We continue to execute against our technology strategy

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deliver best-in-class products, platforms, and experiences</td>
<td>Strengthen our development capabilities and infrastructure</td>
<td>Unlock the power of data</td>
<td>Protect the Firm and our customers</td>
</tr>
</tbody>
</table>

**Customer and client experiences**

- Continued to release new products and experiences that delight our customers:
  - **Account validation**: custom-built engine that validates bank accounts to protect customers
  - **Cash optimization**: enable utilization of residual cash to generate alpha
  - **Connected Commerce**: ecosystem of products connected via reusable APIs
  - **Fusion**: cloud-native data management and reporting platform
  - **Versana**: reduce settlement times and improve liquidity management for syndicated loan market

**Product and platform development**

- Improved speed-to-market of product features by 20% (in days)
- Continued application modernization through refactoring, SaaS replacement, and legacy decommissioning
- Enabled multi-vendor public cloud as target state infrastructure
- Completed ~60% of our application migrations to strategic data centers
- Optimized data center footprint to facilitate public cloud journey

**Modernize technology**

- Ahead of our plan to deliver $1B business value
- +34% YoY growth in AI/ML use cases in production
- Accelerated large-language-model (LLM) enablement
- Matured ability to respond to new threats, including quantum safe encryption
- Delivered business value through cyber as a differentiator
- Maintained flat expense relative to volume increases

**Drive software development excellence**

**Embed data and insights into everything**

**Proactively defend against cyber threats**
Our expense growth is driven by investments, volumes, and structural factors.

**TOTAL TECHNOLOGY EXPENSE ($B)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Investments / volume-related</th>
<th>Structural / volume-related</th>
<th>Run the Bank</th>
<th>CAGR 2019-23</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>$11.7</td>
<td>$12.5</td>
<td>$1.1</td>
<td></td>
<td>$15.3</td>
</tr>
<tr>
<td>2021</td>
<td>$12.5</td>
<td>$14.3</td>
<td>$0.7</td>
<td>$0.5</td>
<td>$16.3</td>
</tr>
<tr>
<td>2022</td>
<td>$14.3</td>
<td>$15.3</td>
<td>$0.5</td>
<td>$0.5</td>
<td>$17.3</td>
</tr>
</tbody>
</table>

- **Wage inflation**: +$0.6
- **Volumes / other**: +$0.5
- **Internal efficiencies**: ($0.4)

**TECH INVESTMENTS BY STRATEGY, 2023**
- Products, platforms, and experiences: $4.0B
- Modernize technology and software development excellence: $3.2B
- Unlock the power of data
- Protect the Firm and our customers

**FULLY LOADED TECH INVESTMENTS BY LOB, 2023**
- CIB: $3.2B
- CCB: $2.7B
- AWM: $0.9B
- CB: $0.3B
- **Total**: $7.2B

**RUN THE BANK INCLUDES**
- Infrastructure
- Software licenses
- Application and production support

Note that totals may not sum due to rounding.
We have delivered $0.5B against our $1.5B productivity target

**OUR 3-YEAR COMMITMENT FROM INVESTOR DAY 2022**

Modernizing technology and software development excellence will drive cost efficiency across the total spend and slow our expense growth

<table>
<thead>
<tr>
<th>Total spend breakdown</th>
<th>Opportunity levers</th>
<th>Opportunity size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>Improve engineer capacity through agile adoption and elimination of non-value adding activities</td>
<td>~10% in productivity and cost efficiency</td>
</tr>
<tr>
<td>Product, design, application support, and other</td>
<td>High levels of automation (testing, release, production support) and streamlined software delivery through our platforms</td>
<td></td>
</tr>
<tr>
<td>Infrastructure and software</td>
<td>Increase utilization of cloud and reduce data center footprint</td>
<td>15-20% in infrastructure cost efficiency</td>
</tr>
<tr>
<td></td>
<td>Break monolithic applications into modular and API-driven architecture to improve cost elasticity</td>
<td></td>
</tr>
</tbody>
</table>

**PROGRESS WE’VE MADE**

~$300mm through engineering efficiencies and labor productivity

~$200mm in infrastructure productivity

~$1.5B in productivity and cost efficiencies over the next 3 years
We continue to modernize our technology estate while keeping infrastructure RTB expense relatively flat

WE’VE MADE SIGNIFICANT PROGRESS IN MODERNIZING APPLICATIONS...

