Overview of Information System in Financial Services 3
Quote Driven VS Order Driven Market 3
NYSE And Nasdaq 4
NYSE and Benefits/Cons of an Auction Market 4
NASDAQ and Benefits/Cons of Market Makers (Dealer Market) 4
Difference Between NYSE and NASDAQ and listing on them 5
After Facebook Fiasco, NYSE-Nasdaq Rivalry Heats Up 6
Advantages and Disadvantages of Dual Listing 7

Impact of IT on Financial Sector 8
Changes in Value Chain – Using IT to improve companies 8
Outsourcing VS Offshoring 9
Comparison Chart – Offshore VS Outsource VS Offshore Outsource 10
Best Practices of Outsourcing/Offshoring 12
Reducing the risks of outsourcing (Prevention, Detection, Containment) 12
Internet banking 13

Trade Cycle 14
Trading Cycle 14
Pre-Trade 14
Trade 15
Post-trade (Refer to IT in the trade cycle (I) and (II)) 16
Post-settlement 16
Advantages and disadvantages of collateral management 16
Metzler and Omgeo Case (Refer to Omgeo case) 17
OTC VS Exchanges 18
Challenges faced by Exchanges 19
Increasing the profitability of Exchanges 19
Challenges of Linking up the different exchanges 19
Advantages and Disadvantages of a Central Clearing Party (and consolidating them) 20
Straight Through Processing 21
Benefits and Challenges of STP 21
Advantages and Disadvantages of using technologies for STP (e.g. Murex) 22
Trends supporting the pickup of STP: (Refer to notes for more information: IT in trade cycle II & III + PPT Seminar 5 Presentation) 22

E-Money and Financial Networks 23
E-money 23
Role of government in adoption of e-money (issues exacerbate at the international level) 23
Evaluation of widespread use of E-money 24
Electronic Payments 25
Risk Management of E-Money and E-Payment 25
Risk Management: Prevention Measures 25
Risk Management: Detection Measures 25
Risk Management: Containment Measures 25
Risk Management: Organizational 26
Financial Networks 26
Payment and Settlement Networks (Refer to E-Money and Financial Networks I) 26
Importance of Payment Systems 26
Risk Mitigation 27
RTGS 28
Net Settlement System 28
Hybrid Settlement System 29
Evaluation of RTGS VS Net Settlement 29
Financial Networks (ATS) 30
How ECN works and Benefits/Cons of ECNs (Refer to Financial Network II for more details) 30
Crossing Networks 30
ECNs VS Crossing Networks 31
Technology Supporting Trading Networks 31

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DMA (See Financial Network (II): Electronic Trading Networks) 31
FIX (Refer to Financial Network (II): Electronic Trading Networks for more details) 32

Algorithm Trading (For computation refer to Algo I & II) 33
Algorithm Trading VS High Frequency Trading VS Automated Trading 33
Algorithm trading in different asset classes (Refer to Algo III) 34
Conditions for good algorithm trading: 34
Implementation Choices – Make or Buy (Refer to Algo III) 34
Limitations of Algorithm Trading 34
Challenges faced by Algorithm Trading 34
Optimal Approach to Algorithmic Trading 35

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Overview of Information System in Financial Services

Quote Driven VS Order Driven Market

Quote Driven Market	Order Driven Market
E.g. NASDAQ, London SEAQ, over-the-counter (OTC) markets such as bond markets, forex markets	E.g. Toronto Stock Exchange in Canada, Paris Bourse
Advantage: Guaranteed order execution, high liquidity as market makers are required to meet their quoted prices by buying or selling. Drawback: Less transparent market	Advantage: Transparency. It clearly shows all market orders and what price people are willing to buy at or sell for. Drawback: No guarantee of order execution
Displays the bid and asks offers of designated market makers, dealers or specialists Dealers revise the quotes periodically in order to relect market conditions, the state of their inventory and competition with other dealers on the same security	Displays all of the bids and asks (detailing the price at which buyers and sellers are willing to buy or sell a security and the amount of securities they are buying) Price discovery is determined by the limit order of the traders in the particular security
Buy and sell orders never interact with one another. Instead, buyers and sellers trade with the dealer (dealer holds the inventory)	Buy and sell orders interact directly. In continuous market, orders are executed as they arrive, subject to some time and price-priority rule
Advantages of quote driven are typically best seen in illiquid markets e.g. securities that are thinly traded (low volume) Improve liquidity in the market.	Advantage of order driven market is best seen in liquid markets. (for high volume trading) The large number of traders willing to buy and sell the security theoretically (larger the better) translates into more competitive and better prices for traders.

Benefits and Risks of a new trading system

Benefits	Explanation
Speed	Allows market participants to act on fast-moving trends Increased liquidity (how quickly trades are made)
Reliability	Processes information on more redundant servers Construction of a backup centre to enable recovery within 24 hours in cases of large-scale disasters
Scalability	New system has more capacity of past peak volume Can be further expanded within one week if necessary
Transparency	Distributes order and quote information in real-time, improving market transparency

Risks	Explanation
Bugs	New system susceptible to glitches, like the incident in 2005
Security threats	Increased expenditure in a difficult time Investors were losing confidence in TSE Requires specialised staff to maintain the system

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NYSE And Nasdaq

NYSE and Benefits/Cons of an Auction Market

Investors place orders through stockbrokers, who then sent those orders to floor brokers. The floor brokers are responsible for copmleting the trade with a "specialist" who then executed trades in the stock of the specific market

At the beginning of the day, specialists establish a fair market price for each of their stocks based on the best bid and ask prices and supply and demand for the stock. All the buying and selling of a stock during normal market hours occurred at the specialist's trading post. Buyers and sellers meet face-to-face at the trading post to determine the best price for a given security of each trade. When highest bid met the lowest offer, a trade was executed and the clearance and settlement process began.

Specialist were also responsible for maintaining a fair, competitive, roderly and efficient market (all orders had an equal opportunity to interact and receive the best price, i.e. customer should be able to buy/sell a reasonable amount of stock at close to the last sale price). Therefore, specialists worked to avoid large price variations between consecutive sales and if there is too much order-flow imbalances, a specialist can halt the trade.

Pros	Cons
Transparency. It clearly shows all market orders and what price people are willing to buy at or sell for.	No guarantee of order execution
Advantage of order driven market is best seen in liquid markets. (for high volume trading) The large number of traders willing to buy and sell the security theoretically (larger the better) translates into more competitive and better prices for traders.	

NASDAQ and Benefits/Cons of Market Makers (Dealer Market)

Market makers made up the core group of NASDAQ participants. Market makers competed for orders by quoting bid and ask prices for selected securities. Market makers are obliged to quote on a continuous basis, stand ready to trade for a minimum quanityt at those prices and make their quotes available to all market particiapnts throught he NASDAQ network. By acting as the principals in the transaction, market makers committed their own capital to the traded securities. Depending on the market conditions and the state of their inventories, they adjusted their quotes and derived profits from the spread.

Pros	Cons
The trading platform usually comes with free charting software and news feeds.	Market makers can present a clear conflict of interest in order execution, because they may trade against you.
Some of them have more user-friendly trading platforms.	They may display worse bid/ask prices than what you could get from another market maker or ECN.
Currency price movements can be less volatile, compared to currency prices quoted on ECNs, although this can be a disadvantage to scalpers.	It is possible for market makers to manipulate currency prices to run their customers' stops or not let customers' trades reach profit objectives. Market makers may also move their currency quotes 10 to 15 pips away from other market rates.
	A huge amount of slippage can occur when news is released. Market makers' quote display and order placing systems may also "freeze" during times of high market volatility.
Guaranteed order execution, high liquidity as market makers are required to meet their quoted prices by buying or selling. Advantages of quote driven are typically best seen in illiquid markets e.g. securities that are thinly traded (low volume) → Improve liquidity in the market.	Less transparent market

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Difference Between NYSE and NASDAQ and listing on them

The essential difference between the NYSE and NASDAQ is their trading principles—the former is an auction market, while the latter is a dealer's market.

In the NYSE, the buyers and sellers trade physically by comparing bid prices and ask prices. If a buyer wishes to invest in a stock, he/she must place an order either to the floor broker or by entering the order into the Universal Trading Platform. A specialist, who is not an NYSE employee, supervises all the trades done by a given company. This specialist will act as a middleman between the buyer and the seller to smoothly complete the trade.

Trading acquires a different climate in the NASDAQ when compared to the NYSE. Here, the buyers and sellers transact through a dealer. There are only two ways to make a trade in the NASDAQ: Stock brokers must either call the dealer or use the online execution system to enter an order. Likewise, dealers must also enter their prices in the system for both selling and buying. The trade is finally executed by the electronic system by matching the prices of both the buyers and the sellers. So, the NASDAQ is quintessentially different from the NYSE because of its exclusively electronic transactions.

The NYSE and NASDAQ both demand different initial requirements and fee structures from companies that want to be listed on their respective stock exchanges. The following table delineates these differences:

NYSE	**NASDAQ**
The company must have issued a minimum of 1,100,000 shares to 400 shareholders at least.	The company must have publicly traded at least 1,250,000 shares, with a minimum bid price of $4.
The market value of the company's public shares must be a minimum of $40 million, with $4 being the minimum share price.	The company must have a minimum of three dealers for its stocks.
For the past three years, the company's pre-tax aggregate should be $10 million, with the last year having $2 million. If this requirement cannot be met, the companycan also apply based on a global market capitalization of at least $500 million, with revenues of at least $100 million in the last year, and no negative cash flow in the three most recent years. The company can also be listed based on revenues of at least $75 million in the last fiscal year.	For the past three years, the company's pre-tax aggregate should be $11 million, with the last year having $2.2 million.
The entry fee for a company to be listed on the NYSE goes up to $250,000.	The entry fee for a company to be listed on the NASDAQ is from $50,000 to $75,000.
The NYSE collects a maximum yearly fee of $500,000.	The NASDAQ collects a yearly fee of around $27,000.
	Must meet stringent government standards.

Comparison: Perceptions
The NASDAQ is perceived as a high-tech exchange and includes many firms that deal with the Internet or electronics. Its stocks are considered more volatile and growth oriented. Meanwhile, the NYSE is considered to be the exchange for well-established companies that have stable and established stocks.

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After Facebook Fiasco, NYSE-Nasdaq Rivalry Heats Up

By JACOB BUNGE And SHAYNDI RAICE

NYSE Euronext is seeking to capitalize on Nasdaq OMX Group Inc.'s role in Facebook Inc.'s bungled offering, renewing efforts to lure more stock listings to its exchange and persuade Nasdaq-listed companies to switch to the Big Board.

A person familiar with the matter said NYSE had sounded out Facebook, exchanging "several emails" with the company, raising the possibility of moving to the Big Board.

NYSE said that there haven't been any discussions with Facebook, "nor do we think a discussion along those lines would be appropriate at this time."

A Nasdaq spokesman declined to comment on the matter.

Share listings are the subject of fierce competition among exchanges and not just for the revenues they bring. Winning the listing of a brand-name company such as Facebook can help burnish an exchange's reputation and is a valuable marketing tool to attract other initial public offerings. Facebook's decision to list on Nasdaq after a tough battle with NYSE was seen as a coup for the electronic exchange, which even changed some of its rules to speed Facebook's inclusion in its benchmark index.

Facebook's disappointing debut, however, has reignited the "battle of the IPOs" between Nasdaq and NYSE.

Technical problems at Nasdaq forced the exchange to delay Facebook's opening last week and left some investors in the dark for hours over whether their orders to buy and sell shares had been fulfilled.

People familiar with the situation said NYSE plans to make the case to prospective issuers that Nasdaq's reliance on automated markets contributed to Facebook's rocky debut. NYSE's contact with Facebook was reported earlier by Fox Business Network.

Nasdaq is responding to its rival's offensive by putting more effort into poaching companies from the Big Board—and reassuring potential listings clients that Nasdaq's market model is sound, according to people close to their plans.

