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Operational Efficiency of Industrialised Information Processing Systems

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Abbreviation	**Meaning**
BO	Back Office
CAS	Complex Adaptive Systems
CB	Commercial Banking
CDO	Collateralised Debt Obligation
CIM	Communications Information Management
CPT	Cost Per Trade
CT	Contingency Theory
FO	Front Office
FTE	Full Time Equivalent
FY	Final Yield
GST	General Systems Theory
IB	Investment Banking
IPO	Input-Process-Output
KPI	Key Performance Indicator
LO	Learning Organisation
LSS	Lean Six-Sigma
MIS	Management Information Systems
MO	Middle Office
LST	Living Systems Theory
RTY	Rolled Throughput Yield
SME	Subject Matter Expert
STP	Straight Through Processing
STS	Socio-Technical Systems
SPC	Statistical Process Control
TQM	Total Quality Management
TPY	Throughput Yield

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Conducting a doctoral research study covers many years and calls for endless hours of dedication and sacrifice. It is not just the researcher who makes such a sacrifice but his family and loved ones.

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Abstract

The British economy has always been a trading nation in terms of goods and more recently services. At the heart of the nation and international trading is London, the hub of a global financial empire that unites the globe on a 24-hour basis. Vast revenues are generated by commercial and investment banking institutions, yet research in this sector has been comparatively low. Management researchers have instead gravitated towards the 'back office' operations of high street banks or general insurance company call centres (Seddon, 2008). Research has focused on repetitive clerical activities for customers, and how these businesses suffer from 'failure demand' and/or 'demand amplification' (Forrester 1961) created when a customer is forced to re-establish contact with a call centre to have their issue/concerns reworked (when it should have been 'right first time').

Modern commercial and investment banks do not share the repetitive and relatively predictable transactions of call centres and instead, represent extreme operations management cases. The workload placed upon commercial and investment banking systems is incredibly high volume, high value and high variety in terms of what clients' demand and how 'the product' (trades) is executed. At this period in time, the financial collapse of 2008 is still shaping working practices due punitive regulatory environment. Many UK banks are now part-owned by the government, there is social and political pressure to stimulate improvement in banking operations which – it is thought – will herald the return of the banks back to private ownership. This thesis addresses the flow of global "trades" through the operations office and explores how the design and fit of the sociotechnical environment provides effective and efficient trade flow performance.

The key research questions emerging from the literature review establishing the gap in knowledge are 1) How efficient are commercial and investment banking trading processing systems? And 2) What are the enablers and inhibitors of efficient and high performance of industrialised processing systems?

To answer these questions, the researcher undertook an in-depth and longitudinal case study whilst at a British bank that was ‘benchmarked’ as underperforming against its peers (MGT Report[1], 2011). The case study strategy was executed using an action research and reflective learning approach (cycles of research) to explore the performance and improvement of banking operations management performance. The findings show that, using systems feedback, the management at the bank were able to develop into a “learning organisation” (Senge 1990) and improve and enhances the flow of work through the system. The study has resulted in significant gains for the case study and a new model of Rolled Throughput Yield is presented that rests on the key concept of “Information Fidelity”. This work marks a contribution to the operations management body of knowledge by exploring “flow” under conditions of high volume and high variety and from within the under-researched context of commercial and investment banking.

[1] “MGT” is an anonymised commercial and investment banking industry report into operational efficiency and cost performance. The report was commissioned by the participant banks and conducted by “MGT Consultants” and is considered highly confidential. The researcher was given a copy of the report while working with the case, forming as the catalyst for the research into operational performance. The researcher was unable to receive “MGT Consultants” agreement to ‘directly’ cite the report as part of this study.

Chapter One: Introduction & Backdrop

1.1 Introduction

The purpose of this chapter is to provide the introduction and context of this study. It will outline the study aims, objectives and the expected contributions to the academic body of knowledge as well as to professional practice. The chapter will present the personal motivations of the researcher to conduct the study and will make visible the guiding research questions that were developed to focus this study.

1.2 Personal Motivations

The researcher has been professionally involved in the British service sector, providing operations improvement consultancy services to financial services organisations[2], for many years. As such the researcher has a professional understanding of the sector and its fascination with transaction processing. The majority of the researcher's professional career has been conducted within financial service organisations that resemble the Slack et al. (2010) typological position of "high volume and low variety" (mass service centres). The focus of this research is however global Commercial and Investment banking. This setting is high in value adding and contradicts this typological position[3] as it is "high volume" in terms of the number of trades conducted per day "high variety" too (Slack et al., 2010). The researcher believes the "high volume and high variety" has rarely been explored and some believe it does not exist Slack et al. (2010). The initial observations from the sector suggested Commercial and Investment banking was a highly complex and dynamic environment which lacks sufficient exploratory research from an operations management perspective and this study seeks to build theory in this context.

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[2] The consultancy services offered to financial service clients includes an expertise in Quality Management, Operations Management and Organisational Change. These services are aimed at increasing operational and organisational performance.

[3] The typical positioning for operations is either "high volume and low variety" or "high variety and low volume" work types.

1.3 Background and Importance

1.3.1 Signature of a Sector in Crisis

Modern banking is a global network of the world's largest institutions, serving markets and countries on a 24-hour basis, interconnected through information technology systems and "big data". The service sector, in the UK, accounts for 79% of GDP[4]. Financial services are the most significant sector component accounting for 10% of GDP, which is the highest of all G7[5] economies. The UK dominates 29% of financial service exports globally with only 15% conducted by the US (Monaghan, 2014). The city of London is at the heart of the global market exchanges and is the "location of choice" for many major banks and corporations. The economic collapse (2008) resulted in impairment and, in some cases, commercial collapse of many major banking institutions. As a result the sector has come under greater scrutiny and operations managers (those managers tasked with the design of systems within global banking sectors) face many challenges in the aftermath of the crisis, to continue to transact business, improve and 'change' systems as well as to comply with the 'imposed' regulations of their employers, market governing bodies, government agencies and the government as an equity holder. The underlying themes driving change are restoring 'operational stability' and financial viability (with new methods for 'product control' and new forms of governance) amidst greater transparency and new levels of expected accuracy in management reporting (The Financial Conduct Authority, 2014). The 'quantification' of system performance (processing performance), by assessing the performance gap created by inefficiency and estimating its impact on the system of "financial trades" (processing under-performance) is now expected.

[4] Gross Domestic Product (GDP) is one of the key performance indicators of the health of an economy.
[5] G7 refers to the Group of 7 most advanced economies in the world.

1.3.2 The Banking Sector

In recent years the UK has not escaped media reports publicising news of recessions, double-dip recessions, contracting economies, job cuts and home losses as a result of the financial crisis. Western societies and their banking systems have been blamed, scrutinised, scorned and publicly ridiculed for their inability to weather this economic instability. The British public and their elected government (even the Queen) of Great Britain has asked the question *"why could no one have predicted the credit crunch?"* (Stewart, 2009). This section will explore the key events leading up to the 'great recession' of 2008 and put in context the scale and pace of unprecedented reform to have ever impacted upon the global banking industry.

1.3.3 Stability of the Banking System

The question "when did it start?" is perhaps an easier question to address than "could it have been predicted?". To answer the question "when did it start?" we must first reassess the popularised date of August 2008 and look farther back in time for signs of earlier instability within the banking system.

The collapse happened under the weight of outstanding debt obligations and the inability to 'settle' (pay) debt obligations from a liquidity perspective. In this context 'liquidity' is at the core of what a bank is perceived to be (which is the appropriated use of funds that are invested to gain a return in the form of interest). The ability of a bank to settle debt obligations has rarely entered into serious public debate until now and remains a contentious subject to the present day.

BNP Paribas (a French banking institution) was one of, if not 'the', largest commercial banking institution in the world in 2008 (Global Finance Magazine, 2015), choosing the city of London as the centre of its trading operations. Within BNP Paribas increasing market instability was the catalyst for the company's financial crises. In August 2007 BNP Paribas froze three funds because the bank had no way of ‘fairly’ valuing the assets within the funds and thus suspended trading for nearly three days (Boyd, 2007). The funds contained Collateralised Debt Obligations (CDO’s, also referred to as securities), which are a large portfolio of home loans/mortgages. Many of BNPs CDO assets originated from the sub-prime mortgage market. BNP were the first global bank to show signs of stress as early as August 2007, a full year before the accepted start of the credit crunch in August 2008 (Kingsley, 2012).

In September 2007, Northern Rock (a British bank) borrowed large sums of cash from the Money Markets to fund consumer mortgages. Northern Rock would then ‘pool’ and ‘package’ volumes of assets into single CDO’s to be sold on the market exchange as an investment product. However, market sentiment for CDO’s had “cooled” (due to the fund valuation risks at BNP Paribas) thus diminishing the value and ability to resell the product. Northern Rock faced a liquidity crisis and were forced to approach the British Government for a loan to fund the bank. January 2008, the British government were forced to ‘nationalise’ Northern Rock in an attempt to shore up the bank, keeping public and private sector confidence in the Bank and indeed the British banking system (Kingsley, 2012).

Across the Atlantic (New York), the first bank to suffer a similar liquidity issue to Northern Rock was Bear Stearns. In March 2008 Bear Sterns, a Wall Street bank with an 85 year pedigree, was on the brink of financial collapse when JP Morgan (with the help of the Federal Reserve/Bank of New York) brokered a deal to buy Bear Stearns. The deal was described at what could be called a ‘bargain basement’ price after the share price dropped from $84 to $2 a share. Essentially the new share price meant original investors lost up to $82 per share (Sidel et al., 2008).

On the 7th September 2008 lending institutions Federal National Mortgage Association (FNMA, commonly known as “Fannie Mae”) and the Federal Home Loan Mortgage

Corporation (FHLMC, commonly known as “Freddie Mac”), were nationalised by the US government. Both institutions purchased mortgage portfolios from ‘customer facing’ banks and repackaged the mortgages into Mortgage Backed Securities (MBS). MBS products are then re-sold to the institutional investor on the global market (much like a CDO). FNMA and FHLMC issued $12 trillion of mortgage debt in the US which accounted for over half of the national mortgage debt (Seager, 2008). By September 2008 Britain and America had nationalised banks that participated in the debt market. The Guardian’s economics editor, Patrick Kingsley (2012), commented on Henry Paulson’s (then secretary of the US treasury) decision to nationalise the first American bank, he argued “*Paulson did not take Fannie Mae and Freddie Mac into public ownership because he has become a born-again socialist, he acted because he feared a systemic global financial crisis that would prompt the biggest depression since the 1930s*” (Kingsley, 2012).

Lehman Brothers (like Bear Sterns) were similarly involved in MBS markets and CDO trading. Lehman’s were heavily exposed to the sub-prime mortgage market. Sub-prime markets offered higher returns on investment reflecting the lower credit quality of the underlying consumer debt. Put simply, the riskier the debt obligation the higher the interest and potential return for the investor. However, risk in this sense is a “double edged sword”, the risk is that the mortgage portfolio goes into default and the investors receive a lower rate of return. In this instance the credit rating and the price of the security drops in the market place. The price of MBS and CDO, during early September 2008, dropped dramatically and Lehman Brothers like Northern Rock struggled for liquidity.

Trading on the global debt markets was all but non-existent while market prices continued to tumble. Scepticism was rife, if high-risk debt could have been sold then it was (traders hoped for a turn of good fortune). As in the case with Bear Stearns and Bank of New York’s acquisition, Barclay’s and Bank of America (BoA) positioned themselves to take over Lehman Brothers. however, Hank Paulson (US treasury secretary) declined to make a deal with either bank to use public money to finance the takeover. Barclay's and BoA waited for the "next play" which never came and the US government all but declined to support Lehman Brothers with liquidity, nor did they facilitate a deal with interested parties (Barclay's/BoA) to acquire Lehman's which may have saved the bank from potential collapse.

By now both Britain and America have 'saved' their troubled banks from collapse using liquidity packages and purchasing capital. One cannot help but reflect on the void of support from Paulson and the US treasury to stabilise its banks. The lack of support may be seen to some, including the researcher, as 'destruction by design' for Lehman Brothers. Did Paulson allow Lehman Brothers collapse to test the stability and resolve of the global markets if a bank collapsed under its weight of debt?

Lehman Brothers, on the 15th September 2008 filed for "chapter 11 bankruptcy" (the US petition to close a business) prompting a worldwide financial panic as trading counterparties and creditors did not receive their settlements from the bank. To this day, debts remain outstanding against the liquidated company (Mathiason, 2008).

Later the same week, BoA (the largest consumer bank in the US), still eager to make an acquisition of a failing investment bank, made a 'lightning fast' deal to acquire Merrill Lynch (another New York investment bank) at a knockdown price of $50 billion (Mathiason, 2008). At roughly $29 per share (some 70% less than the stock closed three days prior and 80% less than the same share price at the beginning of 2008) Merrill Lynch became the second such acquisition for Bank of America in less than a year. In July of 2007 BoA bought Countrywide Financial Corp for £2.5 billion (Bloomberg, 2015) to add to its portfolio.
Across the Atlantic, in the UK, the British banking system was faltering once again as repercussions of the American collapse and takeovers started to fuel public fears of a 'Lehman effect' within domestic banks. Of most scrutiny were two of the largest banks on

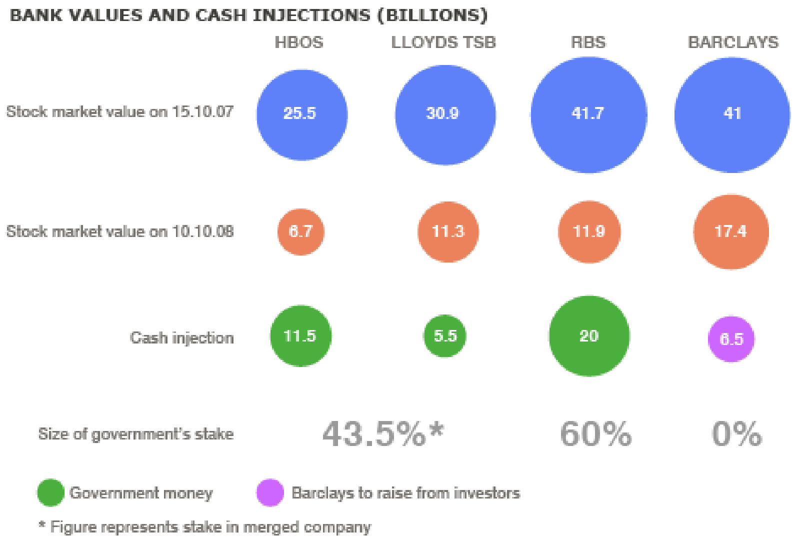
the London stock exchange, The Royal Bank of Scotland (RBS) and The Bank of Scotland (HBOS). On the 18th September 2008 HBOS was rescued from bankruptcy by the British government. The British government backed Lloyds TSB with an initial £17billion to takeover of HBOS following a significant drop in its share price amidst growing concerns over the liquidity of the bank's balance sheet (BBC, 2008b; Jones, 2008).

HBOS, at the time, was the UK's largest mortgage lender and retail account holder. Merging of LTSB and HBOS formed Lloyds Banking Group formally incorporated on the 19th January 2009. The newly formed Lloyds Bank consisted of 22 million current accounts with balances of over £200 billion. The merger circumvented, perhaps flaunted, competition and monopoly laws in the UK and Europe and came under intense scrutiny from the European parliament. However, it seemed that breaking the law was in the public interest (BBC, 2008a). Later in 2008 Gordon Brown (British Prime Minister) gave a further £37 billion in liquidity to HBOS ensuring the bank could continue trading.

On the 5th October 2008 the value of Britain's blue chip companies was **reduced by £90 billion** in the City's worst ever day of trading in decades (Mathiason, 2008).

The evident implosion of the British economy called for drastic measures, as three of the largest Icelandic banks were declared bankrupt. On the 9th of October 2008, the British chancellor Alistair Darling used anti-terror laws in the UK to freeze the assets of Icelandic banks in a move to protect the savings of some 300,000 British investors in the Icelandic banks (Hertling, 2008). On the 13th October 2008 the British government took measures to save RBS from collapse. The government bought a 60% majority stake in RBS for £20 billion keeping the bank solvent and protecting investor and saver interests. Within weeks the British government held an 80% stake in RBS, from which 64% carried voting rights (valued at £9.1billion) and £5.1billion of B class shares (reduction due to capital depreciation of shares (UK Financial Investments, 2014)). Figure 1 summarises the contraction and liquidity received by British banks in 2008.

Figure 1: Contraction of major British Banks 2008



Source: BBC (2008b)

The strategy of Gordon Brown was bold yet some might argue a little late. Brown guaranteed public savings in all the UK banks promising *"to do whatever it takes"* to avoid a "run" on the banks (Mathiason, 2008).

This brief, yet thorough, account of the turbulent operating environment of the world banking institutions has set the scene for one of the most dynamic and challenging change environments in recent memory. It is a scene of disorder, confusion, mistrust, takeovers, Government bailout and nationalisation. Further, nationalisation has applied new governance structures and scrutiny – not least to ensure that the British Tax Payer receives 'value for money' from supporting the banks from collapse. Governments throughout the world have come under pressure to ensure the events of 2007 to 2009 are not repeated as world economies attempt to stabilise.

1.3.4 Increased Regulation

Post collapse, the pace of change of the global banking system since 2008 continues to gather momentum. New 'legal frameworks' sponsored by central banks, such as the Bank of England, European Central Bank and the American Federal Reserve Bank imposed high priority change initiatives. Changes mandated faster trade 'inception' and 'settlement' (confirmation and exchange). Legislation focused primarily on two core themes designed to create greater 'transparency' and **'efficiency'** of interbank trading activities. Exploring efficiency in the context of commercial and investment banking implies 'accurate' and 'faster' processing of interbank financial communication exchanges (European Cental Bank, 2013). The terms appear simple and easy to understand however, as will be seen, these terms can be enigmatic, if not contentious, in their application within the established systems and processes of global institutions that once had full autonomy to operate. The newest regulations to impose changes to trading activities are:

- Dodd - Frank[6] (Wall Street Reform and Consumer Protection Act)
- MiFID[7] (Markets in Financial Instruments Directive)
- EMIR[8] (European Market Infrastructure Regulation)
- TARGET2[9] (Trans-European Automated Real-time Gross-settlement Express Transfer)

Sources: Association International Swaps Derivatives (2013); European Cental Bank (2013); Government of the United States of America (2013); The Financial Conduct Authority (2013)

Regulatory and legislative change directives form a significant, perhaps majority, of the changes imposed on the banking sector in response to the events of 2008.

[6] The Dodd-Frank Act brings comprehensive reform to the regulation of Swaps products. These products, not previously regulated, were at the centre of the 2008 financial crisis. The act will promote transparency, bring standardisation, and lower costs of consumers and businesses.
[7] Legislation includes rules on trading platforms, transparency and investor protection. The overarching objective of the original MiFID framework was to further the integration, competitiveness and efficiency of European financial markets.
[8] Requirements to improve transparency and reduce the risks associated with the derivatives market.
[9] TARGET2 settles payments related to monetary policy operations, interbank and customer payments, and payments relating to the operations of all large-value net settlement systems and other financial market infrastructures.

Compliance with evolving regulatory and legislative directives is a legal requirement imposed on financial institutions by central banks, governments and economic unions throughout the world. Failure to comply with requirements results in fines and the possible revocation of banking licences (in effect shutting down the bank). Commencing this study in 2013 it was found that in the previous year alone the UK Financial Services Authority (FSA, now FCA) levied fines on organisations and individuals for infringement totalling £311million. Table 1 contains a cross section example of infringements and fines from 2012 (National Archives, 2012).

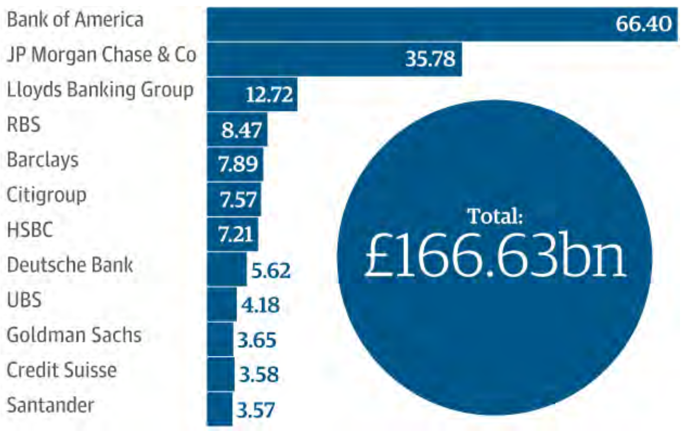
Table 1: Banking Penalties

Penalty Amount	Banking Institution	Date	Infringement
£160,000,000	UBS AG	19/12/2012	Misconduct relating to the London Interbank Offered Rate (LIBOR) and the Euro Interbank Offered Rate (EURIBOR).
£29,700,000	UBS AG	26/11/2012	Significant failings in not preventing large scale unauthorised trading.
£9,533,100	BlackRock	11/9/2012	Failing to protect client money adequately by not putting trust letters in place for certain money market deposits.
£59,500,000	Barclays Bank PLC	27/6/2012	Misconduct relating to the London Interbank Offered Rate (LIBOR) and the Euro Interbank Offered Rate (EURIBOR).
£8,750,000	Coutts & Co	26/03/2012	For failing to take reasonable care to establish and maintain effective anti-money laundering (AML) systems and controls relating to high risk customers, including Politically Exposed Persons (PEPs).

Source: National Archives (2012)

While the FCA dealt with domestic infringements in the United Kingdom it is important to understand that commercial and investment banks are global organisations and trading occurs across borders. Banks that violate ‘local’ legislation potentially face similar accusations of cross border violations. Cross-border information sharing between government agencies is increasing as regulators drive towards closer global governance structures. As regulators drive towards greater transparency and governance they appear to do so by making the cost of ‘compliance’ less than the cost of ‘noncompliance’ (fines and penalties). The total fines levied against banking institutions from 2009 to 2013 reached £166 billion (See figure 2).

Figure 2: Banking fines and penalties 2009-2013



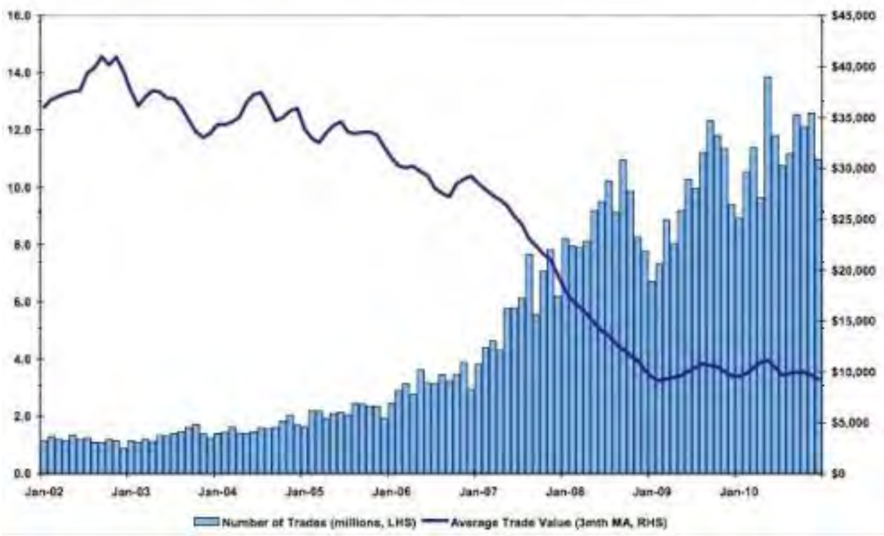
Source: Kollewe et al. (2014)

While regulators were producing quasi-financial incentives for compliance, the rate (speed) with which financial institutions were required to demonstrate compliance with regulatory and legislative directives, posed many operational and organisational challenges. Such challenges were meeting the required pace of change, enacting required IT capabilities, dismantling old and building new organisational structures, building intellectual capital and cultural transformation. All of which cannot be 'bought' at the rate, or indeed at the value, in which fines are currently levied against the banks. In effect, these issues and the '*sense of urgency*' do not imply the banks have yet created a "learning organisation capability" that could result in internal operational improvements. Instead it generated a '*sense of fear and ambiguity*' within financial institutions, and feelings of foreboding from the general public in the UK and indeed around the world.

1.4 Volume and Capacity

The previous section demonstrated the ‘credit crunch’ effectively restricted liquidity across financial markets. Many banking institutions suffered from a total loss of liquidity forcing governments and central banks to provide billions in cash through ‘quantitative easing’ strategies (Bank of England, 2012). Liquidity limitations had a significant impact on global trading and changing the tactics and behaviours of the banks. Trading tactics changed by ‘reducing’ the deal value of trades and ‘increasing’ the volume of trades in an attempt to distribute and spread risk through the markets. The behavioural change had a significant “knock-on effect” increasing transaction volumes placing unprecedented demand upon operations departments amid revenue and cost cutting exercises (see Figure 3 trade volume Vs value).

Figure 3: Trade Volume Vs. Trade Value



Source: Clarke (2011)

Trade volume increased 400% from January 2006 to January 2011, the average trade value decreased approximately by 350% in the same period. Increased trading activities placed an unprecedented ‘demand’ on the global banking system. The banking system was operating even though the internal workings of the products and services were under strain.

McKinsey & Co reported that Foreign Exchange volumes grew by 58% in 2011 yet revenues dropped by 9%. A steady trend had set-in across the market, derivatives volumes also grew by 41% and with that revenues plummeted by 12% (Bremner et al., 2011). As a result of the upturn in demand and downturn in revenue, income was at a record low (13% less in 2012 than in 2008) yet the pressure on the production system[10] was at an unprecedented high (Bloomberg, 2013). In the following months, the "Big Four" UK banks set out on a course to make major savings, however not in the manner which might be expected when trade volume is up 400% in five years. The banks focused on reducing their fixed costs, targeting a 24% reduction in staff which resulted in 189,000 job cuts by the end of 2013 (Bloomberg, 2013; Rankin, 2013). The outcome was to reduce employment to a nine-year low amid a shortage of revenue and unprecedented trade volumes. Ironically, increased demand would require additional staff to maintain the status quo of a stable service environment matching its external demand (Seddon, 2003, 2008a). However, Rankin (2013) reported "job losses" resulted from technology replacing jobs previously undertaken by staff and were an to "trim the wage bill" to meet investor targets (and the expectations of the British government as a significant investor). It has been shown that a bank's "volume" and "capacity" are critical issues which has forced banks to apply technology to automate work system and processes at the expense of jobs. In this new operating environment understanding system efficiency and identification of the enablers leading to high system performance could not be more timely and pertinent to the building a stable system.

1.5 The Uniting Thread

Notwithstanding market volatility, the stability the commercial and investment banking sector (regarding its administration) was in uncharted territory and threatened to negatively affect the world economy should one or more of these institutions collapse in a second episode of disasters. Banking strategy was subjected to competing priorities and objectives. Banks are required to comply with a new series of mandatory reform through new and increased

[10] The terms "operations" and "production" system refers to the transactional processing of services.

regulations and legislation, imposed by domestic and international law. The latter increased the administration required whilst the banks sought to slash operating costs, especially those nationalised banks who are under substantial political and social pressure to return to profitability and shift back to private ownership. Banking policy imposed jobs cuts amid exponential growth in global trade volume and placing an unprecedented demand on system capability and capacity. Banks were motivated to automate, with IT, large sections of manual business operations and introduce processes to increase capacity. However, local systems were fragmented and, when viewed in the wider context, IT would be necessary to unite systems, improve transparency and reduce the risk to market volatility. Compliance with legislation and regulatory reform would therefore place a critical dependency on IT systemisation and improving the interconnectedness the global institutions in a way that was beneficial to efficient data exchanges and trades. The costs of noncompliance for banks were huge with large penalties/fines by regulators that ran into hundreds of billions of pounds and further exposed the fragile banking systems to instability and chaos. At this point, it can be seen that the world of commercial and investment banking was complex in a dynamic environment and set within a political dimension (governments acting as regulators and owners of many banks). The sector of the economy therefore remains an area of high economic risk and of opportunity for systemic ‘change’ concerning ‘performance improvement’ and a fascinating context for this study.

1.6 The Research Gap

Modern commerce is facilitated by connected information technology (IT) and big data systems, none more so, than UK investment banking where products are complex and trades are high in volume (Nicolaou & McKnight, 2011). Such dematerialised products are ‘information exchanges’ between the producer and the customer (Belvedere et al., 2013) and the negative impact of inefficiency when reconciling trade information transactions is punitive and costly. The barriers to process efficiency improvement are not well understood from an academic perspective despite the importance of improvement in this sector following the global financial crisis and new levels of banking performance of scrutiny (Neely, 2007; Seddon, 2008a). Retail banking and General Insurance have dominated research on efficiency but represent a “high volume low variety” business setting (Hayes & Wheelwright, 1984) largely ignored, the high volume and high complexity of UK-Global commercial and investment banking operations has not been studied. Never before in business history has the need to understand these vital trade flows been more important to the banks and the prosperity of nations.

The questions guiding this research are 1) How efficient are commercial and investment banking trading processing systems? And 2) What are the enablers and inhibitors of efficient and high performance of industrialised processing systems?

1.7 Aims and Objectives

The aims and objectives of this thesis are to research and analyse system performance of a British based case study organisation involved in commercial or investment banking activities. An embedded longitudinal case study adopting an action research approach was selected to ensure deep immersion of the researcher within the organisation to observe management practices and learning. The approach was considered effective to provide a broad contextual analysis of “current state” performance and also to assist with identification of enabling/inhibiting factors facing operational managers tasked with performance improvement. The objective of this thesis is to develop an integrated model (framework) for the quantitative analysis of trade processing performance, providing a diagnostic of the system performance inhibitors and the impact on performance by quantitative means. A further objective is to observe management in reflective cycles of action learning through improvement interventions, identifying the enablers that lead to knowledge generation, organisational learning and high performance.

The study objectives, covering the various learning cycles (phases) of research include:

1. To undertake a critical review of the relevant background and focal literature that underpin high performance operations management and management information systems theory, (establishing the academic gap in the body of knowledge).

2. To gain a full understanding of trade flow performance through the automated systems environment focusing on quality and efficiency within the context of commercial banking operations of a British financial institution.

3. Identify the enablers and inhibitors of automated trade flow performance and test adaptations to current systems and frameworks for cause and effect relationships that may positively affect and promote performance improvement.

4. Develop and critically evaluate a model framework that can be used by academics and professionals to interpret system performance, feedback, and investigate causes of "failure demand" (Seddon 2008) within complex sequential processing systems.

1.8 The Importance of Study

The contribution to knowledge will be a model to describe trade flow performance data, derived from multiple rounds of longitudinal research studies and highlighting the enablers and inhibiters of operational improvement within the context of complex global IT-led trading systems. The research is of commercial and national importance in terms of raising the quality and efficiency levels of UK banking operations and play a role in producing stability in this volatile sector of the economy. Moreover, the knowledge generated from this case study can be generalised reaching global Commercial and Investment banking operations management.

1.9 Chapter Layout and Purpose

This chapter has presented the context and justification for this study. It has set-out the importance of the study and the need to garner new insight into this "under researched" and poorly understood dimension of financial services operations management. The chapter has set in context the driving environmental factors necessitating not just change but also the rate of change required by governments and the general public to return banks to private ownership and to stabilise national economies.

Chapter 2 presents a review of the background literature. The chapter provides a discussion of system theory from a sociotechnical perspective before distinguishing the characteristics of a modern high-performance 'service' organisation as a system. The chapter identifies Six Sigma as a precise means to measure and improve quality then turn to address poor quality as an inhibitor of flow efficiency. The discussion highlights the critical nature of system regulation, 'steady state' process flows and organisational learning as key features for systems performance improvement.

Chapter 3 presents the focal literature review of Management Information Systems (MIS) and their critical role in facilitating process flow and as information feedback systems that regulate performance and the quality of transactions for businesses in high speed and dynamic trading conditions. As a core Operations Management (OM) subsystem, the chapter demonstrates why a careful designed 'fit' of the MIS to business processes determines how an organisation supports high performance and how a poorly designed MIS will inhibit trade flow performance and limit organisational learning.

Chapter 4 defends the chosen research strategy of this thesis and its accompanying methodology. The chapter will present the chosen strategy of a longitudinal action-orientated research based on a cycles of the investigation of flow, quality and learning within a financial services organisation. The chapter highlights the limitations of the chosen research design.

Chapter 5 introduces the case study organisation, a British banking institution which will remain anonymous to protect the identity of the company involved (the alias “Alpha Bank” will be used). The case study has been conducted within the Commercial Banking division of Alpha Bank, at the City of London office of this global business. Alpha Bank’s operations office operates a 24-hour, 365-day operating model supporting its Sales and Trading offices situated around the world.

Chapter 6 explores the first phase of the research investigation which analyses a management survey to understand their perceptions of the key performance metric and the metrics its ability to accurately measure trade flow. The analysis also explores the enablers and inhibitors of trade flow from the perspective of the managers at the case. Emergent themes were identified including dissatisfaction with current system performance and inadequate information quality (data) as the main concerns of management. Phase one results lead to further analysis and a quantitative investigation into system dysfunction affecting performance.

Chapter 7 presents the second phase of the project that explores data quality as a cause of system underperformance. The previous chapter identified "static data" (client data profiles) as a key resource required by the system to execute straight through automated processing. The chapter goes on to explore the cause and effect relationship between static data and system performance, testing the fundamental views of management on cause and effect relationships through an experiment on static data quality. Experimentation during this stage follows a Kurt Lewin (1946) approach of ‘unfreeze, change, freeze’, the results helped management polarise thoughts on data quality and performance measurement. Management perform improvement interventions using Lean Six Sigma techniques which produce observable benefit to flow within the subsystem arrangement (data management process) however the performance benefit is undetectable via the key performance metric which gave way to a third phase of the project.

Chapter 8 presents the third phase and ‘tested’ the practical utility of the current measure of flow performance “Straight Through Processing” (STP) with measures of flow performance identified within the literature review. This phase of the investigation caused management to question whether STP was fit for purpose. Management then questioned whether the level of distortion system distortion revealed by the simulation experiment could account for the dichotomy between the flow performance felt by functional managers and the performance levels reported within management information dashboards. Further experiments and testing of STP with alternative flow performance metrics identified within the literature provided irrefutable evidence to management that STP was a poor fit and was unable to describe flow performance characteristics of modern trading operations. The team utilised 'visioning' and quality tools as a means to make sense of complex IT system architecture and design (system flow configuration) to capture and interpret system feedback.

Chapter 9 presents the fourth phase of the research which offers an insight into the reflective process of management through mini cycles of learning and reflection. At management's request the researcher provided insight into Lean Six Sigma principles of flow and failure demand measurement to the interpretation of system feedback. The aim of this phase was to produce a new and more robust measure of flow and quality performance (accurate system feedback). The team constructed and tested a draft performance management framework which quantitatively measured key performance characteristics such as quality, failure demand and flow performance characteristics. Management engaged in double loop learning which produced new knowledge into the system configuration, making visible the inhibitors of flow for the first time, which managers later re-applied as organisational learning to build an improvement strategy to remove the inhibitors that restricted flow performance. The results of the pilot revealed that management can interpret the information contained within the model framework encouraging them to enter into multiple cycles of improvement interventions, continually developing and expanding organisational learning via applied improvement to the system.

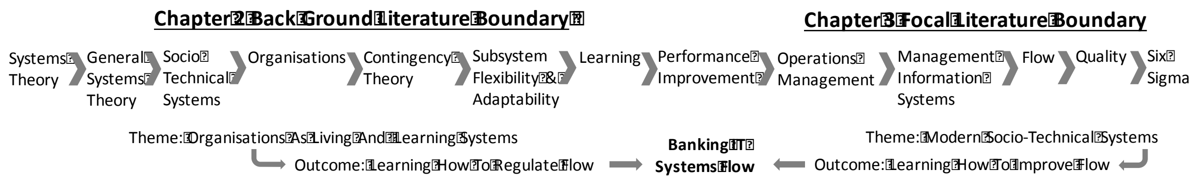
Chapter 10 presents the analysis and positions the results of the investigation answering the research question "what enables and inhibits high performance. The findings are then contrasted with the background and focal literature enabling the researcher to draw parallels between the observations collected within the investigation and those that where suggested within the literature. This phase ends with a long-term audit of performance and stability before producing a positive correlation between organisation learning and performance improvement.

Chapter 11 concludes the thesis, presents the researcher's reflections on the overall approach to the research journey, offers lessons learned, and highlights the implications for professional practice and for further academic study before generalising where new areas of research may result from the contribution of this thesis.

Chapter Two: Background Literature

2.1 Introduction

The purpose of chapters two and three is to examine and discuss the academic background and focal literature upon which the thesis is founded. In order to position this study, it is important to explore the background literature and theories that describe a modern banking organisation. This chapter explores systems theory from a sociotechnical perspective before distinguishing the characteristics of modern high-performance 'service' organisations as systems. The discussion highlights the critical nature of system regulation, 'steady state' process flows and organisational learning as key features for systems performance improvement. The flow diagram below outlines the boundaries to the two-part structure of this systematic literature review connecting Systems Theory, Adaptability and Learning with Performance from an OM, MIS, Flow and Quality perspective.



2.2 Background Literature

2.2.1 Systems Theory

A number of background theories supporting high performance organisations were reviewed but modern systems theory was selected as the foundation of this study.

Classically, organisations were thought of as 'mechanistic' in nature (machine like) and governed by a finite set of variables with decision-making centralised in a hierarchical structure of "command and control" management (Taylor, 1911; Hartzell, 2013). This 'mechanistic' design of organisations prevailed throughout the 18th and 19th centuries, which witnessed the industrialisation and mass production of Europe (coinciding with advancements in technology and mass aggregation of labour) and giving birth to the modern concept of the factory (Smith, 1776).

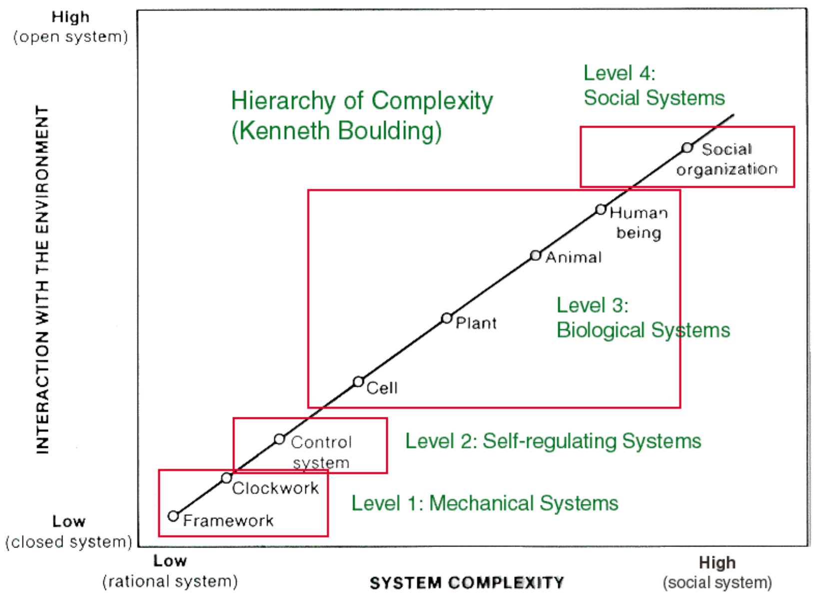
The modern view of an organisation is no longer mechanistic but ‘organismic’ as per Von Bertalanffy (1950, 1969) and his systems theory, where biological organisms interact with the environment. Von Bertalanffy’s concepts have been generalised with great utility to business organisations (Skinner, 1965; Emery, 1969; Emery & Trist, 1973). Much like biological systems, businesses are engaged in complex exchanges with their environment, permitting the organisation to be considered a physical entity of people, machines and systems, interfacing with the surrounding environment and connected by common goals and objectives (to manage flow and improve profits).

GST *“General Systems Theory (in the narrow sense of the term) is a discipline concerned with the general properties and laws of “systems”. A System is defined as a complexity of components in interaction, or by some similar proposition. Systems theory tries to develop those principles that apply to systems in general, irrespective of the nature of the system, of their components, and of the relations or “forces” between them. The system components need not even be material, as, for example, in the system analysis of a commercial enterprise where components such as buildings, machines, personnel, money and goodwill of customers enter”* (Von Bertalanffy, 1967, p. 69).

Trist and Bamforth (1951) extended GST and introduced Socio Technical Systems (STS) theory to describe how workers and technology are aligned to improve performance and to react/adjust to changes in the environment. Modern organisations (such as international banks) are dynamic and face turbulent environments that require ‘integrated decision making’ to accomplish their task objectives and provide profitable service outputs. Later, GST and STS were extended, with utility, to include Living Technical Systems (LTS) that have been used by theorists when studying high performance businesses (Miller, 1978).

Von Bertalanffy (1969) contended that two kinds of systems exist - ‘Open’ and ‘Closed’ systems. Closed systems are considered to be ‘isolated’ from the environment and function in a steady state of ‘equilibrium’ requiring zero energy for its preservation (high entropic[11] value), nor can any material or information (energy[12]) be obtained from it. These systems decay over time whereas ‘Open’ systems are exposed to and interact with the environment producing cause and effect relationships that alter the state of both the system and the environment in which it is contained. Open systems exist in ‘higher orders’ of complexity and are grouped into four levels according to their complexity/interaction with the environment. These levels or systems clarifications are, in order; ‘Framework, ‘Control’, ‘Organism’ and ‘Social’ systems (see figure 4). Open systems have intrigued social scientists as these are the most complex and dynamic in terms of interaction with the environment. Emery & Trist contend “*environments in which organisations exist are themselves changing at an increasing rate and towards increasing complexity*” (Emery & Trist, 1965, p. 21).

