22 May 2015

WFC 2015

Technology Challenges and Opportunities

pwc

Market trends are re-shaping the financial industry, providing technology opportunity and challenges for CSDs
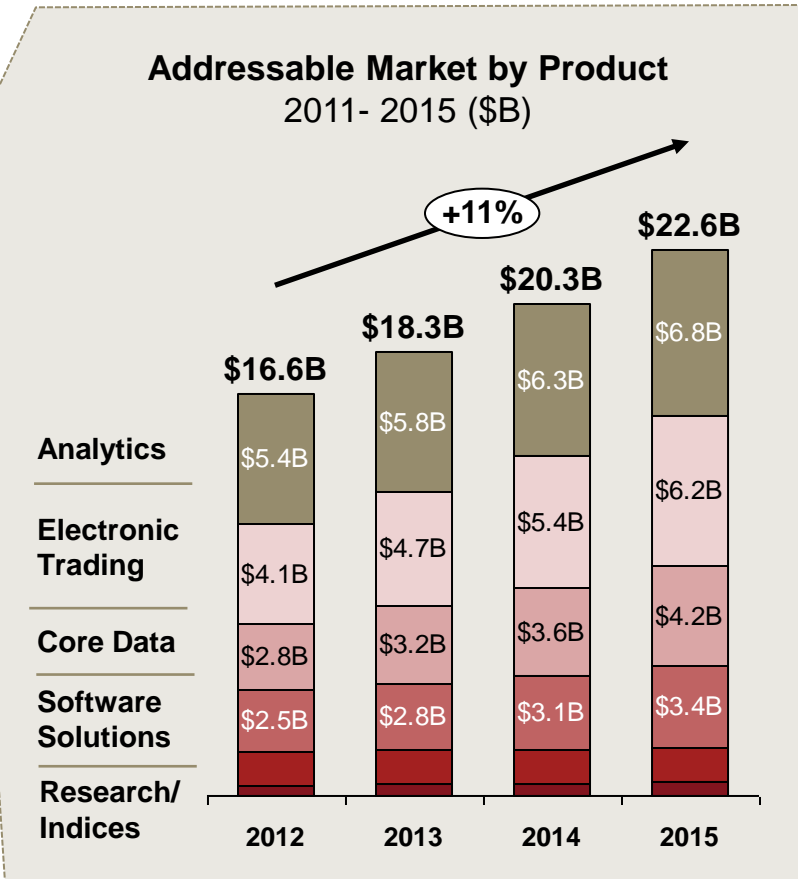
Margin Pressure
- Low AUM net inflows, depressed interest rates
- Investor cost pressures decreased expense ratios (e.g., avg. expense ratio paid down 10% 2009-2012

Regulatory Changes
- Increased cost of compliance to ~$50B by 2015 (e.g., 53% p.a. increase in AML spend since 2011)
- Capital ratio requirements

Globalization
- Greater returns in emerging markets – market cap up 500-2500% for Brazil, China, and India
- Global as well as local regulations drive complexity

Complexity
- Increased use of complex instruments (e.g., Liquid alternative AUM 19% growth 2012-2017)
- Demand to service obscure asset types (e.g., loans)

Technology Innovation
- Technology spend growth 6.9% p.a. 2014-2017, e.g.,
  – Cloud computing market $210B in 2016
  – 52% financial institutions using agile