The exchange said Monday that Western Digital Corp., a hard-drive company, would leave NYSE to list on Nasdaq. "The deals for companies are going to be as sweet as they've ever been," said a person involved in the discussions, referring to listing incentives like promotional efforts and co-branding opportunities with other listed companies.

The Facebook IPO hiccups are "going to require an explanation for any company that's deciding which exchange to list on," said Steve Harrick, a general partner at Institutional Venture Partners, a venture-capital firm in Menlo Park, Calif.

Mr. Harrick said he had talked in recent days with a Nasdaq executive, who sought to explain how the Facebook glitches happened and how Nasdaq had changed its computerized systems so the problems with the Facebook listing won't recur.

"It's definitely a point in NYSE's favor," said Jillian Miller, an analyst with BMO Capital Markets, referring to the rocky Facebook IPO. "When they're out talking to potential issuers, this is probably going to be the first thing they bring up."

For Nasdaq, listings and corporate services contributed $372 million in 2011, about 22% of its total revenue. For NYSE, listings and corporate services brought in $446 million last year, about 17% of revenue.

"We feel our value proposition remains strong," said a spokesman for Nasdaq. "This fight for listings has been a decade-long battle that we're winning through switches, IPOs, and international listings."

NYSE plans to emphasize the role of designated market makers on its New York trading floor, versus Nasdaq's entirely automated markets, according to people familiar with the plans. The human factor in handling share trading became a selling point for NYSE following the May 2010 "flash crash," and the system glitches that blighted Facebook's IPO gives NYSE another chance to underscore the two exchanges' differences.

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"For companies it's going to come down to whether you're comfortable using an exchange that doesn't have a human backstop in case something goes wrong," Ms. Miller said.

Nasdaq has cultivated its image as the stock-listing home to several generations of America's most successful technology companies, from Microsoft Corp. and Oracle Corp. to Amazon.com Inc. and Cisco Systems Inc. to Google Inc. and, now, Facebook.

Other promising tech companies expected to go public in the next year include Palo Alto Networks Inc., Workday Inc., ServiceNow Inc. and Atlassian Inc. And Twitter Inc.'s IPO prospects have already captured IPO investors' imagination.

For NYSE, the fumble of Facebook's IPO could help the Big Board land its next big tech deal after the listing of online business-review site Yelp Inc. in March.

A spokesman for NYSE declined to comment.

"In the short term, if I'm deciding which platform to go with, I'd think twice at this point" before choosing Nasdaq, said Sang Lee, managing partner with Aite Group, a consultancy that researches exchanges.

Some Silicon Valley venture capitalists were adamant that Nasdaq's handling of the Facebook IPO won't affect where they want their start-ups to list.

"The trading glitch the morning of the IPO was embarrassing, but that's the only thing Nasdaq was responsible for," said Mark Siegel, a venture capitalist at Menlo Ventures in Menlo Park, Calif. "The pricing was all in the hands of the company and its bankers."

Advantages and Disadvantages of Dual Listing

Advantages

- Access to a larger pool of potential investors (both retail and institutional)
- Increased liquidity derived from operating in more than one market
- Greater access to capital, particularly in larger markets such as Europe or North America
- Ability to 'tap in to' different markets at different times, depending on macroeconomic conditions etc.
- More relevant peer and/or comparative market
- Increased opportunities for mergers and acquisitions
- Higher public profile

Challenges

- Initial listing costs associated with a second listing
- Ongoing costs associated with a second listing
- Increased liability given different regulatory requirements
- Increased demands on management – time commitment for marketing etc.
- Complications with different clearing systems, are shares fully fungible
- Practicalities of cross-market releases (different time zones)
- Requirement for additional advisers, overseas based directors

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Impact of IT on Financial Sector

Changes in Value Chain – Using IT to improve companies

Decomposition of value chain into specialized entities
Breaking down traditional processes/roles into new fully functional units
IT being the enabler (similar to business process reengineering)

Shared Services (within organization) VS Business Process Outsourcing (outsourced to 3rd party)

Shared services centres are centers for shared services in an organization – is the entity responsible for the execution and the handling of specific operational tasks to streamline transaction processing and offer potential for value-added services. BPO is similar but it is outsourced to a third party.

FOR Business Process Outsourcing	FOR Shared Service
Produces greater cost savings. Superior systems, porcesses, technologies and economices of scale - as well as easier access to offshore labor - often enable an outside vendor to do the work more efficiently. Outsourcing also delivers better quality by capitalizing on a vendor's specialized knowledge, experience and talent	Organisations with sufficient capabilities and scale may be able to save money and achieve better quality by keeping in-house services. Cost of transitioning to outsourced model can be very significant
Faster Implementation, less time wasted on internal politics and inertia	Misalignment of interest between vendor and company. May be better to optimize the company's processes and systems before the transition, even if it takes longer time
Avoids future investments such as costly system upgrades	Upgrades conducted by outsourcing vendors may be limited to their field, which can limit the company's ability to improve end-to-end process, which is typically where the greatest value is found
Greater flexibility by turning fixed costs into variable costs. Better to focus on incremental improvements that are likely to pay off than risk limited resources on a long shot	From a strategic perspective, locking into an outsourcing contract can reduce options and flexibility of company
Leading vendors often have world-class processes and controls that present even less risk than your own. Taking advantage of such capabilities can help company achieve their strategic objectives	Shared services gives more control over processes and outcomes, which reduces risk. This is especially important for key activities that are strategic to the business or bound by strict compliance requirements
Provides more time to focus on activites that are truly competitive differentiators	Business requirements are unique and the systems and processes needed to support them are competitive differentiators that should be kept in house
Well designed outsourcing contracts can provide rigorous procedures for handling and protecting sensitive information	No need to share strategies and other proprietary information with outside party

	Shared Services
Benefits	Cost savings • 25-35% and reduced compliance and audit cost Visibility and transparency • Systems consolidation • Reduced transaction processing times Improved governance • Comprehensive documentation • Clear process owners Transformation of administrative functions • More focus on value-added activities

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	• From transaction processing to strategic advisor
Challenges	Political • Internal politics Skills and culture • Administrative staff mindset • Many disparate systems (how to merge them efficiently together) • No one wants to give up their systems Shared service projects fail (and often end up costing more than they hoped to save) because they cause a disruption to the service flow by moving the work to a central location, creating waste in handoffs, rework and duplication, lengthening the time it takes to deliver a service and consequently creating failure demand (demand caused by a failure to do something or do something right for a customer)

Role of Technology in Shared Services
Technology as an enabler for economics of scale
Telecommunication advancement such as phone calls, video conferencing and emails

Outsourcing VS Offshoring

Outsourcing refers to an organization contracting work out to a 3rd party, while **offshoring** refers to getting work done in a different country, usually to leverage cost advantages. It's possible to outsource work but not offshore it; for example, hiring an outside law firm to review contracts instead of maintaining an in-house staff of lawyers. It is also possible to offshore work but not outsource it; for example, a Dell customer service center in India to serve American clients. **Offshore outsourcing** is the practice of hiring a vendor to do the work offshore, usually to lower costs and take advantage of the vendor's expertise, economies of scale, and large and scalable labor pool.

Why is outsourcing becoming more prevalent?

- Disaggregation of Value Chain – Specialisation (due to the following reasons)
  - Cost considerations
  - Consumer experience
  - Agility – react to market changes
  - Improve efficiency
  - Manage complexity in banking services
  - One of the biggest challenges of disaggregation is the security involved (e.g outsource credit card business: most importantly is how to secure payment and how to make transactions secure)
- I.T. Advancements
  - Reduce costs and increase efficiency
- Large supply of human capital in INDIA, RUSSIA and CHINA to meet the demand
  - Economist Intelligence Unit surveys that 30% of companies outsource their accounting and finance services
- Financial and Economic Difficulties
  - Preferred to do cost savings of up to 50%
- Wider acceptance of standards
  - ISO (Safety, Reliability, Quality); SEI CMM (maturity of software development process); Six-sigma (defects in products and services)
  - Easier to integration for BPO

Role of Technology in outsourcing

1. Telecom Deregulation and Bandwidth Increase
   - Significantly improved the quality and stability of communication links at lower costs. For example, VOIP, emails, video conferencing
   - Parent companies have better control and management of outsourcing at a lower cost
2. Integration Applications and Business Process Management Software
   - More scalable and sophisticated
   - Outsource to take advantage of the expertise and Economies of Scale of the suppliers
   - Focus on core competencies
3. Increasing expense of managing an IT system
   - Outsource to reduce capital investment

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- Change fixed cost to variable cost →reduce operational leverage → easier to be profitable, especially important during bearish economic conditions

Comparison Chart – Offshore VS Outsource VS Offshore Outsource

	Offshoring	Outsourcing	Offshore Outsourcing
Definition	Offshoring means getting work done in a different country.	Outsourcing refers to contracting work out to an external organization.	Both offshore and outsource
Risks and criticism	• Transferring jobs to other countries • Geopolitical risk • Language differences • Poor communication	• Misaligned interests of clients and vendors • Increased reliance on third parties • Lack of in-house knowledge of critical (though not necessarily core) business operations • Loss of control • Cost savings may not happen • Held hostage by contractor (**Solution: Joint venture/co-ownership of asset to co-share the risks**) • Other risks see bottom • SECURITY RISK	While it combines the benefits, it is also susceptible to the risks of both business practices. Risks are magnified because of the complexity being multiplied. For example, while it can be challenging to work with an external organization for projects that require knowledge of your business operations, these challenges could increase manifold when members of the external organization are located in a different country. **Risks** Poor communication Incorrect setting of expectations Disconnected control structures
Benefits	Lower costs Better availability of skilled people Getting work done faster through a global talent pool.	Take advantage of specialized skills, cost efficiencies and labor flexibility. Focus on core competency Lower operating costs Trend of business process outsourcing (i.e. end-to-end outsourcing of a business line or process in its entirety → the third party becomes more like a strategic partner than a traditional supplier)	Offshore outsourcing combines the benefits of outsourcing, such as easier resource ramp up and ramp down, and more specialized skills; with the benefits of offshoring, such as lower costs and higher productivity. In the past decade and a half of increasing globalization, offshoring has been the fastest growing segment of the outsourcing market. This is especially true in the case of manufacturing - with China being a leader - and information technology services, with India leading that space. Business process outsourcing is another area of offshoring that has grown tremendously.

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Risks	Explanation
Country Risk	Singapore MAS's Guidelines on Outsourcing USA Bank Service Corporation Act UK FCA's Considerations for firms thinking of using third-party technology (off-the-shelf) banking solutions
Strategic Risk	The third party may conduct activities on its own behalf which are inconsistent with the overall strategic goals of the regulated entity. (they know about your operations and can potentially jeopardize your plans) Failure to implement appropriate oversight of the outsource provider. Inadequate expertise to oversee the service provider.
Reputation Risk	Poor service from third party. Customer interaction is not consistent with overall standards of the regulated entity. Third party practices not in line with stated practices (ethical or otherwise) of regulated entity.
Compliance Risk	Privacy laws are not complied with. Consumer and prudential laws not adequately complied with. Outsource provider has inadequate compliance systems and controls.
Operational Risk	Technology failure. Inadequate financial capacity to fulfil obligations and/or provide remedies. Fraud or error. Risk that firms find it difficult/costly to undertake inspections.
Security Risks	Breach of information system security There is total dependence on the third party to deliver and may have high exit barriers
Concentration and Systemic Risk	Magnitude of any financial crisis is potentially accelerated if multiple banks goes to the same vendor

Protecting against risks of outsourcing

- Select Qualified Vendor
- Ensure Contractual T&Cs
- Access to Systems
- High Standard of Care & Diligence
- Implement Policies, Procedures & Controls
- Monitor & Review
- Establish Disaster Recovery Framework (DRF)
- Regular Training for DRF
- Monitoring of DRF
- Backup Plans
- Only outsource the less important/ non-core activities

Commonly outsourced services

- Typically the back office operations
- Check clearing
- Payment processing (e.g. credit cards)
- Opening of accounts
- Telemarketing (sourcing for new customers)
- Collection
- Development of software applications

Others include:

- Information Technology Outsourcing (ITO)
- Business Process Outsourcing (BPO)
- Knowledge Process Outsourcing (KPO)

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Best Practices of Outsourcing/Offshoring

There are several best practices that have evolved over the past two decades to mitigate risks and improve outcomes of projects that are offshored and outsourced. Many of these practices are related to business processes. Process maturity models like CMMi and Six-sigma measure not only the quality of processes that outsourcing vendors employ, but also how well companies monitor their processes, measure key metrics and how they continually improve these processes.