Figure 4: Open Systems



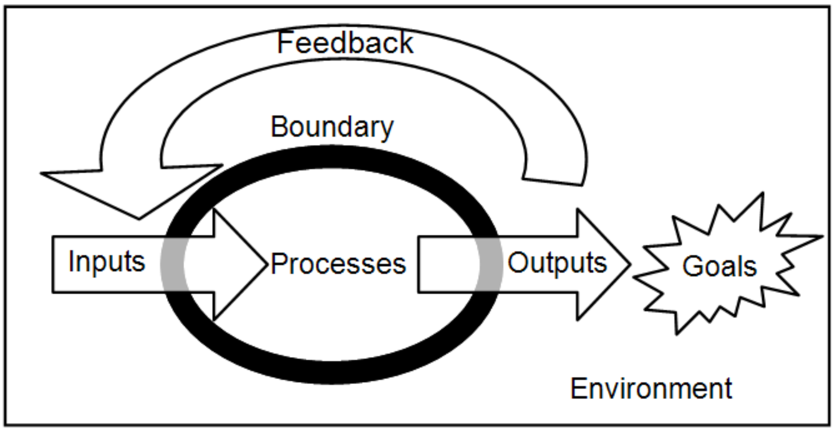
Source: Daft (2001b)

[11] Entropy is the level of order/disorder found with a system, grounded in the second law of thermodynamics, that describes a situation whereby an open system is in an irreversible march towards disorder and decay - low entropy.
[12] Zero emission of particles exiting the system that could carry information.

Von Bertalanffy's argument concerning open systems correlates well with Operations Management, which is the focal literature of this thesis, in terms of the centrality of continuous 'inflow', 'transformation' and 'outflow' to satisfy the goals of the business and the customer. Maintaining a goal orientated 'steady state' of existence is achieved by regulation via 'feedback'[13] (See Figure 5).

"From the physical point of view the characteristic state of the living organism is that of an open system. A system is closed if no material enters or leaves it; it is open if there is import and export and, therefore, change of the components. Living systems are open systems, maintaining themselves in exchange of materials with the environment, and in continuous building up and breaking down of their components" (Von Bertalanffy, 1950, p. 23)

Figure 5: Open System



Source: Worldpress (2011)

A summary of the key concepts of systems theory, adapted from Ackoff (1971) is presented in Table 2 to assist the reader.

[13] In depth discussion regarding feedback systems will continue under the section Management Information Systems.

Table 2: Basic Characteristics and Definitions of Systems

Concept	Definition	Modern Organisation
System	A set of interrelated elements - thus a system is an entity that is composed of at least two elements and a relationship is held between two or more parts.	The overall company or division of a business.
Abstract System	Where all elements are conceptual. Languages, philosophical systems and number systems are examples. Inside and abstract system elements are created by defining the relationship between them, and created by assumptions (axioms).	*Not relevant to modern business.*
Concrete System	Where at least two of the elements that make up the system are physical objects.	A business and its employees.
State	The state of the system at any moment in time is the set of relevant properties which the system has at that specific moment in time.	The current level of performance in satisfying customer demand for a product or service.
Environment	The environment of a system is a set of elements and their relevant properties, in which elements are not part of the system but a change in any of which can produce a change in the state of the system.	The flow of work to the customer and markets.
Environmental State	The state of a systems environment at a specific moment in time is the formation of its relevant properties at that present moment in time.	Market conditions.
Closed System	A closed system is one that has no environment. This may take the form of a conceptual system so that it has no interaction with any element (self-contained).	*Not relevant to modern business applications of the theory only.*
Open System	A system that operates within, and interacts with, its environment.	The dynamic interaction of the business and its markets.
System Event	A system or environmental event is a change in one or more of the structural properties of that system over a period of time.	Market events, financial triggers and other activities which shape of production operations.
Static System	A static system is one where no events occur to force change to its state.	Does not occur in the banking systems.
Dynamic System	A dynamic system is one where events do occur and whose state changes over time, having an effect on the system elements or the environment.	Modern banks operate within this type of system.
Homeostatic System	A homoeostatic system is a static system whose elements and environment are dynamic thus a homoeostatic system is one that maintains? the state of environmental change by means of internal adjustment.	The design and management of this capability is the objective of a modern banking institution.

Source: Adapted from Ackoff (1971)

The long tradition of systems theory and its application to business systems (Von Bertalanffy, 1950; Forrester, 1958; Burns & Stalker, 1961; Emery & Trist, 1965; Emery, 1969; Von Bertalanffy, 1969) is highly relevant to services and Information Technology (IT) dominated work settings. Recently, system theory has been applied to such settings as complex telecommunications (Grove & Baumann, 2012), economics and global markets (Holland, 2006). As such the approach offers much utility for the researcher when conceptualising the complexities of contemporary commercial banking operations.

Systems theory offers a useful analytical framework to understand an organisation from a general perspective, enabling descriptions and explanations to be formed to describe and understand its behaviour. Further, systems theory has a long and significant history in the study of management practice (Emery & Trist, 1965) in particular when research is focused on 'services' regarding social policies and sociotechnical phenomena (Emery & Trist, 1973, pp. 89 - 90). Systems theory was selected as the foundation for this thesis due to its utility and significant academic pedigree when studying management practices of interconnected sociotechnical service systems.

2.2.2 Defining the Organisation

The concept of the modern industrial organisation originated in 18th century when Adam Smith's (1776) book "The Wealth of Nations" provided an early account of mass organisation of work. Smith observed performance advantages through organisation of resources and the decomposition of work into tasks for the manufacture and mass production of pins. He identified the phenomena of the factory emerging as a result of industrialisation - systemisation - of work tasks by means of technology (machines).

Modern organisations are enigmatic. Summarising the features of an organisation can be difficult due to their continued evolution and changing environmental context. Organisations have evolved into organic arrangements of staff and technology. Daft (2013) highlights the major differences in mechanistic and modern organic business types (see Table 3).

Table 3: The Mechanistic vs. Organic Organisation

	Mechanistic	Organic
Task Environment	Work is broken down into specialisms, no boundary spanning activities exist.	Employees work in active participation to reach common objectives.
Work Engagement	Tasks are rigidly defined, performed only has directed.	Tasks are adjusted and redefined through teamwork and collaboration
Level of Bureaucracy	Strict hierarchy of authority and control, many applied rules.	Low hierarchy of authority and control, few applied rules.
Knowledge Retention	Centralised at the top of the organisation.	Located everywhere in the organisation.
Communication	Communication is vertical.	Communication is horizontal.

Source: Adapted from Daft (2013)

Much of the work of Daft (2013) can be traced to earlier systems theory studies by Pugh et al. (1968) who contextualised organisations as social entities which are goal driven, designed as deliberate structures and perform coordinated activities which are linked to the external environment (external system demands and situational effects). Other distinguishing characteristics of an organisation are size, formalisation, scale of decentralisation, specialism and professionalism (Pugh, 1973; Daft & Weick, 1984). Daft (2013) goes further to argue organisations contribute to and shape modern human existence in seven temporal and fundamental ways (table 4).

Table 4: Ways Organisations Shape Modern the Environment

Shaping Features
Organisations bring together resources, labour and materials to achieve desired goals.
Produce goods and services efficiently.
Facilitate innovation.
Use modern manufacturing and information technologies.
Adapt to and influence a changing environment.
Create value for owners, customers and employees.
Accommodate ongoing challenges of diversity, ethics and the motivation and coordination of employees.

Source: Daft (2013)

The importance of business sociotechnical systems is presented by Anderson and Kyprianou (1994) who stress the human component as a central pillar of an organisation.

They propose *"people who not only work for an organisation, are the organisation. As such they affect the structure of the organisation".* Thus, organisations are described as dynamic, evolving, in a constant state of change, learning from experiences from the environmental uncertainty in which they exist (Senge, 1990; Anderson & Kyprianou, 1994; Daft, 2001a; Hines, 2004). Environmental uncertainty involves the dependency on resources from the environment, information from the environment and transactions to satisfy environmental demands. Uncertainty occurs when management cannot obtain sufficient or timely information from changes occurring in the environment (Emery & Trist, 1965; Daft, 2001a).

While external environmental conditions may be uncertain, researchers Anderson and Kyprianou (1994) assert the temporal domains of organisations can be typified by enduring and comparative characteristics (table 5).

Table 5: Characteristics of Organisations

Organisational Characteristics
They exist to perform clear goals and have established values.
They comprise a set of persons and form social systems.
The work is performed …[by means of]… those people …[within]… the social system.
The organisation is in constant interaction with its external environment and …[operates in a]… reciprocal relationship, with changes in one affecting the other.
Organisations attempt to alter, if not control, these external environments. They must adapt to these environments in order to survive and grow.
Organisations have a set of activities and roles usually based on some division of labour.
Organisations have communication and power structures.
Individual and group needs and aspirations must be taken into account.
Organisations tend to display a distinct personality or 'culture'.
Structures and processes are inherent in meeting the task …[objective]…
Organisations control, motivate and coordinate the activities of people to meet the task…[objective]… and adapt to external environments.

Source: Anderson and Kyprianou (1994)

Mintzberg (1989) asserts that organisations require structure and 'layers' of management to facilitate communication and control in the longitudinal sense (top to bottom). Top managers choose strategy, develop policy, and provide direction. Middle management implement policy and strategy. The operating core of skilled workers engage in tasks, technical functions (product development, IT designers, product support) and administration support (day-to-day operations, human resources, accounts). Woodward (1965) argues structures are contextually relative to the complexity of the production processes, methods and systems (IT) employed to achieve the goals and outputs (see Table 6).

Table 6: Link Between Technology and Management Structures

Structural Characteristic	Unit Production	Mass Production	Continuous Production
Number of management levels	Low	Medium	High
Supervisory span of control	Low	High	Low
Ratio of managers to total workforce	Low	Medium	High
Skill level of workers	High	Low	High
Overall structure	Organic	Mechanistic	Organic

Source: Woodward (1965)

Upper management must, with technological considerations, deliberately design the structure and fit the organisation purposefully to achieve its goals and objectives (management choice). At the same time, management must consider the external environment and a balance between the design choices and external environmental uncertainty in order satisfy strategic goals and objectives. The ‘environment’ therefore endures as a significant ‘contingent’ factor in organisational design and learning.

2.2.3 Contingency Theory

Contingency Theorists (CT) emerged in the 1960s to argue that organisations and their performance are subject to characteristics of the ‘environment’ acting upon the organisation (Burns & Stalker, 1961). Woodward (1965) proposes a *“technological determinism”* concerning organisational structure and a series of design choices that are ‘contingent’ on the environment. Her thesis was that a business must maintain a fit with the environment such that information is processed quickly, managed through an appropriate structure and used to prompt improvements in performance. Theorists contend that organisational performance and behaviour is determined in predictable ways by their circumstances (Haberberg & Rieple, 2001). Such characteristics include the rate of environment change (uncertainty, volatility) which would require greater flexibility of resources and a workforce focused on improvement (Woodward, 1965). Each of these key characteristics has a resonance with the case study's contemporary issues – especially the slow pace of change affecting IT trading systems (technology).

Balancing and designing subsystems that fit/interact well determines the success or failure of the organisation. Successful interpretation of environmental forces and carefully selected design choices results in high performance, whereas a poor selection will ultimately lead to loss (Burns & Stalker, 1961; Haberberg & Rieple, 2001). Ironically one of the slowest organisational practices to evolve in commercial banking businesses is the IT infrastructure owing to the high costs of changing trading systems.

An important factor of CT is the influence of environmental uncertainty and the 'boundary' subsystems (conduits) that are responsible for interactions and exchanges (interface) between the internal and external environment, the importance of which must not be underestimated (Lawrence & Lorsch, 1967). In the context of banking these conduits are the 'middle-ware' applications/servers used to access and trade in global markets (the external environment).

CT suggests that change will occur naturally through 'environmental forces' however, a system can in turn influence its environment through a 'situational' approach to its conditions rather than 'adherence' to set parameters. Organisations with 'adaptive' capabilities (learning) will demonstrate an advantage over other organisations, which are slower to adapt or do not adapt at all (inflexible and static). High rates of product development in financial services require an 'adaptive' socio-technical capability to create an advantage of over organisations in the competition for customers. Inflexible operating systems therefore slow the business reaction to environmental uncertainty[14] (chaos and complexity) - and worse - cannot react to catastrophic events such as the 'credit crunch' [15] (Hübler & Wotherspoon, 2009).

The debate between whether "structure leads" or "strategy demands" continues to grow despite the simplistic cause and effect of an initial strategy-led structure. The impact of time on the adaptive capability of a business has led to the emergence of Complex Adaptive Systems (CAS) theory. CAS describes the modern inter-connectivity between open systems and the environment, where the environment and the system enter into 'co-evolution' existing in a higher order organisational supra-system or 'network' system (the global banking system). The performance of a global bank is contingent on information, materials and knowledge as prerequisite system commodities, shared real-time and dynamically across a network of multiple "agents" (boundary spanning[16]), allowing the adaptive system to take form (Chan, 2001; Choi et al., 2001; Holland, 2006). The implication of CAS theory on global banking is how organisations coalesce to maintain a 'fit' and alignment (with collaboration) across business units to ensure 'feed-forward' planning and feedback management (subsystem regulators) adapt to the environment (unstable markets).

A CAS demands that social inter-organisational coalitions are established to select and design the fit and function of a "one size fit all" technology (IT) to exploit opportunities and create co-evolutionary capabilities. For a bank to exist as a CAS they would be required to design the fit and function of global IT systems which permit inter-organisational information and knowledge (shared experience of improvements). However, Joan Woodward (1994) asserts that technology directly determines the **competitive advantage** and disadvantage of organisations (see Table 7). In this manner, her work exposes many interesting gaps in the current body of knowledge concerning the dysfunctions, delays and errors within the modern

[14] Unpredicted and unprecedented, global financial market crash of 2008 – 2009
[15] Credit crunch relates to the tumultuous period between 2008 – 2012 where financial markets the world over struggled with liquidity, forcing countries into recession and even bankruptcy – EU member state Greece.
[16] Network boundary spanning refers to the supply chain of the supra-system.

bank and how IT, people skills and structures enabled or inhibited performance and business recovery post the global banking collapse. The prevailing contingent factors to knowledge generation, learning, problem solving and adaption, withstanding the environment, is the 'organisational structure' manifested in its many forms (bureaucratic, matrix, functional, divisional) within an organisational environment (Weber et al., 1958)

Table 7: Operational Contingency Factors

Environmental Contingency Factors Affecting Organisations
Technology
Suppliers and distributors
Consumer
Competitors
Government
Unions

Source: Adapted from (Woodward, 1994)

Critics of CAS theory argue that the '**competitive advantage**' of organisations diminishes within CAS organisations which are '**co-evolutionary systems**' (Holland, 2006). Co-evolutionary theory implies that organisational knowledge and learning is freely shared between organisations in a 'cooperative'. Competition and innovation within a CAS leads to 'weaker' systems (organisations) and subsystems benefiting from learning and innovation of the 'stronger' organisations within the supra CAS environment. Banking organisations exist in a highly competitive environment where revenue and profit are the goal of the system, in fierce competition with peer organisations (Foster, 2011; Grove & Baumann, 2012). Utilising a CAS lens for this study would result in a poor fit, limiting the study output to a description of the current fit of Alpha Bank coexisting within a CAS. The CAS lens would deviate from the research objectives stated in Chapter 1.7 thus placing the ability to answer the research question in jeopardy. However, modern 'competitive' environments akin to global banking therefore place a premium on organisational learning in order to maintain an advantage in the market and sustain high performance. The modern evolution of systems theory has favoured a sociotechnical systems lens in which to develop learning capabilities. STS offers competitive advantages (the aim of learning) for management within complex service industries (Argyris, 2003). Furthermore, STS delivers a high likelihood of providing an answer to the research question, therefore CAS will be rejected in favour of a STS lens.

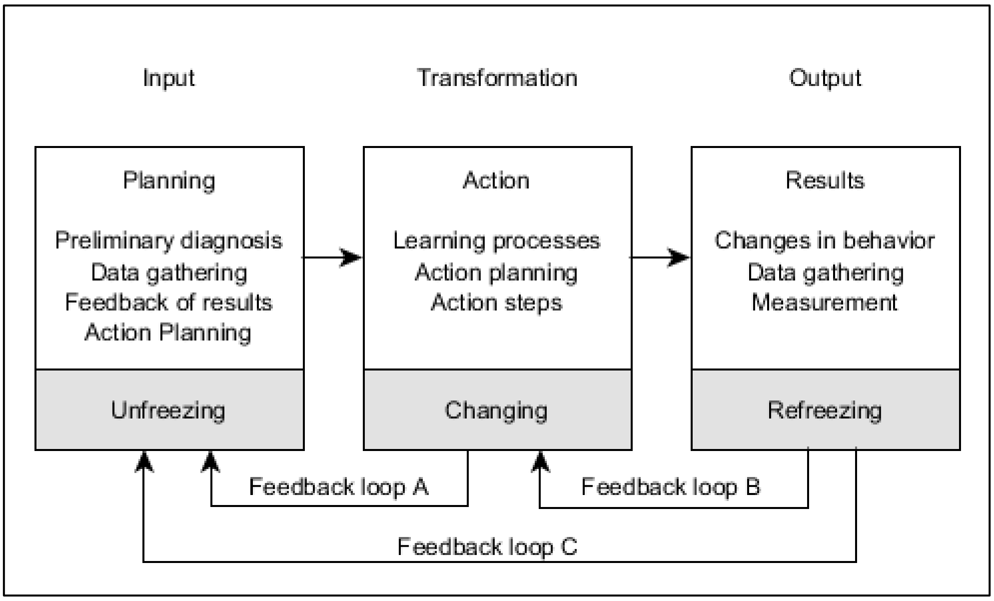
2.2.4 The Learning Organisation

The design of commercial and investment banking IT systems is frequently emulated across industry participants (typically provided by the same vendor). Economic pressures placed upon banking organisations to improve performance has placed new emphasis on learning and adaptive capabilities. However, knowledge development is not a modern phenomenon. Confucius's view of knowledge development will occur *"…By three methods we may learn wisdom: First, by reflection, which is noblest; Second, by imitation, which is easiest; and third by experience, which is the bitterest"* (Confucius, 551 – 479 BC).

Contingency theorists have long been aware of the deterministic factors of the external environmental and their impact on learning (Burns & Stalker, 1961; Woodward, 1965; Lawrence & Lorsch, 1967). Organisational learning is held at a premium, offering a competitive advantage (better performance) to those organisations that have acquired the ability (skills) to collect information and learn from it (Seddon, 2008a).

Lewin (1946), through his 'action research' approach, was one of the first authors to advocate work-based knowledge and experimentation by participant interventions in their business systems. He argued that the social environment of organisations has an influencing effect which can - assuming the conditions are conducive – support learning within the task environment (workplace learning). Learning how to improve involved a cyclical approach to "fact finding" using cyclical experimentation and practical application of knowledge and learning to produce an advantage of the system (increased performance) (Lewin, 1946, 1947). Contemporary studies have recognised the sociotechnical link between people, the workplace environment, learning and performance, resulting in much debate and modification to Lewin’s approach to learning (Pedler et al., 2005, p. 52). Johnson (1976) proposed a modification to Lewin’s “Unfreezing Change Refreeze” change strategy which is beneficial to systems research especially when working with the sophistication of feedback systems such as those identified by Ackoff (1967). The result is a practical framework designed to encourage learning from within the Input-Process-Output or IPO arrangement (see Figure 6[17]). The researcher found this an interesting lens with which to approach modern commercial and investment banking.

Figure 6: Organisational Learning Using Systems Feedback



Graphical representation from Johnson (1976) Source: (Wikipedia, 2015)

Modern approaches to learning acknowledge that the design complexity of organisations, (geographical and cultural) can inhibit the development of experiential organisation learning. Senge (1990, p. 23) identifies learning as being constructed by ‘circles’ of causality. However, most people within an organisation view their environment as linear which can form a “learning horizon” (a limiting boundary). He advocates that people must recognise that they are part of a broader process that delivers customer value, and that value is dependent on flow and management interrelationships across the organisation. He asserts

[17] Input Process Output (IPO) is often used synonymously with Input-Transformation-Output or ITO.

management must become ‘systems thinkers’ who “*see interrelationships rather than linear cause-effect chain, and seeing processes of change rather than snapshots*” (Senge, 1990, p. 73).

A ‘learning organisation’ capability is a prized capability of any modern bank. It encourages interconnected thinking and acknowledgement of flow dependencies of how performance and productivity can improve when looking at the whole system (Forrester, 1958; Emery & Trist, 1965; Senge, 1990; Barker & Camarata, 1998). The latter is a central tenet of Total Quality Management (Oakland, 1995). For Senge (1990) losses in flow performance is a designed-in loss when systems do not adapt and learn (see also Deming, 1986). Barker and Camarata (1998) go further to assert three fundamental preconditions must exist within the organisation for an effective learning journey (see Table 8) reinforcing the findings of (Senge & Sterman, 1992).

Table 8: Preconditions to Learning

Preconditions to Learning	Definition
Trust	The reliability of information and communication exchange are accurate and reflect real conditions. This relies on the dependability of those performing within the organisation to act in coordination and in good faith towards a common goal or objective. Trust implies belief in the organisation itself.
Commitment	Being bound emotionally and intellectually to a course of common action between individuals and groups. It is demonstrated in the attitude to on-going activities in search of long-term goals at the expense of differing gratification.
Perceived Organisation Support	Reinforcement of employee identification and involvement in the goals and objectives, enhancing the sense of connection to the firm. Perception of employee treatment influences their interpretation of the intentions and motives of the organisations future behaviour towards the group.

Source: Adapted from Barker and Camarata (1998, pp. 498-451)

Senge and Sterman (1992) argue the greatest challenge facing an organisation comes from within - the ability to manage knowledge and to enable staff to learn and develop new skills from learning. Barker and Camarata (1998) go further than Senge and Sterman, arguing the required level of communication does not naturally exist within an organisation and must also be developed as a precursory phase before the learning journey can effectively take place (see Table 9). The authors assert that increased and fully developed communication flow is positively correlated with an effective learning capability (vertical and horizontal).

Table 9: Communication and the Indicators that an Organisation is Learning

Communication Indicators	Definition
Organisation Employee Relationship	Horizontal and vertical partnering clearly communicating the extent and depth of the relationship among the learning partners and colleagues facilitates an environment in which learning can continue.
Valuing the Employee	Public praise and messages of support sends a powerful image throughout the organisation that contribution…[to the pursuit of learning]…influences the understanding of how employees are valued.
Employee Empowerment	Establishes a sense of self efficiency, allowing employees freedom to interact beyond structural boundaries, placing them in the loop in terms of information flow and decision making by delegating an appropriate degree of control.
Employee Ownership	Committed employees invest in relationships and will directly communicate a willingness to accept responsibility where they perceive organisational support.

Source: Adapted from Barker and Camarata (1998, pp. 451-453)

A developed and mature learning organisation is strategically equipped to 'self-regulate' towards a 'steady state' and improve to satisfy, or pre-empt, shifts in the environment. Self-regulation is dependent upon the accuracy and speed with which information is collected, feedback, interpreted and 'appropriately responded' to (adjustment decisions). In many cases the 'signal' (change detection) to 'response' (correction adjustment) speed is dictated by 'design features' of the subsystem arrangement, itself a product of learning (Barker & Camarata, 1998; Argyris, 2003, p. 1179). Put simply, for an investment bank, its IT infrastructure and people skills.

Senge (1990) identifies organisations as dynamic systems that must, in order to survive, learn to function in a state of continuous change (influence) and adaptation (equilibrium). The skills and capabilities to detect and identify any divergence from the desired aims and objectives (Senge & Sterman, 1992) are critical, as is acceptance of continual change.

Central to the concept of the 'learning organisation' are five fundamental disciplines held in common with a learning organisation (see Table 10). Senge and Sterman (1992) view learning as a precursory manifestation of perceived realities that occur in the mind of individuals or within a group in preparation for 'problem solving'[18] capability (a key feature of Six Sigma). The ability to detect and react to 'negative stimuli', crisis or common danger affecting the steady state of the business is critical to effective adaptation (Trist & Bamforth, 1951; Skinner, 1965, p. 250; Senge, 1990; Senge & Sterman, 1992, p. 1011). However, most authors agree modern businesses respond to negative stimuli post-event (after an environment shift or internal breakdown) and operate 'time-lagged' problem solving rather than 'prevention'.

Table 10: Five Disciplines of a Learning Organisation

Five Disciplines of a Learning Organisation	Student's Contextual Reflection
Personal Mastery	Personal pursuit of skills development, amassing knowledge and experiences acquired from wider organisational learning. The aim of continuous improvement of both the individual and the organisation.
Mental Models	Traditionally developed opinions relating to the perception of how work activities, work methods, tasks and objectives are set and laid out. Models held by individuals are, on occasion, perceived differently between individuals. Sharing and challenging experiences collectively enriches and clarifies real world events.
Building Shared Vision	The aim for the organisation is to develop shared understanding of processes, objectives and strategies. Organisational structures play a key role in the success or failure to build a shared vision. Hierarchical structures struggle with building a vision due to the perceived cascade of 'executive vision' which may be viewed as 'autocratic', whereas decentralised structures are more bureaucratic and participatory in nature.
Team Learning	Communication of shared experience on processes, the organisation and of customers. The aim is to develop a learning organisation culture through participation (boundary crossing), openness and trust.
Systems Thinking	An organisation is viewed as a system that is comprised of subsystems with a common goal and objective. Systems thinking looks at the micro and macro organisation with a view to describing its functions in easily manageable terms. Systems thinking encourages performance measurement, learning, team building, simplification and continuous improvement.

Source: Adapted from (Senge, 1990)

[18] Problems – those 'conditions' or 'events' negatively impacting on the steady state of a system.

Argyris (1976) proposed that the 'problem-decision' loop increases in complexity and amplifies dysfunction when learning is ill-structured. Further, Argyris and Schön (1978) identify organisations as having single loop and double loop learning where single loop learning is linear, concerned with solving immediate problems in a confined task environment to maintain the status quo (do things right). Double loop learning expands problem solving capabilities beyond 'tasks which are undertaken to repair trade flows' (single loop learning), and challenges the fundamental design features of the wider organisational system (boundary spanning – to do things better/differently), which can lead to failure prevention. The researcher contends that double loop learning produces the most enduring knowledge in which to solve problems and combat perceived threats to stability and performance[19].

A high performance bank would therefore need to operate double loop learning mechanisms within the context of IT systems flow with staff awareness so that the necessary skills are developed to detect situations that could lead to system failure. Such an adaptive capability is necessary to survive in modern market conditions. "*With more time sensitive information available to organisations the acquisition, interpretation, distribution and transformation of this information into market demand outcomes is vital for survival…[in a high performance, highly competitive and constrained market such as commercial and investment banking]"* (Barker & Camarata, 1998).

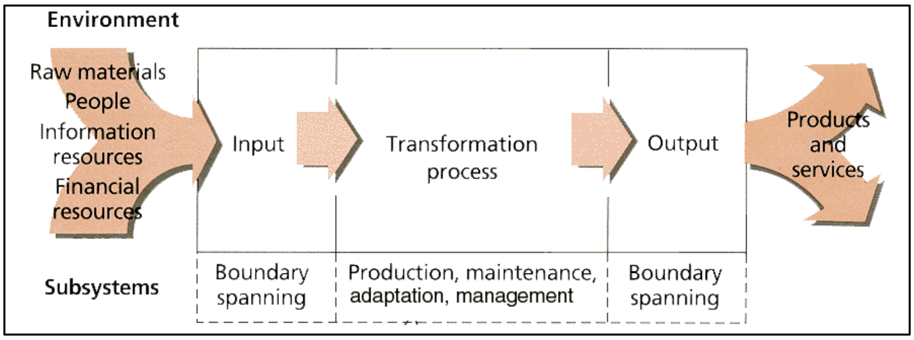
Of paramount importance to a banking institution are the skills to identify and react to deviations leading to performance and quality losses. Directing behaviour that will, with speed and accuracy, regulate the system to an uninterrupted flow of goods and services (products and information to markets) is at its essence a "quality first" approach (Deming, 1986; Ferdows & De Meyer, 1990; Oakland, 2000).

[19] The double loop learning cycle was considered important as the basis for this research study.

2.2.5 Quality and System Performance

Thus far, the researcher has argued that an effective and efficient organisation can be approached as a system, composed of smaller subsystems arrangements which must work together in synergy to remain viable by optimising the flow of work (Von Bertalanffy, 1969). The literature has firmly supported the need for a learning capability and a systems approach to improving the core capabilities of staff skills and IT flexibility. An imbalance to the steady state of transaction process risks unsatisfactory performance and potentially regulatory non-conformance. These findings reinforce the operations management (OM) view of an effective Input Process Output model (see Figure 7).

Figure 7: Input Process Output System



Source: Nielsen (2001)

A system must also possess the ability to appraise its output (assess quality) in order to regulate, adapt or change to reach and maintain a ‘steady state’ performance. In Darwinian terms, failure to achieve this status will result in business decline and failure (death of the system). As such the sophistication of feedback systems that are timely (not lagged) must be effectively designed if a business is to survive and grow. All organisational subsystems are dependent on each other: Their performance is greater than the sum of the subsystems provided that performance is based on effective management of quality through the entire processing system (Emery & Trist, 1965).

Regulating the quality of work flow demands information collected via quality appraisal must be sent to the earlier subsystems and resources (input stages) utilising feedback loops to carry the information required for decision-making and intervention (regulation). This implies high-performance banks are required to tightly control 'system feedback' processes to avoid disturbance of the steady state processing of work through IT systems (Forrester, 1958). Internal failures resulting from a poor system design will distort and amplify external variation (Deming, 1986). `External variability' originates from 1) the environment (demand side) or 2) the resource inputs (supply side). Each variable factor has an ability to affect the state of the subsystem transformation process, ultimately changing the quality and flow of the 'output'. Quality is a critical success factor of system performance: Any deviation from the intended or desired state will result in some form of loss (Juran, 1951; Taguchi, 1986b; Garvin, 1988; Feigenbaum, 1991; Crosby, 1996). With 'loss' comes an increase in processing costs and the need to 'rework' activities to restore quality levels and often 'irreparable' quality will result in a total loss to the system. For a commercial bank such losses have a significant financial penalty attached.

Put in the context of high-performance Commercial and Investment banking operations, the design considerations of sequential processing (conversion) subsystem feedback loops carrying KPI[20] information are of particular importance in order to turn system demand into profitable trades. System designs that fail to collect performance information (flow characteristics) at key stages of the conversion process will be less responsive (Seddon, 2008a, p. 59) and fail to provide an accurate and legitimate account of performance and thus regulation will be impossible. In effect poor IT could threaten the performance and profitability of the bank itself. Furthermore, the same design considerations apply to the quality assessment of output disposal channels in conjunction with the conversion subsystems. The implication of quality feedback at the output disposal stage ultimately

[20] Key Performance Indicators (KPI's) are a feedback measure of system performance against specified targets or conditions (quotas and specifications) to be achieved (Seddon, 2008a, pp. 143, 148, 150).

dictates whether or not the trading counter party (service customer) receives a product that fully satisfies its intended function (last opportunity to substantiate conformity).

Tozer (1994) proposes six principles governing the design of feedback loops (see Table 11), and argues *"Every successful business enterprise the world over, even those of modest size, has a proportion of its activity devoted to managing Information systems. Unfortunately, as many business people have found to their dismay, a considerable proportion of this activity is neither* ***systematic*** *nor particularly* ***informative****"* (p.77) and, as such, a gap exists in knowledge of effective IT systems design under conditions of complexity and uncertainty.

Table 11: Key Principles of Data Quality

Design Principles	Design Implication
All data of use to an organisation should be captured once at source.	Identify measurement points of both key performance indicators and quality appraisal points within the process. Data must be collected 'instantaneously' as products flow through the conversion system. Data must be stored in a centralised data warehouse.
For any entity, the responsibility for creating specific instances relating to each part of the business should be uniquely identified.	The design and demarcation of roles, responsibilities together with system resource requirements and dependencies must be exemplified and accessible across the system.
The form in which particular data is passed from one system to another should be consistent across the entire organisation.	Interconnectivity of subsystem data collection, transportation, storage and accessibility must be a consistent design feature.
As far as possible, each functional need should be met by a single piece of software wherever it occurs in the organisation.	All key features of the product design and conversion tasks must have its own unique data collection and feedback channel achieved by a common measurement apparatus/application.
Where multiple copies of a particular piece of …[data capture]… software are in use, their maintenance and evolution should be controlled centrally.	Centralised management of subsystem design changes to ensure design authority and change control procedures are followed ensuring consistency of approach.
All shareable data should be stored, in whatever application, in a consistent manner.	Access to data warehousing should be made available to management and system users in a consistent format for the purposes of learning and knowledge generation.

Source: Adapted from Tozer (1994, p. 78)

Thus far, the penalties of failures in the IT conversion processes have included sources of delay and loss to a modern bank - worse still these systems are dependent and sequential in nature thus errors prevent onward processing.

2.2.6 Fragility of Sequential Processes

Sequential and linear IT systems needed to process complex products represent a dependent chain of service events and activities (Gupta & Boyd, 2008). W. Edwards Deming (Deming, 2013) argued that an organisational system can be defined as *"a network of interdependent components that work together to try to accomplish the aim of the system*" again reinforcing the need for a systems approach. Each service transaction (product processing) is broken down into a sequence of routines to be performed following a specific predefined arrangement or logical configuration. An absolute dependency exists on fulfilment of prior activities and reaching an acceptable quality level before subsequent activities can be performed. A dependent system must achieve 'fulfilment' and 'quality' in order to achieve flow and overall system performance may be determined by any 'constrained' resource or activity within the system – also known as a 'bottleneck' or inhibitor of flow (Goldratt et al., 2004).

2.2.7 System Scheduling and Feed-Forward Processes

Effective scheduling and control of sequential operations activities is fundamental for flow. Research has shown large fluctuations in demand emanate mainly from poorly designed forecasting and scheduling mechanisms (Forrester, 1958). Oscillations and cyclical events such as seasonal patterns attributed to exogenous forces have a profound ability to affect system stability (Ackoff, 1971, p. 664). The impact of poor quality on achieving a "steady state" cannot be under estimated for any organisation. Large fluctuations in demand and poor quality were first identified as sources of system dynamics ('bullwhip effect') by Forrester (1961). Poor quality causes 'rework' or 'reproduction' of products and services that have earlier failed to exit the system 'right first time' (Seddon, 2008a). The discipline of Systems Dynamics (SD) emerged in the late 1960s at the time of Systems Theory and proposed that a 'chain' or 'network' of feedback loops governed a production system and information exchanges must be controlled or flow would be interrupted by poor, time-lagged or inaccurate information. These chains and networks carry signal information that is susceptible to a phenomenon called ‘white noise’ (system signals - commonly failure demand - distorting quality and flow). Noise distorts the true requirements of the systems, damaging the ability to make accurate forecasting decisions and reducing the ability to produce a “steady state”. Forrester (1961) argues that noise within a system will produce poor performance and eventually chaos. How such noise impacts banking efficiency is considered to be a critical aspect of this research.

2.2.8 The Uniting Thread: What Does It Mean for Alpha Bank

Successful process execution, improvement and high performance is dependent on the workforce sociotechnical interactions and process/systems thinking (not a business as a series of silo functions). Presently, management at Alpha Bank do not possess common mental models that describe the complete processing system (limiting the ability to trace subsystem failures). Early discussions with the director at the case study suggested previous performance improvement initiatives did not deliver sustainable benefits and improvement initiatives had merely sub-optimised system performance. Whether sub-optimisation was intentional or not, it had increased the complexity of the system without realising tangible benefits at the macro level (performance management KPI improvement).

Process pathways at Alpha Bank are sequential and have a significant dependency on ‘right-first-time’ quality to satisfy the operational objective of ‘Straight Through Processing’ (STP). Currently, STP suffers from extreme variability as a result of ‘noise’ amplification due to the necessity of spontaneous manual rework and reprocessing. The impact of spontaneous rework on the “steady state” production system interrupts the flow of products and services to clients, thus limiting the organisation’s ability to compete with high performing peer institutions. The flow and speed at which work is undertaken is at the very essence of all OM systems (Taylor, 1911; Ford, 1913; Fayol, 1965; Deming, 1986; Womack et al., 1990; Slack et al., 2011). A reduction to flow performance will increase costs and result in the accelerated decline of customer service levels. Therefore, speed, accuracy and even workflow is an extremely important capability in the banking system (Schmenner, 2001).

Operational managers within commercial and investment banking encounter difficulties when attempting to forecast resources (a major cost contributor) required to balance system dependencies (staff needed to repair and maintain quasi flow properties through the IT system). Noise (uncertainty) and demand amplification (failure demand) have led to unquantifiable levels of rework and an overwhelming inability to forecast operational activities. At present the strategy of Alpha Bank has been to over-staff to ensure trade flow (product and cash flow). However, this has led to underutilisation and excess capacity which has inflated the key performance measure - Cost Per Trade. A recent industry benchmarking report (2011) indicated that Alpha Bank held a significant cost disadvantage relative to its peer institutions (MGT, 2011). The report identified Alpha Bank as a poor performer, having an inferential high cost of poor quality.

In closing, it can be said that the case study organisation fits the attributes, descriptors and behaviours of ‘sociotechnical system’. Therefore, to study the organisation through such a lens gives the researcher confidence that information collected from the phenomena will produce an instance whereby meaningful conclusions can be drawn to help answer the research question.

Chapter 3: Focal Literature

3.1 Introduction

The background literature has established that high performance service systems are integrated open systems that learn. The researcher also critically reviewed LTS and CAS but selected social technical system theory due to its relevance to the subject concerned. The other theories offered only a partial account of the banking system design. This chapter will further refine the concepts of performance and systems flow, from an operations management and quality management perspective.

3.2 Operations Management

Operations Management has evolved since European and American industrialisation in the 20th century, with the first serious codification of management practice occurring with the rise of Scientific Management and Fredrick. W. Taylor (USA) and Henri Fayol (France). The essence of their work was profit maximisation/cost minimisation, the coercive control of workers and deskilling for greater efficiency in the context of an undemanding consumer market. The purpose of managers was to reduce the 'cost' of production and to control everything including learning.

Many of the modern principles of operations management draw from F.W. Taylor's (1911) 'The Principles of Scientific Management' within which Taylor conceptualised organisational management as the means to a establish "one best way" of production and gain efficiency through maximising the "output of each man and each machine". Taylor proposed 'Four Principles of Scientific Management' including the centralisation of work design as a management activity and the sub-optimisation of work (doing work) to labourers (see Table 12). He proposed the separation of crafts and tradesman-ship into tasks requiring limited skill and capabilities that were only relevant to supporting productivity. In this approach Taylor conceived the concept of the 'production line' (Taylor, 1911; Pugh & Hickson, 2007).

Table 12: Taylor's Four Principles

Taylor's Four Principles of Scientific Management
Develop a science for each element of a man's work which replaces the rule of thumb method.
Scientifically select, train, teach and develop the workforce.
Heartily cooperate with the men so as to ensure all of the work is being done in accordance with the principles of the science which has been developed.
There is an almost equal division of work and the responsibility between the management and the workmen. The management take over all work for which they are better fitted than the workmen, while in the past almost all of the work and the greater part of the responsibility were thrown upon the men.

Source: Taylor (1911)

Fayol, the father of modern operational management theory offered "General and Industrial Management" (Fayol, 1965) His core principles describe the behaviors/activities that operations management must observe to build a strong administration which, coincidently, supported many of the themes found in Taylor's arguments. Fayol, like Taylor, offers a concise collection of core principles to describe the types of behaviors/activities of OM (table 13).

Table 13: Fayol's Five Principles of Management

Fayol's Five Principles of Management
1: Planning: creating a plan of action for the future, determining the stages of the plan and the technology necessary to implement it.
2: Organising: managers need to provide everything necessary to carry it out; including raw materials, tools, capital and human resources.
3: Command: Managers need to implement the plan. They must have an understanding of the strengths and weaknesses of their personnel.
4: Coordination: High-level managers must work to "harmonise" all the activities to facilitate organisational success. Communication is the prime coordinating mechanism.
5: Control: The final element of management involves the comparison of the activities of the personnel to the plan of action. It is the evaluation component of management. The monitoring function evaluates quality in all areas and detects potential or actual deviations from the organisation's plan, ensuring high-quality performance and satisfactory results while maintaining an orderly and problem-free environment. Controlling includes information management, measurement of performance, and institution of corrective actions.

Source: Fayol (1965)

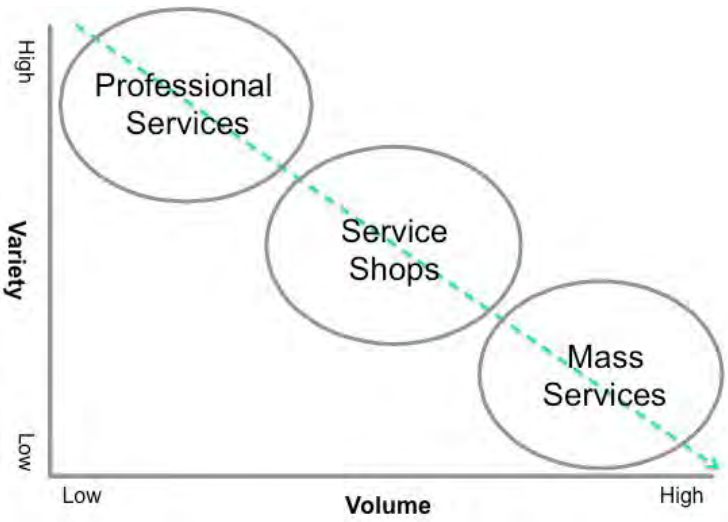
A crucial distinction exists between the two OM approaches, and perhaps the most serious weakness of Taylor's system is that it lacks a feedback loop to stabilise the system. However, Fayol's fifth principle offers managers a control continuum to measure effectiveness across multiple dimensions and success factors (laying the foundations for a "learning system" based on "feedback loops"). Taylorism and Fayolism remained the dominant model until the 1980's although it had weakened in the 1960s (Pugh & Hickson, 2007). The central tenets of Taylorism and Fayolism rest heavily on standardisation and the use of the "one best way" to support the mass production of high volume and low variety outputs in comparatively slow moving environments. These market conditions no longer exist in financial services and contrasts with the enhanced employee learning/multi-skilling needed to accommodate high variety and complex financial trades.

From the midpoint of the 20th century, producer power shifted to customer power in Europe and America. It rendered mass production less effective due to an increase in 'variety' of customers. Consumer demands to broaden product ranges and supply 'variety' challenged the dominant models, exposing weaknesses in their adaptive capability to accommodate such shifts in demands. OM theory reflected this transition and moved from a 'tactical' activity to a 'strategic' core competence to deliver/drive business strategy (Drucker, 1964) based on flexibility and high quality performance (Slack & Lewis, 2011).