Implications on Technology
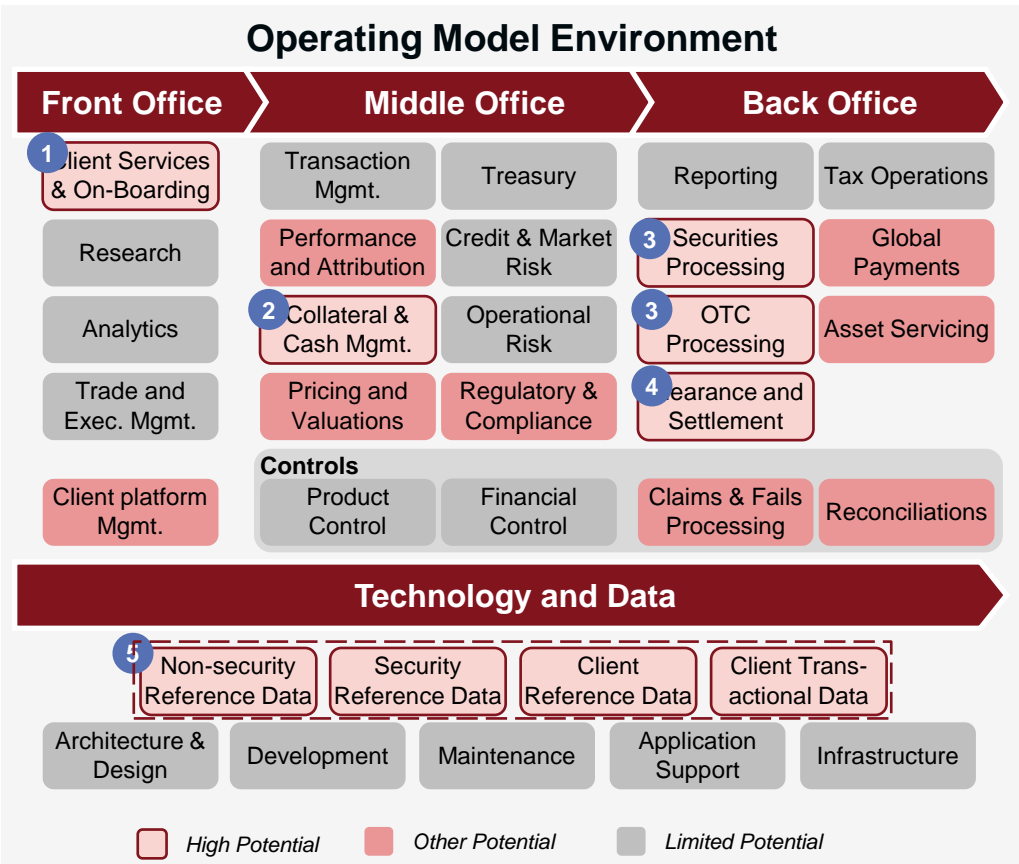
1 *Top Line Growth in data & analytics as well as utilities*

2 *Foundational Capabilities to more rapidly and efficiently meet business needs*

3 *Technology Disruptors that may fundamentally change the way markets work*

Data & Analytics continues to be a rapidly growing market, with front-middle-back revenue opportunities

Impact of Real Time Data/Analytics and Tools

Front Office	Portfolio Managers	• Alpha opportunities from cross-asset trading
	Research Analysts	• Real time commentary/analysis and better credit predictions
	Advisors	• Diversified portfolios with better risks and healthy returns
	Banker / PE	• Integrated news, analytics, and real-time data
	Trading	• Broader range of asset classes
Middle Office	Risk Managers	• Improved intra-day and roll-up risk analysis
	Investment Research	• Advanced data and analytics research and content services
Back Office	Custodians	• Real-time NAV and positions • Single-source transaction data to deliver new products

Addressable Market by Product
2011- 2015 ($B)

+11%

Analytics

Electronic Trading

Core Data

Software Solutions

Research/ Indices

	2012	2013	2014	2015
Total	$16.6B	$18.3B	$20.3B	$22.6B
Analytics	$5.4B	$5.8B	$6.3B	$6.8B
Electronic Trading	$4.1B	$4.7B	$5.4B	$6.2B
Core Data	$2.8B	$3.2B	$3.6B	$4.2B
Software Solutions	$2.5B	$2.8B	$3.1B	$3.4B

"Utility" solutions have begun to emerge across a variety of competencies, with CSDs playing a role

Operating Model Environment

Front Office	Middle Office		Back Office	
1 Client Services & On-Boarding	Transaction Mgmt.	Treasury	Reporting	Tax Operations
Research	Performance and Attribution	Credit & Market Risk	**3** Securities Processing	Global Payments
Analytics	**2** Collateral & Cash Mgmt.	Operational Risk	**3** OTC Processing	Asset Servicing
Trade and Exec. Mgmt.	Pricing and Valuations	Regulatory & Compliance	**4** Clearance and Settlement	

Controls

Client platform Mgmt.	Product Control	Financial Control	Claims & Fails Processing	Reconciliations

Technology and Data

5 | Non-security Reference Data | Security Reference Data | Client Reference Data | Client Trans-actional Data |

Architecture & Design	Development	Maintenance	Application Support	Infrastructure

☐ *High Potential*   ▢ *Other Potential*   ▢ *Limited Potential*

1 **Client Onboarding:** standardize to improve CX and efficiency and reduce risk
markit GENPACT

2 **Collateral Management:** enterprise-wide, with utilities to create "collateral highways"
DTCC · London Stock Exchange Group · euroclear

3 **Post-Trade Processing:** cross-entity, asset, geography services and data
accenture · Broadridge · MUREX