Reducing the risks of outsourcing (Prevention, Detection, Containment)

Outsourcing poses important challenges to the integrity and effectiveness of financial services regulatory systems. First, where outsourcing takes place by regulated entities, a firm's control over the people and processes dealing with the outsourced function may decrease. Nonetheless, regulators require that the outsourcing firm, including its board of directors and senior management, remain fully responsible (towards clients and regulatory authorities) for the outsourced function, as if the service was being performed in-house. In some jurisdictions, regulators impose restrictions on the outsourcing of certain functions where they believe the outsourcing introduces an unacceptable risk or is critical to the function of an intermediary. Second, regulators expect that they will have complete access to books and records concerning an outsourcing firm's activities, even if such documents are in the custody of the firm's service provider. Regulators must also take account of possible operational and systemic risks that may exist in the event that multiple regulated entities use a common service provider.

Constant Monitoring of service provider

Ensure that they have the ability and capacity to undertake the provision of the service effectively

Legally binding contract

Appropriate contractual provisions can reduce the risks of non-performance or disagreements regarding the scope, nature, and quality of the service to be provided. A written contract will help facilitate the monitoring of the outsourced activities by the outsourcing firm and/or by securities regulators.

Back up

Ensure

(a) Procedures are in place to protect the outsourcing firm's proprietary and customer-related information and software; and

(b) Its service providers establish and maintain emergency procedures and a plan for disaster recovery, with periodic testing of backup facilities.

Reducing concentration risks

Taking steps to become aware of cases where a significant proportion of their regulated entities rely upon a single service provider to provide critical functions. This could include, where appropriate, a monitoring program and/or a risk assessment methodology, and the collection of routine information on outsourcing arrangements from outsourcing firms and/or service providers. In this regard, regulators should be cognizant of the potential that subcontracting by service providers of a particular function may itself result in concentration risk

Termination Procedures

Principle: Outsourcing with third party service providers should include contractual provisions relating to termination of the contract and appropriate exit strategies.

Where an activity is outsourced, there is an increased risk that the continuity of the particular activity in terms of daily management and control of that activity, information and data, staff training, and knowledge management, is dependent on the service provider continuing in that role and performing that function. This risk needs to be managed by an agreement between the firm and the service provider taking into account factors such as when an arrangement can be terminated, what will occur on termination and strategies for managing the transfer of the activity back to the firm or to another party.

E.g. Termination rights in case of insolvency, clear delination of intellectual property

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Internet banking

Success of I-Banking

1. Role of Government Insurance to prevent bank runs and reduce the issue of trust and confidence
2. Increases outreach to potentially larger numbers of customers without the overhead costs

Managing the risks of E-banking

- Effective management oversight of e-banking activities
- Establishment of comprehensive security control process
- Comprehensive due diligence and management oversight process for outsourcing relationships and other third-party dependencies
- Appropriate disclosures for e-banking services
- Privacy of customer information
- Incident response planning
- Managing the capacity and contingency plans to ensure availability of e-banking systems and services

Security controls

The 3 quadrants of security are:

1. You have
2. You are
3. You know

For security, you must have 2 of the 3 quadrants. Banks have been relying on what you know and what you know (2 passwords) but it relies on the brain only (easily hacked). That's why banks have dongle/phone (what you have) on top of your PIN number (what you know) to increase the security

Why do you need additional pin before doing bank transfer?

Prevent hacking through pharming. Redirect victim into fake site, ask victim to key in pin while they key it into the real website. (if such a thing happen, hackers can easily transfer all your bank money out of your account). By having an additional pin (generating last 6 digits one-time pin), people cannot hack and transfer cash out easily.

Examples of security controls

- Authentication of e-banking customers
- Accountability for e-banking transaction
- Appropriate measures to ensure segregation of duties
- Proper authorization controls within e-banking systems, databases and application
- Data integrity of e-banking transactions, records and information
- Establishment of clear audit trails for e-banking transactions
- Confidentiality of key bank information

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Trade Cycle

Buy-side: Private bankers, hedge funds, individuals who manage funds, people who want to buy/sell
Sell-side: People who execute the trade for buy-side

Trading Cycle

Pre-Trade

Price Discovery
Supply and Demand determines the market price and market participants want to know this price
Exchanges provide information on these prices but alternative trading venues may be less efficient

Order driven market VS Quote driven market (See above for comparison)
For order driven markets, how to know which bids are executed first:

1. Priority of price
2. Priority of time

Pre Trade analytics
Brokers are developing pre-trade analytics in connection with their algorithms to help buy-side customers determine the best algorithms to use. These tools will help traders calculate the expected market impact of potential trades.

Why is it important?
Today, buy-side traders want immediacy and pre-trade analytics are tools that can be used at the trader's desktops rather than having to call a sales trader for the information. These analytics determine, for example, that a particular trade can be executed with less market impact. In the past, post-trade analytics were all that were available-analysts and portfolio managers would look at past trends to determine potential future outcomes. There is more emphasis on pre-trade analytics today because of the increase in electronic trading; instead of sharing assumptions on the market impact of a trade with a sales trader, buy-side firms have to interact with a black box.

2 goals of pre-trade analytics:

1. Portfolio analysis (responsibility of the buy side)
    a. Simulate the impact of portfolio changes in the long run
    b. Front office software
    c. Off-the-shelf or in-house developed or customized for customers
2. Best execution (responsibility of the sell side → KPI for sell side is to minimize cost for buy side)
    a. Best execution happens with the best price, fastest execution speed and lowest transaction cost for a trade
    b. Transactions cost analysis (ALL ABOUT REDUCING IMPLEMENTATION SHORTFALL!) of the following:
        i. Explicit costs: brokerage fees, exchange fees, taxes
        ii. Implicit costs: Loss of price advantage due to timing and market impact
        iii. Implementation shortfall: difference between the price of the security when the order is given and the cost of it for the buyer

Key Differentiators for a good pre-trade analytics

1. Easily comprehensible format
2. Ease of use
3. Flexibility of platform (ability to examine multiple execution strategies in advance of trade execution)
4. Good, robust global data
5. Provide short term insight into historical patterns and/or short-term mean reversion of volatility or shifts in order book liquidity.
6. Ability to lay off risk more effectively and in particular, to discover or suggest contingent or alternative liquidity.

Compliance and Pre-trade analytics
The pre-trade stage is arguably most important, as it's much easier and more cost-effective to ensure that things are copacetic before the trade, than it is to react to a situation *ex post facto*, which may entail undoing transactions, paying

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regulatory fines, and containing reputational damage. This is especially true for equity-block traders and their larger transactions.

Built in to ensure

1. Credit risk compliance (credit limit for clients/dealers)
2. Market risk compliance (limit on volume for a single equity)
3. Trading restrictions (on certain equity, e.g. "sin stocks")
4. Regulatory compliance (Prevent trades that are non-compliant e.g. wash sale/short-selling)

Limitations of analytics and compliance

The primary challenge here is that pre-trade analytics provides expected results based on prior experiences (by way of historical data), whereas risk and compliance controls seek to prevent possible consequences resulting from unforeseen (and possibly unintentional) activity.

Given the size and nature of block trading, there can be compliance issues beyond broker rules that are not evident until further into the placement and execution process.

Integration of pre-trade and trading technology

Allows buy side to analyse the trades and the relevant transaction costs and execute it straight away

Limitations of pre-trade analytics and improving it moving forward

Broker provided pre-trade analytics may favour their own algorithms

Going forward, pre-trade analysis needs to look beyond the immediate implementation goals towards assisting investment objectives through smarter hedging analysis and offsetting risk. It becomes particularly interesting when you consider pre-trade analysis evolving into suggesting possible proxies for trades. As a result, something that can recommend an alternative solution that provides similar economic exposure might be of more value. For example, instead of trying to predict the liquidity of a particular commodity stock this afternoon, it might recommend the purchase of a proxy basket of commodity futures.

Trade

Order routing and execution

- Trading instructions sent from buyer/seller/buy side institutions to broker
- Broker creates the order and sends it to
    - Exchange
    - ECN (alternative trading platforms)
    - OTC
    - Internalized/purchase by the broker/dealer

Order creation

Trade ticket consist the following information:

- Security identifier
- Buy/sell flag
- Type of order e.g. limit order/market order
- Quantity to be traded
- Trade date
- Marketplace to trade or best execution venue

Order management systems

- Take in real-time data feeds from marketplaces
- Orders can be routed to "any" marketplaces
- Efficiency of the system is measured by 4 factors
    1. Execution price – how close is it from the benchmark national best bid/offer (NBBO)
    2. Price improvements – how much better does it beat the NBBO
    3. Execution speed – time that elapsed between the time broker receives an order at the time the order is executed
    4. Effective spread – the distance from the midpoint of the market at the time when the order is entered to the execution price that is received
- Shift towards DMA market due to buy-side demand

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- Built-in algorithm trading (With the proliferation of algorithm trading and increasing complexity of it, trading cost can dramatically increase if the wrong algorithms are picked)

(To see the technology/architecture, refer to IT in the trade cycle (I)&(II))

Post-trade (Refer to IT in the trade cycle (I) and (II))

Confirm/Affirm Technologies
Trade Matching
Allocation and settlement
Clearing and settlement

Post-settlement

Trade process does not end with settlement. There are many other activities following it:

1. Collateral Management
    a. Evaluating the credit risk of counterparty
    b. Require counterparty to provide collateral to engage in trades
2. Position management
    a. Snapshot of current trading position and all outstanding orders at any time
3. Risk management
    a. Market risk, credit risk, operational risk
4. P/L Accounting
    a. Marking a position in the market
    b. Continually calculate profit/loss based on real-time market data
5. Reconciliation
    a. Ensure one copy of transaction is preserved

Advantages and disadvantages of collateral management

Advantages of collateral:	Disadvantages of collateral:
- **Reduced credit risk**: mitigation of current and potential future exposure to losses due to nonpayment by a counterparty. - **Capital savings**: collaterizing and netting counterparty exposures reduces the amount of economic capital required to cover credit risk and balance sheet protection (e.g. Basel II, Solvency II). This allows increased leverage and profit potential of a bank's assets. - **Increased competitiveness**: the ability to trade in a wider variety of markets where the margins may be higher or profits more predictable. - **Improved market liquidity:** increased opportunity to do more transactions in the markets, with less capital, and less time required for credit review and settlement. - **Access to higher risk trades:** collaterization reduces the risk of illiquid or new trade types which have higher risk but higher profit margins. - **More efficient trading between counterparties**: collaterization formalizes an ongoing relationship and makes transactions and payments smoother, with more opportunity to check valuations and balance the gains and losses in a standard,	**Increases Operational Risk:** Collaterization is complicated. Failure to invest in the correct technologies, staff, third-party relationships, and operate collateral processes accurately and efficiently creates additional operational risk and a false sense of security. - **Legal Risks:** How to structure, document, and manage the collateral agreements requires specialized legal skills, technologies, and trained staff. - Legal procedures: proper documentation, storage, confidentiality, etc. - Priority risk: the risk that some other counterparty has a prior claim on the collateral you hold, making the collateral ineligible. - Enforcement risk: risk that the counterparty won't give back your collateral, and the jurisdiction does not honor the collateral agreements due to lax enforcement of contract laws, political pressures, or other reasons. - **Concentration Risk**: the overreliance on a single counterparty once a collateral relationship is established → increases default correlation, leads to underestimation of single large risks such as the counterparty going bankrupt suddenly. - **Can Increase Market Risk:** Market risk on securities held as collateral can contribute to the firm's Value-at-Risk by increasing correlations in the firm-wide portfolio under market stress. High correlations lead to increased market risk through the belief that you are adequately collaterized, but everything goes down in value at once, resulting in rapid under-

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repeatable manner. - **Benefits to Buy Side (asset managers, corporate treasury, etc.)** - Minimize collateral amounts by cross-collaterization - Minimize collateral movements and give/take collateral on a net basis - Collaterize exposures by client - **Benefits to Sell Side (broker dealers, banks, etc.)** - reduces capital charge to allocate for asset liability management, etc.	collaterization. To account for this, the firm must include collateral securities and cash in portfolio-wide market risk and pricing calculations. - **Expensive:** The solution is often to outsource to triparty collateral service - **Can reduce trading activity:** Collaterizing transactions can actually reduce trading activity by eliminating more risky counterparties. This occurs when there are: - Overly high thresholds - Delays in posting / receiving collateral - Collateral Operations are highly manual and slower than the traders - Trade eligibility is lowered based on low availability of a narrow and expensive range of acceptable collateral (e.g. Treasury Bonds)

Metzler and Omgeo Case (Refer to Omgeo case)

Allocation

The life cycle event where the account breakdown (allocations) of a block trade is communicated electronically to your counterparty.