Lawrence and Lorsch (1967) positioned the concept of the 'high performance' organisation on three deterministic scales 1) Rate of change in environmental conditions 2) Certainty of information at a given time about its environmental conditions 3) The time span of definitive feedback from the environment. Skinner (1969) was the first author to codify a strategic approach to OM design. He argues a robust system design will result in high performance. Whilst he acknowledged the important contribution of OM to cost management within organisations, he contends that Taylorism and Fordism did not fit the modern paradigm. Skinner proclaims that an *"entirely different approach, one adapted far better to the current era of more products, shorter runs, vastly accelerated product changes, and increased marketing competition…[is needed]" (Skinner, 1969, p. 145).*

The work of Skinner was followed and extended, but rarely criticised, by Hayes and Wheelwright (1984). A major catalyst for rethinking 'operations' was the emergence of the 'service sector' and the importance of operations concepts for the design of organisations that had to deliver a service "on demand", without stock and in significantly higher levels of 'variety' than that faced by the traditional manufacturer. Slack (1987) criticised 'the one best way' of management contending that "flexibility is fashionable" and is the least understood manufacturing objective. He defines flexibility as the ability to switch production between products quickly and effortlessly and offers a hierarchical model which he adapted from Hayes & Wheelwright's (1979) production-process matrix (see Figure 8).

Figure 8: Variety versus Volume



Source: Slack & Lewis (2011)

Slack and Lewis (2011) argue that high-variety and high-volume is untypical as a dimension of operations. This view has little support from service operations management researchers (Baines et al., 2009) and Seddon (2008a) argues "variety in customer demand" is typical and will endure as a characteristic of the modern service organisation and in smaller volumes as a result of consumer personalisation. Variety accommodation is an influence on organisational design choices and optimisation and these are highly cherished by commercial and investment banking institutions. Moreover, patterns of demand (trends) can highlight which skills are required, and when, to ‘absorb’ demand – as opposed to the status quo which is to attempt to smooth the ‘effects’ without understanding the causes, leading to the major causes of customer dissatisfaction in services (services managed like production lines) (Seddon (2008).

Seddon (2008) argues that skill buffering and multi-skilling in the service industry is the only means of absorbing volatility – a knowledge capability to buffer the service business. He asserts that the ‘high variety - high volume’ position of Figure 8 must be avoided by intentional design. Furthermore, organisations should simplify back office process however where there is no option to further reduce product complexity (achieving high volume low variety) back office must work to absorb complexity in ‘customised environments’. Seddon’s initial cases were ‘back office’ repetitive, predictable, and high volume with low variety of service tasks (production lines). However, Seddon does not believe businesses will remain in Slack and Lewis’s (2011) lower right quadrant of Mass Production/Service. He is also critical of ‘retro-fitting’ manufacturing concepts for service designs.

Operational measures (essential elements of systems learning and regulation) utilised within the service sector typically reflect ‘financial targets’. Such organisations use production systems and process designs that were initially developed to support mass production/cost minimisation to theoretically achieve profit maximisation (Neely et al., 2005). In the first instance, it may seem logical to minimise costs to increase the profitability of a business to maximise shareholder dividend. However, improvement strategies which are exclusively founded on cost minimisation will lead to the creation of sub-optimal conditions (extraction of value). Such conditions are likely to “increase costs” and reduce quality over time - a result that may appear counterintuitive and diametrically opposed to the intended outcome. Nonetheless, such a result is due to a compromise between quality and the systematic extraction of value from the production system (Juran, 1951, p. Chapter 8). Deming (1886) provides an insight into the dysfunctions of ‘cost myopia’ in scenarios where there is a unilateral focus on cost reduction. Organisations that compete on “quality” will simultaneously reduce costs through the targeted reduction of operational wastes (Deming, 1986). Quality and cost are embodied in Deming’s “fourteen points of management” (see Table 14) and are central to Juran’s contribution to Total Quality Management (TQM). Goldratt (2004), reflecting on the work of Deming, argued that product quality has a significant bearing on the total production cost of a product. Goldratt (2004), Like Deming, established a correlation between quality and costs, revealing that an improvement to product quality will have a corresponding effect on production costs.

Table 14: Deming’s Fourteen Points

#	Deming’s Principles of Management
1	Create constancy of purpose toward improvement of product and service, with the aim to become competitive, to stay in business and to provide jobs.
2	Adopt the new philosophy. We are in a new economic age. Western management must awaken to the challenge, must learn their responsibilities, and take on leadership for change.
3	Cease dependence on inspection to achieve quality. Eliminate the need for massive inspection by building quality into the product in the first place
4	End the practice of awarding business on the basis of a price tag. Instead, minimize total cost. Move towards a single supplier for any one item, on a long-term relationship of loyalty and trust.
5	Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs.
6	Institute training on the job.
7	Institute leadership (see Point 12 and Ch. 8 of "Out of the Crisis"). The aim of supervision should be to help people, machines and gadgets do a better job. Supervision of management is in need of overhaul, as well as supervision of production workers.
8	Drive out fear, so that everyone may work effectively for the company.
9	Break down barriers between departments. People in research, design, sales, and production must work as a team, in order to foresee problems of production and usage that may be encountered with the product or service.
10	Eliminate slogans, exhortations, and targets for the work force asking for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, as the bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the work force.
11	Remove barriers that rob the hourly worker of his right to pride of workmanship. The responsibility of supervisors must be changed from sheer numbers to quality.
12	Remove barriers that rob people in management and in engineering of their right to pride of workmanship. This means, inter alia, abolishment of the annual or merit rating and of management by objectives.
13	Institute a vigorous program of education and self-improvement.
14	Put everybody in the company to work to accomplish the transformation. The transformation is everybody's job.

Source: Deming (1986)

The rise of the service industry was accompanied by an intensification of competition. The 14 points - originally developed for manufacturers - can be applied to the service industry and its improvement. The significant power and flexibility of internationalised Japanese businesses was accelerated by the publication “The Machine That Changed The World” (Womack et al., 1990). At the same time, Ferdows and De Meyer (1990) studied the strategies and performance objectives of large European food producing organisations. Their study yielded the ‘sand cone’ model and four sequential ‘areas of mastery’, which the authors claim can yield superior performance and competitive advantages when mastered. The suggested sequence is Quality, Flexibility, Speed, producing an outcome of Cost Effectiveness. This model and empirical evidence reignited an interest in quality if only to compete with Japan’s dominance.

3.3 Quality

Exploring high performance operations management (measured in terms of flow) has brought quality management to the forefront of the discussion. The chapter will now review the key contributions in this field of study.

3.3.1 Early American Quality

The United States of America pioneered the early ‘quality movement’ as a tactical activity (a subsystem) through Shewhart (1931) who used a set of statistical tools to measure deviations in performance and flow. These tools became known as Statistical Process Control Charts (SPC), and were used to describe (and in some cases predict) the ‘stability’ of processes. Deming (1993) also a statistician (and mentee of Shewhart’s) extended his work to form his ‘System of Profound Knowledge’ (SoPK) which underpins his view of TQM and the role of the manager in systems design. Deming’s work was perhaps more influential in Japan in the years following the reindustrialisation of the country. SoPK compartmentalises Deming’s theories into four themes 1) Appreciation for a system 2) Knowledge of Variation 3) Theory of Knowledge 4) Psychology. These four themes combined with his fourteen principles for business transformation (see Table 15) (Deming, 1986) and offers a tactical as well as strategic framework to stabilise, control and improve an organisation – effectively taking the tenets of systems theory and making them useful for industrial management.

Table 15: America Takes Quality to the World

Name	**Contribution**	**Year of Work**
Shewhart (1931)	Developed the principles of process control, with later deployment and practical use to statically determine the stability of a process or system. Later termed as Statistical Process Control charts.	1931
Deming (2013) Deming (1986)	Best known for the creation of the 'Deming Cycle' consisting of Plan Do Check Act as an iterative management cycle used to stabilise and improve business processes, together with the System of Profound Knowledge and the Fourteen Points of Management.	1943
Juran (1951)	Juran's seminal work on the 'Quality Control Handbook' produced the first practical interpretation of quality management for managers not of a statistical or mathematical background. He also coined the term 'Cost of Poor Quality' (COPQ) which gave management sight of the costs that resulted from the inability to produce a product 'right first time'. Creator of the 'Juran Trilogy', a step by step (and suggested 'universal') guide to developing quality products and designing quality processes and systems of production.	1951
Feigenbaum (1991)	Development of 'Total Quality Control' theory. A conceptual framework that integrated three key continents of; quality development, quality maintenance and quality improvement. He also presented the phenomena of the 'Hidden Plant' arguing that a significant proportion of production capacity is consumed by reworking defective products.	1961

Source: The Researcher 2013

Modern Total Quality Management has a deep rooted and fundamental influence on the ability of an organisation to reach its basic objective which is to provide specific output to a customer in an efficient and effective uninterrupted flow of outputs. In this model, failure to meet certain quality criteria implied a 'loss' to the system and a cost to the organisation through a mixture of wasted resources (labour and material losses). Juran (1951), an associate of Deming, focused on the 'Cost element Of Poor Quality (COPQ). He argued the COPQ is the sum of the total costs that will vanish should systems, processes and products perform to their design specification. Feigenbaum (1991) extended this thinking in his framework which he called 'Total Quality Control' (TQC). TQC is a holistic framework for managing the ‘integration’, ‘maintenance’ and ‘improvement’ cycles of an organisation enabling products and services to be produced at the most economical level to ensure customer ‘satisfaction’ (effectively defining quality as conformance to a predetermined ‘specification’ informed by the customer) (Feigenbaum, 1991; Crosby, 1992; Oakland, 2000). Feigenbaum added the ‘hidden factory’ concept which he defined as the lost production capacity that is wasted due to products not exiting the production system ‘right first time’ and instead creating waste which he argued accounted for as much as 15% - 40% of the production capacity and resources (although he stopped short of making any estimate of service industries losses and the extent of poor quality). By relating quality loss to capacity, Feigenbaum directly linked quality flow with less time loss for processing which is critical for time constrained processes such as global payments in commercial and investment banking. Table 15 presents how the main concepts of quality management have evolved and the contribution of the early American conceptualisation informed management practice in the late 1940s to late 1960s[21].

3.3.2 Emerging Japanese Quality

Early quality ‘gurus’ set out a “systems theory” approach to business post WWII. Japanese industry embraced these ideas and by the 1950’s and 60’s, both Deming and Juran were lecturing and teaching quality management theory and techniques to senior Japanese industrialists (sponsored by the Japanese Union of Scientists and Engineers - JUSE). In the 1960’s, Japan emerged as an industrial power to challenge the market dominance of America and Europe, later investing productive assets in Western economies. Japanese globalisation was based on a ‘quality first’ and systems approach to business (Womack & Jones, 2003). From that period, onwards a distinct Japanese school of quality emerged based on the implementation of Deming’s 14 points and the cost performance focus of Juran.

[21] It should be noted that many publications cited are much later in history and occurred when the thought leaders had written up their approaches and officially published them.

From the 1960's onwards Japanese managers and theorists refined 'quality tools for every worker' engaged with quality improvement (Ishikawa, 1985). The feedback also served to enhance the features of businesses that were later termed "learning organisations" by Senge (2006). Japanese businesses implemented innovations, raised quality, raised productivity, enhanced flow and lowered costs seemingly with ease using this approach. Quality tools for everyone shortened the detection to correction cycle of learning. It also reduced variation and enhanced worker skills (knowledge buffer). Table 16 summarises the leading thinkers of the time[22].

By the late 1970's Japan's manufacturing capabilities were so advanced that they challenged the dominance of companies in the West and in particular America. Many did not foresee the rapid rise in the industrial league rankings by Japan and many more were unsure of the mechanisms of Japanese success[23]. Hayes and Wheelwright (1984) found investments in new system designs and quality management implementation accounted for the performance differential (Womack et al., 1990).

[22] It should be noted that their publications (in English) lag many decades behind the proving of these techniques.
[23] Deming daringly as an American told Japanese industrialists they could capture the world market within five years through investing in quality improvement (ASQ, 2012).

Table 16: The Quality Toolbox – Japanese Develop Tools to put Feedback to Work

Reference	Contribution	Year of Work
Shingo (1986)	The term 'Poka Yoke' loosely translated means 'Mistake Proofing'. The technique of Poka Yoke is a 'in process' check designed to prevent human errors when dealing with assembly and composition of products. Shingo made a distinction between mistakes and defects saying *"defects are mistakes which have gone 'undetected' and reached the customer"*. A Poka Yoke system offers 'detection' in the first instance and then 'prevention' as the ultimate defence (a simplistic analogy is; a round peg can't fit into a square hole).	1961
Akao (1990)	Akao developed Quality Functional Deployment (QFD) as a structured method (taking form as a quantitative matrix) to collect information to assess various features and specification aspects of a product or service using feedback from the customer. Ultimately the QFD tool is deployed to ensure customer expectations are being satisfied by a product or service.	1966
Ishikawa (1985) Hutchins (1985)	Ishikawa's contribution was both to academic theory and processional practice. Most noteworthy of the contributions are; The Ishikawa Diagram (also know as the cause and effect diagram), Seven Basic Tools of Quality (fundamental tools for analysing problems and developing solutions), Total Quality and Quality Circles. The latter are a fusion of Deming and Feigenbaum's philosophies retuned to focus on participative team-driven quality improvements using top management through to shop floor staff (top management having greater influence and responsibility to manage quality).	1969
Taguchi (1986a)	Taguchi's Quality 'Loss Function' takes the 'cost of poor quality' and extends its reach by proposing that there is 'financial loss' to 'society', which increases the further a process is from the target value. This theory contests the class attitude towards quality that argues a product is deemed to be of 'acceptable' quality if it is found to be with specification, ergo in this instance there is no immediate loss. Whereas Taguchi argues there will be some form of loss to the system the further a product is found to be from target while remaining within specification limits.	1970

Source: The Researcher

3.3.3 America Reacts to Japanese Quality Prowess - an Era of Emulation

A buoyant and growing economy in the US post World War II meant there was little pressure to change the American 'standardised' production system, and a weak consumer added to the sluggishness to improve product quality.

During the early 1970's Japan began to compete with America on cost (Altshuler et al., 1984) and, by the end the decade, Japanese products were competing with American products on cost, quality and variety - and winning (Aguayo, 1990). American producers were slow to react to competition and it took America more than a decade to offer a challenge to Japan and another decade to rebuild its manufacturing sector so that its production systems could compete on Quality, Cost, and Flexibility (ASQ, 2012). Table 17 lists the new wave of American quality theorists.

Table 17: Contemporary American Quality Movement

Reference	Contribution	Year of work
Barney (2002a); McCarty (2005)	Motorola began the 1980's with poor customer quality ratings. Bill Smith (a quality consultant) joined Motorola in 1986 introducing statistical techniques to improve quality by identifying and reducing variation found in production processes. Like Taguchi, Smith required processes to be centred on a target value. However, Smith used process variability (the standard deviation, represented in statistical term by the Greek letter Sigma) to asses 'short term' and 'long term' capability to meet quality specifications. In a new and novel way Smith used the amount of variability demonstrated by a process to produce a capability 'index' - Sigma. The ability of a process to vary three standard deviations either side of the 'mean' value without breaching specification limits is termed Six Sigma capable. A process operating in such a state statistically produces 3.4 Defects (product outside specification) Per Million Opportunities (DPMO). Six Sigma was born and Motorola used Smith's method and index as a benchmark quality target for all its manufacturing processes.	1986-1988
Garvin (1987)	Garvin expanded on the quality debate surrounding quality standards particularly in the growing services sector where quality levels were usually internally justified targets. Garvin argued that quality could be categorised into eight dimensions forming a thematic framework: 1. Performance 2. Features 3. Reliability 4. Conformance 5. Durability 6. Serviceability 7. Aesthetics 8. Perceived Quality.	1987-1988
Womack et al. (1990)	The book "Machine That Changed The world" popularised the term 'Lean Manufacturing' and was a successful attempt to describe Toyota's Production System (TPS). A crucial distinction of TPS over others at the time allowed control of production line quality to be monitored by assembly line workers, allowing the line to be halted should any quality concern arise. Preservation and improvement of quality standards were of paramount importance to the TPS such that 'output' was a secondary metric to quality. A key constituent of the system's success was reportedly its ability to pass information (feedback) efficiently and effectively (speed and learning) between production teams to eliminate causes and constraints (wastes). Toyota understood an important feature of 'input-process-output' relationship identifying a vulnerability regarding the in-flow of resources (components) and supplier quality capabilities. Toyota understood that overall product quality relied equally on their internal ability to design and assemble products, but also a significant bearing on supplier capabilities to deliver resources to a specified quality level and	1984-1989

	'frequency'. Resource delivery (frequency) in terms of unimpeded flow was of significant importance. A restriction on in-flow would affect the system, stopping assembly due to shortages. Equally, 'pulses' of large batch deliveries affected the stability of the system by means of inventory costs/management, obsolescence storage and transportation. Quality and frequency of resources entering the system were of equal or greater importance to achieving the goals of the system once the method of production (the process) was established internally. In addition, great importance was placed on management of resource 'information'. Resource management (ordering and delivery) came to be known as "Just In Time" ie all resources delivered to the assembly point at defined frequency and quality standard. The authors argued that the key to successful implementation of TPS lay in an 'understanding' of the complete system and not emulation or 'retrofitting' parts of the system into an existing system.	
Crosby (1992, 1996)	Crosby's writing on the subject of quality increased in volume and content during the 1980's in light of the gap between American and Japanese product quality and a growing competitive advantage in favour of the Japanese manufacturers. Crosby contended that quality should be thought of as 'free', citing that one in every three American dollars spent on production costs could be linked to product non-conformance. By contrast, costs associated with quality planning would be less than the non-conformance costs (appraisal, rework and scrap), mitigating quality as a perceived 'on cost' to production, ergo 'quality is free'. The need to close the gap was a tactical necessity for most, however Crosby argued that America required a quality strategy for the 21st century or 'catch-up' would remain constant. Successfully regaining a competitive edge required a 'completeness' of undertaking, that is to say 'influence' and 'control' over the 'end-to-end' system – and a strengthening of the production chain in which no part of the process should be overlooked. Crosby proposed 'four absolutes' as a framework strategy to improve quality; 1) Conformance to Requirements 2) Quality is Prevention,3) Zero Defects 4) The Measure of Quality is Cost of Non-conformance.	1996
Neely (1999); Neely et al. (2005)	Amid the Internet revolution of the late 1990's products evolved to become 'services'. Services became 'digitised' existing merely as 'information', intangible in the physical sense yet still 'manufactured' and 'assembled'. Product delivery changed also, becoming a 'transmission' of information only (emailing documents and agreements). In essence products exist purely as information (Gummesson, 1994). Neely et al (2005) explored the concepts of quality and performance management in the emergent services sectors where 'physical' quality management theories of the earlier century began to feel like an ill fit for the new digitised system of production. This brought into question the value of the performance measures due to the changing nature of work, changing organisation roles and changing external demands through the power of information technology.	2005

Source: The Researcher

Since then quality has been shown to offer a 'no trade off' approach to organisational excellence and, as a competitive weapon, has been a common feature of all models of operations competitive advantage (Garvin, 1987; Ferdows & DeMeyer, 1990; Neely et al., 2005). Neely et al (2005) began to translate quality models into systems that could be understood for the performance management of services and so too did Seddon (2003) but from a humanistic systems view. The aftershock of buying new large-scale IT systems in response to the Millennium bug – which failed to materialise – and the promises made by vendors about the new power of computing systems for the transformation of tired manufacturing/service system models stimulated research in the area.

3.3.4 Section Summary

A review of Quality Management literature shown quality to be a prerequisite to flow performance (as systems theorists would call it 'feedback') but it has largely ignored this vital reverse flow of information in favour of feed-forward and quality strategy research (Fowler, 1999). The last two decades have witnessed the ascendance of information technology (IT) and its emergence as a core component of the modern organisation and business landscape (customer expectation). There is a large volume of published studies describing the role of IT (hardware and software design) with high performing organisations enjoying much of the academic focus of recent years (Pasmore, 1994; Bresnahan et al., 1999; Bharadwaj, 2000). Considering 'service' organisations, IT has been used to 'dematerialise' paper based workflow, decreasing process execution time and quickening response time (effectively mirroring the early designs of Taylor and Fayol). The net result of these trends was the use of IT to reduce the people required to operate a financial services system and achieve the 'managerialist' goal to become more efficient. In many sectors of the service industry the only apparent options to a business was to 'automate or emigrate'[24] if cost competitiveness was to be achieved.

[24] The choice is to automate to remove staff costs or to move to a low cost labour region in the world (emigrate).

Unlike manufacturing organisations that use IT extensively for dynamic resource planning purposes, financial services organisations use IT as the primary processing engine for data conversion into products and services. Management Information Systems (MIS) are primarily used to generate ‘summary information’ in the form of reports to describe performance (Bech & Hobijn, 2006). In essence an MIS is a subsystem designed to channel feedback from ‘processes’ (work execution) into ‘useful’ information for system control. A timely flow of information allows operatives and managers within the system to build new knowledge and learning, aiding the decision making processes of open systems theory (Emery, 1969; Senge, 1990; Seddon, 2008a). Therefore, an MIS that has a well-designed fit provides a business with learning capabilities for regulation, improvement capability and increased performance (TQM) rather than releasing purely historical monitoring of past performance.

3.4 Management Information Systems

3.4.1 Information to Improve

Operations Management authors acknowledge information triggers physical activity and production of goods and services (Gummesson, 1994; Neely et al., 2005) so information subsystem design, combined with a TQM approach, will enhance flow performance (Forrester, 1961). Furthermore, the IT system must be sensitive enough to be of use to management, not time lagged or prone to erratic ‘variability’ if high flow performance is to be achieved.

The importance of this relationship is acknowledged by Neely, a Cambridge Don and world expert on performance management, in his contention that *“As work is performed, performance should be measured in a way that conveys the maximum amount of information possible, so that it can be used to determine the degree to which performance has been achieved”* (Neely, 2007, p. 454).

A Google Scholar search of “commercial banking management information systems” yielded 1.6 million hits. Refining the search criteria to the period 2007 to coincide with the financial crash to present day and the addition of ‘flow’ and ‘quality’ produced 18,000 and 17,000 respectively. Applying further logic to the search returned just 573 results. After reviewing the search results it was found that none covered the specific area of research in the capacity of trade processing system performance.

3.4.2 Information Feedback

MIS offers the modern organisation a competitive advantage through the application of “Porter’s Law” where competitive advantage is achieved through the seamless flow of work through a ‘value chain’ of inter-organisational information exchange and transmission between organisations to produce products, services and added value (McLeod & Schell, 2004, pp. 28-42). For Operations Managers, those organisational employees tasked with designing systems to support high performance objectives use the connecting power of IT by exploiting ‘speed’ and ‘flexibility’ as well as a ‘precision’ (quality) of data exchanges within process pathways that enable the flow of service transactions (Ferdows & De Meyer, 1990).

According to Nicolaou & McKnight (2011) there are two prerequisites that ‘enable’ higher performance; ‘control transparency’ (availability of information signals) and ‘outcome feedback’. These are required to successfully achieve speed and precision of management information. McLeod and Schell (2004, pp. 32-32) go further and assert that information quality should be compartmentalised into four dimensions that produce “information value’, these are the attributes information quality (See Table 18 which has high correlation with the service quality advice provided by TQM guru Garvin (Garvin, 1988)).

Although not directly connected to the work of McLeod and Schell, Tozer (1994) shares the same views and sentiment towards data quality saying ‘the way data is ‘defined’ should be consistent: “*the definition given to each entity of interest should be ‘complete’,* *'unambiguous' and 'universally' true. It is only by setting this basis of common language that we can begin to build a process for maintaining data quality*" (Tozer, 1994, p. 26).

Table 18: Dimensions of Information

Information Dimension	Definition
Relevancy	Information is 'relevant' when it is factual and offers value to problem solving and learning.
Accuracy	Features that are exact in accordance to the truth of a matter or situation.
Timeliness	Information transmitted or accessible without hindrance of obstruction.
Completeness	Correct amount of aggregation to satisfy a predefined criteria by automated processing systems or supports the specific needs of decision making and problem solving.

Source: Adapted from McLeod and Schell (2004)

3.4.3 Management Information Systems Integration

IT automation capabilities for data collection and to compose reports is a primary process of such systems (Boddy et al., 2002, p. 5) but this has attracted many criticisms including Seddon (2008) who argues these reports create managers who forget about the system and return to managing the workforce and their tasks (Seddon, 2008a). As such the basic MIS has not changed much in the past decade in that it is an aggregation of system feedback presented in a summative form. However contemporary debate argues modern MIS reflect a *'distributed and knowledge driven user integrated system'* over the classical views of a 'structural system of regularly processed reports' (Laudon & Laudon, 2012). The difference argued here suggests there has been a "sea change" in thinking and attitude towards MIS which now forms an 'integrated sociotechnical system' producing value when information is converted into practical use (reaction to feedback and therefore learning). The classical 'bolt on mechanistic subsystem' approach of simply reporting past events offers little value to the learning organisation (Curtis & Cobham, 2008, pp. 486-507). The poor contribution derived from the historic nature of data generated and the inability of managers to use this information productively to enhance 'loss free' system flow (Forrester, 1961; Burbidge, 1975).

Seddon (2008a) believes that most financial services organisations, when tested with his 'Vanguard method' (2012) of 'systems design' have failed to embrace the principles of TQM, Deming's principles – and nor do they actively seek to capture system 'feedback noise'. Seddon, an advocate of Deming, actively seeks out 'noise' and 'feedback' with his Vanguard method and defines this as his critical concept of system loss called "failure demand". He defines failure demand as the 'common cause' of process backlogs eventually leading to 'workflow buffering' and poor flow performance. An integrated MIS allows system feedback to generate knowledge to stimulate problem-solving and other levels of learning so that better informed decisions can create stable and improved flow of 'customer value' (Seddon, 2012). Flow is vitally important to high volume (with high variety) trades because the inability to hold stock means consumers and customers must be satisfied instantly from an instant and uninterrupted quality data flow.

3.4.4 Extracting Management Information from IT Systems

In the service setting, the inability to hold stock means consumers and customers must be satisfied instantly. Therefore, the quality, flow, and speed of service provision is critical (as well as the thoroughness of serving all the customer's needs). The Service environment contrasts with manufacturing are shown in Table 19.

Table 19: Manufacturing Vs Service Characteristics

Characteristic	Manufacturing	Service
Output	Tangible	Intangible
Customer Interaction	Low	High
Uniformity of Output	High	Low
Labour Content	Low	High
Uniformity of Input	High	Low
Measure of Productivity	Easier	Difficult
Opportunity to Correct Quality Problems	Easier	Difficult

Source: The Researcher

However Seddon has restricted his studies only to operations management service systems that are low variety and high volume models (Hayes & Wheelwright, 1984). He has not addressed any other context that would offer insight into the design of high performance service systems (most notably high-variety and high-volume which is the main context within which this study is set). Whilst he discusses task variety for operatives he does not deal with environments of highly complex product variety and corporate forms of banking where financial instruments are complex, highly customised and demand specialist knowledge. This sector is often called a "professional service" rather than a "service shop" or "mass service[25]" (Slack & Lewis, 2011). Seddon (2003, 2008a, 2012), using a replicated case study approach, does portray IT as an inhibitor to flow with, in his view, over-industrial engineered staff jobs and operatives who know little about the system they work in. Sadly, he stops far short of recommending how good IT performs to support quality and high process efficiency.

According to Laudon and Laudon (2012) *"a computer works quickly and accurately; humans work relatively slowly and make mistakes. A computer cannot make independent decisions, however, or formulate steps for solving problems, unless programmed to do so by humans"* (Laudon & Laudon, 2012, p. 14). Such a view reinforces that of quality management authors who argue the automation of processes effectively stops continuous improvement (Ohno, 1988) because computers work with coded knowledge and have no problem solving or creative knowledge. Therefore management information systems are a valuable addition to a system if they are designed effectively to deliver information that can be used by a service provider which allows workers to use data and convert it into knowledge to best serve the customer (Senge, 1990; Edwards et al., 1991). As such, better decisions result from improved feedback information, assisting management learning, adaptation and improvement. Without this essential learning capability (as the previous literature section has shown) all systems will decay and eventually fail.

[25] The domain of Seddon's research.

3.5 Flow Performance

Flow is a critical concept for manufacturing and service organisations (Von Bertalanffy, 1950, 1969; Ohno, 1988) functioning across the IPO system[26]. For Von Bertalanffy (1969) flow was essential for biological survival and so too for organisational systems theorists Emery and Trist (1965). Early industrialists, such as F. W. Taylor and Henry Ford, pursued flow and efficiency in manufacturing operations using scientific management on each subsystem[27] to optimise capacity and increase utilisation (Taylor, 1911). However, sub-optimisation[28] resulted (Goldratt et al., 2004) and the scientific model failed to achieve its goal of profit maximisation. However, “scientific management” thinking endured well into the mid-20th century until it was challenged by the Lean model of flow (Womack et al, 1990; Womack and Jones, 1996). High levels of flow are important for turning products into cashflow and flow may be defined as the uninterrupted processing of work and as such the shortest amount of time required to fulfil a customer order (Mather, 1988; Schmenner and Swink, 1989).

In the latter half of the 20th century, control and maximisation of flow emulated the Japanese post WW2 industrial awakening and operating models. Studying the principles and effects of flow in the industrial context, combined with Total Quality Management (TQM) unlocked a competitive capability for Japanese businesses to challenge the dominance of the USA as an industrial super power (Ishikawa, 1985; Deming, 1986; Shingo, 1986; Ohno, 1988).

3.5.1 What is flow?

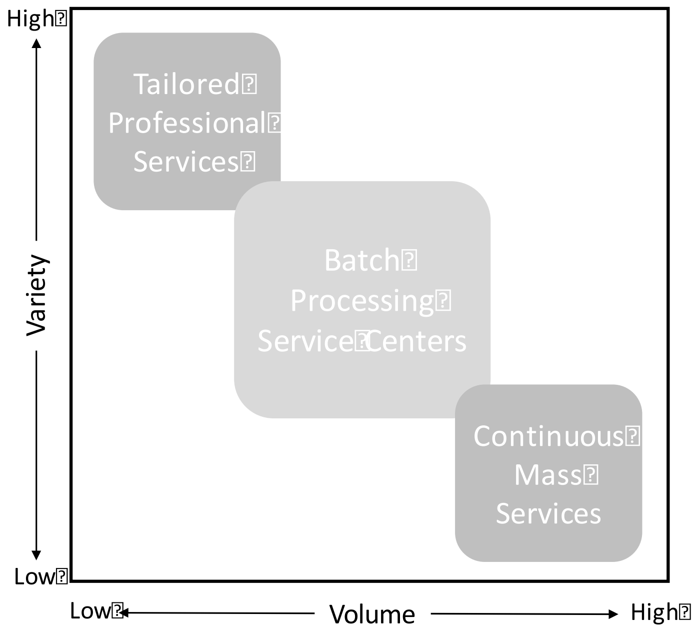
Flow, in the context of operations management, is regarded as the unobstructed movement of resources through the external supply chain and the internal production system (Womack & Jones, 2003, p. 348; Glenday, 2007). The characteristics of flow are dependent on the

[26] IPO stands for Input-Process-Output which is the critical and fundamental cycle of transactions and core process that underpins all organisational systems.
[27] A subsystem is an interconnected component contained within a larger encapsulating system
[28] Sub-optimisation occurs when managers seek to optimise each subsystem independently. It often leads to overall system sub-optimisation due to differences in capacity and bottlenecks.

organisational setting, product complexity and the design of the production systems (Slack et al., 2011). The design of manufacturing systems therefore determine “flow” and the stable and measured movement of materials across a system (Hayes & Wheelwright, 1984; Slack et al., 2004). The same characteristics of flow are apparent in service environments where materials and information are utilised within administration tasks which can be “manual” (low dependency on IT automation) and complex with intermittent flows (legal services and hospitals known as professional services). However, service environments use a high degree of technology and automation to undertake administration tasks (high dependency on IT). Under the “mass services” classification, work is repetitive and standardised, flow is characterised by volume processing and passing work through the system without intervention (online banking, airlines) (Slack et al., 2011). Figure 9 illustrates the service model sophistication and flow.

For Hayes and Wheelwright (1984) only five states existed for manufacturing and later three options for service businesses were added. These options range from high variety services and low volume professional services to low variety and high volume mass services. The researcher found many of these types in the financial services sector which confirmed the views (Seddon, 2003, 2008a) but the context of this research is significantly different. The commercial and investment banking process exhibit an extremely high variety of “trades” and these trades are processed in very high volumes (20,000+ per day) and even if each trade was regarded as unique (i.e. not part of a big batch) then this form of banking has not been studied by leading operations management academics.

Figure 9: Service Sophistication and Flow[29]



Source: Adapted from Slack et al. (2011, p. 95)

Many measures have been used by operations management academics to define and/or operationalise "flow" see Table 20.

Table 20: Measures of Flow and Productivity

Measure	Definition and Supporting Authors	Impact on this study
Capacity Utilisation	The full use of all operations capacity - Skinner (1969).	The capacity and its restriction of flow is not an issue for investment banks as the technology is high speed information technology (24 hours x 7 days).
Throughput velocity & yield metrics	Processing speed from order to delivery - Schmenner and Swink (1998), Yield - Feigenbaum (1991).	Throughput is determined by flow constraints and the velocity (speed) but it does not explain system output yield which is affected by rework due to system errors.
Overall Equipment Effectiveness	The optimised availability, performance and quality of a processing asset – Nakajima (1988).	This maintenance measure works well for a single asset and flow but has significant difficulties in measuring performance for sequential and dependent assets such as sequential IT processes.

Source: The Researcher

[29] In reality 4 'V's are identified as volume, variety, visibility and variation yet volume and variety are considered the main influences on the design of a system.

3.5.2 The Importance of Flow

Achieving and maintaining flow is an essential feature of performance and a planning consideration for operations managers (Seddon, 2008a; Slack et al., 2011). Understanding flow performance reveals the rate in which materials, information and resources are consumed, processed and distributed (Ohno, 1988). Uncovering "flow instability" indicates that turmoil exists within the operating system[30] which will result in unfavourable conditions (disorder) and this may adversely influence administrative planning, supply chain relationships and order fulfilment (Forrester, 1961). Seddon and Caulkin (2007) assert that understanding external demand (in combination with the measurement of flow) is critical to building an appreciation of operating system capability and performance. Capability, they argue, informs "what" is affecting performance - whereas flow can inform managers as to "why" performance has been affected and - if measured systematically – where in the system the dysfunction originates (Seddon, 2008b).

The "ease" with which resources and products move within the supra-system[31] is the main characteristic of flow and determines the speed of the overall production system (the order to delivery capability). See Hopp and Spearman (2011). According to George (2002) understanding "flow velocity" (and identifying processes that cause an imbalance/inequality where improvement must be undertaken or processes streamlined), is required to shift from chaotic to controlled flow. Flow control is therefore the "regulation" of activities, materials and processes to achieve a predictable and orderly flow. Achieving a state of high flow is a capability that generates greater "certainty" within the production system itself, enabling managers to plan and make effective decisions which lead to system improvement and more effective flow (Ohno, 1988; Seddon, 2008b). Flow capability determines the velocity (speed) of a system to produce goods/services and to satisfy customer orders (Ferdows & De Meyer, 1990).

[30] Essentially delays, errors and rework of services.
[31] A suprasystem is an overarching system and the highest form of system for a subject of study.

Uninterrupted flow, as an objective of operations management, offers the greatest cash flow and customer satisfaction (flow that equals the rate of external demand) as well as providing the basis for future improvement in performance (Ohno, 1988; George, 2002, 2003; Seddon & Caulkin, 2007; Seddon, 2008b). Womack and Jones (2003) and Seddon (2008) provide examples where flow improvement has resulted in reduced production and servicing costs. Seddon (2008b), a systems thinker, is a fervent critic of myopic "cost reduction" initiatives, especially in financial services, and provides additional cases of cost reduction exercises that have reduced quality and driven up the cost of services. He argues intensely that service sectors, in particular government owned/run services[32], are the worst and must focus improvement initiatives to improve flow performance. Seddon (2003; 2007; 2008a, 2008b; 2008; 2011; 2012) provides multiple case studies on the topic of flow and systems thinking (which includes studies in retail banking) and for each he identifies vast quantities of "waste"[33]. He specifically identifies IT system designs that impede flow and, most critically, the management structures and 'false' system measures (centralised command and control practices) that create barriers to flow improvement (as they are essentially scientific management practices to ensure subsystem optimisation).

The researcher found close parallels between Seddon's systems thinking (particularly in the banking sector) and a TQM "quality first" approach to flow management. However, Seddon has avoided the study of commercial or investment banking operations preferring the simpler context of back office Retail Banking operations. As such, he has failed to offer insights into the high volume, high-variety, high-complexity of Commercial and Investment banking processes as too has the work of more mainstream and "servitisation" authors such as Slack et al. (2004); (2011). The avoidance of the Commercial and Investment banking setting highlights the significance of the opportunity presented by this case study as a means of

[32] It should be noted that the UK government is now the largest stakeholder of equity in British banks.
[33] Waste is defined as – Time, Inventory, Motion, Waiting Time, Over-production, Over-processing and Defects, Ohno, (1988).

generating insight into an under-researched, poorly understood yet high important sector of the UK and global economy.

3.5.3 Inhibitors of flow

In the industrial context, flow concerns the physical movement of resources and materials through the production processes (Glenday, 2007). Many of these challenges are a result of poor organisational design ‘fit’ (command and control and centralised decision-making) and the use of dysfunctional ‘efficiency/cost’ performance objectives (George, 2002; Seddon, 2003; Womack & Jones, 2003). Current theory (Womack & Jones, 2003; Seddon, 2008a) proposes the main inhibitors to flow performance is the presence of waste in systems designs (Ohno (1988) - see Table 21).

Swank (2003) identified product complexity as an inhibitor of flow performance in financial service settings and argues for “segregation” of customer needs/purpose into multiple channels (queues) where staff service the immediate requirement using functional specialisms (skills) applicable to the work type contained within the queuing system. The aim in this instance is to produce flow via standardisation. Ohno (1988) however argues for a balance between “complexity” and “flexibility” with a single system capable to cope with demand variation and product complexity while striving for maximum possible flow. Ohno’s preferred system is to create flow within a single service channel and he identifies that performance (flow velocity) can only be as “fast” as the slowest performing step within the system (see also Goldratt et al. (2004)).

Table 21: Seven Wastes

Wastes To System Performance	Description
Transportation	Carriage or movement of materials and resources within the production and supply chain system.
Inventory	Stockpiles of materials and resources within the production and supply chain system.
Motion	Physical kinetic motion of people within the system.
Waiting Time	Interruption, pauses and delays of martials and resources within the production and supply chain system.
Over-processing	Expending more effort than is required to satisfy an acceptable performance criterion as defined by the expectations of the customer. Or the use of complicated technology to do a simple routine.
Over-production	Generating more output than is required to satisfy the external demand for products and services.
Defects	Failure to satisfy a minimum quality criteria required by the system and/or as defined by the expectations of the customer.

Source: Adapted from Ohno (1988)

For the purpose of this thesis, velocity, flexibility and design have a significant potential to trigger an imbalance within a processing system and therefore impact on flow stability, planning, and operations improvement.

3.5.4 Measurement of Flow

Hines and Rich (1997) make an overwhelming case for measurement of flow across the "Value Stream" (the production and supply chain system) being critical to planning, improvement and performance. The authors promote the use of value stream mapping (VSM), a mapping tool and quantitative framework to assist managers and systems designers study where inhibitors to flow impact performance. VSM assists managers and system designers to identify the seven wastes of Ohno (1988). Hines and Rich (1997) assert that systematic analysis of the value stream will highlight opportunities to increase the velocity of flow and reduce the effect of wastes on the system. VSM does this by providing a graphical representation and a measureable baseline of the "as is state" of supply chain and production sequence. It identifies wastes by linking information and material flow, building a vivid and comprehensive depiction of flow and where the inhibitors of flow exist (forming an integrated action plan for performance improvement). However, the work of Hines and Rich concerns manufacturing environments and not financial services and as such this work is untested in this particular setting.

A system metric to describe flow is essential to describe the passage of information and/or materials through a system. Feigenbaum (1991) provides such measures in the form of yield metrics; Final Yield, Throughput Yield and Rolled Throughput Yield. These measures have been used with utility in manufacturing settings since 1950's to measure sequential processing output of production lines. However, they have recently found favour in service environments to "describe the successful flow" of information transactions using IT systems as the means of producing financial products and services (Halyer & Nichols 2007).

3.5.5 Flow in the Service Environments

The pursuit of flow continues to gather interest within the service sector and banking institutions are awakening to the benefits that a flow process focus offers their business (Bremner et al., 2011). In this sense, improved flow performance is considered a new competitive edge as banks compete for market share and where service sector "digitisation" of products and services (dematerialisation) is increasing (Dietz et al., 2014). However, product/service complexity is also rising. According to Ohno (1988) a key feature of creating flow is the reduction of complexity, a view shared by Slack et al. (2011) who propose that service sector businesses must reduce product complexity (variety) to increase scale of operations towards mass services (required to achieve high flow performance - see Table 22).

Unlike manufacturing, service and banking organisations imbed the customer/client within the value stream itself. Customer information and the flow of the same is a key resource requirement for the IPO system to work effectively and efficiently. In this instance the customer (and their information) has significant influence on the flow performance of the system. Without both items of information being present flow will cease and further processing cannot be undertaken. The key concern to financial services businesses is therefore the ‘cleanliness’ of information exchanged and therefore the quality of information that is processed into an outcome for the client. As argued previously, the ‘quality first’ approach has been proposed by many authors including Deming (1986), Juran (1988), Crosby (1996) and Garvin (1988) to name but a few[34].