4 **Clearance and Settlement:** new connectivity solutions to disintermediate B/Ds, providing global connectivity
DTCC · omgeo · euroclear · clearstream · BT

5 **Data Management:** aggregate, analyze and store reference, client and bank data
SmartStream · Clarient · euroclear · GoldenSource

There are a set of foundational capabilities critical to improve IT effectiveness and reduce risk

Foundational IT Capabilities in FS

Information Security

Compliance **cost ~ $50Bn in 2015** – 80% of FS firms will enhance IT (e.g., outsource testing, cloud reporting, big data to id breaches)

Digitization / CX

Front-to-back digitization to transform the value chain through automation and digital innovation, leading to a cohesive **customer experience** across all touch points

Agile Development

Improves **time to market by 70%**; 52% adoption in FS with 35% using a "hybrid" methodology to meet regulatory needs

Cloud Infrastructure

Market growth from $77-210Bn from 2010 to 2016, with 63% adoption in FS; **savings 20%–60%, capacity in minutes, not weeks**

Strategic Partner Management

Segmentation and governance keys to identifying critical suppliers and managing the relationship

Fit for Purpose Infrastructure

Optimizes **infrastructure to business driven requirements** for up-time and redundancy, improving efficiency and reducing risk

IT Capabilities

DevOps

Improves integration of development and operations teams; survey of 1,300 IT leaders indicate **improvements from 17-23% in key metrics**
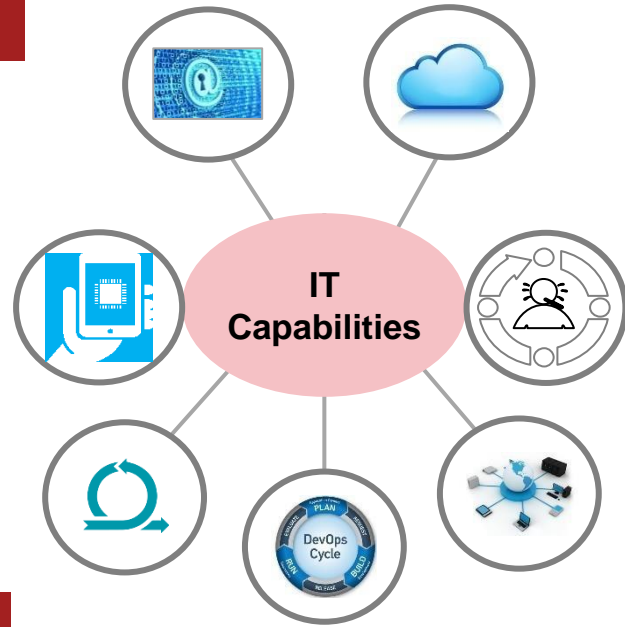
FS Firms are addressing these plus product specific IT capabilities to meet increasing market demands

Business or Product Specific IT Capabilities *(Illustrative Examples)*

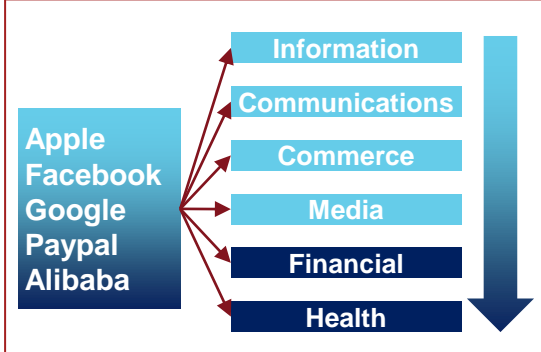| Differentiated Business Need		Associated IT Capability	Relevant Client Example
Predict customer behavior, risk and/or fraud, improving product profitability	**Machine Learning**	Next generation of self evolving algorithms aim to better manage risk inputs, filter noise, and accept unstructured data	**Indy Mac Bank** provided data on 43,000 loans to **USC** professors to create adaptive algorithms to **predict percentage for fraud** and default
Ensure employee productivity while allowing for flexibility to attract top talent	**Workforce Mobility**	Enable "office of the future" across computing, mobile, conference, unified communications and hoteling	A **healthcare provider** implemented workstation virtualization (Thin Clients, Virtual Machines) to enable remote working and BYOD, reducing compute hosting costs by ~40%
Eliminate manual processing on physical document to enhance accuracy and reduce costs	**Document Processing**	Cutting edge document processing and natural language processing capabilities	A **client reference data utility** implemented best-in-class document processing to provide cost efficient KYC and AML services (reducing ~60-80% manual effort)