- We have **increased SaaS adoption** to replace non-differentiating applications with industry-leading SaaS solutions

  ![Growth in SaaS applications](chart)

  - 2022: ~490
  - 2023: ~560
  - +14%

- And we have continued our **legacy application decommissioning journey**

  ![Volume of applications decommissioned since 2017](chart)

  - 2022: ~2,200
  - 2023: ~2,500
  - +300

...WHILE MODERNIZING OUR INFRASTRUCTURE & SUPPORTING GROWING VOLUMES

- In the last year, we have been **modernizing our on-premise infrastructure and growing cloud use**

  ![Cloud as a percentage of total infra spend](chart)

  - 2022: 30%
  - 2023: 38%
  - ~60% of in-scope applications have fully migrated to our modern data centers

- Over time, this has resulted in our **infrastructure run-the-bank expense remaining relatively flat while our volumes have increased**

  ![Storage and compute volumes](chart)

  - 2019: 2022: +50%

  ![Infrastructure run-the-bank expense](chart)

  - 2019: 2022: +2% CAGR

Strengthen our software development capabilities and infrastructure
We’ve made progress on technology modernization and engineering excellence to drive efficiencies in feature delivery and slow our expense growth.

**WHAT WE MEASURE ACROSS SOFTWARE DEVELOPMENT LIFECYCLE**

- **SPEED**
  - Accelerate development and deployment of features into production
  - 60% of apps

- **AGILITY**
  - Adopt and continuously improve agile practices to free engineer capacity
  - 60% of teams

- **STABILITY**
  - Minimize failed changes and unplanned outages
  - 100% of apps

**EXAMPLE OUTCOMES WE’VE ACHIEVED IN 1 YEAR**

- **COVERAGE**
  - 84% of teams exceeded 80% 2022 target on Enterprise Toolchain
  - 100% of apps achieved on-toolchain adoption by YE 2023

- **LAUNCH**
  - ~20% improvement in days from backlog to deployment

- **DEVELOP**
  - ~70% of CCB teams improved YoY performance on agile practices

- **PLAN**
  - 99.9% change success rate while change volumes have gone up ~60%

**STRENGTHEN OUR SOFTWARE DEVELOPMENT CAPABILITIES AND INFRASTRUCTURE**

- Tracking towards ~100% Toolchain adoption by YE 2023

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JPMorgan Chase & Co.
Our modernization strategy is enabling us to deliver significant value across the business

2 Strengthen our software development capabilities and infrastructure

Chase.com

- Completed migration of internet-facing Chase.com to the public cloud in 4Q22, serving all customers through Amazon Web Services
- 15 Chase.com releases weekly, 2 mobile app releases monthly
- 22% increase in change volume
- 100% customers onboarded (including 63mm+ active digital customers)

Connected Commerce

- Moving up-funnel to meet customers earlier in their journeys, protecting our core franchise, and disrupting incumbents in Commerce
- Innovative API-driven platform to automate partner onboarding and simplify integration with Chase ecosystem
- 35% increase in speed to deliver product features YoY
- Offers and recommendations delivered $350mm impact over two months in 2023

JPM Payments Transaction Engine

- Graphite is a scalable, modern strategic platform for processing payments globally, including real-time payments
- Each payment capability built with its own independent component architecture
- Reduced time to launch a new real-time payment market from ~18 months to ~3-6 months
- Third largest payments platform by volume