Table 22: Features of the Modern Service Environment

Features	Practical Example
Services products rapidly becoming intangible.	Products such as insurance policies may never amount to a physical outcome or output.
Service is focused on customer relationships.	In a highly competitive market customer retention and winning new customers will be determined by the relationship.
Customers expect product flexibility.	Customers like design authority over their product to suit their individual requirements.
Services are produced and consumed simultaneously.	Loans, Mortgages and Insurance are some examples where products are bought and consumed immediately and the majority of the time the customer never receives a physical output - only the benefit of the outcome, Loan←→Car, Mortgage ←→ Home, Insurance ←→Protection.
Customer are involved in the production process.	Specific customer information is required to produce the financial product. Product type and performance is unique to the customer.

Source: Adapted from Gronroos (1990a, 1990b)

The improvement of quality, to improve flow, has also been correlated with a mastery of best practices that leads to superior performance and the capabilities necessary to perform at the highest levels (see the “sand cone” model of Ferdows and De Meyer (1990)). Given the critical nature of processing trading transactions, information quality must be correct (accurate) or trades cannot be processed (flow through systems). Each trade that does not flow uninterruptedly, or is unreconciled, is therefore ‘money at risk’ for a bank and indeed worse resulting in a material loss. The current need for manual intervention and/or rework to trade information is imperative so that the trade can flow once the non-conformance is corrected (added costs and waste). Thus, flow in the context of commercial and investment banking is <u>fundamentally linked to the quality of information resources</u>, as opposed to flow constraints found in retail banking which typically suffers from ‘artificial’ demand from

[34] These authors believed that reducing quality errors would lead to reduced system ‘noise’.

customers restricting flow, causing demand amplification (bullwhip effect) and capacity problems.

3.5.6 Flow Summary

This section has presented the concept of flow within financial services as the combination of high quality information that is processed and distributed without interruption or delay. The role of operations managers is to design systems that can accommodate different levels of flow so that services are available when required, and can accommodate the complexity of ‘service options’ (product variety) demanded by modern-day customers (Seddon, 2008b). Moreover, that learning must take place in terms of continuous improvement if systems are to optimise flow and performance.

However, a major inhibitor of flow performance is poor quality. Poor quality is regarded as ‘any’ deviation to predetermined quality criteria expected by IPO systems resulting in partial or full failure of flow performance. In the context of sequential processing systems (IT systems) poor quality obstructs flow (nonconformity) causing interruptions to automated trade processes requiring manual intervention to investigate and repair/remove the immediate flow constraint. Variations and deviations in quality must be detected and reduced and ultimately removed. An approach to quality management adopted by many service organisations is “Six Sigma” quality management which provides managers with a framework consisting of tools and techniques to improve both quality and flow performance.

The commercial and investment banking sector was considered to offer a context that is far removed from the current focus of the service operations management literature (low complexity and high repetitive demand of back office retail banking). No published and academically credible studies exist of the commercial and investment banking sector which confirms the importance of this theory-building study.

3.6 Quality and Six Sigma

TQM has transitioned through three distinct phases of evolution and now rests at a fourth phase. The first stage involved early American gurus teaching Japanese industry about quality from a management perspective. In the second phase, Japanese authors emerged to generate tools that could be used by the majority of employees to solve system problems and in the third Crosby and Garvin promoted the use of strategic quality. In this fourth phase, an approach, methodology and measure has been developed called Six Sigma which has added science to TQM to help businesses improve and optimise performance.

The modern approach to quality management can be traced to the theoretical and practical advice offered by certain key authors. In the early 20th century Walter Shewhart's (1931) reformist approach to quality management argued quality standards alone were an inadequate methodology to guarantee, within a reasonable level of confidence, quality products amidst increasing product complexity and the rapid growth and transformation of manufacturing towards automation and mass production. Shewhart asserted and successfully demonstrated that statistical methods could be applied to quality "standards" and "inspection" (the controls of the age) to, with a reasonable degree of certainty, control the "conformity" of products. Shewhart developed and introduced the method of statistical process control to monitor the stability of production processes, to monitor the signals[35] of "special causes variation" affecting stability and to prevent products being produced outside specification (Shewhart, 1931; Juran, 1951; Feigenbaum, 1991; Crosby, 1996; McCarty et al., 2004; Gygi et al., 2012). This was a quantum leap for theory and practice, representing a significant change in managerial attitude toward quality management where "quality" is a designed output, and not a mere result or consequence of inspection processes (Deming, 1986; Juran & Godfrey, 1999). Shewhart's (1931) work influenced researchers and management consultants such as Joseph Juran (1999) and W. E. Deming (1986). These

[35] A signal from an SPC chart refers to "patterns" or "repetitions" in the data that are "non-random" events breaching control limits, typically assignable causes acting upon the processes (Bass & Lawton, 2009)

authors innovated on the work of Shewhart, developing managerial frameworks such as "Total Quality Management" (Juran) and "The System of Profound Knowledge" (Deming), which they designed to deploy the statistical concepts of quality management and quality control. Juran and Deming, working independently of each other, taught quality management methods to Japanese senior management across many different industrial sectors with exceptional outcomes that have meant Japanese businesses and brands now dominate many world markets (Womack et al., 1990).

3.6.1 TQM

Deming (1986) provided theories, concepts and tools for managing organisations as a system (the interconnected parts including supplier chains, resources, industrial operations, distribution channels and customers). Together, with common aims and objectives to bind the collective understanding of the system, Deming had profound influence on management practice. Juran's approach differed from Deming's (yet remained complementary) in that Juran sought to provide an analytical approach to quality ("The Juran Trilogy"). The trilogy encompassed quality planning, quality control, and quality improvement (Juran the practitioner) (Landesberg, 1999). Juran's work and that of Feigenbaum (1991) proposed that good quality control leads to the development of Total Quality Management. Feigenbaum proposed *"Total quality control's organisational impact involves the managerial and technical implementation of customer orientated <u>quality activities as a prime responsibility of general management</u> and of the mainline operations of marketing, engineering, production, industrial relations, finance and service as well as the quality-control function itself"* (Feigenbaum, 1991, p. 13).

By the mid 1980's the maturity of quality control and its influence on organisational practices heralded the substitution of "control" for "assurance" then "management". Martínez-Lorente et al. (1998) argue that substitution of "control" for "management" ensured the process control focus was now expanded to the 'total' and holistic management of the enterprise-wide system and its improvement. The evolution marked a change in management attitude towards quality and its importance to efficiency and effectiveness (competitive advantage). However, TQM was not the only quality methodology to gain popularity during the mid-1980's and to embrace the fundamental principles of the earlier works of Shewhart (1931), Deming (1986), Juran (1988) and Feigenbaum (1991) – the six sigma approach emerged as a dominant model (George (2002)).

3.6.2 Origins of Six Sigma

The American company Motorola first announced 'Six Sigma' in the mid-1980's (Antony, 2002; Kumar et al., 2009, p. 624). Motorola's vice president of quality (Bill Smith) created the Six Sigma framework as a practical and scientific quality improvement process to address the company's poor quality performance and to combat the competitive advantages enjoyed by Japanese manufacturers especially in tele-tronics sectors (Barney, 2002b). The Six Sigma methodology contains the quality improvement tools (with additional advanced, statistical tools) promoted by Shewhart (1931), Deming (1986) and Juran (1988) to stabilise business processes. The deployment of tools and techniques serves to minimise the frequency of system failures (defects) and to satisfy quality specifications that are critical requirements from the customer's perspective (Critical To Satisfaction) (Pande et al., 2000). Therefore, it can be argued that Motorola's Six Sigma methodology was born out of necessity to achieve two fundamental objectives; 1) Systematically and scientifically improve quality and 2) strengthen customer satisfaction in their products. The results achieved by Motorola over a ten-year period[36] produced enormous commercial advantages for the organisation, based on strict process stability and rigorous product conformance. Extraordinary profitable customer satisfaction resulted from the attention to quality as Deming had earlier predicted (Antony, 2002). Motorola claimed a five-fold growth in sales, profits increased nearly 20%, savings based on Six Sigma projects equated to $14 billion

[36] Period 1987 - 1997

and share price increased by 21% (Pande et al., 2000, p. 7). Jack Welch, distinguished CEO of General Electric, adopted the Six Sigma approach and was first to apply it to a global multi-industry organisation and to deploy the methodology to all of its business operations. GE was also the first organisation to apply the method in financial services at GE Capital (Slater, 2001). *"One of GE Capital's service businesses streamlined the contract review process, leading to faster completion of deals; in other words, more responsive service to customers …[producing]… annual savings of $1 million. While dollars and statistical tools seem to get the most publicity, the emphasis on customers is probably the most remarkable element of Six Sigma at GE" Jack Welch* (Pande et al., 2000, pp. 44-45). Six sigma is therefore the contemporary reincarnation of Total Quality for the modern service business.

3.6.3 The Modern Application of Six Sigma

Antony (2006) argues for the introduction of Six Sigma into financial services identifying three potential areas for deployment:

1. Wire transfers (interbank payment systems)
2. Detecting processing errors which result in defects
3. Investigating and addressing the causes of customer complaints to provide an improved service to remain competitive.

Each of Antony's situations for deployment are characterised within this research and case study including global electronic multi-currency payments, "failure demand", manual intervention of automated systems and below industry average key performance indicators. In this instance Six Sigma and the case study is positively aligned to Antony's situational requirements for deployment. While the practical/technical considerations can be considered aligned, Antony (2002) lists key organisational themes which management must take into account, which the author asserts are the 'key ingredients' for successful deployment of a Six Sigma programme (see Table 23).

Table 23: Key Enablers of Successful Deployment

Key Ingredients To Deployment of Six Sigma	
Management commitment	Top-down ownership of deployment and delivery.
Training	Support a leaning environment through technical and soft skills.
Project management skills	Coordination of team trouble-shooting and improvements.
Project prioritisation	Selection and alignment to corporate strategy and benefit tracking.
Organisational infrastructure	Adequately resourced with SME's and reporting mechanism.
Cultural change	Clear communication, motivation and engagement throughout.

Source: Adapted from Antony (2002)

Kumar et al. (2009) identify the barriers to implementing quality initiatives in which Six Sigma stands as one of few quality improvement initiatives organisations undertake (TQM, Lean Kaizen, Business Process Re-engineering) in their survey of 64 UK SME's (see Table 24). Undertaking new and novel approaches to quality management and business improvement carries 'execution risk'. Management commitment and strong leadership is a key requirement to institutionalise the initiative into the fabric of the corporate culture, increasing the likelihood of successful adoption by employees at all levels.

Table 24: Barriers to Implementation of Quality Initiatives

Barriers To Implementing Quality	Implication
Availability of resources	The resources needed to train and engage in Six Sigma.
Lack of knowledge	An understanding of the capabilities of the approach.
Lack of training	The technical skills and understanding needed to exploit Six Sigma.
Internal resistance	Staff preventing progress of the projects.
Poor employee participation	The time and opportunities for process users to support the projects.
Inadequate process control techniques	Lack of control systems and adequate measures of system performance.
Changing business focus	Losing focus of the critical role of Six Sigma to deliver business and customer benefits.
Lack of top management commitment	Poor reinforcement of the programme and commitment to deliver improvement.
Poor delegation of authority	Poor selection of change agents and champions to drive the programme to execute improvements/savings.
Poor supplier involvement	Setting system boundaries too narrowly to exclude trading partners who may add to innovation or be the source of issues.
Poor project selection	Misapplication of resources and a suboptimal return on investment.

Source: Adapted from Kumar et al. (2009)

Financial institutions have applied the Six Sigma quality improvement methods and Salaheldin (2009) identified top management support as an essential component of a successful deployment. Heckl et al. (2010) found that British financial services organisations had undertaken significant experimentation and held "significant lead" over their European rivals in successful six sigma deployment. They claimed 1/3rd of managers surveyed had coached several improvement projects with an additional 1/3rd taking part in Six Sigma training. However, the research falls short of identifying to what level or intensity training was undertaken. The main drivers of the Six Sigma initiatives were declared as targeted costs reductions, dissatisfied client base and the desire to exploit market opportunities as a result of the current economic climate post-2008 credit crunch. At the current juncture the worsened economic climate and societal pressures to return banks to private ownership would also be drivers.

As much as 25% of the banking institutions in Europe have identified Six Sigma as a suitable methodology for either continuous improvement or cost reduction initiatives (Heckl et al., 2010) however most organisations apply the methodology only as a targeted pilot project only rather than a full corporate strategy deployment. The approach does not imply the benefits are any less tangible and Antony (2004a) argues service environments benefit considerably from:

- Improved cross-functional teamwork across the entire organisation
- Transformation of organisational culture from fire-fighting mode to fire-prevention
- Increased employee morale
- Reduction of non-value added steps in processes leading to faster service delivery
- Reduced costs associated with late delivery and customer complaints
- Increased awareness of various problem-solving tools and techniques, leading to greater job satisfaction for employees (the learning culture)
- Improved consistency of service through systematic reduction of variability in processes and effective management decisions due to reliance on data and facts rather than assumptions and gut-feelings.

Yuniarto and Elhag (2008) explore the relationship between Six Sigma and systems dynamics. They assert the changing behaviour and shifting requirements of customers towards high variety products and highly customisable services has significant impact on the policies of the modern organisation. Increasing product complexity, sophisticated processes and systems, compounded by the demand from a global marketplace have all increased pressure to compete and use quality as a form of competitive advantage within this new environment. Six Sigma has been adapted by the researcher to encompass "systems root cause analysis" - a fusion between Systems Thinking and Total Quality Control (the forerunner of TQM) - under the flexible structure of the Six Sigma methodology (George, 2002). The adaptation involves the modification of the DMAIC[37] project roadmap methodology to allow cyclical "Analysis and Improvement" which stimulates action learning (through closed loop feedback). The approach allows a business to continuously identify sources of variation, waste and failure demand with the aim of continuous performance improvement through system modification and enhancement.

Application of this particular approach to Six Sigma is highly contextual to commercial and investment banking features (volume and variety) where clients demand bespoke financing solutions. Moreover, the cycling between analysis and improvement without return to Define and Measure phases complements the action learning through systems thinking which is again highly contextual given the nature of the case study aims and objectives (to identify the enablers of performance).

Antony et al. (2012) explore Communications and Information Management (CIM) effectiveness and efficiency in a transactional environment using the Six Sigma methodology

[37] DMAIC is the phased roadmap of the Six Sigma improvement sequence. Define Phase: describes the problem in operational terms, determines the primary measure of performance (Y) and sets-up a guiding coalition to work on the business problem. Measure Phase: isolates possible sources of variation/deviation (χ) that can potentially cause the unwanted effect/result, develop hypothesis, and collect data. Analysis Phase: tests root cause hypothesis, establishes power and significance of cause and effect relationship. Improve Phase: develops strategies and solutions to the systemic issues causing the unwanted effects. Control Phase: monitors stability of critical factors (χ) and ensures capability of the performance output through mistake proofing χ's and Y's (Gitlow, 2009, p. 61).

as an improvement framework to identify opportunities within a case study environment where data and information are in abundance. The investigation identified “completeness, timeliness and correctness (accuracy)” as critical features of high performance (enabling efficient and effective movement of information) for an organisational system. The study identified thematic inhibitors affecting information flow throughout the CIM system (see Table 25) which manifest as the root cause of the system deficiencies resulting in the operational defects found within the case study.

Table 25: Inhibitors of Information Flow Leading to System Dysfunction

Data Errors	Communication Errors
Data incorrectly entered into CIM systems.	Delays to information flow and transfer.
Missing Data/Information fields.	Information accessibility.
Typographical admin errors.	Quantity of process nodes (volume complexity).
Faulty information.	Misplaced or absent information.

Source: Adapted from Antony et al. (2012)

The results of a transactional case study (Antony et al. 2012) suggest accurate, complete and real-time information enhances ‘effectiveness’ and ‘flow’ which delivers high-performance capabilities which in turn can produce a competitive edge or strategic advantage, thus reinforcing the importance of quality to business process flow.

In the modern transactional service business, Six Sigma has a relevancy as an improvement framework to assist organisations to develop learning capabilities through action orientated workplace improvement initiatives. Such a capability was duly recognised as important by the researcher as a methodological design issue. Adopting Six Sigma supports effective management decisions, increased awareness and understanding of customer requirements. It also improves the efficient and reliable operation of a business and can transform an organisational culture from reactivity to proactively addressing the inhibitors of performance management (Antony, 2006). It achieves these outcomes through a disciplined and structured problem-solving methodology which is adaptable and enables integration to suit various business contexts and environments (Kumar et al., 2008). The highly contextual application of Six Sigma in services within a high-volume, high-variety setting complements the case study's operating environment which also fits the organisation's drive to increase performance, reduce costs and provide competitive client services.

3.6.4 Six Sigma Versus TQM

It is important to identify the differences, if any, between Six Sigma versus TQM. Barney (2002b) explored the topic and contrasts these methodologies (see Table 26) and highlights that Six Sigma goes beyond its initial quality management approach to propose "*Six Sigma has developed beyond defects analysis in processes or products. The next generation Six Sigma is an overall high-performance system that executes business strategy…[to improve the performance of the organisation]" (Barney, 2002b).*

Table 26: Six Sigma versus TQM

Feature	Six Sigma	TQM
Governance & Control	Executive ownership.	Self-directed work teams.
Deployment model	Business strategy execution system.	Series of quality initiatives.
Scope	Business cross functional	Departmental functional
Learning	Structured training at all levels within the organisation.	Localised training for quality improvement specialists and engineers.
Focus	Business results oriented.	Return on investment.

Source: Adapted from Barney (2002b, p. 13)

Antony's (2009) research paper "Six Sigma vs TQM" took the view of leading six sigma and TQM academics and practitioners. He asked "what are the critical differences between the two methodologies?" (see Table 27). He found a clear preference towards Six Sigma over TQM and the view that businesses need to go beyond quality and process optimisation. Whilst TQM and Six Sigma share the same statistical tools and techniques, a key distinction is that Six Sigma provides a management framework, it establishes direct ownership of the programme and projects, it provides an improvement project roadmap and focuses on holistic business enhancement within the modern IT led business enterprises.

Table 27: Six Sigma Vs TQM

Informant	Six Sigma	TQM	Informant's Preference
Dr Rick L. Edgeman Chair of Department of Statistics, University of Idaho, USA	A highly structured, information-driven strategy for product, system and enterprise innovation and design.	Seeks to satisfy customer needs continuously by providing what they desire at the lowest possible cost as a result of involving a critical mass of the organisation's human resource.	**Six Sigma -** Selection Rationale: Strong algorithmic approach, it follow a structured Roadmap, integrated tools and techniques.
Dr Matthew Hu Vice President of Robust Sigma Technology, USA	Six Sigma has demonstrated success by clearly providing a roadmap and process for the business management (not only quality).	TQM implementation had limited success. Low probability of success deterred many organizations from trying TQM.	**Six Sigma** - Selection Rationale: Six Sigma ties in projects with business priorities aligned with customer requirements and also with bottom line financial results.
Dr Roger Hoer GE Global Research, USA	Six Sigma strives to address several shortcomings of TQM; lack of a bottom-line orientation, lack of dedicated resources, an informal and uncoordinated project selection process.	Six Sigma borrows much from TQM: a process viewpoint, a focus on variation reduction and the use of statistical methods to improve quality.	**Six Sigma** - Selection Rationale: It is unlikely that anyone will go back to TQM once they have seen Six Sigma in action.
Professor Amitava Mitra University of Auburn, USA	Recommended changes in processes are evaluated in terms of performance metrics that can be measured. Also Six Sigma utilises the same three foundations noted in TQM (in cell opposite).	At the core of TQM are the company vision and mission and management commitment. This core attempts to integrate the components of customer, process, and people.	**Six Sigma** - Selection Rationale: Six Sigma has greater structure and representation from senior management - not necessarily the case with TQM.
Professor Sung Park National Seoul University, South Korea	Six Sigma is more process-oriented, project-oriented and profit-oriented than TQM.	*No narrative on TQM given by the informant.*	**Six Sigma** - Selection Rationale: Six Sigma fits in to the knowledge-based information society better than TQM.
Professor S.N. Neogy Indian Statistical Institute, India	Six Sigma has succeeded in presenting a more integrated package or product with required statistical and other available non-statistical tools.	A major deficiency of TQM approach is the absence of real project for driving the improvement vehicle.	**Six Sigma** - Selection Rationale: The Six Sigma vision or approach seems to cover a wider front in tune with the TQM approach as presented in the existing literature.
Professor Jiju Antony University of Strathclyde, Scotland	Six Sigma builds on many of the aspects of previous continuous improvement initiatives, in particular TQM.	TQM often lacked a deployment process and the associated managerial and leadership components needed to drive fundamental change in an organisation.	**Six Sigma** - Selection Rationale: The systematic and disciplined integration of powerful problem solving tools and techniques into the DMAIC framework has been the most important addition of Six Sigma. Such an integrated approach was sorely missing in most TQM implementations.

Source: Adapted from Antony (2009)

From the review of the seminal literature produced by the renowned TQM authors (Feigenbaum, 1991; Oakland, 1995) and built upon the work of (Juran, 1951; Deming, 1986), TQM has become an improvement methodology tuned for specific business needs (customer satisfaction through quality improvement). The strict focus on quality by TQM advocates has led the methodology to fail to generate interest in practitioners to explore financial service operations where "flow" was viewed from a business to customer improvement perspective (mid-1990's to early 2000's banking was still person-to-person transactional before digitisation of products services).

However, Six Sigma in financial services has been the subject of multiple complex and business-to-business case studies (Bank of America, GE Capital and American Express to name but a few). Publications by academics and practitioners have demonstrated - above other positive outcomes – practical utility of the methodology in areas such as client services, operations departments and accountancy (George, 2003; Antony, 2006, p. 237; Hayler & Nichols, 2007; De Koning, 2008; Lin, 2009; Salaheldin, 2009; Delgado et al., 2010).

The discussion has shown Six Sigma has a traceable application to financial service organisations that have deployed the methodology with practical utility. The case study organisation deals directly with clients in large volume (tens of thousands) on a daily basis. Trading is an interactive experience for the client. Trades are performed in multiple locations throughout the world in many different time zones and require their trading partners and market-makers (commercial banking institutions) to act with "speed" and "precision" to ensure the flow of resources and money through the global financial system. Six Sigma therefore provides the potential means with which to assist large and complex organisations improve customer satisfaction in products and services, improve performance and produce tangible financial benefits to bottom-line profitability (Hayler & Nichols, 2007). In the context of this case study research, such benefits are highly attractive. A benchmarking report conducted by a MGT[38] (a management consultancy firm) uncovered a significant cost disadvantage between the case study and their peer institutions in terms of service costs. However, the report fell short of identifying the inhibitor and left the case study organisation in contemplation of how best to address the cost performance issues. The ability of Six Sigma to incorporate financial strategy into the fabric of improvement initiatives, combined with a rigorous investigation framework was considered extremely advantageous to examine the components of the organisational apparatuses, dissecting how the Cost Per Trade is composed, signalling to management where opportunities for improvement may lie.

3.6.5 Six Sigma Mechanics

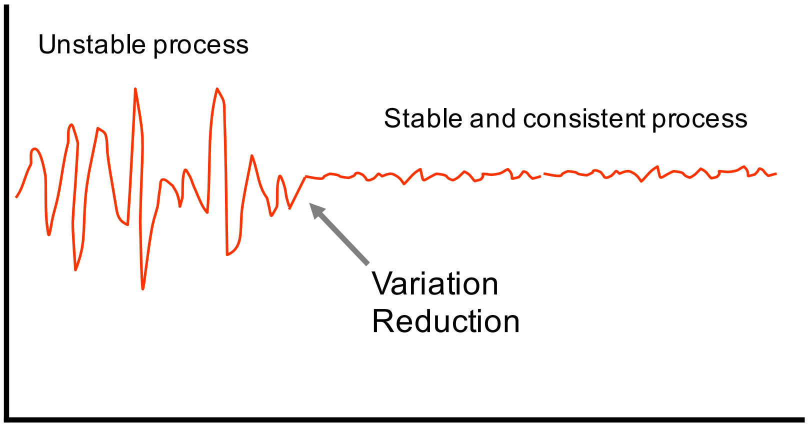
Six Sigma approaches quality by engaging a statistical and quantitative approach. The fundamental concept is to determine product “conformance” with respect to a predefined quality criterion (target and tolerance). The general theme is to achieve and maintain process control to such a degree that conformance to quality requirements is guaranteed to within a certain “statistical” margin. The procedure used to accomplish this outcome is the “identification” and systematic “reduction” of process variation. And the aim is to produce a stable[39] and satisfactory product quality for customers (George, 2002; Arthur, 2011; Gygi et al., 2012). Figure 10 illustrates process variation reduction and stabilisation. “Identification” of the causes of variation is tackled by the application of the problem solving tools (Antony, 2002) which have commonly become known as the Six Sigma toolbox (Bicheno and Catherwood, 2005).

The quantitative and thematic approach of the Six Sigma framework pervades the methodology. Measures play a key role in process evaluation, problem-solving and setting the objective and level of improvement required. The overarching objective is to stabilise and optimise processes such that the variability of the process output is capable (fits)

[38] MGT is a fictitious name given to the consultancy concerned with conducting this actual study.
[39] Process stability – the state of statistical control with no drift or oscillation (Juran & Godfrey, 1999, p. 22.19)

between specification limits. The proximity (distance) of process variation in relation to specification limits (approaching the specification parameters) reduces the “level” (measure) of process capability (Antony, 2006; Gygi et al., 2012, pp. 123-132).

Figure 10: Variation Reduction



Source: The Researcher

Figures 11 & 12 provide an illustration of process performance. These graphs model the process distribution in relation to the specification parameters (lower and upper specification limits). The process distribution shown in Figure 11 demonstrates greater variability (generating events outside the specification limits) than is displayed in the distribution of Figure 12. The model in Figure 11 is deemed incapable due to the variation outside specification parameters.

Figure 11: Process Capability Chart – Incapable

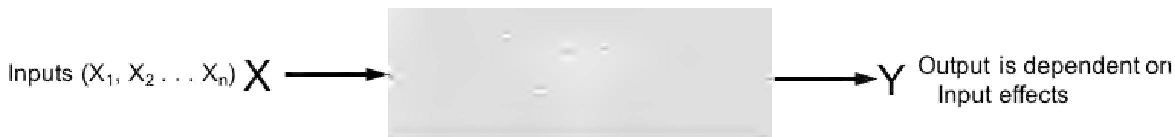
Source: Adapted from George (2002, p. 32)

Figure 12: Process Capability Chart – Capable

Source: Adapted from George (2002, p. 32)

Determining process capability is achieved by interpretation of variation in sample data collected from a predetermined strategic sampling method (Bass and Lawton (2009, p. 81), Capability models “observed” variation, and, predicts “expected” variation. Through this method, predictive models of variation (“long-term” variation) are calculated allowing systems designers and managers to identify processes that are “incapable” or “at risk” of producing defects which - with the foresight of statistical capability – managers can develop strategies to drive process stability and thus quality improvements. The objective is variation reduction to improve conformity to specification limits, reducing the risk of defects (defects being any instance outside specification parameters). Variation reduction is accomplished by identifying and controlling the “critical factors” at work within the IPO model (see Figure 13) that transmit variation through the conversion process to the output (Bass & Lawton, 2009; Gygi et al., 2012).

Figure 13: Input Process Output Model



Source: Adapted from Juran (1988, p. 275)

This risk level associated with process variation (from an output perspective) is defined as the percentage of “defects per million opportunities” (DPMO) that will, as a result of process variation, lie outside specification limits (modelled using a normal distribution curve). Process measurement provides a method and a framework to measure processes performance. Establishing a process capability measure also acts as a risk mitigation technique to identify sources variability that will, if gone unchecked, affect quality and customer satisfaction. Through the measurement of yield and DPMO (Antony, 2006) a Sigma value can be computed providing a measure of process capability (see Figure 14). The goal of this activity is to model process variability and where appropriate reduce variability to achieve Six Sigma (and beyond) which will, statistically, result in a mere 3.4 defects per million opportunities.

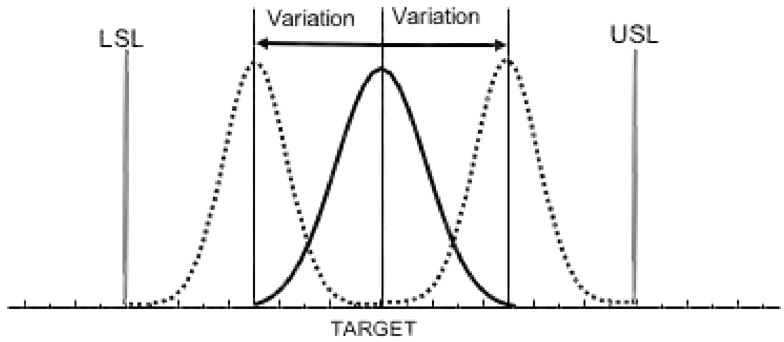
Figure 14: Process Yield Conversion Table

Sigma	Yield	DPMO
1	30.8%	691,500
2	69.1%	308,500
3	93.3%	66,800
4	99.4%	6,200
5	99.977%	230
6	99.9997%	3.4

Source: Adapted from Hayler and Nichols (2007, p. 10)

An important assumption of the Six Sigma methodology is the effect of “long-term” variation that will, to some degree, shift the observed variation through the course of time (Heckl et al., 2010) impacting the long-term capability of a process “under control” - known as the 1.5 sigma shift (see Figure 15). In this instance the observed process distribution must, therefore, be tighter (smaller) than the specification limits, providing a contingency for the effect of long-term variation shifting the distribution and remaining within 3.4 DPMO or Six Sigma long-term capability. However, Antony (2004b) denies that applying the empirical 1.5 sigma shift (a theory established from long-term observation of manufacturing processes) is only an assumption and may not be the case within service processes. Antony asserts this fact alone should be a major thrust for the future study of Six Sigma in services - gap this thesis seeks to close.

Figure 15: Long-term Six Sigma Capability - 1.5 Sigma Shift



Source: Adapted from Heckl et al. (2010)

3.6.6 The Impact of Variation

The scholar, Genichi Taguchi, unites process variation with financial losses of a system (Taguchi, 1986a; Taguchi et al., 2005) and argues any deviation from a specified target will result in some form of loss to customers, the company, and society regardless of the specification limits (Bass & Lawton, 2009, pp. 36-38; Arthur, 2011, p. 195) Taguchi's equation (see Equation[40] 1) quantifies the deviation from the target and assigns a cost of poor quality (COPQ, the "loss") to process variation (Bass & Lawton, 2009).

Equation 1: Taguchi's Loss Function

$$l(y) = k(y - T)^2$$

$$k = \frac{\Delta = \text{failure cost}}{m^2 = |lower\ Specifcation\ limit - T|}$$

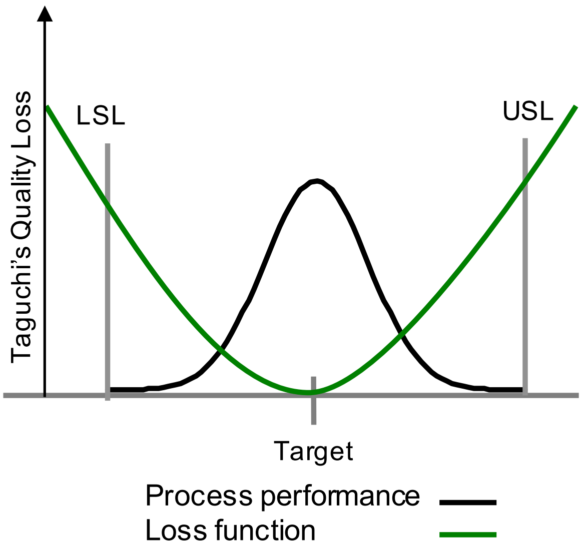
Source: Bass and Lawton (2009, p. 38)

According to Taguchi's model (see Figure 16) the function of the loss "increases" the further from target a product or service is produced. The result of loss may be felt by both customer

[40] The loss function is the square of the deviation multiplied by a constant k, with k being the ratio of the cost of defective product and the square of the tolerance. Y = the measured value and T being the target.

and producers in the instance where poor quality will result in reputational losses affecting servicing/repair costs and future revenue losses due to customer attrition to superior competitor products and services.

Figure 16: Taguchi Loss Function Model



Source: Adapted from (Bass & Lawton, 2009, p. 36)

In this respect, the losses of even seconds to a process operated by an international commercial or investment bank will be huge and significant where high frequency trading activities take place on global markets.

Cost losses are manifest in repair/rework costs. Such losses may be the amount of additional time taken to complete a measured task. For example, a work item is measured to take one hour to complete, however, it takes one hour fifteen minutes to complete. In this instance, there is a loss of resource effectiveness which reduces the available capacity to handle volume thus driving up the cost of service. Equally, there is a negative effect of completing a work item in too short a time. In this scenario, expediting and failing to complete full "due diligence" checks may result in incorrect or missing information. The impact of which will be a profound interruption to flow capability, necessitating manual intervention - attracting repair cost to correct the data profile within the IT system. In instances where there is variation from intended targets, the use of Taguchi's principles on variation can be used as an effective technique to calculate COPQ (Bass & Lawton, 2009; Arthur, 2011)

3.6.7 Six Sigma and Financial Organisations

Global markets are currently in a state of instability, uncertainty and turmoil. Competition for market share and customers is fierce. Customers are also increasingly transient, using the advantage of "choice". Choice has heightened competition in global markets, been accelerated by interconnected market access, dematerialised products and services, created "point of sale" and distribution channels transacted through global trading networks and open access web portals (the internet). Services organisations, such as global banking, are competing on service features such as speed, accuracy, completeness and product variety – and even bespoke products – and customer satisfaction (George, 2003; Hayler & Nichols, 2007; Heckl et al., 2010; Antony et al., 2012; Jumah et al., 2012).
Senior business leaders of successful global organisations have embraced the Six Sigma methodology as a corporate strategy to stabilise their business, improve quality, increase efficiency, develop knowledge and skills and enhance the competitive capability of the bank (Pande et al., 2000; Heckl et al., 2010).

The benefits of Six Sigma to service organisations - especially commercial and investment banking (Hayler & Nichols, 2007; Lin, 2009; Delgado et al., 2010) - are improved customer satisfaction in products and service, ease and efficiency of obtaining products, reduced operating costs and competitive price positions all of which combine to provide a competitive advantage for the organisation (Slater, 2001; Kumar et al., 2008; Delgado et al., 2010). In the specific context of the case study organisation, Six Sigma provides the necessary tools, techniques and framework to assist the organisation to measure the efficiency of its operation and importantly, assists managers to identify sources of system dysfunction leading to poor performance and how under performance affects the business (time, costs and satisfaction). Moreover, Six Sigma has been shown to fit the architecture of the case study organisation which utilises interconnected information communication systems (CIM) as the primary and only means of interacting with the marketplace. Improvements will invariably manifest in enhancements to systems and the sociotechnical interactions of data input, transfer and transformation. Six Sigma has been shown to fit the design and goals of the banking operations and thus it may be applied to the case study with practical utility. However, the literature gap remains.

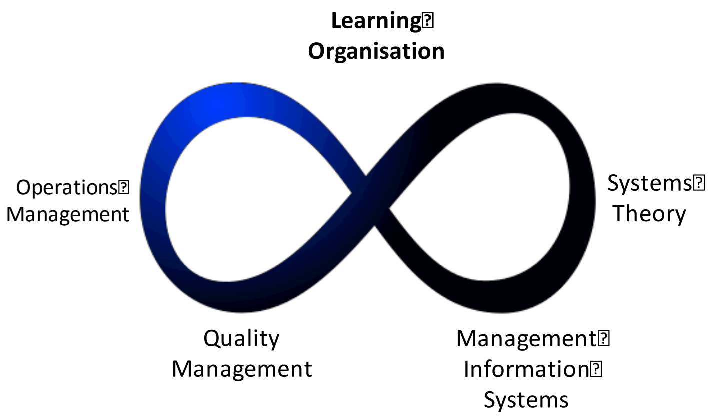
There are few contextual and deep studies of high variety operations and how systems are structured to exploit trade flows. Much more is known of repetitive processes where failures can be identified quickly due to deskilling, repetition of the work and common customer standards. The extremes of investment banking do not have such characteristics and carry high penalties for poor performance (not least in raising the costs of the bank). Even less is known about the learning processes and how a bank evolves using Six Sigma to gain stability and commence its improvement journey and this gap, evident in the literature and highlighted by six sigma researchers in the sector, provides the focus of this study.

3.7 The Uniting Thread

An “infinity loop” (Figure 17) depicts the symbiotic relationship found in the literature review that unites Operations Management, Quality Management and Management Information Systems in a socio-technical systems learning process. Although the infinity loop is portrayed as positive - it may be negative - improvement of quality cannot occur when the costs of changing the system (adapting or replacing it) are greater than the benefits (in terms of total cost savings of the prevention of mistakes). Management theory since 1990’s has emphasised the need for organisations to become a “Learning Organisation” in order for the modern business to survive and grow.

Little research was found that suggested the global financial sector had engaged with this type of transformational journey. Instead, organisations have chosen to utilise IT automation in a manner that has overlooked the benefits of a sociotechnical solution approach, instead believing in 'dematerialisation' and the automation of work (a "silver bullet" solution) to provide an answer to the problems encountered with earlier paper-based systems (Seddon, 2008a). Choosing to automate rather than question and re-engineer tasks into coded processes has unwittingly led to sub-optimal conditions and performance as well as generated an inhibitor to learning and improvement towards higher performance (Hammer, 1990). In effect, human innovation has been automated out of the banking system.

Figure 17: Infinity Cycle – Building Organisational Learning



Source: The Researcher

The review of environmental change literature has presented how the financial services sector has created a conflict of performance objectives, where speed is in conflict with quality, where task and product complexity is in conflict with the rigid nature of a pre-coded IT system and where IT systems that should support staff working appear to prevent system improvement. As such, there remains a major gap in both quality and OM literatures in terms of the improvement of financial services in the high variety context of investment banking.

From an “economy level” perspective, the investment banking sector generates value and revenues as opposed to back office operations that are cost centres and exist to resolve problems/conduct maintenance tasks. The industry is also ‘benchmarked’ periodically and performance shared with other banks so this study is timely and significant in terms of understanding how such important institutions learn to improve (especially as the government is an equity owner) and what inhibitors prevent a free flow of services to generate a profit, reduce total costs and assist the liquidity of the bank.

3.8 Conclusions

The literature review started with an “open systems” view of the organisation and the centrality of uninterrupted OM flow as the basis for value adding for the customer market environment. The chapter has also explored the OM types and presented commercial and investment banking as a highly complex context within which MIS systems are essential but that they are sequential and dependent when processing trades. It was argued that, without an engaged workforce and without managers as systems thinkers, errors in the system will amplify and consume more resources to rework and repair poor quality data in order to restore the system to flow. The flow of services is, it is argued, uninterrupted when there are conditions of high quality (completeness of information necessary to perform services without error or delay) and stable information systems that allow services to be completed effectively (Williams and Durray, 2013).

The nature of high-volume, high-variety and high-value financial services trading has highlighted the critical importance of an integrated management information system of complex trades, the maintenance of system stability and stated the centrality of the system regulating towards a “steady state”. From a sociotechnical system perspective, the commercial and investment banking sector is an open system, critically impacted by feedback from the environment, and driven towards a goal oriented outcome of trades flowing in, and from, the global markets without financial loss or delay (traded in milliseconds). This faultless reconciliation of profitable ‘trades’ is critically important in the current period where the UK Government has become a major stakeholder and equity owner of the bank following the collapse of the global banking system.

Later analysis will show the Case Study company has an uncomfortable structural and process design and, due to the design choices, the organisation is departmentally focused on the task environment work-flow. The organisation performs compartmentalised sub-process and sequential administrative duties where a product is designed to a predetermined specification and must be processed with high levels of efficiency (implying accuracy). The high level of dependence between processes results in errors, delays and rework, has severe consequences for efficiency and could incur penalty clauses if a client does not receive the expected flow of products and currency (and as a result of poor processing) and the system design raises ‘failure demand’ levels.

Operations management theorists have also avoided the investment banking sector in favour of more repetitive and mundane processing environments and there has been little challenge to the OM body of knowledge since the 1980’s (Hayes & Wheelwright, 1979; Slack & Lewis, 2011). However, the case study is a high-volume trading organisation with a high-variety of product types (20,000 trades per day from a bespoke product suite). The study context is arguably uncharted territory for OM academics and challenges the accepted model of production systems design (Hayes & Wheelwright, 1984). As such the financial services sector presents the opportunity to contribute to OM and quality management fields of study in terms of flow performance and systems learning/thinking within a complex dynamic OM system.

The literature review has also highlighted the negative consequences of ‘system noise’ and abnormal system “variations” and whilst Seddon (2008a), a controversial researcher, has named routine processing losses as “failure demand” he fails to apply his method to the commercial and investment banking system where penalties for failure are much higher and profound on the performance of the bank. Service dissatisfaction with global corporates and institutional investors puts key revenue streams 'at risk' and thus jeopardises the recovery of the bank. Seddon's answer is to design open systems that 'absorb' variety in customer requirements, helping produce flow capabilities and together with quality methods stimulates sustainable improvement and knowledge management - but this has yet to be tested within a commercial or investment bank. Michael George (2003) in his study of American services industries (including banking) has identified failure demand and "demand variation" and he argues for solutions to reduce the former and "engineer out" the process to 'flatten' the latter. In essence this preferred treatment of noise (variation) is to 'desensitise' its effect on the production system, in essence flattening demand variation through forecasting and buffering Service Level Agreements (SLA's). The latter is a typical answer provided by an advocate of industrial engineering and scientific management thinking rather than a socio-technical theorist. George's (2003) approach may be considered an apology or a 'work around' for a poor system design as a result of insufficient understanding of the sociotechnical processes and policies which results in a weak model and poor fit within the particular setting.

Considering the nature of the case organisation and its particular context (commercial banking), failure demand is present but there is poor understanding of the volume of failure demand or excessive human resources needed to conduct the rework. The "sense of urgency" (Kotter, 1995) created by the poor performance reported in the sector benchmarking report by MGT has exposed a fundamental weakness in the operating model of Alpha Bank and raised the awareness of flow performance in the business (for customer service and lower processing costs). Initial conversations with functional managers at the time of receiving the MGT Industry benchmarking report (2011) suggested system performance reports are of questionable veracity, do not represent a 'true' reflection of 'real world' interactions and have been greeted by management 'denial' (Kübler-Ross & Kessler, 2005). Reflecting on the literature review, together with the comments and concerns of the functional mangers, suggests that complex financial service organisations do not have an alternative OM model (such as the lean model versus mass production). Thus, this requires the case organisation to “learn” how to improve rather than to ‘emulate’ or deploy best practice. According to the MIS literatures two possible issues exist. First a poor ‘fit’ exists between systems and the subsystem feedback arrangement and/or systems and subsystem feedback is not being interpreted in a way that generates knowledge/learning for performance improvement (in effect identifying issues as they happen rather than passing poor quality products to the next sequential point in the process).