New technology providers are moving into Financial Services, creating opportunity in efficiency and innovation

Personalized Direct Investing

Retail Customer → **Robo advisor**

- Direct Investment
- Mutual Funds
- ETFs

Custodian / Broker/Dealer
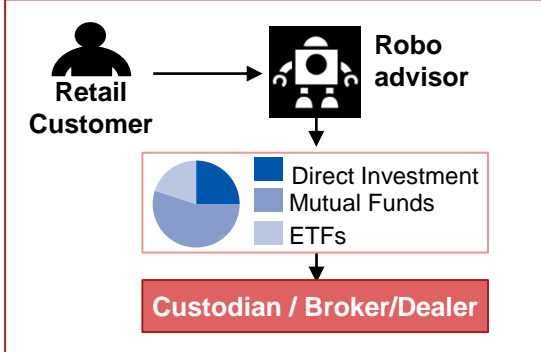
- In 2014 **passive funds had net inflow of $420B** while active funds $44B, almost 10x

- US mass market (<$100k assets) is a **$1.5T opportunity**

- Robo-Advising is **personalizing investing,** growing 90% in 2014

- **AM revenue reduced** as flows continue shift, and more **assets will be held at B/D directly**

Digital Distribution Platforms

Apple Facebook Google Paypal Alibaba →

- Information
- Communications
- Commerce
- Media
- Financial
- Health

- Technology players are entering– **ApplePay, Google** investing in ~30 startups**, $1.1B VC** in 2014

- **Alibaba** expanded into AM with money market fund **Yu'E Bao**

- Potential **infrastructure upgrades** to manage new volume

- Platform providers are wary of regulated space, creating **partnership opportunities**

Digital Asset Transfer Platforms

Internet Protocol   **Blockchain Protocol**
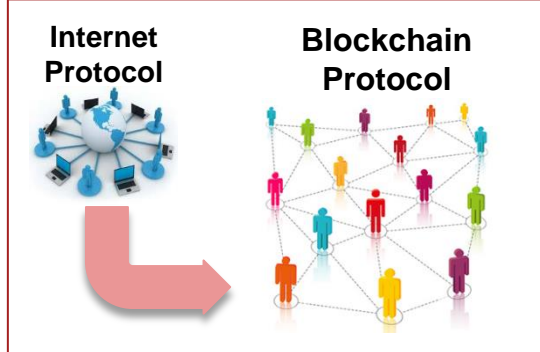
- Blockchain protocol **enables peer-to-peer transactions** through a managed, decentralized "ledger"
  – Wallets (e.g., Coinbase)
  – Exchanges (e.g., BitShares)
  – Smart Contracts (e.g., Codius)
  – Payments (e.g., Bitpay)

- E.g., **Ripple** interbank payments can provide **real-time settlement**

The benefits of blockchain are significant, and the move towards peer-to-peer models could accelerate adoption

Benefits of using the blockchain

Transparency — Retains a **digital record of every transaction** as well as balances and open orders

Risk Control — Decentralized participants reach consensus and **confirm transactions prior to settlement**
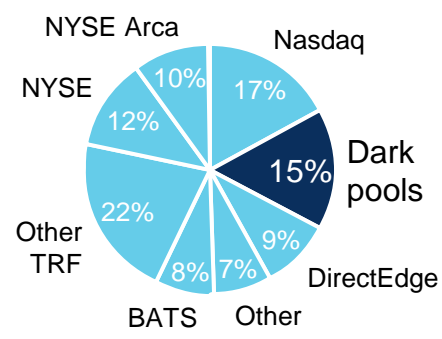
Efficiency — Eliminates need for multiple intermediaries, **decreasing settlement time and costs**
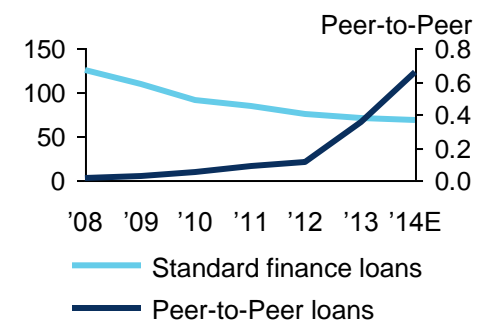
Innovation — Decentralized participants can function as fiat gateways and/or **market makers for new services**

Peer-to-Peer Industry Model

US equity market share %
(May 12-16, 2014)