Omgeo CTM
Omgeo Connect
OASYS (US)
TradeHub (US)

Confirm/Affirm

The life cycle event where two trade counterparties communicate and agree upon the economic details of a trade in order to achieve settlement.

Omgeo CTM
Omgeo Connect
OASYS-TradeMatch (US)
TradeSuite ID (US)

Settlement Notification

A life cycle event where notifications of trade details are sent electronically to custodians, trustees, administrators or other interested third parties.

Omgeo CTM
Omgeo Connect
TradeHub (US)
TradeSuite ID (US)

Enrichment

A life cycle event where the appropriate settlement instruction data is associated with the trade to ensure effective settlement. Also includes a web-based repository for storing confirm disclosures.

ALERT
Omgeo InSITE

Operational Analytics

Tools to provide clients and their counterparties with detailed information on their operational performance. Also includes a reporting mechanism to ensure compliance with regulatory responsibilities.

Benchmarks

Collateral Management & Reconciliation

Represents various life cycle events that manage counterparty risk and handle all aspects of your portfolio of open transactions and collateral balances.

Omgeo ProtoColl

Managing the Downside

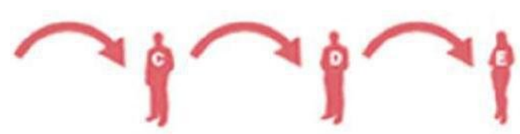
The face of risk is changing. Tougher regulations, the emergence of more sophisticated trade strategies and increasing pressures from trade counterparts have introduced new categories of risk that firms must guard against in order to ensure profits and protect their bottom lines. Omgeo provides our community with the tools needed to manage this broader portfolio of risks through the automation and timely confirmation of trade details.

Counterparty Risk

Appraisal of your counterparty's viability is essential to managing the downside of trade failure and default. With Omgeo, you can proactively handle every aspect of your portfolio of open transactions and collateral balances to effectively mitigate counterparty risk exposure, obtain complete transparency into your portfolios (positions and breaks), and automate the valuation and margin call process. And, you can manage all of this within one of the most trusted and secure communities in the financial world.

Manage Counterparty Risk +

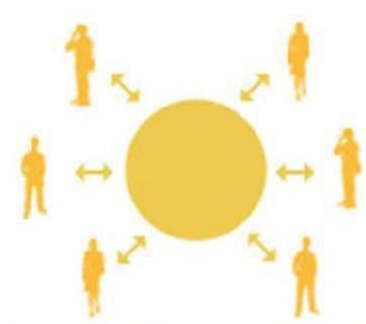
Operational Risk



Uncertainty stemming from back office trade process inefficiencies is responsible for an alarmingly high rate of trade failures. As demand and volumes continue to increase, firms' exposure to operational risk will only intensify. By introducing greater automation and rigor to the middle and back office, Omgeo helps you to handle increasing volumes more efficiently and reduces your operation costs and trade failures by up to 70%.

Manage Operational Risk +

Compliance Risk



The tightening regulatory environment poses serious risks to firms' earnings and reputations as a result of nonconformance. Through participation in Omgeo's efficient community of trade partners, clients can more easily remain aware of regulatory developments through industry updates and advisory board reports. Omgeo's products provide improved controls to ensure compliance with SEC regulations, such as 10b-10.

Manage Compliance Risk +

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OTC VS Exchanges

Over-the-counter (OTC) is a security traded in some context other than on a formal exchange such as the NYSE, TSX, AMEX, etc. The phrase "over-the-counter" can be used to refer to stocks that trade via a dealer network as opposed to on a centralized exchange. It also refers to debt securities and other financial instruments such as derivatives, which are traded through a dealer network.In general, the reason for which a stock is traded over-the-counter is usually because the company is small, making it unable to meet exchange listing requirements. Also known as "unlisted stock", these securities are traded by broker-dealers who negotiate directly with one another over computer networks and by phone.Instruments such as bonds do not trade on a formal exchange and are, therefore, also considered OTC securities. Most debt instruments are traded by investment banks making markets for specific issues. If an investor wants to buy or sell a bond, he or she must call the bank that makes the market in that bond and asks for quotes.

	OTC	Financial Exchanges
Definition	No centralized place where trades are made. Markets are made of all participants in the market trading among themselves. E.g. structured securities, derivatives	• Stock trades conducted via a centralized place. • Buy/sell is conducted through the exchange and there is no direct contact between seller and buyer. Exchanges will act as a counterparty to all trades
Advantages	Heavy competition to attract the most traders and trading volume to their firm Lower transaction cost compared to exchange market Firms can set their instrument prices Quality of execution varies from firm to firm for same instrument	• Reduces counterparty risk • Trade obligations guaranteed • All trade flow through 1 central place – price for an instrument same regardless of size of trading entity • Firms on exchanges must be registered → greater regulatory, safer place for individuals trade
Disadvantages	Dishonest firms due to low barriers to enter the market and lack of heavy oversight. Serious implications that led to financial crisis: **1. The inability to value one's holdings** Without liquid and orderly markets, there was no price discovery process and in turn no easy and definitive way to value the securities. The failure of the price discovery process aggravated the problems at banks and other financial firms during the recent crisis by making it more difficult to meet disclosure and reporting requirements on the value of their securities and derivatives positions. No efficient direct market prices + no benchmark prices → assets and positions that were once valued at market prices now valued through models that are not adequately informed by benchmark prices. These valuation problems further depressed prices of affected securities. **2. The inability to sell them** Dealers, facing a crunch on the funding side of their balance sheets and holding an excessive amount of illiquid assets on the other, withdrew from the markets. The jump in volatility made it especially dangerous and expensive for dealers to continue to make markets. Without the dealers, there was no trading. With no buyers, investors could not reduce losses by trading out of losing positions and they could not sell those positions to meet calls for more margin or collateral to pledge against loans they had	• Higher cost due to regulatory constraints • Increased transaction costs due to exchange fees and commissions

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	taken out to buy those instruments. This illiquidity in OTC markets exacerbated the financial crisis.	

Challenges faced by Exchanges

1. Capacity issues arising from algorithmic trading
2. Increased importance of capacity planning for the exchange industry.
3. ECNs, with its low cost structure and speed of execution, were challenging the traditional market maker/broker model
4. More Reliance on Technology to make Exchanges -> Technical Glitches and Breakdowns
    a. eg. NYSE Trade Halt on July 2015
    b. Nasdaq market paralyzed by three hour shutdown.
5. Potential Cyber Attacks
6. Hardware failures
7. Poor performance of "big" data access
    a. Surge in data volumes (2TB per day) makes it difficult to ingest, synthesize and make it consumable to downstream applications
8. Poor availability and accessibility of data for users
    a. NYSE Euronext trades 14 different types of products. The different product types have different data structures, increasing the integration challenge
9. Poor Integration of reference data
    a. Unable to effectively integrate data across multiple exchanges and enterprises

Increasing the profitability of Exchanges

1. Regular maintenance to prevent against hardware failures.
2. Advancement in Security Systems to combat cyber attacks.
3. Development of an even more well-refined system.
4. Faster processing time
    - Adoption of Massively Parallel Processing technology streamlines and prioritise information flow to increase faster transaction speed.
5. Better IT infrastructure
    - Increase product offerings and resolving existing integration challenge leads to increase in revenue.
6. Technology and IT can also create new market - promote high speed trading + co-location services
7. ECNs and ATS (driven by technology) are low frequency trading because they promote anonymity

Challenges of Linking up the different exchanges

Pre-trade activities

How to aggregate information and provide a single platform from all the different exchanges (Ease of use of platform)
Provide real time information for traders in different time zones
Laws and regulations vary across countries – standardizing them to increase the efficiency and reduce regulatory costs and increase ease of trading for investors when doing cross-border trading

Trade Activities

1. Infrastructure Development for ease of order routing and order creation.
2. Unwillingness of countries to join:
    a. Different maturity stages of different exchanges: a country whose capital market is less mature prioritizes developing its own market and securing a competitive edge, tending to become cautious about joining the link.
    b. Furthermore, if all exchanges of ASEAN members participate in the link, stocks of companies listed on one exchange will be allowed to be traded on any other. Therefore, there is concern that listings could be concentrated in a few highly liquid and reliable exchanges, such as Singapore Exchange, and as a result, some bourses could suffer sluggish growth in the number of listed companies.

Post-Trade Activities

1. Standardizing clearance and settlement process across the different countries for crossborder trading. Currently, this process is carried out in the country where the stock is listed. As a result, the use of the trading link does not reduce costs in the post-trading process.
2. Which clearing party owns the rights to all the equities and securities → Sensitive issue

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3. Laws and regulations vary across countries – standardizing them to increase the efficiency and reduce regulatory costs and increase ease of trading for investors when doing cross-border trading
4. Post trading - How different markets are able to handle multi-market, multi-currency settlement instructions efficiently

Achieving STP

In a multi-market environment, clearing and settlement is something that is very important for us, because you're trying to make electronic trading as seamless as possible and different clients have different needs. In addition, the big difficulty for clearing and settlement comes when you have day-trading clients who might want to do day-to-day set-off and contra trading. When you are doing things manually, you can intervene and have exceptional handling processing, but electronic trading poses a challenge in these circumstances. It stops the whole straight-through processing and you need to intervene manually. Risk management and tracking or collateral becomes important to handle such clients.