Chapter one explained the catalyst for this study which was reinforced by the unfavourable MGT report (2011) to reduce the accepted cost measure (and not a direct flow measure) called “Cost Per Trade”. Cost per trade is the financial cost for a business to complete a service transaction. The benchmarking report shows the case study organisation has excessive cost across various dimensions of its service. The discovery of a competitive disadvantage (larger cost per trade than peer organisations) is the business motivation to reduce costs which is considered desirable to close the gap between peer institutions.

Ferdows & DeMeyer (1990) with Seddon (2003) argue operational costs are a product of system design/system performance and active quality management. Ferdows and DeMeyer argue that system performance is an aggregation of Quality, Dependability, Speed and Flexibility and starting with Quality will improve flow and reduce costs. In effect, improving quality through Six Sigma methodologies would reduce the fragility, variability and costs of the processing system and reduce the high cost buffers of staff dedicated to data repairs. The literature review has found no academically robust studies of investment banking to date that are available in the public domain.

The research void and gap in the body of knowledge supports the following research questions:

- How efficient are commercial and investment banking trading processing systems?
- What enables and inhibits the efficient and high performance of industrialised processing systems?

In the context of the recent global credit crunch and the collapse of financial institutions amidst the increasing pressure for transparency of organisational performances in the sector – this study is timely, highly relevant to management good practice and has the potential to improve the operating effectiveness of the case study.

Chapter 4: Research Strategy and Methodology

4.1 Introduction

This chapter presents and defends the theoretical and practical design considerations when undertaking research as a professional DBA researcher and the constraints of such an exercise[41]. The researcher will clearly show the rationale and the selection processes required to design a suitable research methodology and foundation upon which to study the operations management research gap that exists. The literature review has demonstrated the gap to be: How efficient are commercial banking processes? And what enables or inhibits the achievement of high performance for investment banking businesses?

The intention of this chapter is to identify, discuss, justify and defend the research strategy as a suitable methodology to generate new information and insight so as to offer an explanation of the case study (observable phenomena of modern investment banking operations). The chapter will also present the limitations and ethical considerations of the study.

4.1.1 Conducting Research

There are several questions that demand special consideration by researchers, none more so than 'what will I research?' and 'how will I research it?'. The question "what will I research?" may be restricted by environmental factors such as access and privacy which - as most professional doctoral researchers are active employees within an organisation (as is the case with the researcher) - access is typically not the issue that it is for PhD researchers. However, limitations emerge in the private/commercial sector concerning cross-sectional studies due to privacy so this limits what can be achieved. 'How will I conduct my research?' has significantly more need for 'value-freedom' than 'what will I research?' in the context of

[41] These constraints include the word count for the document that is significantly less than a PhD research programme.

this particular study. To answer these questions, it is first necessary to conduct a review of the philosophical debates concerning research, reality and valid knowledge.

4.2 Philosophical Research Paradigms

To outline the basic concepts of philosophy a short discussion is required to 'place' the sociological concepts of ontology and epistemology in context to understand the fundamental principles of knowledge generation.

Ontology concerns what constitutes 'reality' and is the philosophical debate concerning how reality is conceived. Epistemology is defined as 'what constitutes valid knowledge' (knowable) and determines how it can be obtained and validated or legitimated (worth knowing). Epistemological designs therefore answer the question 'how' to determine what is reality - what steps must be taken to gain knowledge about the world. The choice of epistemology is partly determined by the researcher's personal views and bias (axiology), partly by the subject being researched and partly by academic tradition.

4.2.1 Ontological, Epistemological, Axiological Perspective

A research philosophy is an overarching term that relates of the development and evolution of new knowledge and how such knowledge generation is considered 'valid'. Research is conducted within an underlying philosophical position which determines what is valid knowledge (Cresswell, 2013). According to Saunders et al. (2015) research has three key areas of philosophical consideration ontology, epistemology and axiology. The authors assert that philosophical choices underpin and lead the researcher through a system of beliefs and assumptions on a course to develop new knowledge.

Ontology concerns the nature of and what constitutes reality, and the study of being. Ontological assumptions shape research and how to engage with research subjects (Stevenson, 1997; Blackstone, 2012; Saunders et al., 2015). In the context of the research topic, the ontological assumptions are the way in which the researcher views organisations, management structures, production processes, individuals and workplace events (Wacker, 1998). The ontological perspective of the researcher is that reality is the observed and the perceived within a case study organisation that is “a living entity”. It is a sociotechnical system within which reality has both meaning and measurable processes.

Epistemology deals with reality and “how do we know what is” (Blackstone, 2012). It asks “what constitutes acceptable and valid knowledge”. The choice of epistemology is partly determined by the researcher’s views (ontology) but also the research subject itself. It determines how knowledge can be obtained, validated/legitimated and communicated to others (Maylor & Blackmon, 2005; Saunders et al., 2015). The basic framework of epistemological positions is represented by a continuum from Positivism (quantitative - reliant on measured phenomena exclusively) to Interpretivism where no reality exists beyond the thoughts of the person being researched (reliant on perceptions that cannot be generalised) – see Table 28.

Axiology refers to the researcher’s own values and opinion (ethics) at play within the research process. Awareness and understanding of these axiomatic beliefs help to understand the influences their role may have on the research design. It helps a researcher to reflect on why they steer towards a particular research topic over other competing topics or subjects (Saunders et al., 2015).

Table 28: Philosophical Assumptions

Assumption Type	Questions	Continua of Extremes

Ontology	• What is the nature of reality?
	• What is the world like?
	For example:
	  • What are organisations like?
	  • What is it like being in organisations?
	  • What is it like being a manager?
		External ←→Socially Constructed.
		One true reality←→multiple realties
		Order ←→ Chaos.

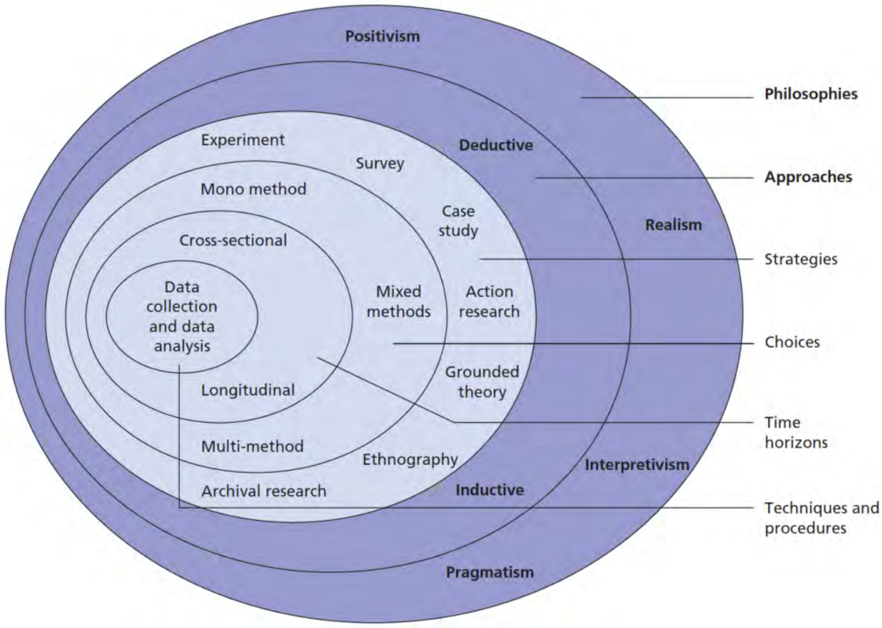
Epistemology	• How can we know what we know? • What is considered acceptable knowledge? • What constitutes good quality data? • What kinds of contribution to knowledge can be made?	Facts ←→ Opinions. Numbers ←→Narrative. Observable ←→ Possible meanings Generalisation←→Contextualisation
Axiology	• What is the role of values in research? • How should we treat our own values when we conduct research? • How should we deal with the values of research participants?	Value free ←→ Value bound. Detachment ←→Integral / reflexive.

Source: Adapted from Saunders et al. (2015)

4.3 Research Philosophies

Developing from a philosophical approach is the research strategy and methodological design as an aligned process to generate new knowledge that can be considered valid. Saunders et al (2009) present an effective framework for such navigation through the various design choices. The authors describe a ‘research onion’ comprised of ‘layers’ which a researcher must ‘peel-back’ to reveal new considerations and choices until a final design methodology is achieved (see Figure 18).

Figure 18: The Research Onion



Source: Saunders et al. (2009)

The selection of a particular design is influenced by a particular view of valid knowledge and the process in which it is created as well as the personal views held by the researcher (objectively measurable reality and positivism or subjectivity and the interpretivist view). Peeling the research 'onion' creates alignment (philosophies, approaches and strategies) applicable to the study considered here (Saunders & Lewis, 2012). The major research epistemologies will now be summarised.

4.3.1 Positivism

Positivism is the quest for objective measured reality as only valid knowledge (Saunders et al. (2009). Positivists tend to construct a theory hypothesis to test using 'deductive' methods (theory testing). These tests lead to explanations or 'laws' which are scientifically assessed for validity. The approach is suitable for established subject areas where reality is observable and can or has been 'scaled' and measurable. Knowledge is produced through the aggregation of observable 'facts' that, when assembled in significant quantity, provides the basis (evidence) for proposal of laws. Within this particular philosophy the researcher believes the world can be measured and this is typical of the sciences where mathematics can be applied to the world in an absolute manner. Using well-defined scales and established concept measures, positivists construct a body of research grounded in statistical verification to generate legitimate knowledge[42]. 'Deductive' positivism provides a weight of evidence (proof) that remains in support of hypotheses or the hypothesis is rejected and the search for new knowledge begins – as such positive studies continually test hypotheses in new and in different applications (See Table 29). Operations Management has traditionally been dominated by the positivist tradition (Wacker, 1998) but recently has given way to contextual studies.

Table 29: Positivist Characteristics

Feature	Attribute
Advantages	A clear theoretical focus of the research topic is produced when commencing the study. Researcher maintains control of the process throughout the research process.
Disadvantages	Positivism may be seen to be inflexible in that the directions may not be altered once collection of data has commenced. Moreover, it provides a weaker understanding of the social introspective process of an organisational construct. Adoption of positivism in business studies and other studies can be criticised for reliance on status quo. In other words, research findings in positivism studies are largely 'descriptive', thus they lack insight into in-depth emotive topics.
Typical Methods	Experiment and the large scale survey.

Source: The Researcher

4.3.2 Interpretivism

Interpretivism is diametrically opposed to positivism and stems from a 'critique' of the natural sciences to represent the vagaries of 'social research' (Blackstone, 2012). It is a quest for 'subjective' knowledge utilising an inductive or theory building approach. Interpretivists argue humans and their social domains cannot be studied using the same approach as physical phenomena, asserting that social science must be approached with a different philosophical

[42] Although positivism is typically deductive in nature - 'inductive' positivism exists where law-like generalisations are replicated by other researchers to test and generate comparative results. This thesis will focus on the deductive approach.

attitude than the natural sciences. As such positivism is ineffective at extracting meaning from the social environment where emotions and illogical behaviour can exist (Saunders et al., 2015). As such, interpretivists are highly critical of positivists' attempts to deduce finite laws and generalise their application.

The basic and fundamental questions of the interpretivist are "how do 'people' perceive their environment?" and "how does that view differ from subject to subject?" (Goldkuhl, 2012). Interpretivists place importance and emphasis on the human as the primary and only subject of study not populations of behaviours. Interpretivist researchers believe reality consists of subjective, idiosyncratic, experiences of their external world and therefore elucidate meaning to theorise possible cause and effect relationships. Saunders et al (2009) argue interpretivist observations cannot be detached from their knowledge indicating a clear link between the researcher and the subject of the study. In this approach the researcher acts as "a detective" interpreting the subjective to form reality and make 'sense' of information.

Typical research designs of interpretivists do not favour the large scale questionnaires of the positivist but instead focus on 'context rich' observations of feelings, emotions and perceptions (Saunders et al., 2015) through ethnographic studies. The interpretivists develop new contextual understanding and interpretations of social reality which only seeks to 'describe' part of reality but acknowledge that a complete understanding of reality may never be achieved. In the context of Operations Management an example of interpretivist studies could include "how do staff feel about new technology?"[43] - See Table 30 for a summary of the Interpretivist research approach.

[43] Other questions could include why workers feel demotivated at work or how workers see leadership behaviour as a case study.

Table 30: Interpretivist Characteristics

Feature	**Attribute**
Advantages	Facilitates an understanding of 'how' and 'why' a phenomenon occurs. Garners a good understanding of social processes at work within an organisation, allowing for complexity and contextual factors to be examined and expressed that might not be 'detectable' when using scientific approaches.
Disadvantages	Researcher faces additional challenges designing qualitative data collection frameworks (the means by which information is extracted), they are: • Lengthy data collection exercises. • Time consuming conversion of information into data ready for analysis Expected patterns and arrangements of data may not emerge from the study. A certain amount of ambiguity (and criticism) may exist in the final research results.
Typical Methods	Small in-depth investigations, typically qualitative.

Source: The Researcher

After significant review, the researcher rejected both the Positivist and Interpretivist extreme epistemological positions. For this research, positivistic detailed and well defined scales do not exist in the study of flow management and individual and social reflections would not support the study of flow and performance management within a complex banking operation. This would be of limited practical utility to the Operations Management body of knowledge and the bank therefore an epistemological 'middle-position' was designed (realism).

4.3.3 Realism

Realism is a midpoint on the continuum between Interpretivism and Positivism. It combines both and is concerned with interpretation of entities (organisations) to provide a robust understanding of the subject and its context (Sayer, 2000). As such, realism allows data to be collected and anecdotes/opinions to create a greater understanding. The realist approach has a wide variety of research methods available to it and the actual research strategy design is dependent upon the object under study – 'the messy reality' (Sayer, 2000, pp. 19-20). Reality is a combination of observed practices (positivist) and the perceptions of those within the organisation (management interpretations) and how they make sense of their environment and interact.

Blending positivist and interpretivist philosophies allows the researcher to select either 'direct realism' (also known as empirical realism) and 'critical realism' (biased towards the subjective) according to Saunders et al., (2009). Direct realism operates within a narrow frame of reference, focusing on a single level of enquiry (such as an individual, team, organisational layer or organisation). For the realist, these levels are perceived to be static and unchanging and therefore favourable conditions for action research (purposeful change) (Saunders et al., 2009). Critical realism however recognises the importance of multi-level study simultaneously at individual, group and organisational levels. These methodologies have the ability to change the researcher's perception of what is being studied and lead to a greater understanding of business structures, processes, systems and their interactive tendencies (Saunders et al., 2009).

Critical realism implies two steps to understand reality by understanding the social events, and experiences of employees to build a picture of reality (which is enough for the direct realist). Secondly, the critical realist will engage in 'mental conceptualisation' of reality by reasoning backwards in time 'after' an event to craft an understanding of reality (Bryman & Bell, 2007; Saunders et al., 2015). Critical realism seeks to establish an explanation of observable organisational 'events' by searching for a cause and effect relationship through interpretation of the deep social interactions and structures which shape the organisation (see Table 31).

4.3.4 Pragmatism

Finally, pragmatists (another midpoint) are concerned with action research through interventional changes (experimentation) made by, or on behalf, of the researcher. Pragmatism has generated intense debate in terms of the uniting of 'truth with practicality' and whilst *"striving to reconcile objectivism and subjectivism, facts and values, accurate and rigorous knowledge and different contextual experiences"* are collected (Saunders et al., 2015).

Table 31: Realism Characteristics

Feature	Attribute
Advantages	Positioned such that a mixture of quantitative and qualitative tools can be used to extract and analyse data, increasing the likelihood of producing valid knowledge from the study. Epistemologically - observable phenomena, and the study of, will provide credible facts and data.
Disadvantages	Perceptions of observer and the impact of perception on observed reality are not taken into account. Omitting the possibly of an interaction between observer and object could potentially skew results using realism (Saunders et al., 2009).
Typical Methods	Design to fit subject matter, qualitative and/or quantitative.

Source: The Researcher

Critics of pragmatism contest that unnecessary limits are placed on human behaviour and understanding due to the 'forced' conditions where the researcher is shaping the research. The pragmatists however assert all thoughts, beliefs and actions are a result of a practical and logical agenda thus capable of study (Stevenson, 1997; Coughlan and Coghlan, 2002). Pragmatists therefore consider 'knowledge' to be the product of the interplay between cycles of intervention and learning and of more value when the researcher is imbedded in the study as opposed to being an independent state (Goldkuhl, 2012). Pragmatist research typically focuses on a practical problem and aims to construct a practical solution – often going further to define 'best practice' and communicate it as generalisable knowledge (Saunders et al., 2015). Goldkuhl (2012) argues the pragmatic approach to research is suitable for studies concerning organisational change that are interventionalist-led. However, critics argue that pragmatism research can overlook the generation of legitimate knowledge (and learning) that doesn't satisfy the axiological position (value laden objectives) and unilateral agenda searching only for a practical solution. See Table 32 for a review of Pragmatism research.

Table 32: Pragmatism Characteristics

Feature	**Attribute**
Advantages	Researcher acts within the study (interventions by researcher) to collect quantitative and qualitative data. Values play a large role in interpreting results, the researcher adopting both objective and subjective points of view.
Disadvantages	Researcher is active in the change process and therefore it is subject to bias (testing the knowledge and the ability of the researcher to produce results).
Typical Methods	Mixed or multiple methods, qualitative and/or quantitative.

Source: The Researcher

The researcher rejected the pragmatist approach as this implied he would lead a change programme within the case study and potentially introduce bias[44]. Instead, the study objectives call for an identification of organisational and social enablers and inhibitors to flow (the objective of this case study). The researcher also believed pragmatist research may overlook and abandon knowledge which is not focused on achieving a practical result but would be incredibly useful in theory building. The pragmatist research perspective was duly rejected. Table 33 summarises the continuum of epistemological perspectives.

All four research philosophies (associated with business management) have now been defined, discussed and assessed. The chosen epistemology was that of a realist approach as this offered the greatest potential to build new theory in a credible manner. This was the most suitable choice given the case, access, organisational setting, dynamics of the research objectives and research questions crafted from the systematic literature review.

[44] The researcher believed that leading a change programme would merely test his ability to enforce change and would be less of a study about flow performance as a result.

Table 33: Business Research Philosophies and their Philosophical Assumptions

Philosophy	Ontological View	Epistemological View (valid knowledge)	Axiology
Positivism	Reality is independent, existing externally of the observer.	Reality can be measured through study of observable facts using scientific methods, producing causal explanations and predictions of reality.	Value free, researcher detached from the object of study, operating independently and maintaining an objective stance.
Realism	Reality is a physical construct, actual and empirical. It exists independently of human thoughts, belief and knowledge.	Observable phenomena provide credible data with which to determine causality. Focuses on providing an explanation within a context or contexts.	Value laden, the researcher is biased towards world views, culture and environmental upbringing.
Interpretivism	Socially constructed through culture and language, producing multiple meanings and interpretations of reality.	Focus on narratives, anecdotes, perceptions and interpretations. Subjective meanings motivating actions. New understanding and world views as the research contribution.	Value bound research, the researcher is part of what is researched and cannot be separated and so will be subjective. Reflective researcher contribution.
Pragmatism	Complex, rich and external. Reality is the practical consequence of ideas.	Observable phenomena and subjective meanings can provide acceptable knowledge. Focus on problems, practices and relevance. Problem solving and informed future practice as contribution	Value driven research. Research initiated and driven by researcher's doubts and beliefs. The researcher may adopt both objective and subjective points of view.

Source: Adapted from Saunders et al. (2015)

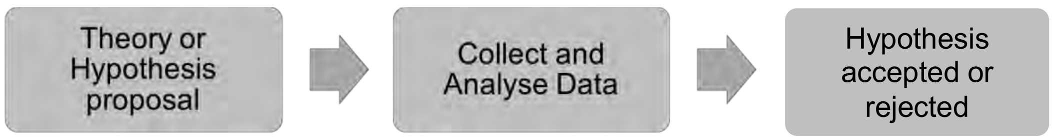
4.4 Research Approaches to Theory Development

The realist approach allows inductive and deductive cycles of research to occur with inductive opinions and views then being tested by deductive studies (Eisenhardt, 1989; Easterby-Smith et al, 2012).

4.4.1 Deduction

The collection of data is a prerequisite of hypothesis testing - the preferential data type is quantitative data[45] (Black, 2005). When designing a deductive approach the researcher must ensure they remain independent from the object of study to safeguard objectivity of conclusions and inferences when describing a general population derived from a sample (Saunders et al., 2009; Blackstone, 2012; Creswell, 2012). The purist deductive approach was not utilised for the design of this study due to the philosophical view that the rich contextual knowledge should be developed as opposed to knowledge purely derived from theory testing and the body of knowledge was insufficiently developed to house a theory or hypothesis (Figure 19).

Figure 19: Deductive Approach



Source: Blackstone (2012)

4.4.2 Induction

The ‘inductive’ approach contrasts deduction and seeks to understand the ‘context’ in which events take place or occur (interpretivist). This approach has utility within organisational case studies of operations management where interactions between and within sociotechnical constructs are messy and poorly understood social phenomena but of importance to the researcher (Wacker, 1998; Maylor & Blackmon, 2005). Research therefore focuses on small sample communities (not the large samples of the deductive researcher). Induction favours qualitative data over quantitative data, where views and opinions expressed by the subjects (persons) of the study produce the rich contextual

[45] Qualitative data may be collected as long as it can be calibrated for later statistical testing.

content and explanations of events or data. Rich contextual data also captures contrasts and variations in ‘perception’ between subjects and groups. The data collected may also be primary or secondary data dependent on the particular subject of study. In certain situations a research study may require a mixture of primary and secondary data to produce rich descriptions of behaviours and inform theory concerning a particular phenomenon (Blackstone, 2012; Creswell, 2012). The approach accepts individuals and groups appraise their environment and, through inference, will react to it (Alreck & Settle, 2004; Saunders et al., 2009). For business research the aim is to accumulate and ‘stack evidence’ from the bottom up (theory building) to assess reality using organisational ethnography that provides explanations of patterns, behaviour, beliefs and relationships (Arbnor & Bjerke, 2009; Saunders et al., 2009; Gill & Johnson, 2010; Creswell, 2012; Saunders et al., 2015). A rudimentary example of an inductive approach is set out in Figure 20.

Figure 20: Inductive Approach

Source: Blackstone (2012)

Research projects being finite are constrained by a timeframe and access granted to the researcher. Inductive research is often lengthy due to the design and setup of data collection instruments. Moreover physical information collection, data generation and analysis can be protracted due to the response methods and the competing/practical agendas of managers within a professional environment. On the other hand deductive research can be executed quicker (the construction of experiments and tests) but these miss context and describe rather than explain a modern phenomenon (Huberman & Miles, 2002; Gillham, 2007; Creswell, 2012).

4.4.3 Contrasting Approaches

Each approach is not without risk. Deductive approaches are relatively low risk compared to the inductive that may not produce recognisable patterns or explanations at all (Huberman & Miles, 2002; Saunders et al., 2009). As such, the researcher must understand and balance the pros and cons of either approach consciously and in parallel with the study research objectives. A summary of the key difference between Deductive and Inductive approaches is shown in Table 34.

Table 34: Deductive and Inductive Approaches

Deduction	Induction
Scientific Principles.	Understanding-meaning humans attached to social experiences.
Theory to Data.	Produces a deep understanding from a research context.
Emphasis on quantitative data.	Emphasis on qualitative data.
Structured Approach (rigid form).	Flexible approach permits changes to research techniques.
Researcher separate from the research.	Researcher is imbedded within the study project.
Generalise results from sample analysis	Less concerned with the need to generalise results.
Explanation of 'causal relationships'.	

Source: Adapted from Saunders et al. (2009)

Abduction is another middle ground for the researcher and this will now be reviewed.

4.4.4 Abduction

A third approach to the development of theory is again a coalition which accepts the legitimacy of moving between inductive and deductive approaches cycles of research, known as abduction. Cycling between deduction (theory into data) and induction (data into theory) contained in one approach typically begins with an observation or catalyst (an event). From this stimulus a theory can be composed to account for the observation – then building and testing of theory allows the test data to build a new theory and the cycle continues until a weight of evidence is produced as a perceptual explanation or framework to describe the phenomenon (Saunders et al., 2015). This approach offers the researcher an ability to mitigate risks and comply with constraints (the lack of data, small sample sizes and lack of prior knowledge or experience of the subject of study).

In the context of this study, such risk factors are less likely to impact the overall design of the study due to the open engagement with senior management, their ability to remove roadblocks that would challenge and pose problems to external researchers and allow a reduction in any form of bias (Table 35 summaries all three approaches).

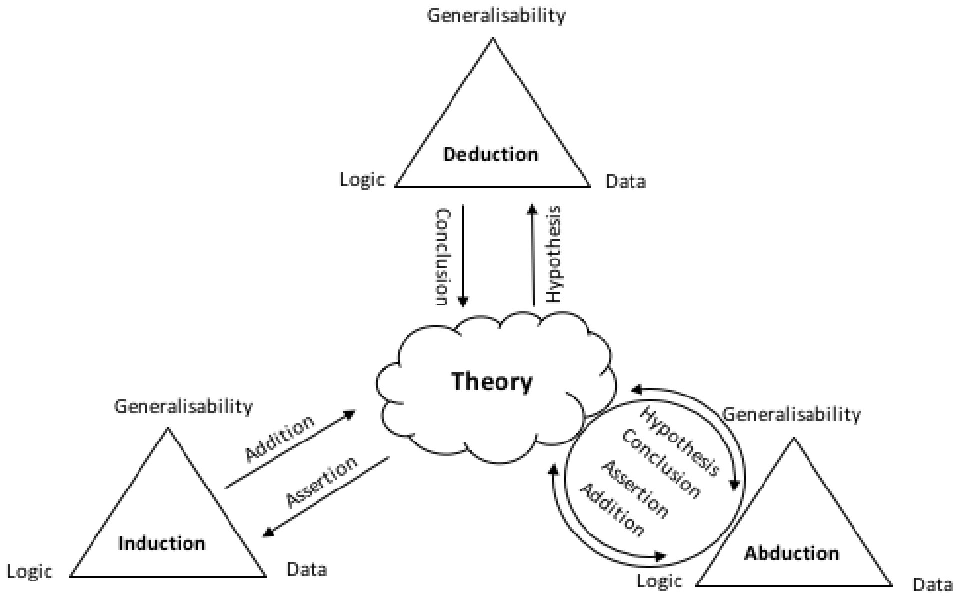
Table 35: Research Approaches

	Deduction	Induction	Abduction
Logic	When the premise is true the conclusion must therefore be true	Known premises are used to generate untested conclusions	Known premises are used to generate testable conclusions
Generalisability	Generalising from the general to the specific	Generalising from the specific to the general	Generalising from the interactions between the specific and the general
Use of data	Data collection is used to evaluate propositions or hypotheses related to an existing theory	Data collection is used to explore a phenomenon, identify themes and patterns, creating a conceptual framework	Data collection used to explore a phenomenon, identify themes and patterns, locates the same on a conceptual framework which are retested and validated
Theory	Theory rejection or acceptance	Theory generation and building	Theory generation or modification

Source: Adapted from Saunders et al. (2015)

Figure 21 presents a pictorial representation of all three approaches and their interaction with, and ‘on’, theory.

Figure 21: Research Approaches in Practice



Source: The Researcher

4.4.5 Approach Selection

The researcher has reviewed the merits of each option and, after significant reflection, abduction was rejected on the grounds that 'testing' under the lens of the natural sciences could perhaps overlook vital social cause and effect relationships. The deductive approach risks overlooking the emergence of patterns leading to new contextual understanding, helping answer the 'how' and 'why', together with identification of the promoters and inhibitors of operational performance in order to answer the research question and close a gap in the operations management body of knowledge. Therefore, the researcher has chosen induction as the most suitable approach to generating the rich context and theory required from a study of this nature but accepts that cycles of research will be needed to achieve this outcome.

4.5 Research Strategy

A research methodology (the actual methods used to collect legitimate information upon which to build theory) is set within a strategy. According to Saunders et al. (2015) the strategic choices selected will dictate how the general research is conducted. Strategies include Survey, Case Study, Action Research, Grounded Theory, and Ethnography. Within each strategy, a researcher can use a singular (mono method) or mixed methods (multiple). Each option again has advantages and disadvantages. A single method has weaknesses whereas a combination of methods that counterbalances the weaknesses of any individual method offers robust insight but requires time. Multi methods where many cycles and methods are used throughout the study is another option (see Table 36). Following an extensive review of the merits of each approach, a case study strategy was selected employing multiple methods and multiple cycles were designed to improve the robustness and generalisation of study findings.

Table 36: Research Strategies

Type	Description	Decision
Survey and Experiment	Detailed scales and control over the subject.	Rejected: As researcher cannot control the organisation under study.
Action Research	Leading change processes	Partially Rejected: Due to bias if the researcher is acting as a lead consultant. Partially accepted – using system data presented to staff and witnessing their reaction and use of it.
Grounded Theory	Generating knowledge from observations then looking to explain the findings using existing literature.	Rejected: Due to practical timing issues and the need for a conceptual framework before entering the study. Dynamism of the environment would generate noise and confusion therefore making sense of the study would be impossible. Saturation point is difficult to determine.
Ethnography	Collecting individual perceptions	Rejected: Individual perceptions do not show up the qualities of an organisation and are subject to what is happening currently within the organisation.
Archival Research	Generating knowledge based on documented past historic events	Rejected: Historic decision are subject to bias and do not offer insight into the organisation.
Case Strategy	Building knowledge from one or more organisations that are likely to exhibit the phenomena (research topic)	Accepted: with the caveat that different types of case study exist. Seen as the best way of offering insight into the qualities of the organisation if blended with multiple methods.

Source: Adapted from Maylor and Blackmon (2005); Bryman and Bell (2007); Saunders et al. (2009)

4.5.1 Case Study Method

Single, multiple and embedded case studies exist as options to research an organisation and typically this strategy is associated with the use of multiple methods for data collection (Meredith, 1998). A multiple case study offers insight into more than one organisation (Yin, 2011) which is beyond the scope of this research and a field study was deemed unsuitable for the purposes of this specific study (incompatible with research questions) as it would require a deep emersion with multiple organisations (impractical and unfeasible) due to privacy issues as the researcher is employed by Alpha Bank Banking group (a peer institution of potential study organisations) (Blumberg et al., 2011; Yin, 2011, 2015). A single case study was purposely selected in an organisation that was likely to exhibit all the behaviour associated with complex and highly dependent trading systems (case study organisation chosen by design on basis of access and fit with the identified gaps in the literature). Saunders et al. (2009) suggest the researcher must "sense-check" the selected research strategy by placing the research questions alongside the strategy to ensure a "fit". The authors describe three purposeful classifications of research and set out the criterion of each which are;

- Exploratory – valuable means to pose open ended questions, entering into dialogue to discover what is occurring, gaining an insight into a particular topic of interest
- Descriptive – obtain an accurate (categorical) profile of people, events or situations, often an extension of an exploratory piece of research or a precursor to an explanatory piece.
- Explanatory – establishing causal relationships that explains how or why a particular phenomenon occurs.

The research questions that underpin this study and the selection of a case study method means the study format will be explanatory, conducted within a single embedded case study organisation and multiple phases of research to identify and explain the enablers and inhibitors of performance.

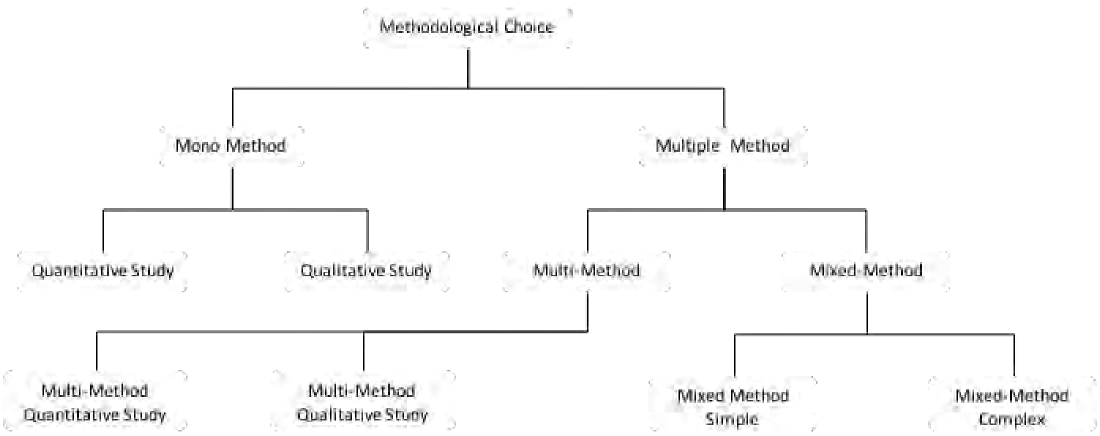
4.6 Methodological Choices

Methodological choices include the techniques that enable the collection of information and data from the object/subject of study. Central to the discussion on techniques is the debate between quantitative and qualitative data (Blackstone, 2012).

4.6.1 Qualitative and Quantitative Choices

Recognising the distinctions between data types enables the researcher to decide the most appropriate methods/techniques to collect data and transform it into useful information. Two fundamental types of data exist, quantitative data (the numerical data) and qualitative data (the contextual data). Quantitative data (associated with positivist philosophies) is highly ordered, observable, and structured (IT system data, census data etc.) (Huberman & Miles, 2002). Qualitative data (associated with interpretivist studies) are unstandardised and open-ended (Goldkuhl, 2012). Whether quantitative or qualitative, data can be collected using a 'mono' or 'multiple' methods. Mono methods are exclusive to qualitative or quantitative data collection and analysis techniques such as a questionnaire and corresponding analytical procedure (Figure 22).

Figure 22: Methodological Choice Breakdown



Source: Saunders et al. (2015, p. 167)

4.6.2 Mono Methods

Tables 37 and 38 provide a brief summary of the strengths and weakness of quantitative and qualitative mono methods in the research context.

4.6.3 Multiple Methods

Multiple methods provide access to a wider range of possible methodological techniques, expanding the options and the ability to explore the object of study (Johnson & Onwuegbuzie, 2004). Within this branch of Figure 22, researchers are presented with a variation on the term 'multiple' which is Multi-method and Mixed method.

Table 37: Strength and weaknesses of Quantitative Study

Strengths	Weaknesses
Testing and validating pre-constructed theories about how, and to a lesser degree, why phenomena occur.	The researcher's categorical design may not fully reflect the views of subjects.
Generalisability of research findings when the data is based on random samples of sufficient size.	The researcher's theories that are used may not reflect reality.
Generalisability of research findings when studies have been replicated on many different populations and subpopulations.	The researcher may miss out on phenomena occurring because of the focus on theory or hypothesis testing rather than on theory or hypothesis generation (called the confirmation bias).
Useful for obtaining information that allow quantitative predictions to be made.	Knowledge produced may be too abstract and general for direct application to specific local situations, contexts, and individuals.
The researcher may construct a situation that eliminates the confounding influence of many variables, allowing one to more credibly assess cause-and-effect relationships.	
Data collection is relatively fast (surveys and secondary data).	
Provides precise, quantitative, numerical data.	
Data analysis is fast when using statistical software packages and graphical output.	
Research results are relatively independent of the researcher.	
Numbers and statistics tend to have higher credibility with many people in power (management and project stakeholders).	
Useful for studying large numbers of people.	

Sources: Adapted from Johnson and Onwuegbuzie (2004)

Multi-method, in its most simplistic sense, is the use of more than one qualitative or quantitative technique (but does not mix the two) to collect data with the corresponding analysis method. The term mixed method on the other hand actively combines the qualitative and quantitative methods each having a specific emphasis and scope within the study and each having an established analytical procedure (Bryman & Bell, 2007).

Table 38: Strength and Weaknesses of Qualitative Study

Strengths	Weaknesses
The data is based on the participants' own categories of meaning.	Knowledge produced may not generalise to other people or other settings (findings may be unique to the relatively few people included in the research study).
Studying a limited number of cases in depth.	Difficult to make quantitative predictions.
Useful for describing complex phenomena.	Difficult to test hypotheses and theories.
Provides individual case information.	It may have lower credibility with some administrators and commissioners of programs.
Can conduct cross-case comparisons and analysis.	Long period of time to collect data compared to quantitative research.
Provides understanding and description of people's personal experiences of phenomena	Data analysis is often time consuming.
Can describe, in rich detail, phenomena as they are situated and embedded in local contexts.	The results are easily influenced by the researcher's personal biases and idiosyncrasies
The researcher identifies contextual and setting factors as they relate to the phenomenon of interest.	
The researcher can study dynamic processes (documenting sequential patterns and change).	
The researcher can use the primarily qualitative method of "grounded theory" to generate inductively a tentative but explanatory theory about a phenomenon.	
Can determine how participants interpret "constructs" (social and technical systems).	
Qualitative researchers are responsive to changes that occur during the conduct of a study (especially during extended fieldwork) and may shift the focus of their studies as a result.	
Determine idiographic causation (determination of causes of a particular event).	

Source: Adapted from Johnson and Onwuegbuzie (2004)

According to Saunders et al. (2015) pragmatist researchers favour mixed methods research designs involving qualitative and quantitative and using inductive, deductive or abductive approaches. Such methods allow the researcher greater freedom to act on information in-flight increasing the likelihood of coming closer to the research objectives. For example, ‘explanatory’ research may employ a qualitative survey asking ‘why’ a particular phenomenon occurs, then transfers to quantitative testing of the hypothesis constructed from the qualitative phase of the study. The same authors go further and describe a method of *“fully integrated mixed method research”* offering the researcher full flexibility to cycle between qualitative and quantitative methods in multiple phases within the study. Such designs presents the researcher with the ability to triangulate analysis midway through the study, improving the robustness of the decision-making process and the accuracy of the overall research results and greater confidence being placed on the research conclusions (Saunders et al., 2009).

4.6.4 Methods Selection

Given the previous discussion, the researcher chose an integrated mixed method approach to the multiple phases of the study. The selection will provide the opportunity to cycle between qualitative and quantitative methods which is a critical feature of ‘Action Research’[46] (See Figure 23). The approach also allows the researcher to be ‘responsive’ to observations and emergent issues that are identified during the reflective stages of the study. The design also allows for ‘in-flight’ triangulation of data and corroboration between methods which supports the internal validity with the action research approach.

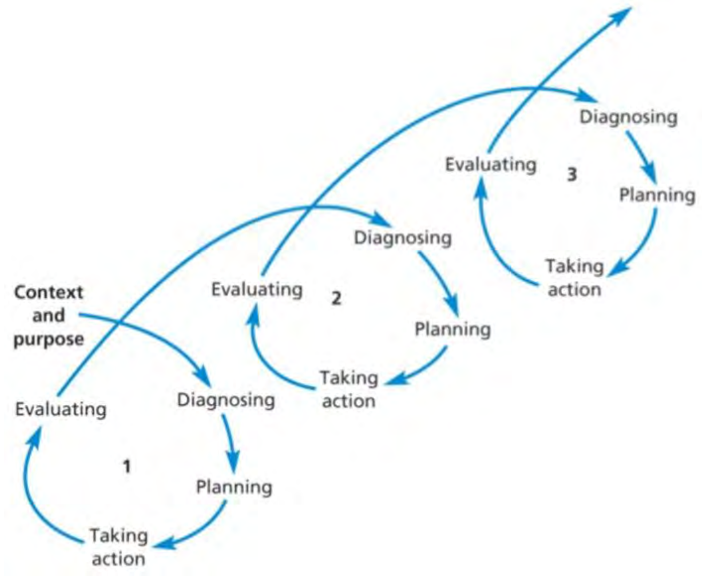
4.7 Time horizons

Time is an important consideration for research studies and case studies may be conceptualised as either cross sectional or longitudinal. A cross sectional study was not deemed appropriate as the case study is the single system (as per the literature review). A

[46] The cyclical steps within Saunders et al. (2009) action research model will be devolved to the organisation to interpret and reflect on their environment. The goal of the research will be to observe and study the mangers as they progress through the study which means the research will remain independent

cross section study would ‘segment’ parts of the organisation and would therefore limit the research to a study of subsystem and a partial explanation of the phenomena (fragmented snapshot). Longitudinal studies allow the researcher to study organisational behaviour over a period of time, which is an important feature, and an aim of this research study is to assess the effects of change over time in order to observe and identify changes with staff behaviours (Saunders et al., 2009). Therefore, the selected time horizon chosen for this case study will be longitudinal in nature and involve several cycles of action research performed by the managers from the case. The researcher will not lead the action research approach, instead he will use observation to reflect on the cycles of action research (see Table 36 for clarification on the decision criteria to accept or reject research strategies).

Figure 23: Action Research Cycle



Source: Saunders et al. (2009)

4.8 Data Collection Procedures and Analysis

Data collection and data interpretation will follow a structured approach, cyclical in nature, and in keeping with inductive research principles. The selected informants are drawn from the management grades and twenty-two managers have been identified as key stakeholders to represent every aspect of the bank's processing departments ('the process'). The managers have an average tenure at the bank of over 8 years which assured the researcher that they were aware and had worked with the systems of the bank. The managers were selected as they hold organisational responsibility for key subsystems and will serve as the facilitated learning group. Managers will then determine how system knowledge and learning will be put to practical use (organisational learning) to improve system performance. Table 39 presents the procedures that will be used to operate the project within the case study.