- NYSE Arca 10%
- Nasdaq 17%
- Dark pools 15%
- NYSE 12%
- Other TRF 22%
- BATS 8%
- Other 7%
- DirectEdge 9%

Peer-to-Peer lending vs standard finance loans
('08-'14), USD Billions
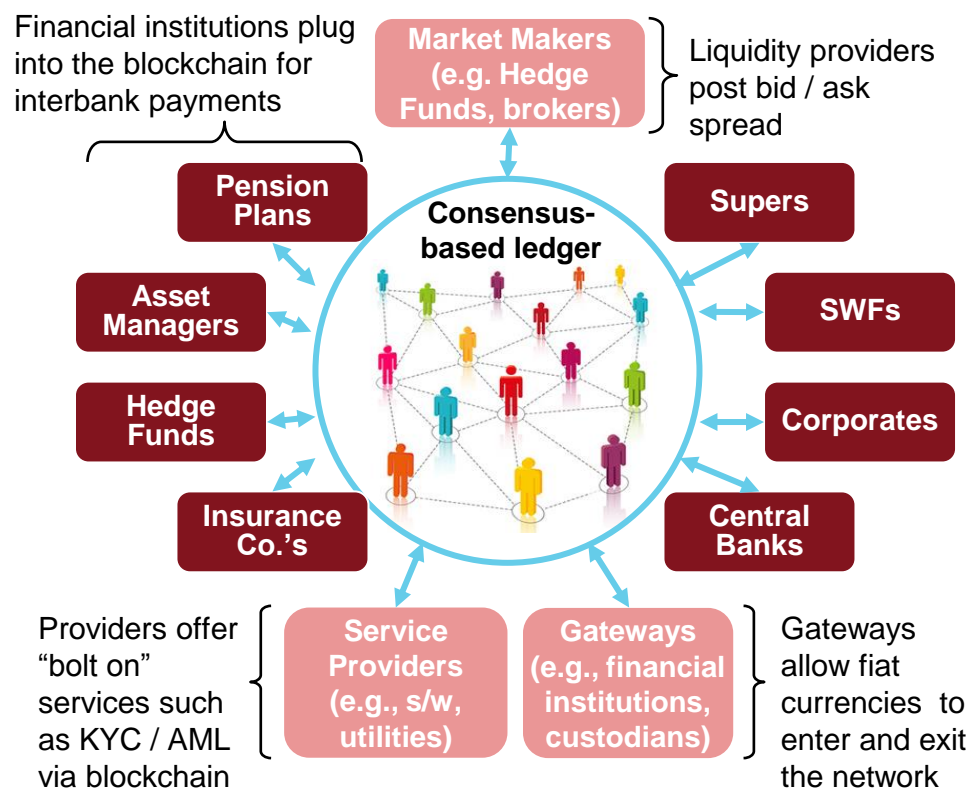

Standard finance loans
Peer-to-Peer loans

- **Hedge funds** becoming FX market makers **on Ripple**

- **Ripple partnerships** with banks (e.g., CBW Bank) and payment networks (e.g., Earthport)

- **Increasing VC** for blockchain enabled tools (e.g., Coinbase raised $75M; investors include NYSE, USAA, BBVA, DoCoMo)

- **$335M** in bitcoin VC investment in 2014

In one 2020 scenario, blockchain (e.g., via Ripple) becomes the default protocol, with hedge funds as early adopters

Digital Asset Transfer Platforms – 2020 Scenario

Financial institutions plug into the blockchain for interbank payments

Market Makers (e.g. Hedge Funds, brokers)

Liquidity providers post bid / ask spread

Pension Plans

Consensus-based ledger

Supers

Asset Managers

SWFs

Hedge Funds

Corporates

Insurance Co.'s

Central Banks

Providers offer "bolt on" services such as KYC / AML via blockchain

Service Providers (e.g., s/w, utilities)

Gateways (e.g., financial institutions, custodians)

Gateways allow fiat currencies to enter and exit the network

- Blockchain becomes **default protocol** for cross-border payments and frontier / exotic FX transactions. Hedge funds are early adopters and become market makers on the platform. SWIFT use declines

- **Real-time settlement** reduces importance of intermediaries and associated services (e.g., reconciliation, recordkeeping).

- As platform gains acceptance as a cheaper alternative, **AMs adopt blockchain for bi-lateral trading of alternatives** (e.g., OTC derivatives, private equity)

- Large AMs, software hosts (e.g., Sunguard) **compete with custodians to re-define asset servicing** based on automation efficiency blockchain provides

THANK YOU