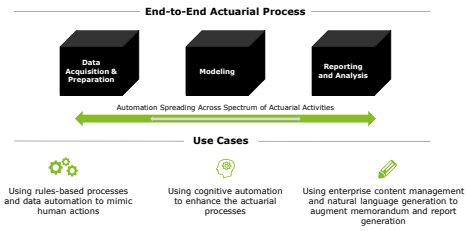
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**Application to the workflow**  
 Various segments of the Actuarial process can be automated and enhanced



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**Typical Actuarial Automation Opportunities**  
 There are more opportunities across the spectrum of Actuarial activities than one may think.

Actuarial Capabilities			
Reserving	Pricing / Product Development	Capital Modeling	Data Management
Model setup	Large account pricing	Capital model design	Data capture
Assumption selection	Rate indicator and filing	Sensitivity analysis	Data cleaning
Ad hoc analysis	Trend analysis	Assumption selection	Data extraction
Executive reporting	Predictive analytics	Enterprise risk management	Data distribution
Financial close	Product design	Capital management	Metadata
Regulatory compliance	Product development	Model updates	Data issue resolution
Control reports	Competitive analysis	Scenario analysis	Data aggregation
Reserve documentation	Rating algorithm	Capital planning	Capacity planning
Statutory reporting	Underwriting models	Reinsurance planning & purchasing	Data dictionary
	Pricing strategy development	Model validation	

Opportunity for Automation: Low Medium High

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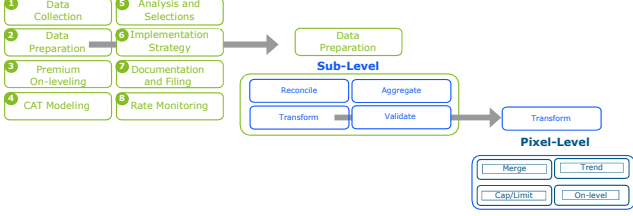
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**Pixelation Deconstructs an Activity into its Core Components (pixels)**  
Identify the components of the activity in order to architect the right approach and leverage the best mix of technologies, people and crowds to deliver results.

**Illustrative pixelated actuarial process**

**Rate Indication & Filing Activities**



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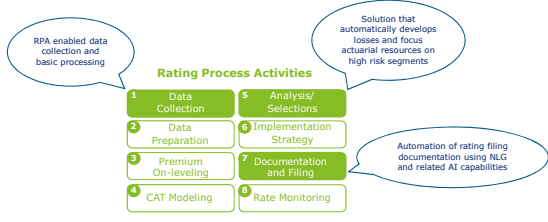
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**Example Solutions for Rating Process Activities**  
Several solutions can be deployed in the rating and filing process to increase efficiency and free-up resource time to execute on more value-added activities.



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**Concluding Remarks**

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How do you get started?

ESTABLISH A DIGITAL INSURANCE PROFESSIONAL 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 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 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

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Blank lines for notes corresponding to the 'How do you get started?' section.

Key Takeaways



Disruption will impact actuaries, underwriters, 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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