Advantages and Disadvantages of a Central Clearing Party (and consolidating them)

Benefits of Central Clearing Party	Cons of a Central Clearing Party
• The reduction of risk exposure by providing a prime counterparty. CCPs are backed by a series of capital buffers (in the form of initial margins, default fund, reserves and equity) and a risk-sharing arrangement among CCP members. CCPs are also subject to a special regulatory regime. Consequently, CCPs are deemed to be low-risk counterparties, for which reason, they can benefit from reduced regulatory risk capital charges. • Multilateral netting of risk exposures. • More rigorous risk management practices than many market users. • The reduction of balance sheets through netting. • Operational efficiencies from the netting of payments and transfers. • The potential for enhancing market transparency, given that CCPs collect data on transactions and are therefore in a position to publish aggregated price and volume data (eg the DTCC in the US publishes a repo rate index). • Increased transparency in transactions	• As a higher proportion of trading is cleared across CCPs, more and more credit, liquidity and operational risks will be concentrated in these institutions, which will themselves become potential sources of systemic risk. • Greater use of CCPs means greater collective reliance on a limited range of risk management methodologies, which may synchronise reactions to news (eg changes in haircuts or collateral eligibility) and generate pro-cyclical shocks to the financial system. Strict haircutting by CCPs arguably had such an effect on Greece, Ireland, Italy, Portugal and Spain in 2011. • Although CCPs apply more rigorous risk management practices than many market users, their methodologies are often proprietary and therefore opaque, and it is not possible for members to scrutinise these methodologies, despite their critical dependence on them. • CCPs tend to specialise in particular products or asset classes. Use of CCPs therefore reduces the scope for netting across products, which institutions are currently able to do on a bilateral basis. • CCPs are expensive to use. The extra cost of using CCPs will raise the cost of funding to all market-users. • CCPs increases transparency in the market → providers may not want the transparency to reap profits from it • CCPs accept a limited range of collateral assets, usually only cash in major currencies and top-quality government bonds. This may contribute to a systemic shortage of collateral.

Benefits of Consolidating CCPs	Cons of Consolidating CCPs
1) **Consolidation reduces costs for traders** - No need to maintain separate collateral accounts	1) **Regulatory issues** - Incompatible regulations set by different countries or exchanges

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for each clearing and settlement organisation - No need to reconcile end-of-day balances with multiple clearinghouses, each with different and often incompatible rules 2) **Lower credit risks for traders** - Risk of settlement failure and default is spread over a larger number of firms - Larger consolidated clearinghouses can be better capitalized with the collateral of more firms and can have larger guarantee funds so that the risk of the clearinghouse defaulting is reduced for traders	- Some clearinghouses may be tied to governments so there is political interest against consolidation 2) **Increase in systemic risk** - The collapse of a single central clearinghouse will devastate the financial system more greatly than the collapse of a smaller clearinghouse 3) **Creation of monopoly** - Inelastic pricing of clearinghouse services due to lack of competition

Advantages and Disadvantages/Risks of SaaS over Enterprise Order Management Systems

Advantages	Disadvantages /Risks

• Cost Savings
  ○ Infrastructure, management and maintenance costs could be saved by paying the cheaper SaaS subscription fees instead.
• Scalability
  ○ With a change in business size, firm can opt to change flexibly the SaaS service to meet their needs.
• Functionality
  ○ SaaS generally provides more relevant functions which are required to solve emerging problems faced by firms today.
• Upgradeability
  ○ With technology constantly evolving, systems have to be upgraded frequently. With SaaS, the onus of upgrading is with the service provider.
• SaaS is capable and scalable enough to follow the growth in volumes and complexity, while enterprise order management systems provided by traditional vendors are not.
	• Lack of Control
	  ○ Engaging firm may not have autonomy to decide on upgrade of current software or expansion of existing service to suit their needs. (Vendor choose not to upgrade certain function as the demand for it is very low)
	• Latency Issues
	  ○ As data are not stored locally, information crucial to make immediate trades might not be available as readily.
	• Security
	  ○ As information is not stored locally, there is a higher chance of information leak which can be costly to firms with high profile clients.
	• Outage
	  ○ In events of outage, customers has to rely on provider in order to fix everything.
	• Bound to one provider
	  ○ Customers that has stayed with a provider for a long time will find it difficult to move to another SaaS if necessary.

Straight Through Processing

STP is the intial drive for shortening settlement cycle of securities. It represents the complete automation of trade related processes in the securities industry. It constitutes an end-to-end streamlining of operations within and across firms. (Replaces manual process)

Benefits and Challenges of STP

Benefits of STP	Challenges of STP
1. Process higher volume with greater accuracy and faster results →increased scalability. 2. STP enhances internal collaboration and communication, because information is stored in one location and is easily accessible. As a result, the amount of operational risk and data errors is reduced. 3. Reduces cost and control risks 4. Financial institutions need to see the value of implementing STP in	1. System integration and security 2. Managing exceptions on customer limits and authorizations and bringing a payment back into the STP route as soon as an exception is resolved 3. Increased focus on compliance checks on payment instructions 4. Complexity, cost and magnitude of changes required for a fully

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customer onboarding. Be more competitive and responsive than the competition. 5. Enhanced regulatory compliance 6. Minimize operations cost	efficient STP is huge 5. Participants may want to maintain a degree of freedom of control on the flow of the transactions → full STP may not be possible 6. Legal implications?

Considerations to improve STP implementation

- Construction of an STP system should be based on modular or component-driven design, with a clear vision on the final landscape
- Adopting a phased approach for a transformation program and avoidance of any big bang situations to manage and mitigate associated risks at an acceptable level
- Any short-term changes should be aligned to the longer term goal or vision of the STP transformation program
- Creating key performance indicators which can be measured during this transformation
- Leveraging any existing payments services, processes or infrastructure and stressing on reusability of functionality to avoid creating new silos during this process
- Creating a strong governance model around the payment operations to be supported, and clearly differentiating between core and localization needs

Advantages and Disadvantages of using technologies for STP (e.g. Murex)

Advantages	Disadvantages
• Improve the business operating model, addressing not just the Audit and Compliance requirements • A complex workflow that includes check and balances to ensure trades trade within their approved limits and inform credit if they come close to their limits. • Streamlined processes reduces time required to carry out a transaction and record it. • Not just for efficiencies but also for private reasons (what the employee knows is an asset and limiting that to the minimum with these technologies allows companies to hold their trade secrets better)	• Expensive → Hence smaller companies are still using spreadsheets • Requires training → Murex is more complicated to learn • Less secure → as data are being stored online

Trends supporting the pickup of STP: (Refer to notes for more information: IT in trade cycle II & III + PPT Seminar 5 Presentation)

1. Exploding Trading Volumes
2. Shrinking Margins
3. Evolving marketplaces
4. Changing revenue model (Low touch ad high touch model)
5. Transformation of the buy-side
6. Globalization
7. Regulatory Pressures

4 Pillars of STP

Seamless communication between parties
Significant real-time processing, less batch processing
Electronic, not physical processing
Concurrent, not sequential exchange of information

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E-Money and Financial Networks

E-money

E-money is electronic money that is exchanged electronically over a technical device such as a computer or mobile phone. E-money in circulation operates as a pre-paid bearer instrument. They are intended to be used as a general, multipurpose means of payment in contrast to many existing single purpose prepaid card products.

The best known example of e-money is the Bitcoin, which can be bought with real money and traded on an exchange like any other currency.

Criteria for something to be E-money:

1. Ownership of token → Ownership of money
2. Is it for general multi-purpose use or single purpose? Single purpose not considered e-money.

E-payment VS E-money

E-payments ARE NOT e-money!

Electronic payment as a form of financial exchange that takes place between the buyer and seller facilitated by means of electronic communication. The value of electronic payment goes way beyond the immediate convenience and safety of cards to a greater sphere of contributing to overall economic development.

Benefits of E-money	Challenges of E-money Adoption
1. Lower costs (eliminates cash handling costs) 2. Reductions in check and credit card fraud 3. Reduced risk of theft and vandalism in retail outlets 4. Increased convenience for consumers 5. More value-added services a. Electronic money technology–particularly smart card applications–could help sharpen merchants' offers of value-added services, strengthening customer relationships. For example, retailers could track customer activities (to an even greater extent than they currently do with credit cards) to discern buying patterns and offer buyer-specific discounts and loyalty programs. These targeted promotions, also known as "micro-marketing," are generally viewed as more efficient than the mass-marketing techniques currently used.	1. 2-sided market externality problem a. Go to customers → merchants do not accept b. Go to merchants → No customers c. To start, one will have to subsidize one party to get onboard first and the merchants are normally subsidized (very costly though) 2. Security a. Confidence in using and trust in the e-money 3. Compatibility a. Backward Compatible (e.g. credit cards EMV chip + magnetic strip – not used in SG but in US, therefore also implement) 4. Seigniorage – who should bear the costs a. Minimize costs 5. Develop standards for interoperability among the hardware and software systems merchants must use when accepting electronic money (The greater the acceptance of common standards, the greater the degree of interoperability – length, thickness,width of EMV chips)

Role of government in adoption of e-money (issues exacerbate at the international level)

Governmental support through subsidies and laws

CEPAS Example

- Singapore government: demonstrated that deployment of CEPAS (contactless payment) could be safe, reliant and convenient experience
- Retail adoption: not having a common terminal network across all card managers in retail arena.
- IDA offers S$16 million to jointly fund the cost of local merchants to switch from POS terminal to CEPAS

Privacy

As noted previously, electronic commerce and finance creates new opportunities for unauthorized access to and manipulation of private information. Although the European Parliament has moved to address some of those issues,

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few federal laws address them.22 The extension of electronic debit and electronic cash systems to the Internet presents additional risks. Data traveling through the open network of the Internet is more susceptible to interception and can be copied or modified. The extent of the risk to privacy will depend on the design of the systems and the types of information traveling over the Internet.

Law enforcement

As noted earlier, electronic cash could, depending on how it is developed, share an important attribute with traditional cash. Like cash, it could lead to anonymous transactions that do not leave a "paper trail." While those attributes give ordinary citizens privacy, they also make possible the commission of large-scale financial crimes with relatively low risk of apprehension. Should the use of electronic cash become pervasive, government may question the effectiveness of its regulatory provisions and investigative strategies and techniques in combating financial crimes.

Benefits of E-money

Issuers of electronic money

The question of who may issue electronic money cuts across a wide spectrum of interest. Answers to the question have the potential to affect such activities as the regulation and supervision of issuers; and the management of both the payments system and monetary policy.

Legal Issues

Supervision of issuers, oversight of payment system, the effect of the issuance of e-money on consumer and data protection. In several countries, legislation exists which provides the legal context for internet and mobile payments. There are notions where the legal aspects have not caught up with the developments.

Evaluation of widespread use of E-money

There are many obstacles to growth. These include issues relating to interoperability, security and privacy, and transaction verification and authentication.

The prospect of measured growth does not mean that government can simply sit back and wait for problems to develop. This is an area where major developments are taking place that could greatly alter the payments systems domestically and internationally. Accordingly, industry, the public, and government should use the available breathing room to consider the fundamental questions: What is the appropriate role for government with respect to electronic money? What course should government follow to carry out its responsibilities without unnecessarily inhibiting market forces that are shaping the development of electronic money systems?

Answers to those questions lie in assessing how and when electronic money will affect the ability of government to carry out basic responsibilities. Policy makers will likely wrestle, sooner rather than later, with questions in four areas: (1) consumer issues–clarifying rights and responsibilities; (2) law enforcement–evaluating the effectiveness of traditional tools in combating financial crimes; (3) government payments–moving steadily toward the complete use of EFT technology; and (4) international coordination–reinforcing the foundations of cooperative action across a wide range of issues. Traditional government responsibility for areas such as payments system stability and monetary policy may require government action, if and when electronic money systems are more fully developed and commonplace, although the timing for that is likely to be well down the road.

In acting upon the nearer-term issues, government can have an effect upon the removal of barriers to growth, a process in which the private sector has a considerable financial interest. Electronic payments and EBT initiatives can affect standards for interoperability. Law enforcement needs for information can affect privacy interests of consumers and merchants, as well as the technical standards that provide the security, transaction verification, and authentication of computerized messages. Specification of consumer rights and responsibilities can affect consumer confidence and acceptance of electronic money products.

Consequently, in meeting its responsibilities, government must combine patience with aggressive fact-finding, study, and coordination among government units both nationally and internationally. Premature action among government agencies or decisions based upon incomplete analysis could thwart innovation and its ensuing benefits, including, perhaps, the ability of U.S. firms to compete effectively in global markets.

For electronic money and banking, progress is best achieved through innovation by industry, and by government acting when markets are clearly unable to address concerns on their own. Even then it is important that industry, consumers, and government work together to find constructive solutions to problems.