Markets Regulatory Reporting Platform

- Regulatory data warehouse responsible for global regulatory reporting for Cash Equities, Futures, and Options in 15+ countries
- Running on public cloud, enabling real-time audit trail calculation and report generation
- Increased ability to scale to 2.5B trades per day on public cloud from 500mm trades per day on-premise
- Reduced monthly running cost by >50%
Unlock the power of data

We continue to prioritize our investment in Data and AI/ML, and see increasing value in our businesses

**WE EXPECT TO BEAT OUR AI/ML IMPACT TARGETS**

<table>
<thead>
<tr>
<th>Year</th>
<th>AI/ML driven business impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>$1.5B target</td>
</tr>
<tr>
<td>2022</td>
<td>$220mm impact</td>
</tr>
<tr>
<td>2023</td>
<td>$100mm impact</td>
</tr>
</tbody>
</table>

3.6x growth from 2021 to 2023

**Select thematic examples across our 300+ use cases in production**

- **Personalization of products and experiences for retail customers**
  - ~25 use cases
  - ~$220mm impact in 2022

- **Deepening client relationships through improved analytics and insights**
  - ~60 use cases
  - ~$100mm impact in 2022

**CONTINUING TO ACCELERATE THE POWER OF OUR DATA AND AI/ML**

**Building an industry-leading team**

- **900+ data scientists**
- **600+ ML engineers**
- **200+ AI researchers**
- **Ranked #1 Evident AI Index**

**Expanding our technology platforms**

- Improving capabilities, with embedded governance and Responsible AI
- Integrating ML Ops capability to support teams to develop models faster and measure performance
- Increased use cases leveraging firmwide model development and training platform by 2.2x YoY

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1. JPMC ranked number one in the Evident AI Index (January 2023), the first public benchmark of major banks on their AI maturity
We continue to evolve our best-in-class Cyber capabilities through a dynamic threat environment.

**MANAGING EXPENSE WHILE DOING MORE**

- **Security alerts processed per day**
  - 2022: [Graph]
  - 2023: [Graph]
  - Increase: +22%

- **Supplier vulnerabilities proactively mitigated by JPMC**
  - 2022: [Graph]
  - 2023: [Graph]
  - Increase: >2x

- **Cybersecurity exercises and simulations**
  - 2022: [Graph]
  - 2023: [Graph]
  - Increase: +66%

- **Cyber-related expenditure**
  - 2020: [Graph]
  - 2021: [Graph]
  - 2022: [Graph]
  - 2023: [Graph]
  - Increase: +4% CAGR

**CREATING VALUE WHILE PROTECTING THE FIRM AND FINANCIAL SERVICES INDUSTRY CRITICAL INFRASTRUCTURE**

- **Further strengthening access and authentication**, improving user experience while lowering the burden of managing passwords

- **Automating security controls** by default in development, data, and infrastructure platforms, **reducing the number of required developer actions by over 60%**

- **Reduced required actions and introduced straight-through-processing** for cloud regulatory compliance resulting in **automated approval for over 60% of deployments**

- **Advising U.S. Government and policy makers** to improve public-private partnership and enhance cybersecurity for critical infrastructure

- **Engaging with NIST** as a financial services member of the National Cybersecurity Center of Excellence and collaborating on post-quantum cryptography migration guidelines

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1 National Institute of Standards and Technology
We are well positioned to lead across our businesses, backed by resilient, innovative technology, for years to come

1. **Deliver best-in-class products and experiences to customers**

   Continued to release new products and experiences that delight our customers

2. **Strengthen our software development capabilities and infrastructure**

   Improved **speed-to-market of product features** by 20%

   $0.5B productivity impact delivered against **$1.5B target**

   ~100% Enterprise Toolchain adoption by year-end

3. **Unlock the power of data**

   Ahead of our plan to deliver **$1B business value**

   300+ use cases in production

   $1.5B value target to be delivered by year-end 2023

4. **Protect the Firm and our customers**

   Creating value while protecting our Firm and customers

   Optimizing our expense while volumes increase