Table 39: Procedures

Researcher Activity	Management Activity	Cyclical Activity	Procedure
●			Negotiating access and introduction to stakeholders
●			Review and analyse historical managerial surveys
●			Study system performance.
●			Researcher reflections on system performance and managerial view of performance, identify potential gaps
●			Present findings to Managers.
●		●	Observe management's reflective process and document their actions
	●	●	Develop strategies to interpret system information
●		●	Observe management's reflective process as a result of new information/knowledge and document their actions
	●	●	Develop improvement intervention strategies to influence system performance
●		●	Verification of changes to system performance using structured quantitative analysis
●		●	Validation of learning and performance improvement

Source: The Researcher

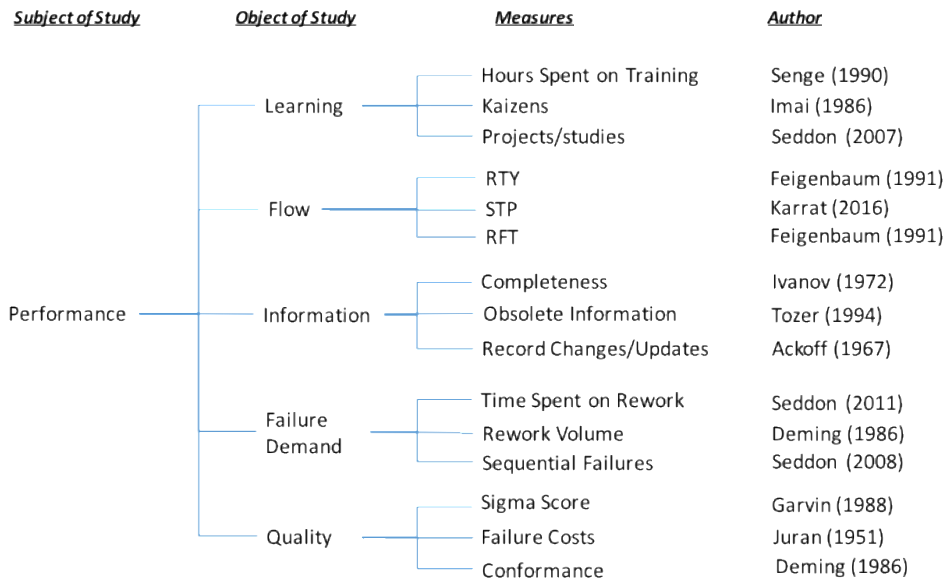
A systematic literature review was undertaken to frame and boundary the study rather than create a strict theoretical framework which would restrict learning. The review identified a gap in the body of knowledge regarding high performance in commercial and investment banking operations. It identified a lack of understanding of how flow and quality processes are managed. The literature review enabled the researcher to contextualise high performance and performance measurement as found in mature organisational settings (where systems are adapted). These findings, paired with the research question "How efficient are commercial and investment banking trading processing systems?" requires the appropriate performance measures be in place within the case study organisation which is not the case.

Commercial and investment banking organisations, notably their operations departments, have been slow to adopt quality and flow measures used by operations gurus such as Deming (1986); Oakland (1995); Goldratt et al. (2004); Slack et al. (2010) and of Seddon (2008a) who came closest to doing so in the service industry of retail banks but stopped short of any studies in commercial and investment banks. Almost all publications and studies regarding performance management in commercial and investment banking operations have been dominated by a few management consultancies as opposed to rigorous academic studies (Bremner et al., 2011; Dietz et al., 2014; Manyika et al., 2014).

The researcher found few performance management metrics that sufficiently described the operational environment of commercial and investment banking with the exception of the Cost Per Trade and Straight Through Processing measures (a single measure does not have the same contextual power as a methodological framework). These measures fail to fully interpret quality, flow and efficiency of the system (which will be demonstrated later in the document). The existence of this gap has required the researcher to design a performance measurement framework to allow the study to continue and - with good intention – to provide a more robust account of operational performance and – importantly – how it is achieved and improved upon.

The researcher reflected on the comprehensive literature review process identifying the key authors and their contributions to OM, Quality Management, MIS and Systems Theory. This process has illuminated five metrics which according to the literature hold a significant relationship with high performance. They are Learning, Flow, Information, Failure Demand and Quality. The researcher has designed a horizontal flow diagram defining measurement 'feedback' channels from measure through to performance metric (see Figure 24). This measurement framework presents the choice available to collect information and data to analyse and interpret cause and effect relationships that promote or inhibit performance. During the course of the study the researcher discovered that the measures were of greater practical utility when they were combined into a performance metric. For example, the researcher combined flow measure (RTY) with learning measure (time developing skills) which demonstrated a link between learning, flow and performance (findings presented in detail in chapter 10.3.3). Figure 24 is a flow-down from Figure 14 the learning Infinity Loop.

Figure 24: Performance Measurement Framework[47]



Source: The Researcher

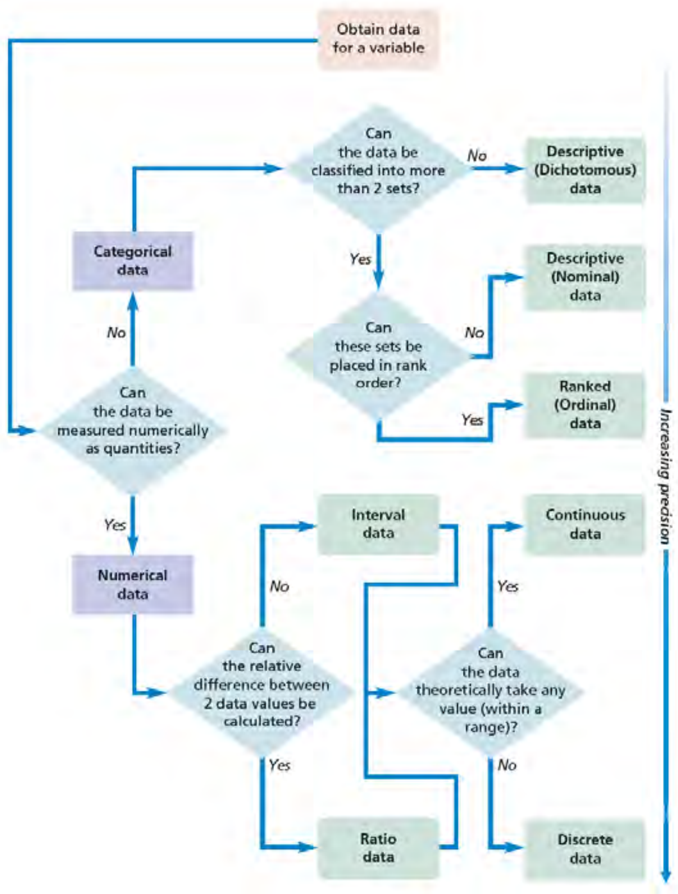
The researcher would like to make clear that, at the outset of the project these measures may not be readily accessed or collected by the case study. Nonetheless, the framework shows the choice and availability of measures within each of the key performance indicators (object of this study). To operationalise the framework in a way that benefits the case study project, the researcher has shared a copy of the framework with his director of studies, operations managers and IT and discussed the combined data collection requirements.

[47] The researcher would like to clarify that these measures may or may not be present at the case study and would require managers to collate such information.

4.8.1 Secondary Data

The researcher collected extensive historical quantitative data produced and obtained from trade processing systems (secondary data). Saunders et al. (2015) provide a flow chart (Figure 25) of “data-types”. At the early stages of the project, determining the appropriate types of data to describe performance will dictate the researcher’s ability to perform a robust analysis and detect the issues affecting performance. Therefore, special planning and consideration has been given to the types of data that can be requested from the case study. Following the guidance of Saunders et al. (2015) and the data collection layout of Figure 16, a data collection plan (see Table 40) has been constructed which will act as a management tool for the data collection requirements necessary to conduct the first phase of the investigation.

Figure 25: Types of Data Collection



Source: Saunders et al. (2015, p. 499)

Table 40: Data Collection Plan

Data Collection Plan		**Planning - Who, How, Where and When**						
Data Measure	**Measure Type / Data Type**	**Who will collect the data?**	**How/where recorded?**	**Related conditions to record (i.e. time of day, month, shift, team, location, etc.)**	**Frequency / timing (e.g. how often and at what intervals will the data be collected?)**	**Sampling notes (any conditions or characteristics about the sample that should be noted)**	**How will bias be minimised?**	**How will the data be displayed? What graphical tools will be utilised to summarise the data collected so it can be analysed?**
Sequential System Layout	System architecture	Managers	Process map from systems architecture documentation	No changes to be made to system architecture during study period.	N/A		Invite subject matter experts from IT and Business functions into the map meetings.	Architecture maps which will be changed into System flow diagrams.
Volume of products	Continuous	Systems IT	System extract	Full month of trade data.	Month end	Split by asset class, product type and trade booking system.	Consistent measurement system.	Time Series Plot and Scatter Plot, SPC.
Multiple Client trading records	Continuous	Static Data Dept	System extract	Snapshot of present day.	N/A	Full dataset of month on month amendments.	Consistent measurement system.	Pareto Chart. Time series plots.
Task time (time spent on daily task in fulfilment of trade flow)	Continuous	Ops managers	System extract	Continuous	Daily	Any system outage, maintenance or upgrades.	Consistent measurement system.	Time Series Plots, Box plots, Pareto, descriptive stats.
Method of STP computation	Continuous	IT & MI Delivery	System extract & AMI database	Summit & Murex Exception and Trade Vol.	Month end	Exception Volumes for three months.	Consistent measurement system.	Data tables to model the different computations.
Exception Volume	Descriptive	Systems IT	System extract	Full month of trade data.	Month end	Product, exception description, time, and duration to repair.	Consistent measurement system.	Pareto Chart.
Time spent on training	Continuous	Ops Managers	Training log	Type of activity.	Month end	Time, activity role.	Management verification.	Correlation scatter plot.

Typical data collection must be executed using a statistically significant "probability sampling" technique when testing for causality (to a degree of certainty) according to Saunders et al., (2015 pp.275-281). The imbedded nature of this project allows the researcher direct access to corporate databases and a team of IT database developers. This rare level of access permits the collection of "population" or "continuous" sampling data over a prolonged period which significantly increases the accuracy (to an extremely low margin of error) thus strengthening the conclusions made from the dataset (Bryman & Bell, 2007; Saunders et al., 2015). This is both time and cost efficient and is a risk averse strategy. Performance data will be analysed with the intention of identifying cause and effect relationships that inhibit or enable performance. Quantitative data analysis will be performed using statistical techniques found in the literature of business research and quality management. Such techniques may include; Two Sample T-Test, Two Proportion T-Tests, Pareto Charts, Time Series Plots, Descriptive Statistics, Statistical Process Control Charts, Scatter Plots, Trend Analysis and Peron's Correlation Coefficient (Oakland, 1995; Hayler & Nichols, 2007; Saunders et al., 2015). The data collected and tested during each phase will be declared during each field research chapter.

4.8.1.1 Observational Data Capture

Direct first-hand "eye witness" accounts of social action have always been regarded as an essential technique in answering "What is going on?" (Schwandt, 2005). Participant observation and structured observation are methods that generate information about social interactions characterised by events and actions, enabling the researcher to construct meanings set inside a specific social context. However, the latter is concerned with frequencies of action rather than why they occur and was rejected by the researcher as an effective method for this case study. Theorists have criticised the technique as being a passive recording of correspondence between beliefs and observable facts (Schwandt, 2005) although Saunders et al. (2015) assert observational research and an immersion into an organisational setting is important as the researcher learns from direct experience of the social situation. Moreover, they assert participant observation has been used extensively with utility in industrial sociology. Table 41 summarises the observation method as a means to obtain data.

Table 41: Advantages and Disadvantages of Observation

Advantages	Disadvantages
It is good at explaining 'what is going on' in particular social situations.	It can be very time consuming.
It heightens the researcher's awareness of significant social processes.	There can be high levels of role conflict for the researcher (e.g. 'colleague' versus researcher).
It is particularly useful for researchers working within their own organisations.	The closeness of the researcher to the situation being observed can lead to significant observer bias.
Some participant observation affords the opportunity for the researcher to experience 'for real' the emotions of those who are being researched	The participant observer role is a very demanding one, to which not all researchers will be suited.
Virtually all data collected are useful.	Access to organisations may be difficult.
	Data recording is often very difficult for the Researcher.

Source: Saunders et al. (2015)

The case study is an industrialised setting, requiring deep immersion of the researcher and as such observation was duly accepted as a legitimate means of contextual recording and data collection. Participant observation demands the researcher maintains a "practical independence" to ensure the researcher is close enough to understand the social situation but remains objective (researcher living among the participants) (Saunders et al., 2015). Saunders et al. (2015, pp. 358-360) argue the researcher must act as "observer-as-participant" allowing engagement in dialogue and discourse with informants (in this case managers within the organisation) but not leading decision-making. The implication is that action research will allow the researcher to observe change that results from management learning and adaptations from system feedback. The researcher will document his observations regarding choices and behavioural changes of managers when they are involved in action learning in the working environment, using journal entries concerning managerial decisions taken to improve performance of the systems.

4.8.1.2 Historical Management Surveys

A managerial survey conducted by the case study organisation have been made available to the researcher[48]. This particular survey was conducted approximately five months before the beginning of the field research for this thesis but the information presented can be considered current. The employee survey group involved four tiers of management and includes twenty-two respondents. The survey was designed as a questionnaire and was self-completed using an internet-based web portal. The topics covered within the questionnaire follow the themes of this study - operational performance and the enabling factors. The rationale to include the survey in the research is based upon its criterion related validity (Saunders et al., 2015), providing a description of management experiences within the organisation. Initial review of the data indicates the existence of performance inhibitors, from the viewpoint of experienced functional managers, which is rich in detail as perceived by internal informants (Johnson & Onwuegbuzie, 2004). The survey was both quantitative and qualitative in design[49] and the results were shown as descriptive statistics including proportion graphs, thematic analyses, expressions, and patterns relating to operational performance (Alreck & Settle, 2004). The graphical output is likely to consist of word-trees and word-cloud cluster diagrams.

4.8.1.3 Learning

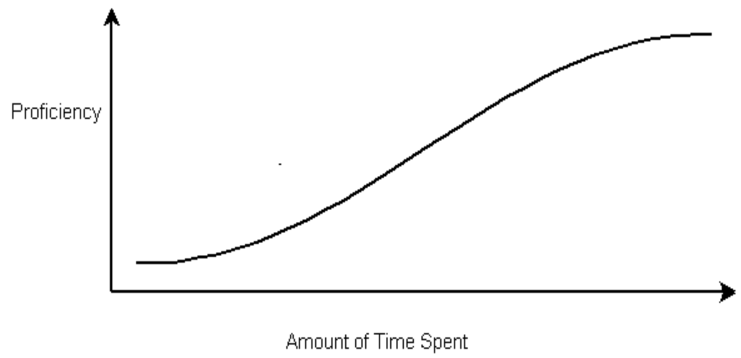
Many researchers have studied the psychology of organisational learning in distinctive and diverse settings[50]. Several studies declare that a correlation exists between learning and gradual performance improvement although the performance measures used in such studies are as varied as the organisational setting (Trist & Bamforth, 1951; Argyris, 1976; Senge & Sterman, 1992; Seddon & Caulkin, 2008). Neely et al. (2005) point out that selecting

[48] The pre-existence of the questionnaire survey is regarded as interesting but will not be weighted high in importance given the composure (wording) of survey questions preceded this case study.
[49] The questionnaire was composed of a mixture of questions, including discrete “yes/no” questions; attribute questions “rated1 to 5”; and “open question” elements which allow for a rich, contextual and experiential data collection.
[50] The methodological protocol used for this thesis draws from Revans (1980) – a sociotechnical systems researcher – who used action learning to support work-based learning as a research process in itself (Leonard & Lang, 2010)

performance metrics that correlate to, and directly measure, the effects of learning presents a significant challenge to the researcher. Neely et al (2005) propose within action learning: *"performance measurement can be defined as the process of quantifying the efficiency and effectiveness of action …[in this context]… a performance measure can be defined as a metric used to quantify the efficiency and/or effectiveness of an action ...[on a system]. A performance measurement system can be defined as the set of metrics used to quantify both the efficiency and effectiveness of actions"* (Neely et al., 2005, p. 1229).

Research to date has tended to correlate 'learning' with 'status quo' measures which include a combination of unit cost, quality, productivity and customer satisfaction (Speed, Yield, Net Promoter Score) also known as Key Performance Indicators (KPI's) (Senge, 1990; Feigenbaum, 1991; Oakland, 1995, pp. 163-184). Numerous attempts have been made to scientifically model and analyse the 'effect' and the 'effectiveness' of organisational learning across industry sectors. Such studies have generated theoretical models known as 'learning curves' which measure the effect learning has on organisational performance (Hax & Majluf, 1982; Argote & Epple, 1990). Argote (2013), a professor and researcher of organisational behaviour, supports the creation of learning curves as a suitable means to measure learning in the organisational context (including service organisations). Argote supports the correlation of measures such as 'time' spent on action learning activities (individual and team problem solving) and KPI's that support the effectiveness of learning on performance. Further, a measure of learning may also include the 'quantity' of action orientated initiatives undertaken by an organisation. Carefully aligned learning abilities (aligned with improved performance) have the capability to provide an organisation with a competitive advantage (Argote & Ingram, 2000; Seddon, 2008a). Studies show measures such as costs, defects and production inhibitors to flow will decrease as staff become proficient (knowledgeable) at performing tasks through interaction with the production system (the environment) (Argote & Epple, 1990; Argote et al., 2000; Seddon & Caulkin, 2007; Seddon, 2008a). See Figure 26 for a basic example of a learning curve model.

Figure 26: Learning Curve Model



Source: Malaher (2007)

The challenge faced by the researcher within the case study is to select a measurement system that can quantitatively measure the effectiveness of organisational learning as a result of management-led improvement interventions. Considering the brief review, the researcher has chosen two measures which will build towards the final measurement systems and metric used to evaluate the project. Firstly, the Time (hours) individuals spend on training activities will be captured and secondly, the Number of Intervention (NOI) initiatives undertaken within the case study organisation (the operations office) will also be captured[51]. The learning measurement will be captured by an organisational log conducted by each management informant and shared with the researcher on a monthly basis. However, as found in the literature, the effectiveness of learning may not be immediately demonstrable and the effects on performance may lag in time[52].

The second measure required to complete the correlation is the measure of 'flow'. Suitable measures of operational performance must fit the case context and only when both flow and learning measures are combined will it be possible to evaluate the outcome of the research.

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[51] It was considered that these measures would be good indicators of the health of an improvement programme.
[52] The researcher will be mindful of such a lag and allow enough time to elapse before analysis and conclusions are drawn on the outcome of the research.

4.8.1.4 Flow

The literature review has defined ‘flow’[53] and presented associated measures. Flow is characterised by the ‘arrival’ of materials and resources (inputs) by means of ‘coordinated’ activities enabling seamless ‘conversion’ (processing) of materials and resources into complete products and services (outputs). Outputs are ‘disposed’ of (delivered to the consumer) at a predetermined timeframe without need to stockpile (at any point). In essence ‘flow’ is the balanced movement of all activities and resources across the value-chain in a coordinated manner (Womack & Jones, 2003, pp. 50-66).

Straight Through Processing

Commercial and investment banking operations use an industry standard measure called Straight Through Processing (STP) as a metric of flow (Ricketts, 2013). This measure was an innovation of Mr James Karat – a practicing senior manager in the London financial services sector[54]. STP computes a “yield” measure of flow performance (automation performance) and is calculated at two ‘levels’ within trade flows: Firstly, the subtask level or ‘process step’; and secondly the End-to-End level or ‘overall system’ level (amalgamation of all sequential steps). See equations 2 & 3 for STP calculations.

Equation 2: Step STP

$$Step\ STP = \frac{\#\ Exiting\ process\ step\ without\ intervention}{\#\ Entering\ process\ step}$$

Source: Smith (2009); Karat (2016)

[53] Defined as “the unimpeded movement of information and materials through an organisation at the desired rate (speed) to match the external demand on the system for products or services” (Ohno, 1988).
[54] Despite the dominance of the measure, the researcher has found no published academic articles on the subject but has found many sector reports and industry material stating the fact (including Wikipedia) and the researcher has interviewed Mr Karat during this study.

Equation 3: End-to-End STP

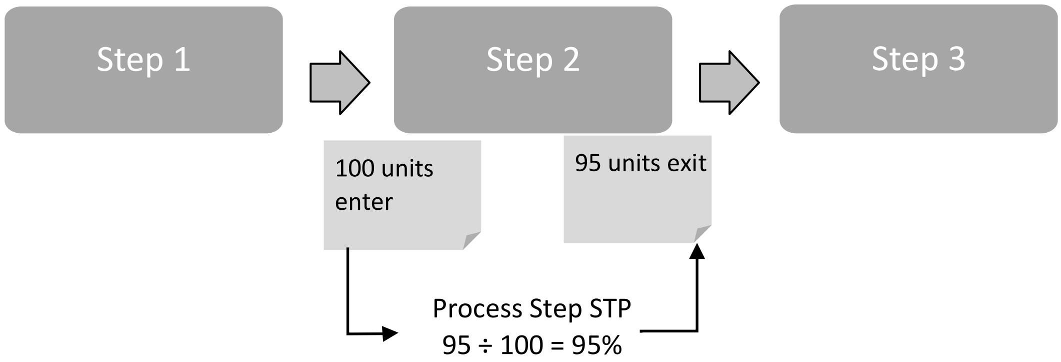
$$End\ to\ End\ STP = \frac{\left(\frac{\#\ Exiting\ process\ step\ without\ intervention}{\#\ Entering\ process\ step}\right) + N}{\#\ Process\ Steps\ in\ the\ production\ System}$$

Source: Case Study Organisation (2013)

Depending on the perspective of the system designer both metrics achieve the same desired outcome: a measure of flow performance. The difference in perspective appears to be that system designers view trade ‘processing’ as either one encompassing task (as demonstrated in Equation 1) or as a series sequential tasks (demonstrated by equation 2) (Marlor, 2014). Considering the individual subtask arrangement (steps) within the sequential production system, each step is managed/administered (which includes rework/repair tasks on that particular step) by a dedicated team of subject matter experts (functional specialists) who work exclusively to ensure all trades flow out and onto the adjacent step.

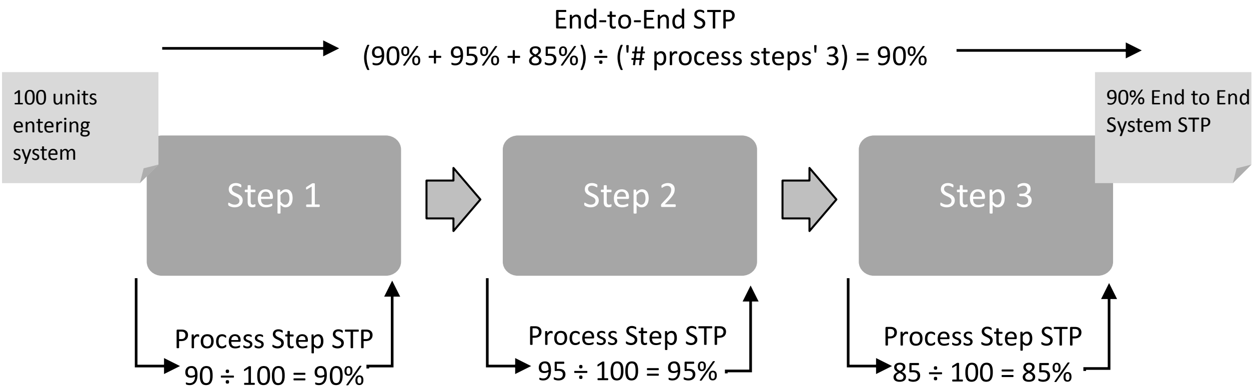
Functional managers lead the team and are responsible for the automated performance (STP) of the particular step. A simple example of STP at the step level is shown in Figure 27. Senior managers sit above functional managers within the organisational hierarchy and take a higher level view of the production system and are primarily accountable for the End-to-End STP performance. The End-to-End Measurement appraises the production systems’ ability to process a trade without creating the need for manual intervention (rework). Senior and functional managers are responsible for, amongst other product administration tasks, increasing efficiency and performance of the production system. A simple example of End-to-End STP is shown in Figure 28.

Figure 27: Step STP



Source: Karat (2016)

Figure 28: Example End-to-End STP



Source: The Case (2013)

The researcher found the measurement of flow to be a characteristic of most, if not all, industrial processes, both manufacturing and service. The features of flow within an organisation are strikingly similar, principally the speed and successful movement (flow) of materials and information. STP is the primary measure of trade performance in banking (Ricketts, 2013; Investoo.com, 2014; Marlor, 2014), capturing the capability of individual trades to enter and exit the production system within a time frame, thus measuring flow performance. The researcher has accepted the STP metric as an appropriate measure of flow performance to assist with providing an answer to the research question.

4.8.2 Primary Data Collected from the STP Designer

This phase of the research is qualitative and focuses on in-depth information, gathered from a single informant who was chosen purposely to generate expert insight. The researcher adopted a semi-structured interview method executed during a single interview, on a one-to-one basis between the identified subject matter expert and the researcher. The interview consisted of seven themed questions which were used to explore the informants' perspective on the enablers and inhibitors of flow performance measurement within commercial and investment banking. The design of the semi-structured interview offers the informant freedom to express their particular views and experiences, while allowing the researcher to invite the informant to contextualise areas of interest to the investigation, should the need arise.

The data collected was used to assist the researcher generate insight (and quotations) concerning how poor quality performance affects flow in dependent sequential trade processing systems. The expert perspective was used to inform the researcher's analysis. Furthermore, the interviewee was the designer of the primary measure of flow performance for the entire industry and would be able to identify known limitations to the measure, the impact of system automation of highly complex trade processing and provide a narrative of the industry and its changes[55]. The informant agreed that named quotations and direct references could be extracted from the interview which adds gravitas to the research study and its impact/generalisation.

4.8.3 Data Collection Procedures and Analysis Summary

The research uses primary and secondary data for triangulation purposes and to build in multiple cycles of action research undertaken with managers at the case study (Yin, 2011; Saunders & Lewis, 2012; Yin, 2015). Action learning is used to theory build from actions to

[55] The informant and researcher are known to each other but only through shared membership of professional banking network groups.

improve the banking system, using measured data and verified using multiple data streams drawn from the production system. A summary of the data collection methods and techniques are shown in Table 42.

Table 42: Data Collection Techniques

Data Collection	Technique
Observations	Journal logs of observations witnessing the flow of work and the actions of managers as they explore and learn from system feedback
Primary Data	Semi-structured interview
Secondary Data	Quantitative: Performance data and information collected from IT systems. Qualitative: Analysis of historical managerial surveys conducted by the organisation ahead of commencing the case study investigation
Reflective Groups	Operations managers review system data/information to build learning constructs where they test assumptions that affect performance
Group Participants	Management and subject matter experts involved in work flow execution
Triangulation of results	Multiple data points drawn from different parts of the operational work flow

Sources: Adapted from Saunders et al. (2015)

4.9 Ethical Considerations

The study complies with the British Psychological Society code of standards for research and the policies contained within the Code of Ethical Conduct stipulated by Cardiff Metropolitan University. Based on discussions with university experts and a review of ethical protocols there were no ethical issues identified with the design and execution of the study.

4.9.1 Ethics and Secondary Data

The researcher has discussed the research methodology, strategy, approach and data collection techniques with the director of operations (project sponsor) at the case study organisation. Secondary data will form the main source of data for the study and includes data from historical management surveys concerning management perception of performance enablers and inhibiters and performance related extracts retrieved from the case's IT systems. This makes up the main proportion of the data that will be used to answer the research questions. No ethical issues were encountered with the research in this regard.

4.9.1.1 Historical Management Surveys

The case study organisation has granted access to management surveys conducted by the case study organisation and other reports. The researcher applied and received approval to use this data from the university ethics committee. The desire to utilise this data was to capture a snapshot of the leadership ambition to improve system performance in the wake of the MGT (2011) report that shocked the case study. A second survey was distributed to the senior and functional management cohort in an attempt to understand whether management had a combined view of the problem. The data was treated with the same ethical considerations as primary data. Each respondent’s personal information such as their name and job title was summarised to their managerial level and their names coded to ensure anonymity. For example: “Informant #1 Senior Manager”. No personal information will be stored and all surveys will be permanently deleted upon completion of the analysis.

4.9.1.2 Observational Data

Observational data was recorded using journal entries comprised of researcher reflections on day to day events as the project team proceed with the case study. The researcher has disclosed his identity and disclosed the objectives to the informants, providing notice when observations are being taken within meetings and conversations. No experimentation or manipulation of the working environment was undertaken as part of this study. All informants are management employees of the case study and are of working age between 18 and 68. Moreover, the names of the managers were not used to distinguish any particular detail of the observations collected. The managers were informed of their rights to withdraw from the observational study at any time without consequences.

4.9.2 Ethics and the Expert Interview (Primary Data)

The final research stage involved a semi-structured interview with an industry expert and consultant (who has no professional association with the case study). As such, the intended interview required additional ethical approval. The university ethics committee was provided with a full justification and detailed specification of the techniques and risks/mitigation activities used as well as an interview protocol[56]. The data collected by semi-structured interview was used to assist the researcher to adopt another view of how poor quality performance affects flow through dependent sequential trade processing systems and in the wider context of the commercial banking industry. The informant (designer of the primary measure of flow performance) provided great insight into the limitations of the metric and the development IT system automation of trade processing.

4.10 Access

The case study - a global commercial banking institution - is located in the city of London and access was successfully granted for the duration of the research. The researcher was given access to the director of operations (the champion) and his immediate executive management team, consisting of departmental heads and business managers (the learning and steering committee). Access was granted to interact with staff from the operations office (at senior and middle management levels who perform the role of system designers and administrators) and IT systems specialists (to support the collection of secondary data from production system IT databases)[57]. As the researcher is embedded in the case study, social system researcher objectivity was maintained to avoid reflexivity and to maintain the impartiality of the researcher.

[56] The documentation supplied to the committee included the participant information sheet, the participant consent form and a copy of the semi-structured interview questions. No primary information would be stored after the closure of the research.
[57] The researcher is a quasi-employee and was engaged on a fixed term services supplier contract with the case study. The contract commenced several months before enrolling on the DBA programme.

4.11 The Research Process

To assist the reader, the research process will now be presented (Table 43):

Table 43: Data Collection Techniques

Stage	Commentary	Chapter
Systematic Literature Review	The scoping of the literature to create the literature gap in the body of knowledge.	3
Access and Initial Field Research	Positioning the case study organisation within the global commercial and investment banking context	5
Reflective Period	Researcher reflects on learning and 'sense makes' from the research phase undertaken.	
Field research cycle #1	Analysis of management survey responses regarding performance measurement and potential sources of system dysfunction.	6
Reflective Period	Researcher reflects on learning and 'sense makes' from the research phase undertaken.	
Field research cycle #2	Observation of management learning as a result of intervention exercises to determine root cause of system dysfunction leading to poor performance and also the improvement initiatives taken to increase performance	7
Reflective Period	Researcher reflects on learning and 'sense makes' from the research phase undertaken.	
Field research cycle #3	Documents the learning journey of management as they rationalise the outcome of system interventions.	8
Reflective Period	Researcher reflects on learning and 'sense makes' from the research phase undertaken.	
Field research cycle #4	Follows the design and implementation of a new management information system to measure trade flow performance. Double loop learning at management and administrator level occurs for the first time in the study.	9
Reflective Period	Researcher reflects on learning and 'sense makes' from the research phase undertaken.	
Interview with Industry Expert	Interview with Mr James Karat to gain an alternative perspective on the industry and its flow and performance issues. Used as a narrative to support the growing theory building of the researcher.	10
Reflective Period	Researcher reflects on learning and 'sense makes' from the research phase undertaken.	
Analysis	Triangulation of findings between the literature and the data captured at the case study	10
Conclusions	Highlights the enablers and inhibitors of trade flow performance, providing answers to the research questions and sets out the context for future academic research and the areas of opportunity for professional and practice	11

4.12 Limitations

The main limitation of this study involves developing theory from a single case study organisation (Yin, 2011). The complexity of the study and gaining access were reasons to purposely select a single case. The study is set within a time period whereby the commercial banking industry is in turmoil due to uncertain global economic conditions which may influence some decisions undertaken by the management team (e.g. lack of funding for change/investments). Generalisability of the single case study findings will be on the basis of 'equivalence' to similar organisations conducting comparable services through a dependent processing system. The design of the study excluded the direct engagement with bank traders deliberately to narrow the scope to process improvement.

4.13 In Summary

The research commenced with a systematic literature review. After consideration of the relevant philosophical and methodological literature, in relation to business management studies and the purposeful development of new knowledge within the context of a complex banking organisation, the researcher will build a theoretical framework (locating himself within "the onion"). From a planning perspective (according to Saunders et al. (2009)) the researcher has located himself within the academic 'onion' model making purposeful decisions with regards to philosophy, approach, strategy, choices, time horizons and data collection. The researcher will approach the research from a systems perspective choosing an embedded case study using an inductive approach composed of cyclical iterations of investigation. The organisation will be observed using a realist perspective, critiquing the social environment with the objective of generating new theory and adding to operations management knowledge. Data collection and analysis will be performed using mixed-methods in an inductive capacity to provide explanatory conclusions to the research questions and further insight into the phenomenon of high performance banking operations. The data collection techniques will be based principally on quantitative secondary data in the form of; systems extracts, qualitative historical management surveys and gathering the reflective observations of the researcher (as the embedded study is conducted over a sustained period of observation over approximately 12-18 months). One instance of primary data collection will take place by means of a purposefully selected informant. The informant's input to the study will provide a narrative response - thus a qualitative evaluation will be conducted highlighting key themes and patterns, enabling the researcher to position the output from the secondary analysis. Moreover, the summation of all data collection and analysis will produce a “data rich” body of evidence in both qualitative and quantitative form. The data output will enable the researcher to triangulate research findings using multiple sources, building a thorough and robust account of performance and answering the research question and reflective conclusion to be drawn on the case study.

Chapter 5: Alpha Bank Case Study

5.1 Introduction

This chapter will provide a brief contextual sensitisation for the reader and explore the impetus for a change project at the case. The case is a large UK financial institution with over 100,000 employees in the UK and offices located in other major financial centres around the world. The case has located its chief operating office and trading global operations office in the city of London. The case owns and operates multiple brands (divisions of the corporate body), the core of which is the Commercial Banking arm (the subject of this study). The exact boundary of the study concerns the processes and systems of the Commercial Banks' Operations Office. The office is also located in the city of London and is responsible for global financial trades and momentary flows. Handling of global transaction requires the office to operate on a 24-hour, 7-day per week model.

The operations office provides a vital service to the Commercial Bank by supporting the 'front office' sales teams by operationalising trade transactions and ensuring the flow of cash, securities and contracts across the international financial markets. The Operations Office's primary administration duties are to 'incept' trades and to issue and confirm 'contracts' (where applicable), 'settle' and reconcile all financial flow on behalf of the front office sales traders and 'market makers'.

To service the 'front office', the Operations Office is comprised of a "middle office" (trade due diligence and reporting) and a "back office" (settlement and reconciliations) functions. The nature of the business conducted is fast paced and high risk with transactions totalling over 15,000 markets trades daily at a gross value of circa £550 billion daily. The bank operates 130 different currency accounts providing access to the majority of the world's markets, enabling the bank to provide high-value financial products and solutions to national and international businesses and investor clients.

5.2 The External Environment

Chapter 1 presented a summary of the collapse of the banking industry spanning 2007 to 2010. The path to recovery is still very much a journey of discovery for banking institutions whose livelihood and profits have rarely been challenged. The emergent issues facing banking institutions were the result of their failure to recognise and react to system inefficiency and poor governance controls. The external environment (the markets) is uncertain and there exists a constant state of competition and flux which has increased since the events of 2008.

As banking organisations seek stability and a return to profit through effective cash flow management, they are also engaged in a process of “survival of the fittest”. Processing efficiency is a key area of attention and so too is the “ability and speed of adaptation”. Economic instability and market regulation has led to unprecedented levels of change on a size and scale unseen by the industry (FSB, 2012; Monaghan, 2014; Price Waterhouse Coopers, 2015). Three of the most significant and far reaching reforms driving the change agenda are:

- Dodd - Frank (Wall Street Reform and Consumer Protection Act)
- MiFID (Markets in Financial Instruments Directive)
- EMIR (European Market Infrastructure Regulation)

The new emphasis on risk management and “controls” to safeguard the higher threshold of capital and liquidity within the banking system are designed to protect all investors[58]. Governments have turned to their domestic banking regulators to oversee the implementation, governance and on-going compliance of the banks which has increased transparency as well as the pace of change/improvement. Prohibitively high penalties and poor competitiveness exist for those who are slow to comply with the required rate of change (see Table 44).

[58] The process covers investors of every size and public as well as private organisations.

Table 44: The Extent and Cost of Compliance

The Cost of Compliance
JPMorgan employed 4,000 additional compliance staff in 2013 and spent an extra $1billion on controls. The spending came as the lender agreed to pay large fines to settle a range of compliance issues including the London whale.
Deutsche Bank's 2014 results included €1.3billion in extra regulatory-related spending. €500million was described as "temporary or one off", another €400million was related to regulatory projects which have not yet been completed and the final €400million was for "incremental headcount to comply with additional regulatory requirements" and extra charges such as bank levies.
Citigroup noted that about half the bank's $3.4billion efficiency savings were being consumed by additional internal regulatory and compliance activities.
UBS spent 900million Swiss Franks ($946m) on regulatory demands in 2014. $400million of this are permanent costs
In September 2013, HSBC took on 3,000 more compliance staff, bringing the total number working in compliance to more than 5,000. That number has since increased to more than 7,000 according to the bank's latest annual reports. The 2013 hiring came after the bank was fined a record $1.9bn

Source: Adapted from Noonan (2015)

The regulatory impact on this case study is unavoidable and peer institutions are engaging in improvement to increase efficiency and re-invest savings to fund additional reactions to the regulated market conditions. Organisations that improve towards higher performance and efficient work systems (as seen in the case of Citi Group) produce a competitive advantage? and/or bolster profits and the case study faces these challenges[59]. Therefore, this study of efficiency to identify the enablers and inhibitors to processing flow is a significant organisational change programme.

5.4 Commercial Banking Products & Service Providers

Alpha Bank participates in the global markets, trading with peer institutions, large corporates, mid-markets and SME clients. It has an extensive product range enabling the bank to deal directly in foreign and domestics markets under the five principal asset classes; Foreign Exchange, Bonds (primary and secondary), Money Markets, and Derivatives (Table 45). The products (known as "instruments") belong to an asset class. The bank can therefore conduct financial business throughout the world and 24 hours a day. The products offered by Alpha Bank are risk management products to mitigate or hedge against the

[59] Change will cost the industry and case study organisation hundreds of millions - perhaps billions - over the course of the next three to five years to respond to the change in environment.

effects of market forces which could negatively impact the client or the bank itself[60], and investment products (money making instruments). A single trade (agreed between the dealing bank and the client) will typically result in multiple trades to hedge any risk exposure.

Table 45: Alpha Banks Core Products

Asset Class	Products	Description and Purpose
Money Market	Loans	Medium to long-term product comprising Corporate Loans, Real Estate Financing and Loan Syndication. This instrument is offered to Mid Markets and global corporates for national and international clients.
	Deposits	Short, medium and long-term cash deposits offering a low risk and low return investment.
Foreign Exchange	Spot	Spot trades are foreign currency exchange trades between a currency pairs a buy and a sell currency. The previous sentence doesn't make sense to me. The value of the currency trade is valued on the "spot" rather than at some point in the future.
	Forward	A forward exchange contract functions in a similar fashion to a 'spot' trade however the agreement is to exchange currencies at a time in the future at a fixed rate.
	Option	A currency option contract allows the holder to buy or sell currency at a pre-agreed rate. A contract premium is paid by the holder of the contract. This product is used as a hedging instrument against adverse exchange rate movements.
	Swap	Currency swaps are a bilateral exchange of principle and interest in two different currencies, typically paired with a loan product.
Primary Bonds	PBI	Primary Bond Issuance is an instrument which issues 'new' bonds on behalf of a large corporate into the market to raise large sums of capital from investors (>50 million) and is a long-term investment product.
	MTN	Minimum Term Notes is a debt instrument issued into the market by organisations to raise capital and provide liquidity. MTN's are traded on the open market which offer the purchaser a 'coupon' payment on a regular basis.
	CD	Certificate of Deposit is a medium term (1-5yr) fixed maturity and fixed interest rate product issued by commercial banks as a funding vehicle.
	CP	Commercial Paper is an unsecured short term financing instrument issued by banks to assist organisations generate capital for periods typically less than twelve months.
Secondary Bonds	SB's	Secondary Bonds are corporate bonds exchange traded on the open market between investors.
	Repo's	Repurchase Agreement are short term agreements between dealer organisations using bonds and other securities which are 'swapped' for cash. In essence a 'repo' is a collateralised short term loan which offers the holder of security an interest payment while in their possession.
	Gilts/Gov Bonds	Sovereign government bonds (also known as UK 'Gilts') are generally low risk and long term fixed income investment products

(Continued over page)

[60] Products are rarely transacted on an individual trade with the bank and are complex combinations of instruments.

Asset Class	Products	Description and Purpose
Derivatives	Forward Rate Agreements	An "over the counter" contract between two parties fixing the rate of interest payable by the purchaser of the FRA on loans or other instruments that are 'derived' from 'floating rate obligations' such as the Bank of England base rate.
	Caps & Floors	Caps and Floor are products that set upper and lower limits regarding the amount of interest payable. An interest rate cap is a contract in which the seller agrees to compensate the buyer for the difference in value if/when a variable interest rate on a derived product exceeds the agreed rate in the bilateral. A Floor contract works in reverse and is used to 'hedge' the buyer against a drop in interest rates. Caps and Floors are usually purchased in tandem.
	Futures	A futures contract obligates the buyer (or vice versa) to enter into a financial product or buy a commodity at a predetermined price.
	Swaps	A swap is a contract in which two parties exchange financial instruments. Predominantly swaps are interest rates based on a notional amount of money. This money is the 'principle' - however money never changes hands - only the difference in interest is exchanged. This is dependent on the difference between the fixed rate position and the market floating rate.
	Swap Options	A swap-option gives the buyer an "option" but not an "obligation" to enter in to a swap contract (typically an interest rate swap). The buyer will pay an "option premium" over and above the price of a swap contract.
	SIPS	Structured Investment Products are derived from a mixture of products arranged specifically to meet the needs (risk tolerance) of an investor. Layers of products - typically involving layers of fixed income (bonds) and other derivatives - hedge risk exposure, creating a stable investment product
	DCD	Dual Currency Deposits are fixed terms deposits in one currency and on maturity they are settled in another. The investor carries the risk of exchange rate movements.
	TRS	Total Return Swaps is an agreement whereby one party makes payments based on a rate (fixed or variable). The counterparty makes payments based on the return of a derived asset which is typically pegged with the performance of a Bond, MBS & ABS Are MBS and ABS explained/referenced somewhere? Loan, or Equity Index without owning the physical asset - however gaining access to the return performance.
	ILS	Inflation Linked Swaps products transfer the risk of inflation where one party pays out on a fixed rate on a notional amount. The other party pays a floating rate linked to an inflation index such as retail price index or the consumer price index. This protect the buyer from price increases (in the chosen index) affecting their business operations.