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Electronic Payments

Mainly through the Internet or mobile phones
B2B (Business-to-Business), B2C (Business-to-Customers), P2P (person-to-person)
Online credit card payment, inter-bank transfer, wire transfer

E.g. of P2P Electronic Payment Networks
Yahoo! – PayDirect
Ebay – Paypal (allows people to make payments across the world)
Western Union – BidPay (till 31 Dec 2007)
Citibank – c2it (till 22 Feb 2004)

General issues and concerns about e-money and security risks:

1. Legal Issues
    a. Oversight of payment systems
2. Security
    a. Encryption? Temper Resistant? Limits in value?
3. Issuer Details. Who issues?
4. Security risks
    a. Fraud Risk
    b. Duplication of devices
    c. Alteration or duplication of data or software
    d. Alteration of messages
    e. Theft
    f. Repudiation of transactions
5. Malfunctions
    a. Balance cost with robustness of device

Risk Management of E-Money and E-Payment

Risk Management: Prevention Measures

1. Tamper-resistance of devices
    a. Security-related processing is performed inside a physically secured module (smart card chip)
    b. Sophisticated features include both logical (software) and physical (hardware) protection
2. Cryptography
    a. Logical protection of electronic money systems by ensuring the confidentiality, authenticity and integrity
3. Online authorization
    a. What you know, who you are and what you have
4. Procedural and administrative controls
    a. Card manufacture, cryptographic key management
    b. Separated geographically and administratively

Risk Management: Detection Measures

1. Transaction traceability and monitoring
    a. Balance between cost to run the system and the risk management
2. Interaction with a central system
3. Limits on transferability
4. Statistical analysis
    a. Detect unusual volumes of payments that could be indicative of fraud

Risk Management: Containment Measures

1. Time and value limits on devices
    a. Value limits are to contain the magnitude of losses from successful fraud attempts
    b. Cloning large number of devices is required for attacker to make the effort financially worthwhile
    c. Expiration dates on device contain the extent of any fraud (limit the upside potential of creating the card)
2. Registration of devices
    a. Facilitate investigation of any attempted fraudulent activity
3. Hot lists and disabiling of devices
    a. Hot lists are records of the serial numbers of suspect devices matined by a central system operator

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b. Disabling of devices can include multiple attemps to enter a PIN or multiple failed transactions
4. System suspension
   a. Implement facilities to rapidly change the cryptographic keys or algorithms used if a wide-ranging fraud is detected

Risk Management: Organizational

1. Manufacturing of devices
   a. Manufacturing, initialization and personalization are strictly controlled and carried out by different organizations
   b. Separation of staff within organization for different responsibility
2. Security evaluation: to be performed by independent 3rd party (external audit)
3. Background checks for merchants, staff involved
4. Monitoring of financial institutions, due dilligence programs

Financial Networks

Credit Risks and Liquidity Risks

A credit risk is the risk of default on a debt that may arise from a borrower failing to make required payments. Liquidity risk is the risk that a company or bank may be unable to meet short term financial demands. This usually occurs due to the inability to convert a security or hard asset to cash without a loss of capital and/or income in the process.

Liquidity is a real risk that can become credit risk very quickly! (due to domino effect → one company defaults, then suddenly no cash inflow for the bank and as a result, they default as well

Upgrading a financial network: Things to take note

1. Concurrent usage and upgrading
2. Backward compatibility and installed base
   a. Compatibility vs Technology improvements
3. Balance between disruptions and upgrades
4. Relying on existing externalities for compatibility
   a. Europay and MC; Plus and Visa; Discover and AMEX

Payment and Settlement Networks (Refer to E-Money and Financial Networks I)

Importance of Payment Systems

In most situations, the realisation of a given payment and settlement risk is likely to impose costs on multiple parties. While the system, institution or service provider that is the source of an initial credit, liquidity or operational disruption may face losses as a result of its problem, additional costs or losses may also be borne by the customers and counterparties of that entity. For example, an operational outage affecting one system participant may lead it to lose revenue or face replacement costs. To complete all of their own obligations, however, the counterparties of that institution might also need to purchase additional funds or securities at a potentially higher market price, leading to replacement costs. Moreover, some types of interdependencies among systems can allow an initial disruption to activate a chain of different risks and transmit an initial disruption through multiple systems. Considering these various factors, payment and settlement risks have the potential to impose losses on the entity not only at the source of a disruption, but also on its direct counterparties or customers, and in some circumstances, their counterparties or customers.

Concentration of risks

Concentrated sources of risk that affect multiple systems lead to two important, but opposing implications. First, the concentration of risk in a given system, institution or service provider could potentially allow a reduction in the aggregate likelihood of operational disruptions. This potential arises if concentration leads to a reduction and consolidation in operational steps that could potentially fail. For example, the reliance of many systems on SWIFT for network services might be viewed as promoting straight-through-processing and allowing institutions a high level of standardisation across different payment and settlement operations. Assuming that processing facilities and risk management procedures can handle the increased activity, this type of consolidation or standardisation could reduce the likelihood of operational disruptions. In addition, the risk of operational failures might also be reduced if consolidation allowed for more effective and efficient risk mitigation measures. Second, working in the opposite direction, the concentration in the sources of risk also means that a larger number of parties could be affected if a disruption occurred.

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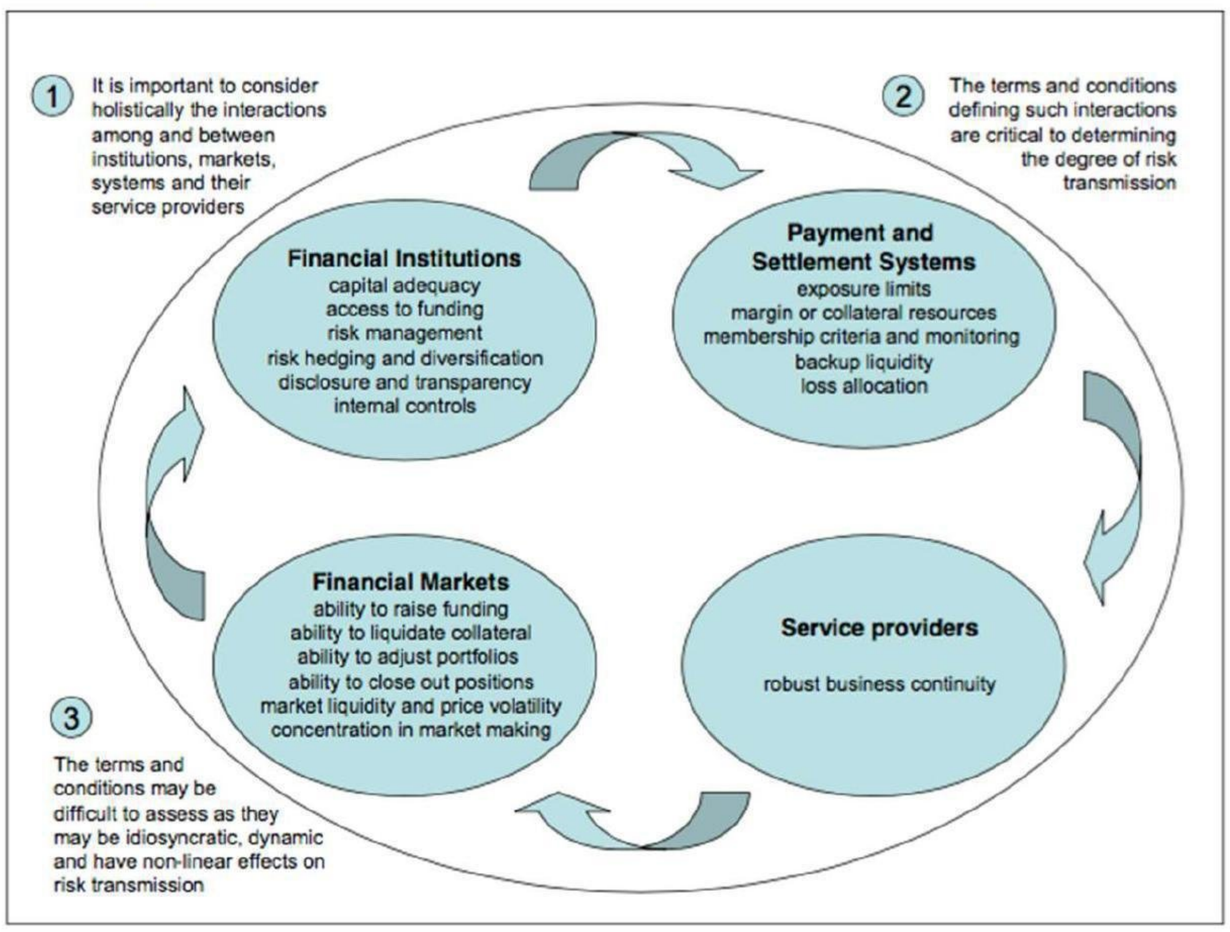
The analysis provided above shows that the development of interdependencies has significantly altered the risk profiles of payment and settlement systems in CPSS countries. On the positive side, interdependencies improve the safety of the global payment and settlement infrastructure by facilitating DVP and PVP processes and thereby eliminating a key source of principal credit risk.33 In addition, interdependencies can reduce credit and liquidity risk by facilitating the use of central bank money as a settlement medium. Interdependencies can also help to reduce operational risk through better integration of the different steps across systems.

These clear benefits, however, come at some cost. In particular, interdependencies can lead to new, cross-system sources of liquidity and operational risks. In addition, risks have become increasingly concentrated in a limited number of critical systems, institutions and service providers. In some cases, such as that of CLS, this trade-off has been anticipated and accepted, especially in the light of the reduction of principal credit risk.

Overall, the increasing interdependence of payment and settlement systems has reduced some specific risks in the global clearing and settlement system. But, interdependencies change the nature of remaining risks such that a given disruption may have implications for multiple systems. The following section further explores this topic, analysing whether and how interdependencies affect the transmission of risk across systems.

Disruption caused very quickly, widespread and to multiple financial markets

Risk Mitigation



Operational risk management

Alternative access methods can become critical in various situations. In the event of participant-level operational disruptions, tools like "offline" or "manual" transfers can be quite useful as they can significantly moderate systems' and institutions' dependence on the LVPS, for example. However, the benefits of these disaster procedures (both in LVPSs and SSSs) may be somewhat limited by capacity constraints and by the increased risk of human error. In the event of a general network disruption, alternative network arrangements may also be useful. Some systems, such as CHIPS, have implemented this approach.

The availability of alternative settlement channels for systems and their participants may also be quite useful to limit the transmission of disruptions between interdependent systems in case of an operational problem affecting one of them. Although maintaining alternative settlement channels could be costly, including in terms of the fragmentation of liquidity, the potential benefits are significant.

Liquidity risk management

It is also important for institutions' contingency funding plans to accurately reflect the time and steps required to move liquidity across currencies and systems. While financial markets and institutions' clearing and settlement arrangements theoretically allow an institution to transform any type of asset into funds in any currency, these mechanisms can take time.

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Coordination among stakeholders
A number of key systems and service providers have established detailed communication procedures for use in the event of major operational disruptions. In some cases, these arrangements involve a broad range of stakeholders, including participants or customers, as well as relevant central banks. Many central banks have also established national-level crisis communication networks for timely exchange of information among key stakeholders. Some arrangements also exist at the international level, including among central banks as system operators.

Widespread distribution of accurate information
In addition, the availability of accurate information is a critical component of risk management. Given how disruptions may pass among systems, the initial source of a problem may not always be obvious. A wrong assessment of the source of a problem and its potential impacts through interdependencies may contribute to amplifying the transmission of disruptions. Global banks have a complicated set of arrangements to handle their payments and settlements which makes it difficult for market participants and central banks to react to a problem.

In order to help prevent such misperceptions and their adverse consequences, it is important that proper information is transmitted to all relevant parties. The methods used for this communication, however, should provide a high degree of security for this potentially sensitive information. Beyond sharing proper information, there may also be a need to coordinate some of the actions of all relevant parties in addressing the disruptions in order to reach an effective and appropriate response.

RTGS

Advantages	Disadvantages /Risks/Challenges
1. **Real-time Payment Settlement:** Payments settled in real time on a transaction-by-transaction basis, as soon as they are accepted by the system. 2. **No Credit Risk**: There is no credit and settlement risk involved in RTGS system for receiving participant as each payment transaction is settled instantly. 3. **Systematic Risk:** With real time settlement taking place intraday interbank exposures are substantially reduced. 4. **Predictability of Cash Flows:** RTGS facilitates predictability of cash flows as customers know when their accounts will be debited or credited. 5. **Benefits to Economy**: The instant finality of payments ensures fast, secure and irrevocable settlement of major business and financial market transactions. 6. **No Reversals of Payments**: Payments are irrevocable and unconditional	**Challenges to change to an RTGS System** 1. Corporate cash management services will undergo a change and managing operational risk will be a critical issue from the liability perspective. 2. The system will have a substantial impact on current operations in the banks, particularly in the area of treasury, payment division, corporate banking and cash management. Banks will need to implement new strategies, processes, systems and organisation. **Risks** 1. Requires more liquidity than net settlement systems, as liquidity has to be available for each individual payment. 2. Ways to mitigate this liquidity problem: • The system could have rules for how fast payments should be made in the system. • RTGS system and the participants can develop queuing features, and algorithms that calculate the order of which payments should be made in order to get a smooth flow of payments

Net Settlement System

Advantages	Disadvantages /Risks/Challenges
Savings in liquidity needed to support any given gross volume of payment transactions, which can be greatly beneficial to the operational efficiency of the system	1. Settlement Risks arising from failure owing to liquidity or solvency difficulties of one or more participants 2. This can be addressed in the following ways: a. Impose membership criteria b. Shorten settlement lag c. Limit intraday exposures by imposing bilateral or multilateral limits d. Developing loss-sharing agreements e. Mandate the posting of collaterals

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Hybrid Settlement System

Advantages	Disadvantages /Risks/Challenges
1. Much faster compared to net settlement 2. Achieve finality faster compared to net settlement 3. Lesser settlement risk compared to net settlement 4. Need lesser funding 5. Real time information on intraday finality	1. Still greatly subjected to settlement Risks arising from failure owing to liquidity or solvency difficulties of one or more participants 2. This can be addressed in the following ways: a. Impose membership criteria b. Shorten settlement lag c. Limit intraday exposures by imposing bilateral or multilateral limits d. Developing loss-sharing agreements e. Mandate the posting of collaterals 3. Effectiveness of Hybrid system dependent on algorithm

Evaluation of RTGS VS Net Settlement

It is therefore possible to opt for a gross settlement system, because of its advantages in the area of risk, and take appropriate measures to tackle the operational efficiency problems that can arise. This seems to be what is increasingly occuring when **central banks own and operate large value transfer systems (LVTS)**. Central banks are currently implementing RTGS in various countries.

By the same token, it is equally possible to opt for a netting system, in light of its economical requirements for reserve balances, and take appropriate measures to ensure settlement finality within the system. This seems to be the tendency when large value transfer systems (LVTS) are owned and operated by private sector. Thus, it is not an exaggeration to conclude that a major reason for the tendency towards RTGS systems is that LVTS tend to be owned and administered mainly by central banks. If central banks want to encourage the private sector to embrace gross systems, because of a strong view that gross systems are superior to netting systems from the point of view of global welfare, then central banks must find a way to assure the private sector that adequate liquidity will be supplied by the central banks to the economy as a whole to guarantee a level of operational efficiency of the system no less than what would be obtained under a netting system.

In brief, the trade-offs between real-time gross and net settlement systems may be viewed differently by commercial banks and central banks. From a commercial bank's perspective, one of the key questions is the opportunity cost of reserve balances held for settlement purposes. From the central bank's perspective, the stability of the payment system is a critical issue, and most central banks tend to perceive RTGS systems as associated with a level of systemic risk that is lower than that of net settlement systems.

CHIPS (Hybrid System) VS FedWire (RTGS System)

CHIPS – Hybrid	Fedwire - RTGS
Netting system	Gross settlement
Less expensive	More expensive
Centralized queue (slower)	Real-time
Privately owned	Owned and operated by the 12 Federal Reserve Banks in the U.S
47 member participants	9,289 banking institutions
Requires prefunded account before payments can be sent/received	No prefunding requirements

How CHIPS work

- Each CHIPS participant has a Pre-established Opening Position Requirement
- Has to Fedwire the funds to CHIPS prefunded balance account (CHIPS Account) (based on past 30 days transaction level → if there are large and many transactions, there is a higher pre-funding level required)
- Required before sending/receiving of CHIPS payment orders
- CHIPS participant submits Payment Order to Centralized Queue maintained by CHIPS
- Optimized algorithm releases relevant Payment Order from Centralized Queue upon settlement
- Note * payment orders are finally settled at time of release from centralized queue.
- Attempt to match, net, set off and release as many Payment Orders as possible.

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    - Payments that they received are ranked in various priority, they are netted in different
    - Net within 90 seconds (70-80% of the trades are done in that time)
    - Low priority payments are done at the end of the day
- Unreleased Payment Orders undergoes multilateral net basis
- Participant (1) with negative position are known as Final Position Requirement
- Final Position Requirement has to Fedwire transfer fund to CHIPS account
- CHIPS transfer payments to participants with remaining balance.
- At the end of day, CHIPS account amounts to zero

Financial Networks (ATS)

Why do some of the ATS want to become exchanges?
Exchanges can earn money that ATS can never get - e.g. IPO
However, if the regulatory costs are manageable, they will still become an exchange!
But they would then lose their attraction as an anoymity - they can still have subsidiaries that are like ATS!

How ECN works and Benefits/Cons of ECNs (Refer to Financial Network II for more details)

ECNs pass on prices from multiple market participants, such as banks and market makers, as well as other traders connected to the ECN, and display the best bid/ask quotes on their trading platforms based on these prices. ECN-type brokers also serve as counterparties to forex transactions, but they operate on a settlement, rather than pricing basis.

Electronic networks make money by charging customers a fixed commission for each transaction. Authentic ECNs do not play any role in making or setting prices, therefore, the risks of price manipulation are reduced for retail traders.

Advantages	Disadvantages
Better bid/ask prices because they are derived from several sources + Reduce transaction costs because of the bypass of human intermediaries.	Many of them do not offer integrated charting and news feeds.
It is possible to trade on prices that have very little or no spread at certain times.	Their trading platforms tend to be less user-friendly.
Retail investors appreciated the transprency of their pricing mechanism and that they operated over longer hours than NASDAQ and the NYSE.	It may be more difficult to calculate stop-loss and breakeven points in pips in advance, because of variable spreads between the bid and the ask prices.
ECNS were bound to fewer legal obligations than traditional market makers and could, for e.g., choose to withhold certain services that market makers need to provide.	Traders have to pay commissions for each transaction.
Anoymity of trades	
Allows buy-side traders to access multiple execution venues and liquidity pools without broker's trading desk → increase efficiency of the market	
Facilitate hedge funds –the most aggressive users of ECN	

Crossing Networks

Another form of ATS. Only buy side are allowed to trade, not sell side. This is because the sell side are normally high frequency traders, and coming in to try to find out information about these people. If no such pitch, these guys will be using sniping algorithms to find out if a big order is coming in. Using their high frequency algorithm, they can then buy all the shares first, then sell to the people who really want to buy (defeats the purpose of Crossing Networks)

Advantages	Disadvantages
Participants no longer pay the bid ask spread to transact	A potential lack of immediate executions stems from the fact that crossing networks require both buy and sell orders in order to facilitate a cross. Participants may have to leave an order on a crossing network for a period of time before another party takes the other side of the trade.

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the orders are confidential, and only if a cross is successfully executed are the price and transacted volume communicated to the transacting parties. Regardless of the crossing outcome, the parties are never publicly identified. (Prevent market makers from front running them by buying the shares in the market and sell them at higher prices)	Potential for gaming - Traders known as 'gamers' are thought to be fishing for orders in ways that may be illegal. The gamers exploit dark pools by buying small increments of small cap stocks on conventional exchanges, then selling a block in a dark pool at a better price. Gaming is more viable with small caps because they are thinly traded, making it easier to push the price around.
informed participants trading large positions are less likely to leak information when trading on CNs than on traditional exchanges	One potential problem with crossing networks is the so-called winner's curse. Fulfillment of an order implies that the seller actually had more liquidity behind their order than the buyer. If the seller was making many small orders across a long period of time, this would not be relevant. However, when large volumes are being traded, it can be assumed that the other side—being even larger—has the power to cause market impact and thus push the price against the buyer. Paradoxically, the fulfillment of a large order is actually an indicator that the buyer would have benefitted from not placing the order to begin with—he or she would have been better off waiting for the seller's market impact, and then purchasing at the new price.
Minimize the price impact of a trade, leading to further savings	

Potential Problems of Crossing Networks

1. Strong claims and potential misrepresentation by providers
    a. Pipeline Trading scandal 2011: false claims of confidentiality. Owners of pipeline owned trading company that provides the orders
    b. Barclays dark pool scandal 2014/5: HFT vs non-HFT. Claims that it is HFT free, but alleged to have invited HFTs.
2. Main value proposition is secrecy: So who and how to monitor?

ECNs VS Crossing Networks

Similarities	Differences
1. Electronic Forms of Alternative Trading System (automatically and anonymously match orders without third parties) 2. Both offer relatively low transaction costs (although that of crossing networks can be driven downwards more because of the huge blocks traded) **3.** Typically can be traded after hours (dependent on servers and systems)	1. ECNs are registered with Securities and Exchange Commission (SEC) 2. Crossing Networks usually trade huge blocks of securities while ECNs trade in any amounts 3. CNs often have restricted membership (internalisation pool) while ECNs in general do not 4. Insignificant market impact of Crossing Network 5. No price discovery of all crossing network; no price negotiation; price is decided by the CN system based on various parameters, usually at mid-point.

Technology Supporting Trading Networks

DMA (See Financial Network (II): Electronic Trading Networks)

Direct market access (DMA) is a term used to describe:

- The ability of a buy-side trading desk to route orders directly to an execution venue without intervention by a sell-side trades; the sell-side provides memberships, technology, trade support and credit
- Today, DMA is often combined with algorithmic trading giving access to many different trading strategies.