Source: The Researcher

The case study operates in global markets on a 24-hour, 7-day a week model, similar to its competitors, and transacting products (making and receiving cross-border payments) continuously in the majority of the world currencies[61]. Table 46 shows the main customers and users of the banks products.

[61] Except from those which are under international sanctions and hostile government regimes.

Table 46: Market Participants

Market Participants	Description
Central Banks	Monetary authorities - policy makers of sovereign banking systems.
Commercial Banks	Banking institutions that participate in global markets and act as markets makers in the interbank market. They typically do not hold risk positions on their books therefore trades are hedged by the bank entering into trades with correspondent banks to cover the position.
Investment Banks	Major operators in the global financial markets. Typically, their business is underpinned by large investment funds, with investment managers accessing the markets and trading to continually improve the fund performance (growth and return).
Multinational large corporates	Global organisations typically listed in the top 250 companies of stock exchanges around the world.
SME	Small to medium enterprises - companies that typically have less than 250 staff and turnover of less than £50 million.
Brokers	Provide markets access and "pairing" services between a financial institution and client looking for a particular service.

Source: The Researcher

5.5 Trading Infrastructure

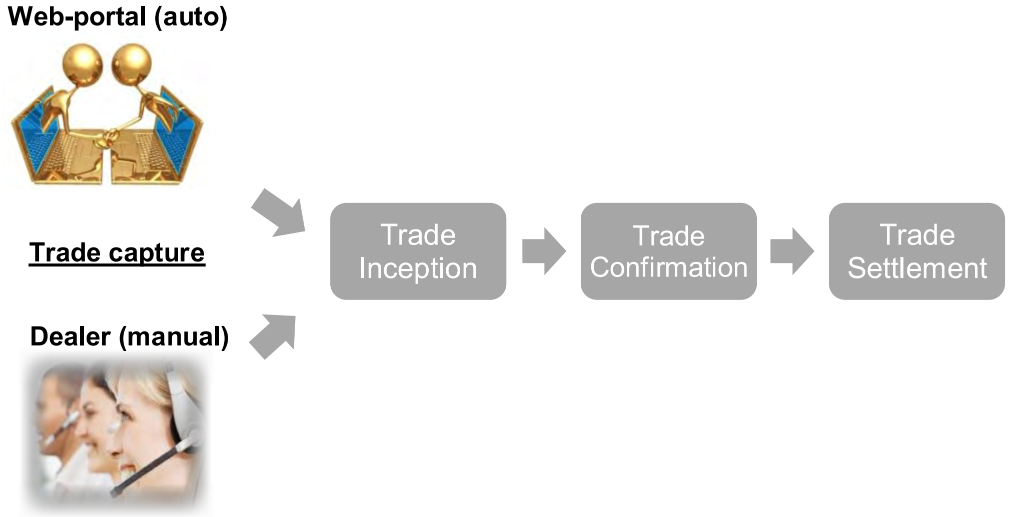
To sensitise the read, a simple account of a typical trading process will show the importance of IT and its utilisation to automate trading activities. Operational trade processing is a linear sequential activity[62] within a complex Social Technical System (the case organisation). Processes require a demand input (customer order) which is the 'initiation point' of the operational cycle/procedure. Various trade initiation methods are used; Dealer-to-Dealer (manually keyed), Broker-to-Dealer (manually keyed), Web portal-direct (automated), Exchange-to-dealer (manually keyed). At this point the specific product variables (detailed input requirements) are collected and evaluated alongside market data (environmental variables such as interest rates and credit ratings etc.) and 'programmable inputs' as defined by the bank (risk profiles, exposure tolerances etc.). Once the trade is "captured" the information is supplied to the trade processing automated servers.

[62] With many similarities to a car assembly line and the complexity of parts/options for vehicles (see Slack et al. 2010).

In general, there are three stages involved within the 'life' of a trade. Processing is automated at each stage and is composed of sub-task processes and validation routines performed by the system (Figure 29). The main stages are:

1. Trade Inception – booked trade awaiting legal confirmation
2. Trade Confirmation – exchange of trade contracts
3. Trade Settlement – request payment / make payment

Figure 29: Trade Lifecycle



Source: The Researcher

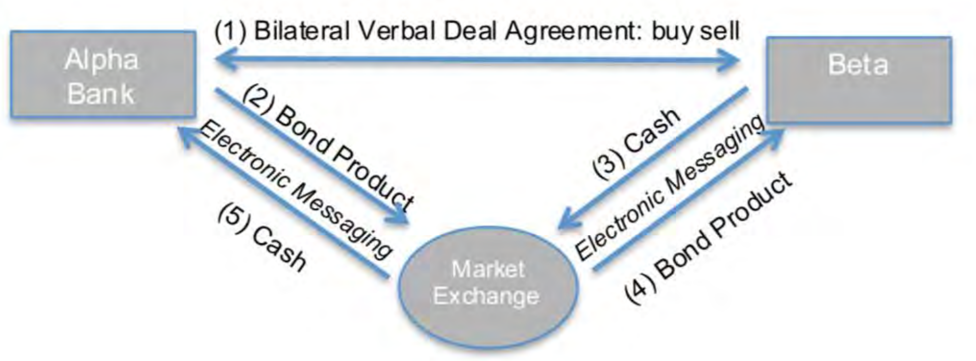
The commercial banking trader buys/sells contracts on behalf of the bank to a counter party from a peer institution or by request from a commercial client. In the main, transactions occur on a bilateral basis (direct between two parties) or through a broker (a 'third party'). Bilateral trading and dealing activities are largely bespoke practices tailored to the investor's needs. Trades and contracts do not have a standardised 'cookie-cutter' proforma shape beyond the instrument type (its purpose and function). It is for this reason that the majority of commercial and investment banking trading activities are largely bespoke, resembling a high variety and high volume mass service (Slack & Lewis, 2011).

The IT infrastructure (known as the "IT estate") to support investment banking is a complex interconnected system and a business critical resource for the bank to interact with the market (Burton et al., 2009). IT Systems have removed the previous manual burden of information processing and achieved new global speeds where no human could keep pace. IT spend runs into hundreds of millions of pounds each year (Caldo et al., 2013) for individual banks to develop/adapt systems and security. Trade transaction information and payment messages are exchanged between peer institutions, brokers, market exchanges and central banks and the speed, efficiency, accuracy and capacity of IT systems to handle financial messages is a strategic capability that must continue to be exploited to maintain a competitive edge (Laudon & Laudon, 2012). This further reinforces the importance of this study.

Core IT processing systems can send, receive, and interpret electronic information to satisfy external demand, at a quality level which allows information to flow between organisations which is crucial for commercial success (Nicolaou & McKnight, 2011; Laudon & Laudon, 2012). A simple example of a trade transaction (Figure 30) depicts the transaction process of a "simple bond" purchase and is described below.

1. Core processing system receives information (keyed directly by the trader during or immediately after the sales call known as the "dealing call").
2. The seller sends an electronic message which is supplied to the market Exchange (registering the sale and the trade specific details forming the sell side of the trade).
3. The buyer sends an electronic message to the market Exchange registering the purchase (the trade specific details forming the buy side of the trade).
4. The Exchange moves the bonds internally from the seller account to the buyer account (and the cash between the buyer and seller accounts).
5. The Exchange moves the cash internally from the buyer account to the seller account.

Figure 30: Basic Trading Exchange Model



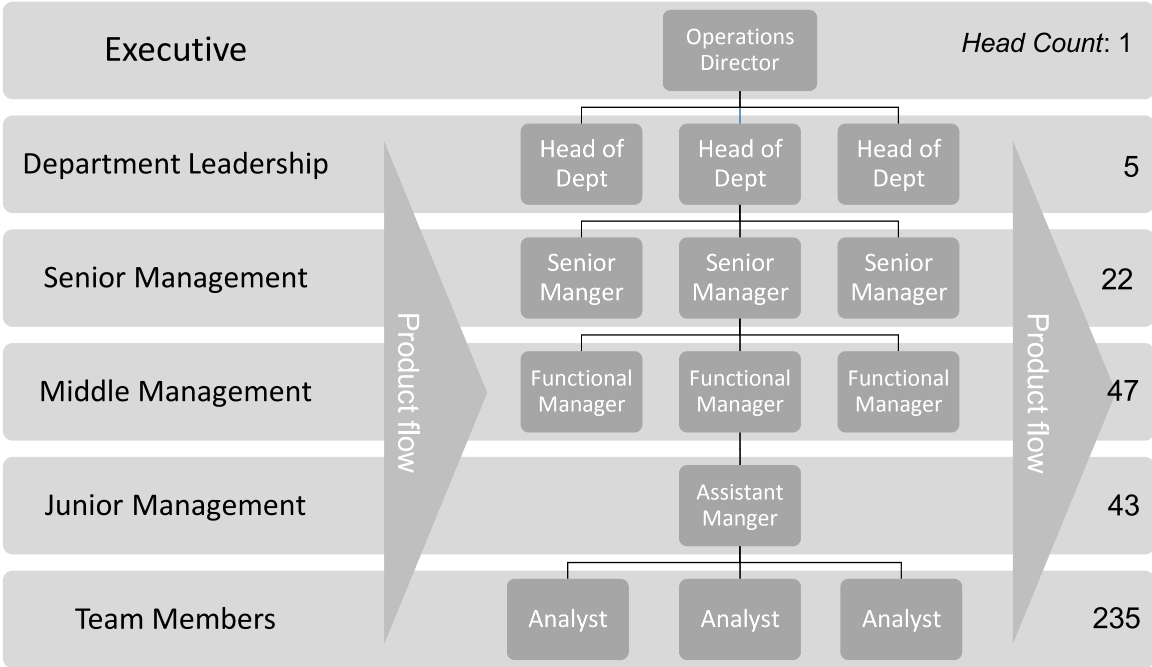
Source: The Researcher

In this environment, physical transportation of materials (products) does not occur. All exchanges are information exchanges directly or with a third party. Transactions can and will only ‘complete’ when information exchanges accurately reflect the details of the trades (quality) are sent in a timely manner (speed) without delay (flow).

5.6 Structure

The structure of the ‘operations office’ is coordinated by a functional management hierarchy (Weber, 1958). Functional specialism exists and is characterised by a “command and control” style of top down management, communication, and decision making (effectively creating silos – see Seddon and Caulkin (2008)). A Likert “Linking Pin” model (Mullins, 1989, p. 372) is also used where managers, leaders and team members of a peer group form an operational chain of command). Figure 31 provides a simplified model of the organisational structure demonstrating the vertical tiers of management of the departmental design.

Figure 31: Simplified Organisational Structure



Source: The Researcher

The structure suggests horizontal communication across teams and functional 'silos' may inhibit inter-organisational information changes (feedback loops) and knowledge sharing (McLeod & Schell, 2004).

5.7 Performance Problems

In 2010 Alpha Bank participated in an industry benchmarking survey of its commercial banking operations. The survey included peer financial institutions. The purpose of this survey was to benchmark and measure operational performance to yield a 'baseline' and position each ranked bank[63]. The study's sole measure of performance was Cost Per Trade (CPT).

The study found Alpha Bank lagged the industry and was "subscale" (below the industry curve) and it concluded there were theoretical operational savings estimated at 33% if

[63] The report benchmarked the costs of processing in a simplistic manner. It positioned banks in order of cost efficiency and included anonymised individual data-points per bank.

industry average CTP was achieved. The report showed Alpha Bank had lower productivity than its peers which created this CTP disadvantage.

The report, by MGT[64], suggested achievable cost savings (based on a contrast between Alpha Bank and peers) but stopped short of explaining how to achieve this or how other institutions had gained a theoretical advantage. The report has served to show that costs were larger in the case of Alpha Bank for its "trade volume" even though the operations office cannot and, is not, responsible for generating trade volume through sales (demand). The net outcome of this survey is a cost-volume but it did indicate potential sub-optimisation of the Alpha Bank system (its infrastructure and FTE costs needed to ensure transactions were completed effectively). Essentially, the report showed "how much is spent and where, divided by how many trades the bank happen to book"[65]. The researcher believes the report failed to identify tangible improvements for operations but did highlight a pending opportunity to be exploited through the study of the trade processing system, by establishing the key factors that influenced process efficiency and, by extension, the ability to reduce Cost Per Trade. This event and resultant 'sense of urgency' (Kotter, 1995) provided the opportunity for this study and the willingness of the Operations Office senior management team to engage with the researcher to study business flow within IT transactional process in systems.

5.8 Identification of the Change Champion

The Operations Director (the accountable executive for all business administration activities) was the recipient of the MGT report. His remit covered two of the most critical and largest departments within the Operations Office of the Commercial bank. The Operations Director also held executive responsibility for change and performance improvement of systems (including reference data and data management). Consideration was given to which

[64] A fictitious name to disguise the actual provider.
[65] This is not aligned with the title of the report which claims to be a diagnostic report.

manager should be responsible for this research programme (for example reporting to the Head of the 'Middle' and 'Back Office' as this was the operational management level responsible for enacting change). It was considered that 'heads of' had influencing capabilities within their respective departments but did not possess a systems view of the business. The result was democratic "sponsorship by committee" with all stakeholders engaged (Kotter, 1995). Although this would add political complexity to the project it was a natural learning group with power to enact change[66]. It was also decided that the researcher would report to the Operations Director (as project champion) as this role possessed ultimate decision making responsibility for the system, could exercise authoritative control and governance, and had access to resources (financial and other) necessary to oversee an 'end-to-end' systems view of improvement.

5.9 Summary

This chapter has contextualised the socio-technical system in terms of the organisational structure, products, processes and systems that are commissioned to provide client services and access to global financial market trading. It has also set in context the external environmental factors affecting the organisation. Factors which, as well as affecting internal regulation (costs of compliance) also affects peer organisations engaged in, and pitted against the cases study, in the survival of the fittest. Moreover, the chapter highlights the internal events (poor performance) that have motivated the bank to engage in a rigorous research process. Furthermore, it has identified the case study champion as the Executive Director of Operations - who will provide access, resources and political support to the case study that will enable the research to conduct a longitudinal study.

[66] It should be noted that the researcher was keen to avoid politics and conflict practically and as part of his risk register (see methodology section).

Chapter 6: First Cycle

6.1 Introduction

To assist the reader, the chapter executive summary is presented in Table 47:

Table 47: Chapter Six Executive Summary

Background	The case study took part in an industry-wide performance benchmarking exercise conducted by a leading management consultancy firm. Alpha Bank's performance was perceived to lag the industry in many key areas of operations. A significant event for the bank and potentially exposing weaknesses in its operating model. Such potentials for improvement framed the practical need for the study.
Team Learning	The research project team (22 cross-functional managers of which 14 are functional and 8 are senior managers) has been established and, as a group, have reflected upon the MGT report. The report offers CPT as its primary measure of analysis. The learning group find this metric a purely 'cost measure' believed to be a poor proxy measure of trade flow performance.
The Research	The team engaged in the project and observed to follow the Tuckman and Jensen (1977)[67] model of team formation. The team where intently focused on the exploitation of the new meaning that was produced by the survey analysis in conjunction with implications of the 'MGT' report.
	The team show a lack of faith in the key measure of performance contained within the 'MGT' report. What is more, there is equal lack of faith in the industry measure of trade flow performance (shown in internal survey results)
	Activities: team brainstorming, secondary research, and staff survey leading to Phase 2 investments in first improvement activity.
Analysis	Survey data was obtained from the case, analysed with NVIVO and presented back to the management team showing the wholesale rejection of the STP measure as the primary system performance measure. However, It is seen as a cost indicator not an indicator of Quality or Flow.
Phase Duration	December 2012 to end January 2013 then period of reflection.
Reflections	The initial phase created an infrastructure for change (management coalition) as per Kotter (1995). The learning group focused on a jointly agreed measure

6.2 Creating the 'Sense of Urgency'

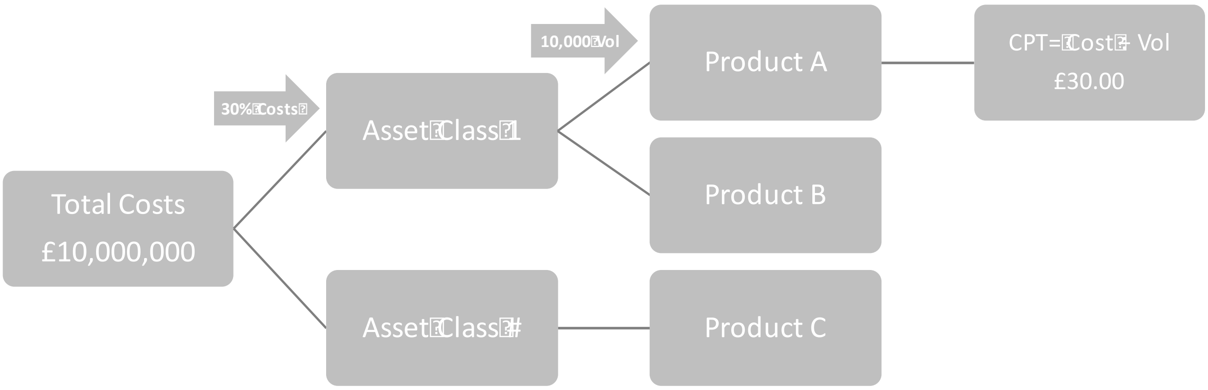
The stimulus for the research was industry "benchmark survey" of commercial banks 2010 (published 2011) by MGT which reported underperformance at Alpha Bank (below the industry average Cost Per Trade and alluded to a productivity gap in asset classes[68] performance). The peer cost comparison exercise ranked Alpha Bank poorly (using high-level costs to banks[69]) relative to its quantified trade volume. The researcher noted the

[67] The Tuckman (1965) model includes stages of forming, norming, storming, and performing (later adjourning). Such a 'bonding' serves to unite the learning group on the focus of the study.
[68] Approximately 90%+ of the asset classes (products) were calibrated at 'below the average' ranking.
[69] These costs included IT costs, Middle and Back Office costs, salary and property costs, and 3rd party fees for clearing and settlement services.

report entitled “Trade Processing Benchmarking Survey” was essentially a ‘cost benchmarking exercise’ for the industry. It did not focus on performance capabilities and contained no specific areas of improvement recommendation for Alpha Bank. The overwhelming message perceived by the management team was to “cut costs” to improve (Figure 32).

The report created a sense of urgency but failed to identify whether cost cutting was achievable or desirable. In addition, there was no analysis of organisational culture or operational differences (other than “trade volume”) which is a process beyond the control of operations teams (a Front Office sales responsibility)[70]. Moreover, the report failed to include operational performance measures including analyses of “flow” and “quality”. These particular measures are fundamental to effective and efficient operations management performance (Chapter two – literature review), however, they were absent from the report.

Figure 32: Simple Method of Calculation of Cost Per Trade



Source: The Researcher

The report was therefore of marginal utility beyond a financial comparison of “situational factors” such as FTE costs, headcount by function and trade volume between peer groups. These measures, when combined, produce the principal metric of performance Cost Per

[70] It should be noted that the front office operations were not included in this study as the study boundary was set as the processing operations (see Research Strategy chapter).

Trade - an industry-wide performance metric and primary means of analysing bank performance/peer group performance (see Figure 32 for a simplified example of CPT). Such a lens presupposes all trading banks are similar (with the assumption of like-for-like structures) providing the generalisation that 'performance' is a measure of the degree to which managers have optimised their resources. This is not the case where flow is a feature.

Internal circulation of the MGT report brought unwarranted attention. Initial meetings with the management team (the learning group) focused on the report and its implications. The report suggested an operational cost reduction of 33% was achievable (a figure which translates to tens of millions of pounds in potential savings). An improvement to productivity implies an increase to trade volume (business up lift, which is outside the groups remit) or simply a head count reduction (resource cost saving, with their remit). The establishment the learning group in response to the report is regarded as a critical event that has generated a "sense of urgency" for the management team (Kotter, 1995)[71].

At this point, the researcher collected information concerning existing performance measures in operation at Alpha Bank and from industry benchmark reports (Smith, 2009) (Table 48 presents a summary of the measures of performance used at the case). The MGT report employed similar measures to identify potential improvement opportunities for the bank relative to their peer group (improvements in right hand side column of Table 48).

The MGT report added to pressure on the operations office (from board level) to reduce costs by increasing the general performance of trade processing systems supporting the recovery of the bank. The operations management at the case (from now on termed 'the learning group') voiced significant concerns over their practical first-hand experience of CPT (demand versus capacity). The measure of cost apportioning with CB and IB is

[71] Technically the report is a disturbance to the management system and its steady state which has prompted a reaction. It has injected energy into the STS at Alpha Bank.

demonstrated in Table 48. At this point in time, managerial views conflicted with executive leadership views of performance (formulated by the survey report) and the legitimacy of the report to identify feasible improvements on which to build a change strategy.

Table 48: Measures of Cost Apportioning

	Factor / Measure	Description	Improvement
Structure	Offshoring capability	% FTEs and cost per FTE at offshore location	Ability to make structural adaptations
	Depth of controls	% managers at low/medium/high cost locations	
	Shared services (Multi-skilled / flexible workforce)	% FTEs in shared service functions working across multiple asset classes	
Processing	Trades per FTE (Trd Vol / Headcount)	Number of trades per FTE by asset class	Simplification of processes
	Settlement failures and cancels or corrections	Settlement failures as a % of trade volume	
	Cost Per Head	Cost divided by FTE	
	Cost Per Trade	Cost divided by Trade Volume	
Value Services	Penalty charges (% of revenue)	Penalties/fees (repair fees, etc.) per trade paid to 3rd parties as a share of total 3rd part fees	Potential saving on Service Fees
	Internal settlements (%)	Share of trades settled internally	
Infrastructure	Electronic eligibility and electronic confirmation	% trades eligible for electronic confirmation and actual electronic volume	Increased Automation
	IT/CTB spend as a % of total spend	IT/CTB costs as a % of total costs	
Scope	Total ops IT spend as a % of total IT spend	Ratio of IT spend as reported by the survey to total IT (FO, MO, BO) cost	Verification of overall costs apportioning
	Total finance cost/total MO+BO cost	Ratio of capital markets finance activities spend to total MO BO costs	

Source: Adapted from Smith (2009, p. 26) and The Case Study

The Operations Director reflect that he sensed an emerging gap between the executive leadership and the lower tiers of management (Senior and functional managers). The inability of the MGT report to identify “what” and “how” to change the system created irritation within the learning group due to disconnection between the report and their reality.

Table 49: Reflections

The researcher reflects that the literature review suggested an initial system disturbance would lead to change and also the words of caution offered by OM and organisational authors in selecting the most appropriate measures to drive behaviour. Cost accounting measures have been associated with dysfunctional behaviour (see Goldratt et al. 2004 and more recently Seddon (2008).

The key message of the MGT report suggested a 33% cost minimisation could be achieved at the case. However, the report offered no insight into the reasons behind system failures (the need for system intervention and trade repair) and no insight into the issues affecting quality which was, according to the report, attracting excessive resource repair costs (Deming, 1986). Seddon (2008a) and Seddon and O'Donovan (2011) assert targeting cost reductions without understanding flow and quality performance will invariably drive up service costs. Moreover, a headcount reduction without any improvement to quality and flow would impair the case studies ability to provide a consistent level of service (creating new bottlenecks), demoralising staff and potentially creating demand 'amplification' in work flow (Forrester, 1961).

For the sensitisation of the reader, Smith (2009) - head of benchmarking at McLagan Consulting[72] - provides a summary of the flow performance metric Straight Through Processing used in commercial and investment banking, used in parallel with CPT. STP is typically measured as a percentage of trades NOT requiring manual intervention, i.e. a 95% STP rate implies manual intervention/repair is undertaken on 5% of trades to allow them passage through the system[73]. STP is the common measure of flow performance by which all commercial and investment banks to measure their intraday, weekly and monthly efficiency. By these means, banking organisations form a relationship between STP and CTP (higher volume of trades flowing STP, the fewer resources thus fewer costs required).

Prior to establishing the learning group, the Director of Operations requested that a survey of his management team be carried out to identify the reasons why managers lacked faith in the current business performance metrics. The poor faith in STP and CPT metrics intensified management fears that executive leadership would regard them in a 'bad light' dominated

[72] Competitor to MGT.
[73] *According to McLagan "…a trade is 100% STP if it is processed without human intervention from trade capture to settlement with automatic generation of all confirmations, accounting entries and feeds to ancillary systems"* (Smith, 2009).

early discussions[74]. The situation described to the researcher has a significant resonance with Deming's (1986) key principle *"Drive out fear, so that everyone may work effectively for the company".* And Goldratt's view *"Tell me how you measure me and I will tell you how I will behave. If you measure me in an illogical way… do not complain about illogical behaviour…"(Goldratt et al., 2004).* To compound the scepticism regarding the MGT report. The learning group debated the veracity of the data supplied to MGT Consultants which, according to the group, was extracted from the same IT / MIS system being criticised.

6.3 Exploring The Team View of Performance

At this point, the researcher engaged with the learning group as the facilitator to the discussion. He made extensive use of his day journal to note discussions. In total twelve meetings were held over the period from December 2012 to January 2013. During this period, the Operations Director passed to the researcher the data from the internal survey regarding measures and inhibitors of performance. This questionnaire was administered to the whole operations management team in August 2012 but had remained in a 'rough state'. The researcher was given access to the original dataset and was asked by the Director and learning group to evaluate, from an academic perspective, the findings of the questionnaire and to feed back the findings to the group.

The remainder of the chapter will examine the questionnaire[75]. The aim of the group, discussed in the meetings, was to explore and uncover 'meaning' hidden in the qualitative analysis from data provided by Alpha Bank managers. The questionnaire was used to detect emerging themes and patterns in the response data and to 'playback' the findings to the managers. The researcher would also inductively observe the response of the team to the information, how they made sense of data and what new understanding/debate it generated about their working environment.

[74] The situation has parallels with Deming's view that 'fear' will inhibit effective working practices (collaboration).
[75] The questionnaire was designed by an in-house member of staff at the request of the Operations Director.

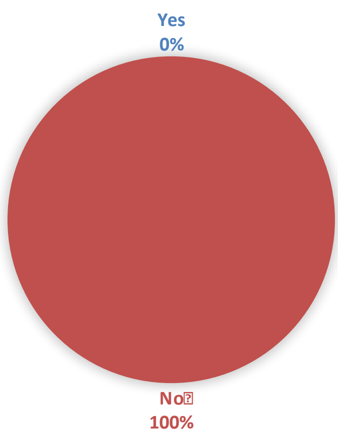
Table 50: Survey Design Overview

Survey Design	
Number of Management participants	22 (100% response rate)
Survey questionnaire format	5 quantitative questions comprised of a mixture of discreet and ordinal responses, and 1 qualitative open-end textural response question
Analysis techniques	Frequency of response variables and thematic coding and analysis of textural responses using Nvivo qualitative analysis software conducted by the researcher.

Survey Analysis of Senior and Functional Managers: Presented to the Learning Group

Q1. *Does the metric STP in its current applied format, accurately interpret performance of trade processing systems?*

Figure 32: Response to question one



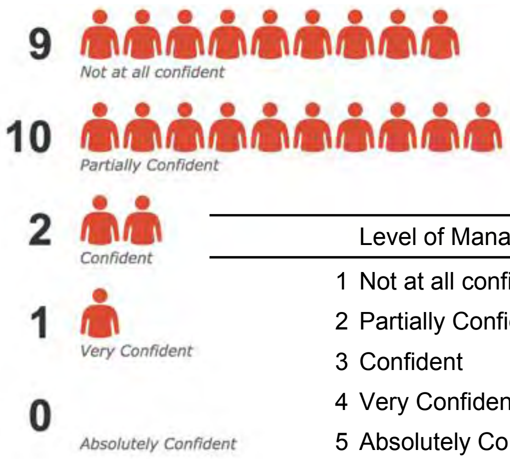
Learning Group Reaction: the presentation meeting, conducted in December 2012, recorded unanimous agreement, from all twenty-two learning group managers, that the STP metric was an inadequate interpretation of trade processing performance. The result confirms the team have 'no faith' in this or the CTP measure. The researcher noted earlier in this chapter that the STP measure is used by all major banks and Management Consultancy firms undertaking process performance analysis. As such it was an established measure – an industry standard but the researcher could not understand how vociferous, emotional and hostile the general feeling towards the measure generated[76]. Such emotion suggested a

[76] The researcher could not rule out the potential of the measure being a "mis-fit" with current Alpha Bank practice even though many mangers in the learning group had previously held careers at other banks.

form of futility for managers and that the measure was an inhibitor to meaningful engagement of the system management level of the bank.

Q2. *How confident are you that reported STP figure tracks the true system performance to within +/- 5% of the actual?*

Figure 33: Response to question two

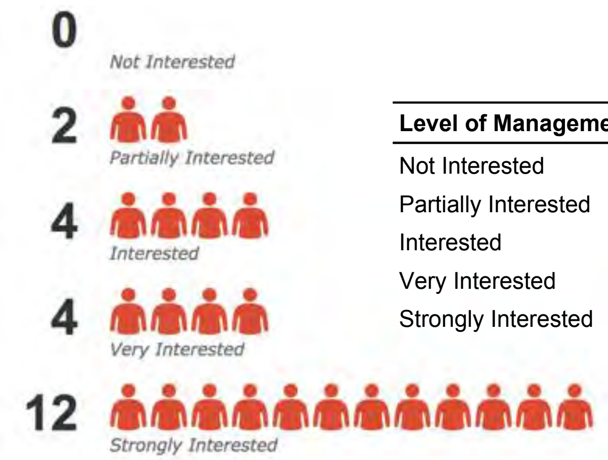


	Level of Management Confidence	Count	%
1	Not at all confident	9	41%
2	Partially Confident	10	45%
3	Confident	2	9%
4	Very Confident	1	5%
5	Absolutely Confident	0	0%

Researcher reflection: The learning group is split, but there is a sizeable scepticism regarding the accuracy of the STP metric (19/22). Nine managers clearly do not trust the accuracy with ten being only partially confident - who during the review demonstrated they were unconvinced of the measures accuracy. Three managers believe the measure to be capable of measuring performance with the *+/- 5%.* In the context of question 1 and during the discussion, these three managers stated STP in its applied format did not interpret performance but in the context of this question, they believe that STP is capable of doing so within a reasonable margin of error. The question is perhaps, is 5% error enough to warrant the level of discontent in the metric? The meeting discussion would the answer is 'yes' and some managers went further to state it skews performance and is an inhibitor to performance improvement.

Q3. *Rate your appetite for research into the application of STP metrics as a means of understanding* system under performance.

Figure 34: Response to question three

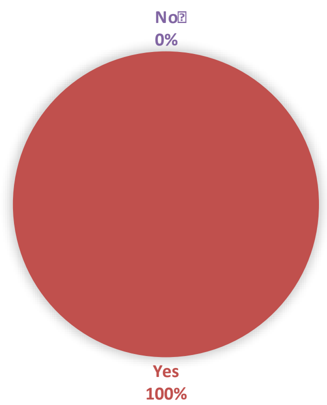


Level of Management Interest	Count	%
Not Interested	0	0%
Partially Interested	2	9%
Interested	4	18%
Very Interested	4	18%
Strongly Interested	12	55%

Researcher Reflection: The majority of the learning group support such a research investigation. The discussion concerned the measure and application as well as a discussion concerning other measures and what other banks and industry sectors calculate. The team did not have all the answers and many Post-It notes were written and attached to the walls of the room. The team continued to challenge the fit of the STP to accurately measure performance. A minority of managers had personalities that made them “early adopters” or willing subjects to go and test new measures. These influential participants were joined by a further four to eight managers who suggested their willingness to see what other measures were and could be applied. There were, however, two mangers that were disengaged with the discussion and showed an interest in change but did not regard it as their most pressing issue or were happy maintaining the status quo.

Q4. *Would you support changes to the measurement framework to help improve performance?*

Figure 35: Response to question four

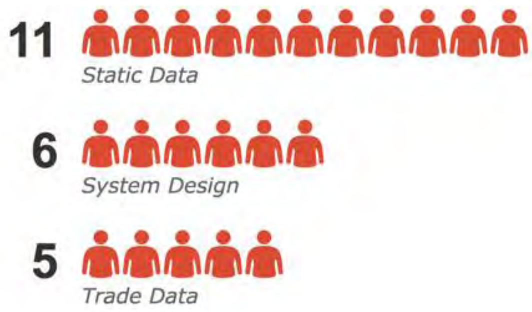


Continuing with the presentation, the inevitable and unanimous response was recorded, even by those seemingly content with the STP measure that they would support its adaptation.

Researcher Reflection: The unanimous agreement to support change suggested that the STP measure may not be entirely incorrect but that it was not contingently localised when introduced. The learning group, therefore, indicated that modification was important rather than a wholesale rejection of the measure itself. Thus, the researcher believed the 'essential logic' of straight through flow remained pertinent to the management and a potential benefit for process management. The STP measurement framework, and STP use as a performance management metric, was questioned heavily by the management. Yet, hostility in the room had subsequently abated somewhat as managers held candid and frank discussions on what had previously been regarded as a contentious topic.

Q5. What is the cause of any STP under performance?

Figure 36: Response to question five



Researcher Reflection: 50% of managers cited system static/reference data as the cause of system underperformance. Such data is 'fixed input' data and information resources related to customer/client profiles such as account numbers, contact details and legal entity information. Omissions and errors in static data have concerned the management as this type of trade information is a fundamental and basic data requirement to complete a transaction. Managements' theory implies that client onboarding practices were not thoroughly followed which - in the view of some managers – will result in system logic failure and 'agency' was being exercised by traders which resulted in incomplete data exchanges required to set-up a trading account. Moreover, this view also implied that client profiles might contain obsolete information which would result in a similar logic break and failed trades. Such a result has a direct correlation with Seddon (2008) and his investigation of failure demand requiring significant rework and additional labour to reprocess work that should have passed straight through. Such a scenario absorbs more labour and would inflate banking costs. This aspect of the study was discussed at length and across several asset classes which suggested the phenomena was in fact a systemic system failure.

A subset of six managers cited the system design (IT processing system design) as the key causal issue although the team were unsure if this included the design of the STP metric and as such the question may be misleading for the managers. However, five managers rated the cause as “keyed” input trade data resources and in effect a human error issue. The point being made is similar to the cause ‘failure demand’ implying the product cannot flow as information is also inaccurate/missing.

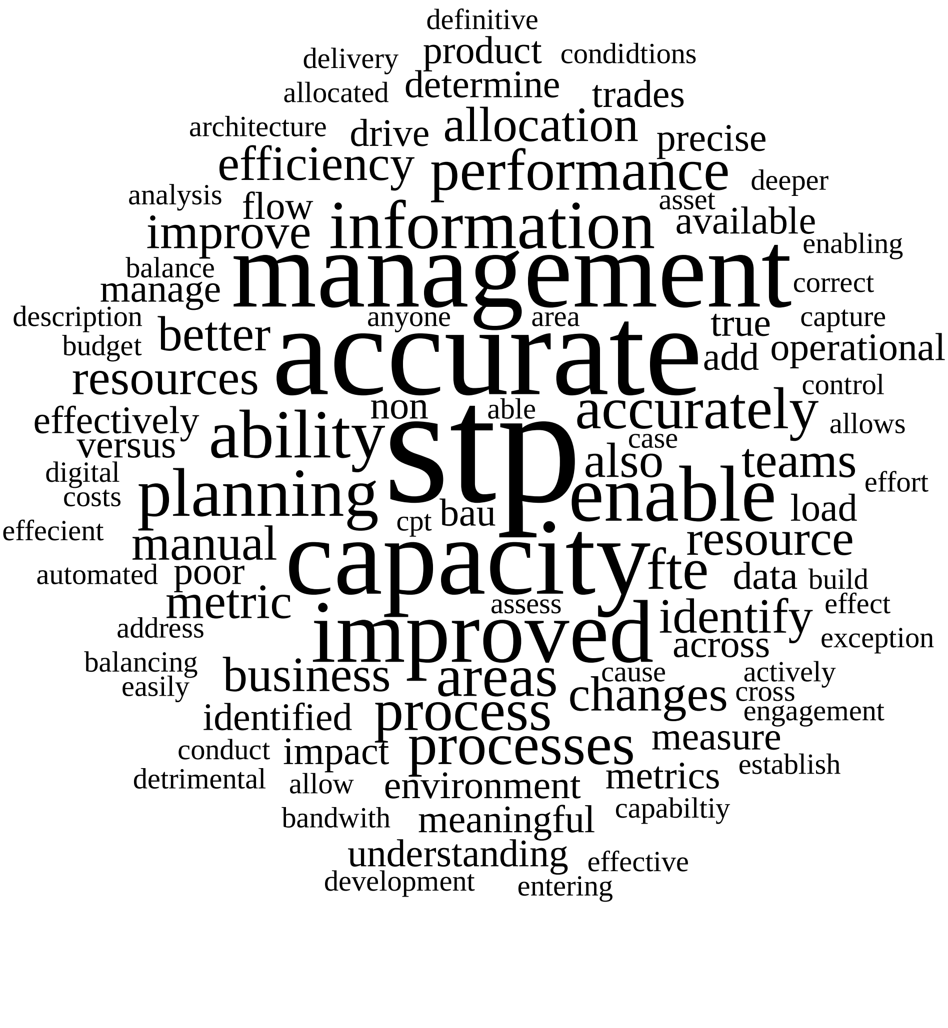
The debate of the learning group was interesting, and all managers were quick to identify sources of errors that eroded the utility of the measure. However, it was also evident in the discussion that while managers could identify problems they had not actively engaged in the removal of these issues or improvement of processes. The researcher reflected that this caused a rift – the application of a measure which the learning group held little faith in and a measure that prompted no improvement. From the STS literature on feedback systems the researcher had systematically reviewed in a previous stage of this research it was becoming clear that this complex operating environment that is transacting over £550 billion per day in fractions of a second. Yet the case has issues generating improvement from STP measures.

The researcher was further intrigued when the team discussed the insignificance of costs (salaries) for staff to repair work passed from the trading front office. When the relative costs of a staff member were compared with trade revenue per day the cost seemed insignificant but the MGT report suggested it was much higher than peer banks. This discussion was one of the most interesting to observe. For the management learning group were, at this stage, starting to explain their logic to each other with a common denominator that they all wanted to increase the flow of work through the system.

The responses to the latter part of the questionnaire - comprised of an open-ended question – demonstrated that managers went to great lengths to provide thoughtful responses, delivering detailed contextual explanations to the exploratory question. The researcher discovered that the qualitative question provided enormous utility exposing deeper meaning to the observations the researcher recorded when interfacing with the managers. The qualitative responses were analysed by the researchers using NVIVO a qualitative software package to expose emergent themes contained within the narrative responses. The analysis and graphical representation of the data (using a Word Cloud) were feedback to the learning group, which proved to stimulated heightened discussion and cohesion between the group.

Q6. *What are potential benefits of having a precise and accurate process performance metric?*

Figure 37: Word Cloud of Emergent Themes

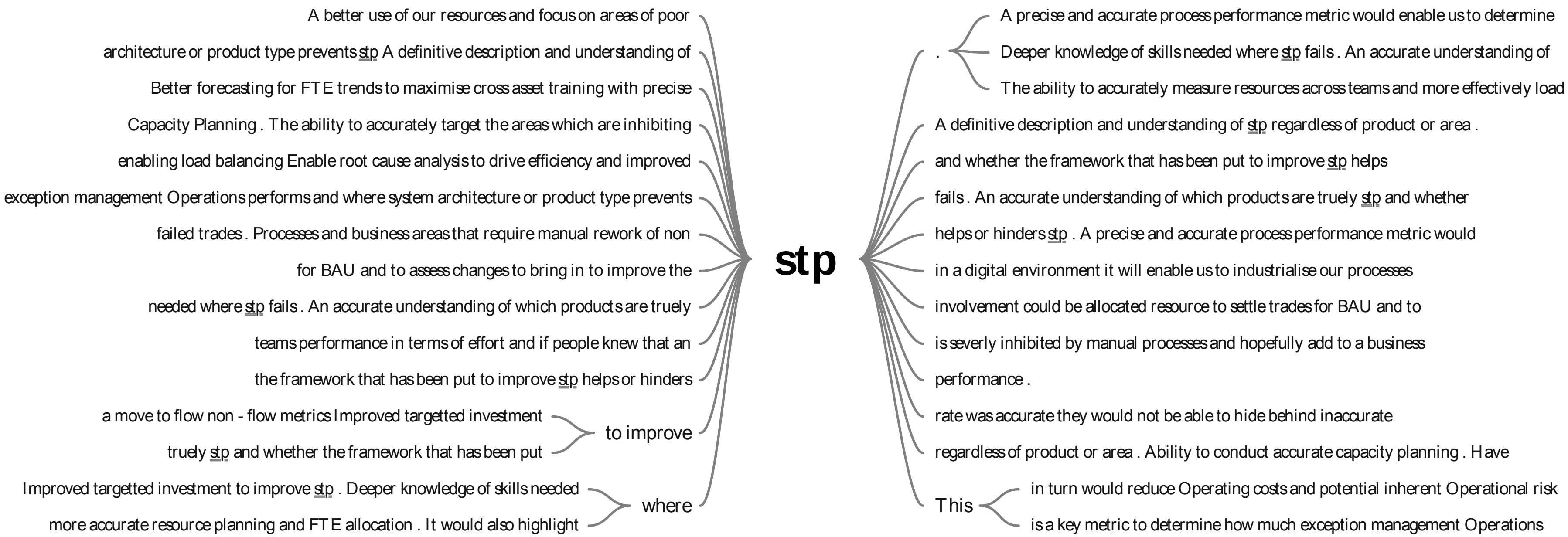


Researcher Reflection: The Word Cloud Analysis (displaying frequently used terms and phrases contained in the narrative responses) highlighted emergent themes. The NVIVO software, coded by the researcher, orders textual responses in a structured manner. The larger and more central the text is presented in the Word Cloud, the more frequent and significant the text in the response narrative. The response indicates that; "STP", "accurate", "improved", "capacity" and "management" are central a component of the management psyche.