Pros	Cons
• Speed to market • Ownership of Execution risk (increased control) • Price (less brokerage fee from transactions)	• Ownership of Execution risk (increased risks of high execution costs) • Expertise

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• Anonymity • Fast, efficient and transparent method of trading • Ensures that the investor is trading on real market prices and liquidity • Increased liquidity with the use of crossing networks or ECNs • Facilitate STP, can be integrated with other clearing or settlement systems	• Infrastructure • Premium paid for DMA (Participation fee) • Required to be a trading member and collaterals collected (A lot of cost to provide DMA to buy-side and it is passed on as the fees for DMA)

DMA VS Market Maker

	Direct Market Access	Market Maker
Transparency and Pricing	The DMA model has complete transparency whereby the purchaser of the CFD can determine his exact entry and exit values.	Having a middle man to execute your orders will create a degree of separation. He has the ability to set his own prices and market, although they are still somewhat based on market prices.
Structure	Based exactly on market values.	Mirroring closely to market values.
Market Liquidity	Based on the market.	Can sometimes provide better than the market.
Influence on share prices?	Trading DMA will make the share price go up or down.	Trading MM CFD's will not affect the current market share price of the asset.
Profits Made by Portal?	Because this position is 100% hedged, the Direct Market Access makes money from the transaction fees only.	The Market Maker does not need to completely hedge his position. This means he may profit as a direct result of your loss or your profit.
Speed of Transaction	Quick and Direct	Somewhat slower due to price being re-quoted and at discretion of dealer

FIX (Refer to Financial Network (II): Electronic Trading Networks for more details)

Sending over Public Network

Advantages	Disadvantages
1. Significantly lower cost and faster implementation a. Only require some access points and a proper connection to the Internet to function 2. Scalability a. Number of trading partners within the network can be easily managed	1. Encryption may result in latency in message transmission 2. Possibility of DoS (Denial of Service) attacks 3. Prevents legitimate users from accessing the service 4. Dependent on strength of Internet connectivity of both parties 5. Relatively more insecure 6. Easier to intercept Internet traffic than data sent over a private network 7. Some firms have a policy of not using the Internet for sensitive business traffic

Sending over Private Network

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Advantages	Disadvantages
1. Guarantees on uptime, latency and bandwidth by their service providers 2. Safe from DoS attacks 3. High security for vital information 4. Self-containment 5. Problems like losses in Internet connectivity do not affect its performance **6.** Problems can be addressed by servicing the network equipment rather than waiting for a reply from an ISP or server operator	1. Costly and complex, especially when one has to communicate with many partners 2. Have to establish many private networks with partners 3. Extra hardware/ equipment, security measures and access restrictions required 4. Isolation 5. Information is only circulated within the network → no information exchange with parties that are not in the private network

Algorithm Trading (For computation refer to Algo I & II)

Algorithm Trading VS High Frequency Trading VS Automated Trading

Algorithmic Trading is slicing of the order to achieve a good price for a specific period of time and moderate the aggressiveness in the market. The aim is not to sell high or buy low, instead the execution strategies offered by the sell side are used to get a good price for the order and monitoring closely the transaction costs of the trade. The system has a predefined set of parameters and constraints which help in deducing the right price for the order. Also algorithmic Trading is mostly used for large orders, where slicing is possible.

Automated trading is the absolute automation of all steps of Trade Capture. That involves Order creation, order submission to the market and order execution. It also includes quantitative representation and parameters to determine what time the trade would close or initiate portfolio risk assessment and also include Algorithmic Trading. If you are an investor, then you would need to subscribe to these computer based systems often referred to as trading applications. Just choose the services, put in some funds and you are ready to trade. The automated trading service also comes with preloaded algorithms and execution strategies. You can easily monitor your securities performance over time or against industry set benchmark. The automated trading is usually done by hedge funds that utilize proprietary execution algorithms and trade via sponsored access or DMA.

High Frequency Trading [HFT] is a division of Automated Trading, subset of algorithm trading. To put it simply – HFT uses the modern age technology to execute the ancient trading strategies. Unlike the olden days, when manually people used to punch orders or trades were verbal, now with the evolving technology, it could be done at a lightning fast speed which no human brain could achieve. But the strategies are still the same.

HFT is simple use of technology to make speedy trades, which could last for milliseconds or less. HFT traders never ever hold any positions overnight, and you might see heavy trading execution done before the closing bell by HFT traders. The way the HFT firms gain is by trading for large or huge volume of trades, numbering even in the millions.

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Advantages of Algorithm Trading	Criticisms of Algorithm Trading
1. Improve liquidity in the market 2. While they exacerbates market crash, they can also correct errors relatively quickly, faster than humans 3. Help to trade at multiple electronic trading venues e.g. exchange, ECNs at very fast speeds 4. **Ability to Backtest.** Backtesting applies trading rules to historical market data to determine the viability of the idea. Traders can take these precise sets of rules and test them on historical data before risking money in live trading. Careful backtesting allows traders to evaluate and fine-tune a trading idea, and to determine the system's expectancy. 5. Algorithmic trading cuts down time needed to trade and transaction costs: allows investment managers to take control of their own trading processes. 6. Facilitate the size and timing of orders based on trading parameters in different markets 7. Actively seek out trading opportunities 8. Stealth – mask true trading directions	1. Their blackbox-ness - Traders have intuitive senses of how the world works. But with these systems you pour in a bunch of numbers, and something comes out the other end, and it's not always intuitive or clear why the black box latched onto certain data or relationships 2. Greater reliance on sophisticated technology and modelling brings with it a greater risk that systems failure can result in business interruption 3. Contribute greatly to volatility and exacerbates market crash a. Solution to volatility – Circuit breakers: i. Algorithm: Prevent crazy orders from spitting out ii. Logical – Exchanges suspend trade if trade is too volatile 4. Over-optimisation – becomes a plan that is unreliable in live trading

E.g. Knight Capital Technology glitch
Knight Capital said losses from an August 1 trading error had grown to $461.1m as the electronic trading and market-making company said it had begun the process of recovering from the glitch, which sent it to the brink of bankruptcy. The company suffered the self-imposed wounds when its trading systems malfunctioned 11 weeks ago, causing the inadvertent purchase of billions of dollars worth of shares in 148 stocks on the New York Stock Exchange. The losses from unwinding those mistaken positions were initially reported as having cost the company $440m but that figure was raised by $20.1m on Wednesday as Knight reported quarterly results.

Algorithm trading in different asset classes (Refer to Algo III)

Conditions for good algorithm trading:

1. Highly traded market (high liquidity)
2. There is real time free flow of market information for forecasting and estimation in VWAP, POV, etc
3. Standardized products that can be objectively defined for algorithm trading
4. Well established secondary market
5. Electronic market

Implementation Choices – Make or Buy (Refer to Algo III)

Limitations of Algorithm Trading

Algorithms Acting on Other Algorithms
If fund managers' trading pattern is spotted and regular; tracked with the use of algorithms, then these algo- rithms are liable to be 'reverse engineered'. This implies that their buy and sell orders are pre-empted and used to the maximum effect by their competitors. Here, algorithms are acting on other algorithms.

Challenges faced by Algorithm Trading

1. Buy-side complains
    a. Few algorithms handle illiquid stocks well
    b. Algorithm do not react well to news (earnings, analyst upgrades) – structured vs unstructured problems (algorithms are not good against unstructured problems/information and require human intervention)
        i. Standardizing news delivery will enable algorithms to incorporate events into their models
    c. Algorithms need to be more flexible – Can it be modified easily
        i. Increasing customization will need to be balanced with usability
2. VWAP algorithms have become commoditized
    a. Innovation is needed to differentiate products
3. What happens when volatility exists?
    a. Quality algorithms will outperform generic methodologies

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Optimal Approach to Algorithmic Trading

The best execution through use of algorithmic tools depends to a large extent on the presence of various critical ingredients, such as:

- Clear understanding of portfolio management strategies' objectives
- Robust pre-trade models
- Balancing timing and impact cost issues
- Effective intelligent integration of OMS and direct market access trading platforms Close, iterative relationships with algorithmic trading providers
- Thorough post-trade analysis and feedback

All these critical requirements make the design of the algorithmic platform a daunting challenge requiring the following attributes:

- Adaptable:
  - Providing high speed transmission of market data and transaction messages to other applications and users
  - Offering a vendor-agnostic platform that is able to accept and distribute data from any market data vendor
  - Having pre-integrated security and monitoring for both compliance and cost-effective operations
- Streamlined:
  - Ensuring optimized acquisition, processing, and delivery of market data through an ef cient and integrated platform
- Reliable:
  - Enabling continuous delivery of market data with the robustness to support the needs of the front office
- Open Architecture:
  - Promoting interoperability by using open published speci cations for Application Program Interface (APIs), protocols, and data and le formats. Open architectures enable companies to build loosely coupled, exible, and recon gurable solutions

Risks of Algorithm Trading

Systemic Risk

- **Intensifying Volatility**: First, since there's a great deal of algorithmic HFT activity in present-day markets, attempting to outfox the competition is an in-built trait of most algorithms. Algorithms can react instantaneously to market conditions. As a result, during tumultuous markets, algorithms may greatly widen their bid-ask spreads or will temporarily stop trading altogether, which diminishes liquidity and exacerbates volatility.
- **Ripple Effects:** Given the increasing degree of integration between markets and asset classes in the global economy, a meltdown in a major market or asset class often ripples across to other markets and asset classes in a chain reaction. For example, the U.S. housing market crash caused a global recession and debt crisis because substantial holdings of U.S. sub-prime paper were held not just by U.S. banks, but also by European and other financial institutions.
- **Uncertainty:** Algorithmic HFT is a notable contributor to exaggerated market volatility, which can stoke investor uncertainty in the near term and affect consumer confidence over the long term. When a market suddenly collapses, investors are left wondering about the reasons for such a dramatic move. During the news vacuum that often exists at such times, large traders (including HFT firms) will cut their trading positions to scale back risk, putting more downward pressure on the markets. As the markets move lower, more stop-losses are activated, and this negative feedback loop creates a downward spiral. If a bear market develops because of such activity, consumer confidence is shaken by the erosion of stock market wealth and the recessionary signals emanating from a major market meltdown.

Errant Algorithms: The dazzling speed at which most algorithmic HFT trading takes place means that one errant or faulty algorithm can rack up millions in losses in a very short period. An infamous example of the damage that an errant algorithm can cause is that of Knight Capital. Unfortunately, the hyper-efficiency of algorithmic HFT -- wherein algorithms constantly monitor markets for just this sort of pricing discrepancy -- meant that rival traders swooped in and took advantage of Knight's dilemma while Knight employees frantically tried to isolate the source of the problem. By the time they did, Knight had been pushed close to bankruptcy, which led to its eventual acquisition by Getco LLC.

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Huge Investor Losses: Volatility swings worsened by algorithmic HFT can saddle investors with huge losses. Many investors routinely place stop-loss orders on their stock holdings at levels that are 5% away from current trading prices. If the markets gap down for no apparent reason (or even for a very good reason), these stop-losses would be triggered. To add insult to injury, if stocks subsequently rebound in short order, investors would have needlessly incurred trading losses and lost their holdings. While some trades were reversed or canceled during unusual bouts of market volatility like the Flash Crash and the Knight fiasco, most trades were not.

Loss of Confidence in Market Integrity: Investors trade in financial markets because they have full faith and confidence in their integrity. However, repeated episodes of unusual market volatility like the Flash Crash could shake this confidence and lead some conservative investors to abandon the markets altogether. In May 2012, Facebook's IPO had numerous technology issues and delayed confirmations, while on August 22, 2013, Nasdaq stopped trading for three hours due to a problem with its software. In April 2014, close to 20,000 erroneous trades had to be canceled following a computer malfunction at IntercontinentalExchange Group's two U.S. options exchanges. Another major blow-up like the Flash Crash could greatly shake investors' confidence in the integrity of markets.

Measures to Combat HFT Risks

With the Flash Crash and Knight Trading "Knightmare" highlighting the risks of algorithmic HFT, exchanges and regulators have been implementing protective measures.

In 2014, the Nasdaq OMX Group introduced a **"kill switch" for** its member firms that would cut off trading once a pre-set risk exposure level is breached. While many HFT firms already have "kill" switches that can stop all trading activity under certain circumstances, the Nasdaq switch provides an additional level of safety to counter rogue algorithms.

Circuit-breakers were introduced after "Black Monday" in October 1987, and are used to quell market panic when there's a huge sell-off. The SEC approved revised rules in 2012 that enable circuit breakers to kick in if the S&P 500 index tumbles 7% (from the previous day's closing level) before 3:25 PM EST, which would halt market-wide trading for 15 minutes. A 13% plunge before 3:25 PM would trigger another 15-minute halt in the entire market, while a 20% dive would shut the stock market for the rest of the day.

In November 2014, the Commodity Futures Trading Commission proposed regulations for firms using algorithmic trading in derivatives. These **regulations would require such firms to have pre-trade risk controls**, while a controversial provision would require them to make the source code of their programs available to the government, if requested.

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