To make sense of the emergent themes, the researcher has attempted to join the text from the Word could using the logic of 'size' and 'priority' to produce a cohesive narrative. "Straight Through Processing ...[enables]... accurate capacity management and information to improve performance and planning".

The main themes, "STP", "Management" and "Capacity" were analysed further using a Word Tree to investigate how these words are used in context within the managerial narrative to the question (see Figures 38-40).

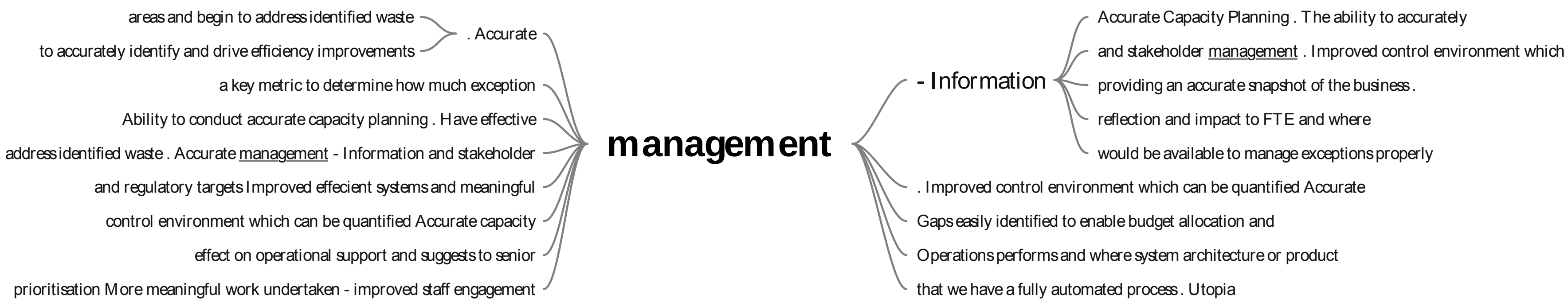
Figure 38: STP Word Tree



Revealing Captions:

- A better use if our resources and focus on areas of poor STP
- An accurate understanding of which products are truly STP
- A move to Flow Non-Flow Metrics, improved targeted investment to improve STP
- A definitive description of and understanding of STP regardless of product area
- STP is a key metric to determine how much exception management (failure demand) operations …[undertakes]
- STP, this in turn would reduce operating costs and potential inherent operational risk
- STP is severely inhibited by manual processes
- STP in a digital environment, it will enable us to industrialise or processes
- A framework that has been put in to improve STP

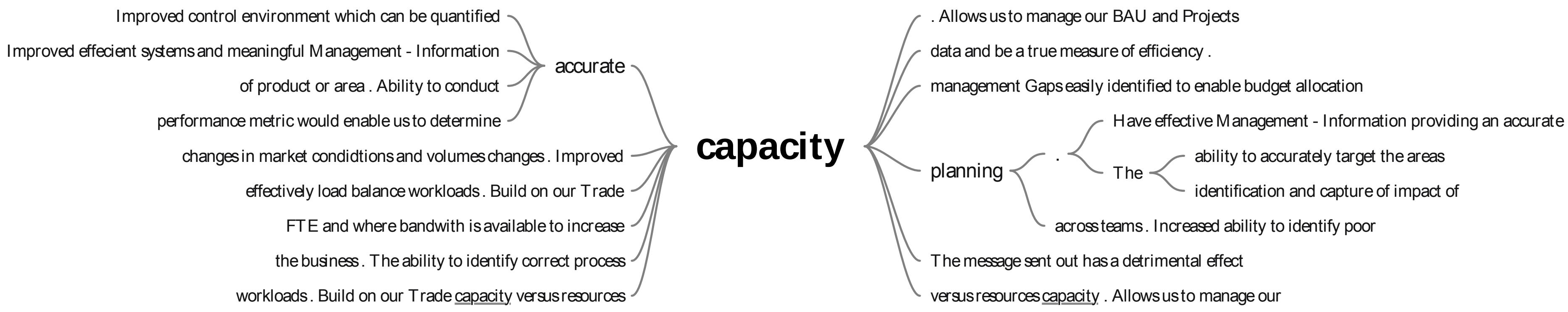
Figure 39: Management Word Tree



Revealing Captions:

- A key metric to determine how much exception management (failure demand) …[occurs]
- Accurate management information and stakeholder management
- Address identified waste, accurate management information and stakeholder management
- More meaningful work undertaken – improved staff engagement
- Management information accurate capacity planning
- Management information would be available to manage exception (failure demand) properly
- [show]… management we have fully automated processes.

Figure 40: Capacity Word Tree



Revealing Captions:

- Improved control environment which can be quantified accurate capacity
- A performance metric that would enable us to determine accurate capacity
- The ability to identify correct process capacity
- Build on our trade capacity versus resource capacity
- Capacity management gaps easily identified to enable budget allocation

The 'Word Trees' served to tie together and contextualise the narrative presented to the management learning group. The analysis identified themes that resonated with the group (emergent coded word themes) building a common understanding and shared vision of the issue facing the organisation. The meeting confirmed the association between high-performance STP, Capacity planning and efficient utilisation of resources and accurate management information systems. Collectively, these terms provide a basic framework of holistic management, control and improvement of the production system (Slack et al., 2010). It was interesting for the researcher to witness operations management concepts being linked with the term 'improvement' given the palpable inertia towards tactical improvement currently exhibited while operating within the STP framework.

This final piece of qualitative analysis was purposefully undertaken to discover emergent themes - but from a slightly different approach. For the researchers own purposes, the analysis carried-out was immensely valuable. The narrative of the managers could be directly linked to the focal literature such as Ackoff (1967); Deming (1986); Juran (1988); Ohno (1988); Senge (1990); Crosby (1996); Seddon (2008a); Slack et al. (2010). The objective of the researcher was to understand how staff conceptualised their working environment and whether, on reflection of the results, if this feedback augmented their perceptions of the environment – both individually and collectively. Witnessing this feedback and reflections, the researcher's own thoughts were then compared to the literature to gain an insight into staff perceptions and motivations towards the system.

Table 51 displays the emergent themes contain within responses to question six. The researcher coded sections of the narrative associated with the literature themes and used Pareto principles to order the themes in relation to their frequency found within the narrative.

Table 51: Emergent Themes

Emergent Theme	Occurance	%
Capacity Planning	11	19%
Performance Management	11	19%
Management Infromation Systems	7	12%
Learning Organisation	6	10%
Failure Demand	5	9%
Improvement	5	9%
Efficiency	4	7%
Automation	3	5%
Cost Management	2	3%
Investment	2	3%
Quality Management	1	2%
Regulatory Change	1	2%

Researcher Reflection: The analysis showed “capacity planning” to be the key theme for management. Using this theme in conjunction with the earlier analysis of “capacity” in the Word Tree, the researcher reflects that learning group are indeed cognisant of their managerial responsibility to balance staff FTE (Full Time Equivalent) levels in union with external service demand. The researcher believes capacity planning features in joint top position due to the learning groups awareness of the MGT report and its proposal that significant headcount reductions (30%) can be achieved. The outcome of FTE reductions would - according to MGT consultants – provide an improvement to the “cost per trade ratio” performance indicator and improve Alpha Banks position relative to its peers.

Comparatively, “performance management” in joint top with “capacity”, is linked closely with “management information” in Figure 39 Word Tree. Combining the top three emergent themes equates to 50% of the coded qualitative response to question six. The researcher reflects that the emergent themes are synonymous robust management frameworks which, cording to Crosby (1996); Seddon (2008a); Slack et al. (2010) enables business governance. The following three categories in Table 51, “learning organisation”, “failure demand” and “improvement” could be merged to form a new ‘super group’ describing the features that encourage “change” to system performance. Merging the three categories equates to 28% of all emergent themes. The next categories “efficiency” and “automation” reflects management’s desire to utilise technology to take advantage of the perceived benefits automation has on flow and efficiency. The researcher reflects that the learning group are exhibiting a sensitivity to the features and enablers of performance. These categories equate to 12% of the emergent themes.

The penultimate categories “cost management” and “investment” equates to 6% of the emergent themes. The researcher reflects that this weighting appears unusually low considering the motivation within the industry to reduce operational costs. This opinion is triangulated by the MGT report which bases operational performance (and peer comparison) exclusively on cost measures. However, the learning group seem not to priorities costs as a lesser feature of the system. Finally, “Quality management” and “regulatory change” each equate to 2% of the themes. Curiously, quality management has emerged to be joint lowest. This is a potential weakness in the context of question six. Managers do not link quality performance with a robust system of quality measurement. The quality of the resources entering the conversion system tends to inform the flow performance of the system. Quality performance is a feature of flow, poor quality results in failure demand which impede flow due to manual intervention and rework activities (George, 2002; Seddon, 2008a, 2008b).

6.4 Survey Feedback

The researcher presented the survey data to the learning group. This meeting allowed managers to discuss amongst themselves their results in an open forum and debate the aspects of the system which, in the view, led to underperformance. Managers discussed STP measurement, system design intensely and “data”, intensely and in a critical fashion. All managers agreed that system flow performance (STP) was below expectation and in their view provided the reason as to why a higher than industry average headcount was required to “run the business”. A major point of debate ensued, with raised voices and emotions on show, when the conversation moved to discussion root causes of underperformance.

The researcher observed that the operations management learning group were passionate about their role and appeared motivated to do a good job for Alpha Bank, but frustrations existed within the sociotechnical system impeding the ability to improve on performance. The learning group is a combination of all key workflow stakeholders, a fully integrated and closed-loop containing all managerial system designers who held responsibility for the semi-sequential processing of trade flow (akin to the design of car assembly lines). During the following period of reflection, purposefully designed into each cycle of the research, the researcher reflected upon his observations. The overwhelming residing view was that managers do not possess a full appreciation of the organisational system within which they work, and that system sub-optimisation was evident as managers focused on their departmental tasks and processes (silo sub-optimisation of work and responsibility). The discussions at the meetings also suggested managers had little knowledge of the end-to-end trade processing through other business departments and their inter-dependencies[77].

Upon reflection, the researcher believed that the semi-sequential process flow generated a great amount of subjectivity and ambiguity when discussing potential root causes of system failure. The managers suggested many potential lines of enquiry (some suggestions were obviously descriptions of the symptoms of a deeper root cause) yet opinion remained divided and contentious (blame). The researcher reflected on the benefits of peer group debate which generated constructive relationship for the managers concerned even to the self-admission from one manager who stated "*I don't know anything about your* (fellow managers) *business area however my team deal with large amounts of exceptions* (trades requiring investigation because flow has failed) on a *daily because your team regularly fail to*

[77] Such a view would later be reinforced by an interview with the designer of STP and industry expert J. Karat.

set up client data in time for the trade to flow". Such an openness and the feeling of comfort in expressing this without implication of political gaming was regarded by the researcher the passage of the team to the 'storming' phase of team development. Another manager admitted openly that "*we make manual payments because the system tells us we have to, or the trade will fail to settle in time before the market closes. We have no time to go and check why its failed, and I would not know where to start*". The open discussion and honesty amongst the system stakeholders reflected the openness of the Operations Director and his interest in his direct reports and their maturity as group of colleagues.

6.5 Where Next?

The series of meetings concluded in a key management decision – to investigate sources of system failure. A decision that was – for the first time - based on reasoned learning (uninfluenced by the researcher) and objective judgement, determining the direction of their actions (the first cycle of action research). The objective proved difficult to establish at first. However, managers remained open-minded during the discussion, but still defended their respective business units from overt criticism - implying the manager was 'weak' in the management sense providing a possible rationale for targeted investigation by the peer group[78].

Through a period of negotiation, the managers settled on an investigation of processing failure under the responsibility of the Static Data department. This department is responsible for creating and maintain all client trading records. It adds essential information that is required to match a trade for it to be "incepted" (booked correctly) and "settled" (payments). The researcher notes that the discussion produced little in the way of a good rationale for investigating this area at this point in the learning journey, but it was identified in question five of the questionnaire and received the majority of votes by the team.

[78] These observations resonated with Goldratt's (2004) fictional account "The Goal" which typifies the "protection" behaviours of managers embarking performance/process root cause analysis, albeit in a factory setting.

Chapter 7: Second Cycle

7.1 Introduction

The previous chapter presented the stimulus for this study and reviewed the learning group debates at the outset of this research plan. A benchmarking report and internal survey focused management's attention on the issue of business performance and banking systems/processes. Managers discussed and reflected upon the potential inhibitors to trade flow performance. The management cohort decided that the first cycle of investigation should explore static data dysfunction within the Static Data department. The rationale for this decision was that it featured in the management survey as a likely (but not absolute) inhibitor of trade flow and that such data is a primary resource required by the system to perform and legitimise a trade transaction.

At this point in the study, it is important to note the researchers' professional capacity within the case study organisation. The researcher is engaged in a rolling management consultancy capacity, providing Lean and Six Sigma training, coaching and mentoring to the management of the case study, up to and including the Director of Operations. The researcher is an experienced and professional Lean and Six Sigma Master Black Belt[79].

This chapter presents the emergent approach and decision-making processes the learning group of managers undertook to increase their knowledge of Alpha Bank's trade processing systems. It presents the results of action learning through interventions performed by mangers in the organisational systems and processes. The chapter also documents the evolving attitude of management towards performance and its improvement. The chapter ends with setting the context for the second cycle of action research with the case study. To assist the reader, the chapter executive summary is presented in Table 52.

[79] With seven years' experience of manufacturing (automotive and aerospace) and financial service (banking and finance) settings.

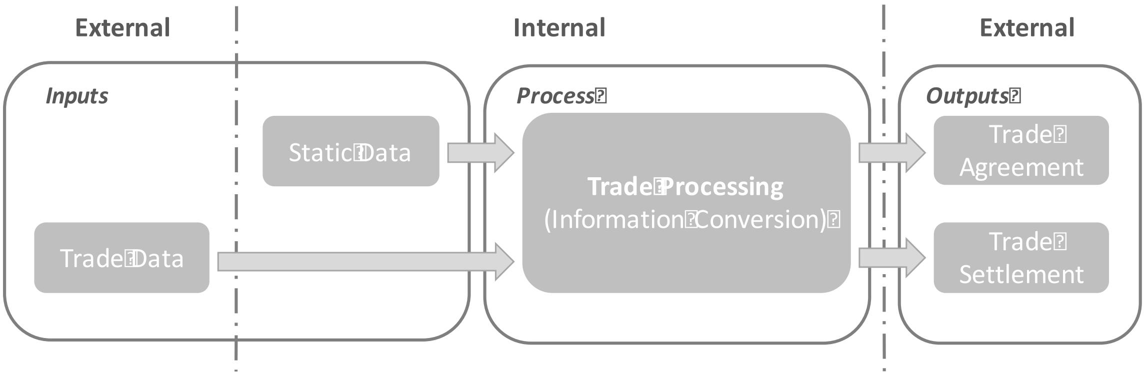
Table 52: Chapter Seven Executive Summary

Background	A learning group of managers has formed; they have identified from a learning cycle the importance (timely and accurate) of 'static data' to support trade flow. Managers set-out to identify and tackle the cause of static data deficiency, with the aim of performing system interventions and improvements which positively influence flow performance.
Team Learning	The 22 cross-functional managers learn from system intervention through the application of quantitative and analytical methods within the static data function of the case, reflecting on their experience producing new knowledge
The Research	The team identify static data as a potential problem area for processing flows. The team focus their investigation on the subsystem arrangement, witnessing the process flows first-hand.
	The managers engage in a series of team activities utilising LSS tools to describe the flow of client information (static data) forming a trading prerequisite. The team are involved in small cycles of investigation as they seek out system dysfunction within various process pathways.
	Activities: Brainstorming, SIPOC, Mapping, VOC, SPC and visual management, data analysis and other system interrogation tools to collect performance data extracted from system databases.
Analysis	The team reviewed flow and quality of information at **a specific point** in the production of a trade. SPC and 2 Sample T-test were used to assess results.
Phase Duration	January to April 2013 followed by a period of reflection.
Reflections	This phase was the first action research cycle conducted by the case managers. Manager built mental models to describe their environment generating fresh understanding of system flow in-keeping with Senge (1990). What's more, it was found that system manipulation was common practice to satisfy internal service levels which have parity with Seddon's (2008) findings in service environments.

7.2 Static Data Impact to Flow Performance

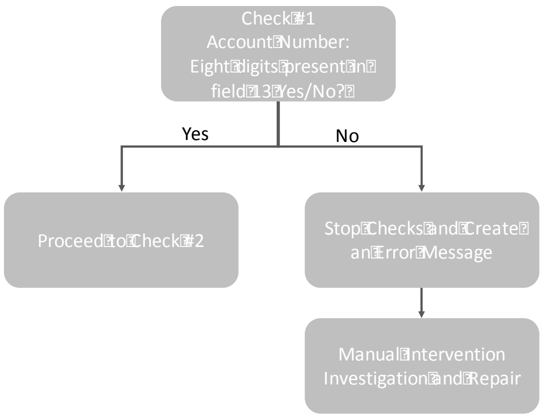
The purpose of the Static Data Department (SDD) is to act as an in-house curator of client and market data. The primary duty of the department is to create and amend 'reference data files' (records). Reference information (static data) is a key process input required by the processing system to produce (servitise) a trade product. Therefore, reference data is considered a prerequisite to support physical trade flow - in combination with trade specific data (the clients trade specification - product type, value, account details etc.). In this context, "static data" and "trade data" can be considered as files containing a large volume of information input variables that are transported through the processing system to be transformed (broken-down and/or built-up) into a product and service. See Figure 41 which provides an overview of the IPO system.

Figure 41: Basic Overview of Trade IPO System



The trade system is an information conversion process that follows predefined and programmable logic routines. Systems of this nature are not “intelligent”, cannot “think” or make decisions to self-correct from accumulated experience (Laudon & Laudon, 2012, p. 15). In this context, the trade processing system operates with logic verification capabilities only, checking predetermined fields are populated in order to permit further processing. A simplistic example of the type and nature of logic checking can be found in Figure 42.

Figure 42: System Logic - Trade Verification



During the Management meetings (Chapter six) the learning group identified static data related issues as inhibitors STP performance. For static data to inhibit flow, it must contain “logic errors” that interrupt trade flow and require manual intervention to correct and restore the product back into its flow. According to Seddon (2008a, 2008b) this type of work is “failure demand” and is missing information consumes unnecessary resource (including delays). Failure demand is, in the main, self-inflicted through the inability to satisfy demand 'right first time'. However, in the sense of banking processes then IT systems are capable of handling demand, but the rework activities are created when data is missing, mismatched or requires a manual intervention to correct the failure.

The majority of managers, therefore, associate 'failure demand' (words they do not use at present) with poor STP performance such that poor quality static data reduces flow and increases intervention costs. The management learning group developed a hypothesis that a proportion of client trading records were "inaccurate" due to a time lag between receiving the client instruction to update the record and executing the instruction (due to work-in-process). Failing to amend a record before it is required by the trade processing system (poor synchronicity) would mean the arrival of sub-standard quality information entering the trade processing system which would ultimately fail logic verification routines inhibiting onward processing to occur – resulting in total flow failure (example provided in Figure 42).

The learning group began intervention preparations by establishing the criteria of the investigation – setting the scope, metrics and objectives of their initiative (see Table 53).

Table 53: Criteria and Objectives

Problem Statement	Poor static data (quality or availability of data) is in some way affecting the ability of a product to flow through trade processing systems affecting STP performance. Management believe static data amendment requests are not carried out right-first-time, causing an 'information bottleneck' causing waste and inefficiency
Process Output	A complete and accurate client "static data" (reference data) record available to all trade processing systems.
Boundaries	Limited to the Data Hub system – "amendments process"
Metrics	Primary metrics: Number and percentage of records amended within 30 days of account opening. And number and percentage of records being amended multiple times within 30 days. Secondary metric: STP performance
Objective	Reduce the frequency of non-value add amendments, servicing static data amendment requests on a right-first-time basis

Source: Extract from Learning Group Documentation (2013)

7.3 Approach and Scope of Static Data Investigation

The approach chosen by managers to investigate the suspected issues concerning static data dysfunction was a Lean Six Sigma LSS methodology. Such an approach was familiar to the managers at the case study which is a current corporate initiative (at a relatively immature stage of introduction at the bank). At this point, the awareness of the learning group to LSS was embryonic and therefore the team had not engaged in an improvement using the approach or practiced the methods.

The scope of this investigation was established using a SIPOC[80] mapping tool which established the process and procedural boundaries of the investigation. The SIPOC covers the inputs and outputs of the process. A detailed process mapping exercise documented the workflow and produced a visual appreciation of the work flow (see Appendix A, Figures 75 and 76). Both mapping exercises were conducted at a managerial and subject matter expert team event. The event was facilitated and observed by the researcher.

The output from these exercises established a visual representation of the process (known as 'the current state'). The activities conducted by the team included ascertaining and documenting the sequential flow and task-logic through which the static data amendments requests progressed the business. The managers engaged in active writing up their findings on paper tacked to the walls of the meeting room,

On completion of the visual flow representations, the managers were keen to collect performance metrics on the volume of amendments to establish baseline performance. The team, therefore, self-organising, collected as much data as they could obtain.

The session taught managers that performance measurement lacked clarity and it was not always possible to identify process performance against service demand. The primary

[80] SIPOC: Supplier Input Process Out Customer, is a high-level requirements mapping tool (McCarty et al., 2004)

measure of performance selected was a ‘demand to fulfilment’ measure. The data collection showed:

- 100 amendment requests were received – 85 amendments performed, performance 85% (representing ‘work done’).
- Pipeline performance, 200 request existing 0-1 days from receipt of request, 100 requests 1-3 days and 50 requests 4-7 days (work to be done).

Team leaders were the focus of the management attention. When interviewed by the management the team leaders revealed they had implemented “acceptable threshold scales” for each measure. The team leaders informed management that they “controlled productivity to keep within the standard” effectively allocated staff to meet self-designed and local performance measures. Team Leaders advised that any department that requested a static data amendment were informed of a Service Level Agreement (SLA) attached to the application. The SLA stood as the team’s commitment to the applicant (internal customer) that the amendment would be carried out within a set number of days (these SLAs ranged from 1 day to 7 days).

After a lengthy discourse with the team leaders, the learning group concluded there was no metric to identify the quality performance of the “completed” data amendments. Notwithstanding the 'duration' of the SLA’s, managers were concerned with the 'quality' of static data profiles affecting trade performance. The first piece of learning developed from this action research initiative has identified that there was no measure of quality within the amendments process. Despite the new insight, it was impossible to obtain an answer the question “was the amendment carried out right-first-time?”.

To gain a ‘benchmark’ of quality, the managers created a data collection plan to collect new data to understand quality performance. After a brief discussion between the learning group and functional team leaders the decision was taken collect the following the key measures of subsystem performance:

- The number of amendments taking place on a data profile within 30 days of profile creation (managers believe this to be an important proxy measure of quality being “right first time’ without need for later intervention during the period).
- The number of amendments taking place within 30 days of initial amendment (proxy measure of quality which management believe highlights failures to complete the amendment request “right first time”)
- STP of “Foreign Exchange” and “Money Market” instruments. These products were selected by the team because they represent two high volume asset classes. Such flows are frequent and should be well known to the administration teams.

7.4 Baseline Performance

7.4.1 STP Performance

Figures 43 and 44 presents STP performance - using statistical process control charts - of two high-volume asset classes (Money Market and Foreign Exchange). Seven months of historical data was extracted from systems and graphically analysed. The data showed stability within the set control limits. The data output was of no surprise to management (they receive STP performance information), however, this was the first opportunity to visualise STP using statistical process control charts.

Researcher Reflection

The researcher was surprised at the reception of the SPC data by the managers. There was no major ‘earth shattering revelations in the data’ but rather it confirmed stability in STP. The production of management elation across the learning group was surprising.

Figure 43: SPC Chart of STP % Performance – Money Market

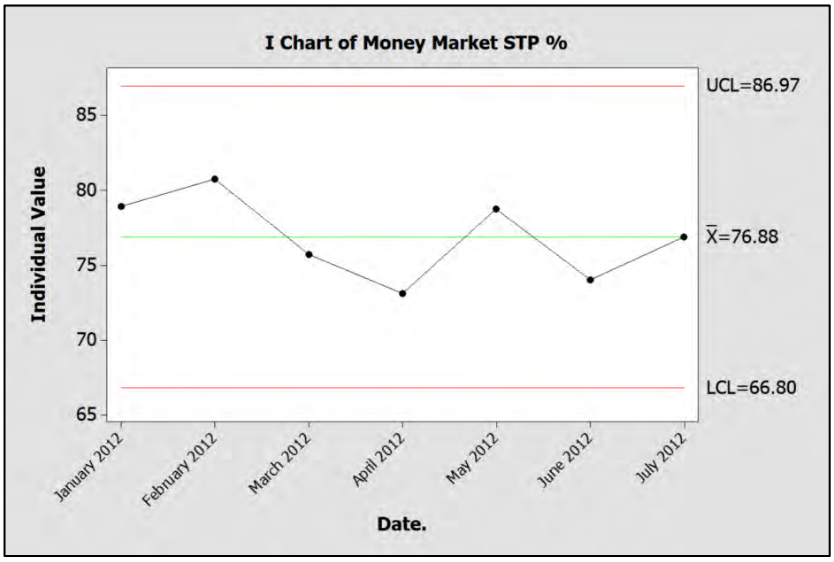
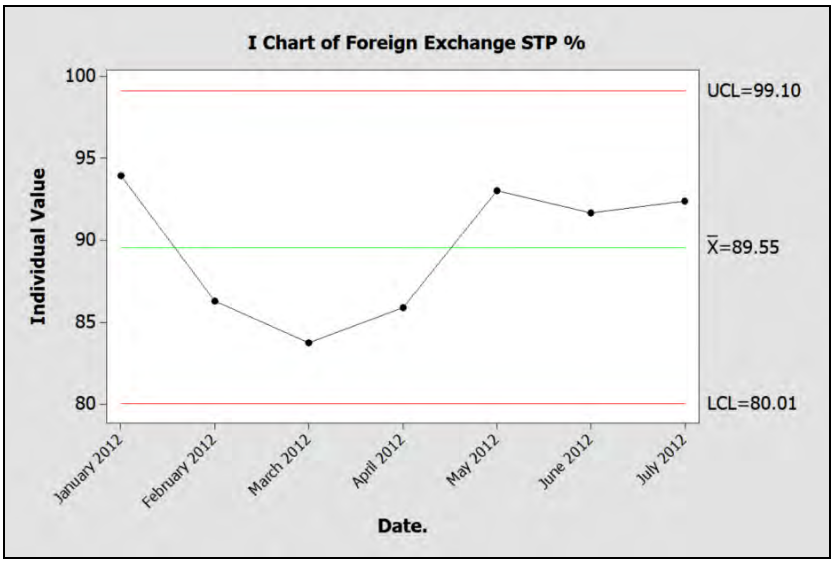


Figure 43 features relative stability across the mean and variability within control limits.

Figure 44: SPC Chart of STP % Performance - Foreign Exchange



The above chart features some instability across the mean however variability is within control limits. Instability may suggest special cause variation – meaning that random variation of the process across the mean is being influenced by some other unknown factor.

7.4.2 Baseline Performance - Amendments

Figures 45 and 46 show the 'Individual' and 'Proportion' SPC charts respectively. These charts were produced using historical data collected from a system database and spanning a period of seventeen months. Figure 45 plots the monthly volume of data amendments within a thirty-day period of the initial client data profile being created. The chart confirms the volume of 'amendment' work is stable - averaging 416 amends within 30 days of creating a client profile. The result provided evidence that re-work (failure demand) is a persistent feature of the current process.

Figure 45: SPC Chart of Amendments within 30 Days of Creation

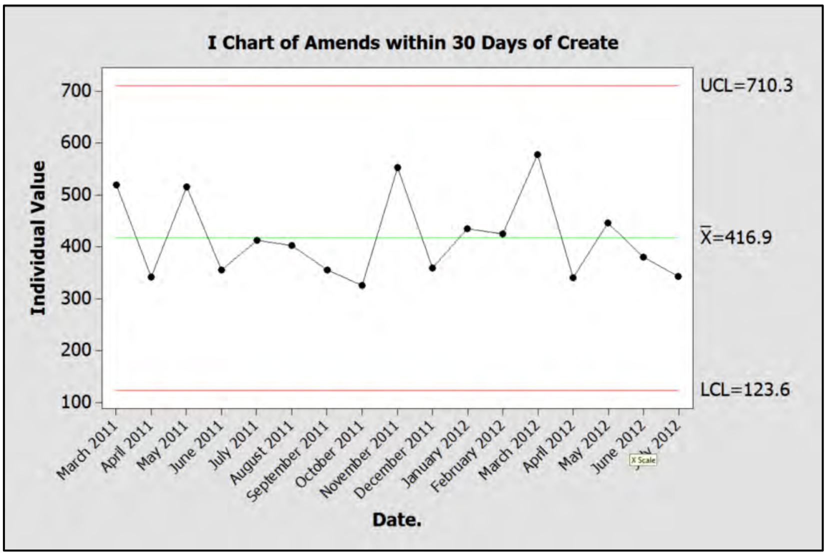
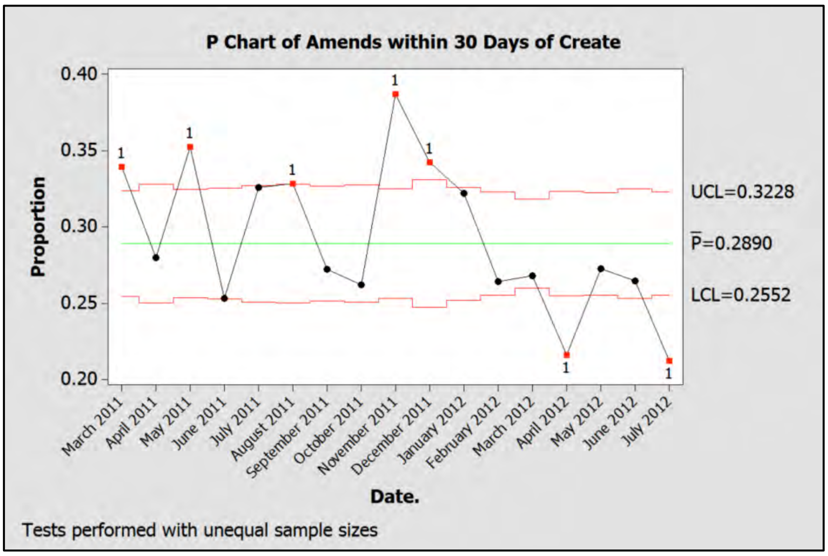


Figure 46 plots the relative proportion of amendment work versus the volume of "new work" entering the system. This chart helped the managers contextualise the ratio of system demand versus failure demand. On average 29% of all demand (peaking at 39% in November 2011) was failure demand and the proportion chart also shows instability (red observations outside control limits). At this point in the investigation management could not account for such instability during their discussions and research.

Figure 46: Proportion SPC Chart Amendments within 30 Days of Creation



Figures 47 and 48 are ‘Individual’ and ‘Proportion’ SPC charts and plot the volume of multiple amendments within thirty days of the initial amendment (2nd to X$^{th\ldots}$ amendments on a client profile within 30 days of create). Figure 47 plots the volume of multiple amendments which average 828 per month. This chart confirms the volume of ‘multiple amendments’ work is stable providing further evidence that re-work is a persistent feature of the current process.

Upon receiving the charts, management reflected and discussed the work volumes (rework volumes). Each manager mooted work volumes were beyond comprehension. One manager noted this type of workflow failure demand was beyond detection by any of the current management information system - they expressed “*how could we have known about this given the current SLA’s governing this process? What is more troubling is the fact that it …[the rework]… would have remained an undisclosed issue if not for this investigation. However, my concern is where else might we find the same or similar issues concerning rework.*

Figure 47: SPC Chart of Amendments within 30 Days of Previous Amendment

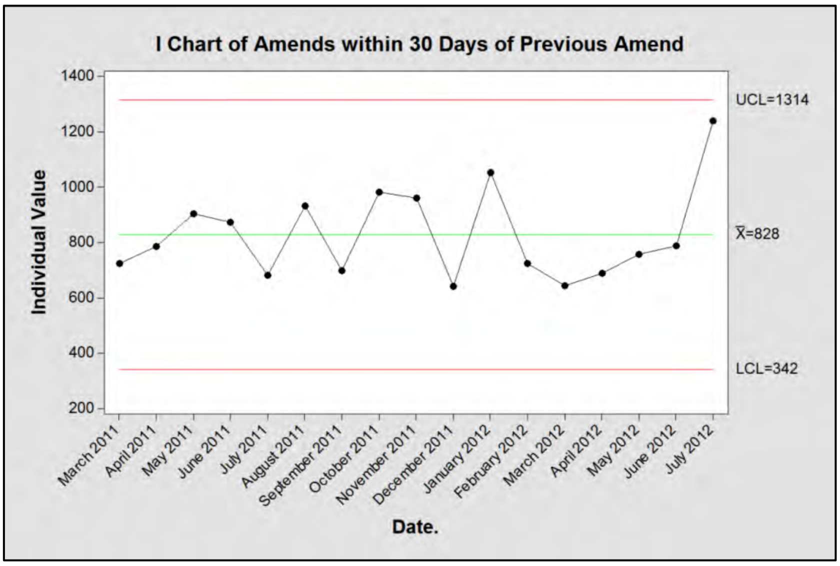
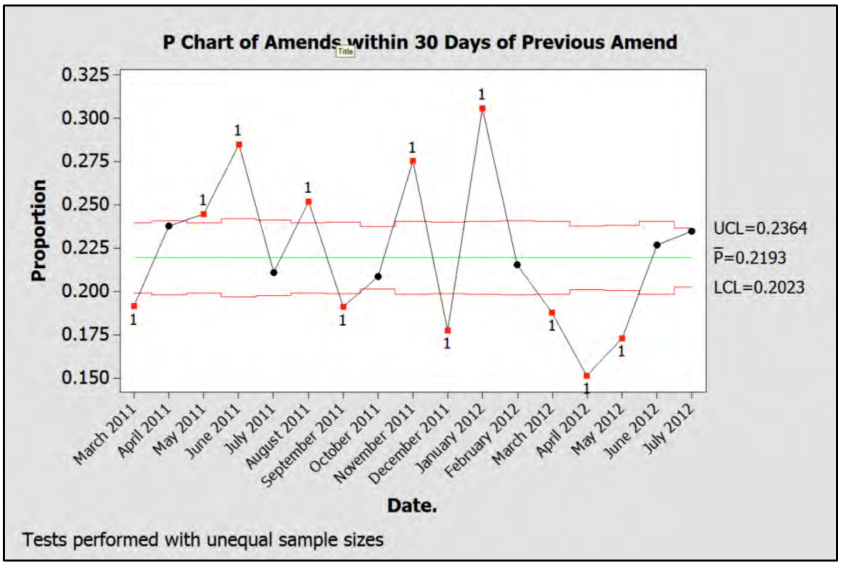


Figure 47 features stability across the mean however special cause variation is detected.

Figure 48 plots the proportion of multiple amends within thirty days of initial amendment (numerator) versus the volume of amendment requests (denominator) entering the system. This chart contextualises the ratio of legitimate amendment demand versus failure demand. On average this was 22% of all amendment demand (peaking at 30% in February 2012). The proportion control chart shows instability.

Figure 48: Proportion SPC Chart of Multiple Amendments within 30 Days of Previous



Researcher Reflection

The performance benchmarking exercise highlighted the existence of a significant amount of failure demand within the system. The learning group believe they have identified a significant donor to STP underperformance. However, the researcher tested the data and found no evidence to directly connect volumes and proportion of amendment failure demand and poor STP performance.

The mapping and data collection session ended with a 'wash-up' and the entire event was positively received by the managers. It was considered a positive learning experience even though a breakthrough project had yet to be found (which was the initial expectation of the investigation). The teams decided to continue to meet to find answers to their questions (and growing questions).

7.5 Learning

In this phase, managers embark on the first cycle of action learning. They form into three teams of five to six people and head out into business and engage with Client Relationship Managers and the frontline staff who administrate the amendments process. The exercise was undertaken to sensitise the managers to the system flow, and to 'objectivity' garner an understanding of the issue affecting flow. The outputs from this activity moulded the "Voice of the Customer" (VOC) diagram. Establishing a VOC facilitated a comparative analysis of the alignment of the system design versus the system's ability to meet customer expectations (see Appendix A Figure 77). The output of the VOC found that customers valued accuracy and speed – features that were unattainable by the current system design compounded by cultural influences and perceptions towards system failure.

7.5.1 Root Cause Hypothesis

The team conducted a session to identify potential failures and built a Fishbone diagram (aka Ishikawa diagram (1985)) which enabled a visualisation of a whole range of potential causes that would lead to multiple amendments (failure demand) (see Appendix A Figure 78). The physical activity of investigation, questioning, discussing and coding solidified the view of the team and allowed them to see where the likely sources of system dysfunction lay. The outcome of this exercise produced a new data collection plan to collect further information to substantiate root causes. As such, learning had resulted in new learning and the researcher was intrigued how managers exhibited a desire for data whereas historical encounters with such staff had often resulted in decision-making using intuition or the views of an individual SEM. The data collection is shown in Table 54.

Table 54: Data Collection Plan

Data Source	Sample size collected[81]	Data Requirement	Samples Analysed
Duplicate Amendments within 30 days of create	100	Collect reason code for amendment	93
Multiple amends within 30 days of first amend	250	Collect reason code for amendment	226

7.5.2 Analysis of Root Cause Data

Data was duly collected and analysed by the team. The selected approach to turn data into information was the Pareto approach to rank ordering issues from most frequent occurrence through to lowest in order to detect patterns in the data. The contributing factor or factors leading to the issues at hand are shown in Figures 49 and 50.

[81] Sample size calculation: MSS=(2÷Precision)^2 x EPD x(1-EPD) (MSS Minimum Sample Size & EPD Estimated Percent Defect)

Figure 49: Pareto Chart of Reason Code for Amendment

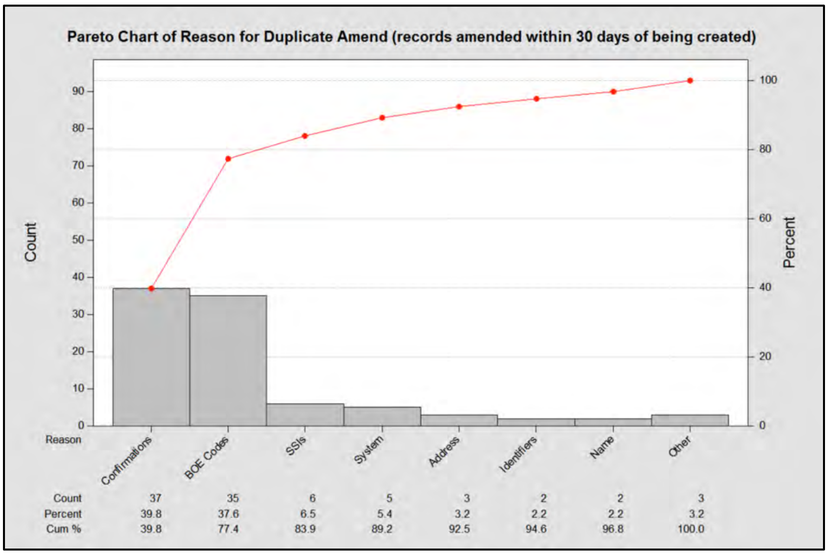
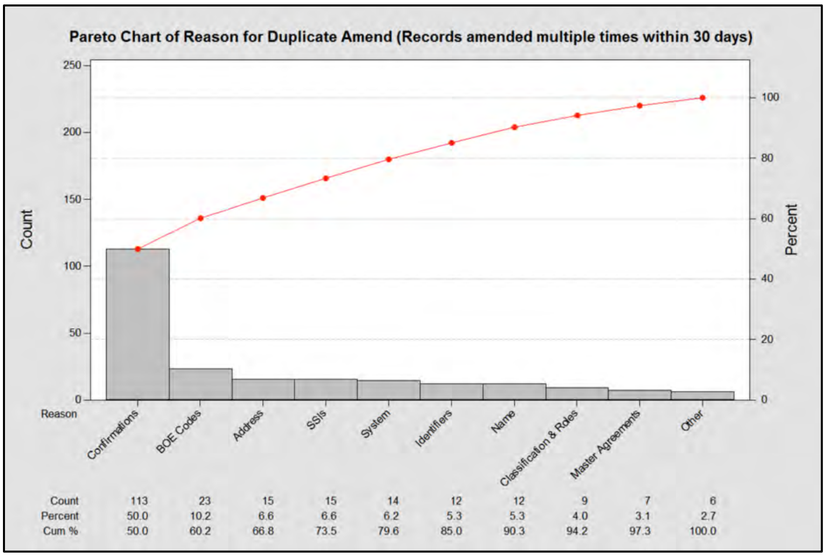


Figure 50: Pareto Chart of Reason Code for Amendment



In each case, “confirmations” featured as the most frequent cause for amendment and multiple amendments of 40% and 50% respectively (conformations refers to the entry, update or change to the trade confirmation method field within the data profile.

In the case of records amended “within 30 days of create”, it was found that the confirmation information details were “missing” from the original “create” work item (account opening). In the case of multiple amends, it was found that this issue was a continuation of the “missing” confirmation information. On further investigation, it was found that ‘confirmation information’ was a prerequisite field within the system logic (a fundamental step in the bank’s value-add service). Examination of the system protocols exposed manipulation or gaming to fulfil a departmental agenda – the trader/relationship manager sets the ‘default’ confirmation method during the account opening procedure. By selecting postal confirmation, all trades booked under these conditions flow unimpeded from the front office to back office systems. In this instance, the trade will later fail confirmation validation necessitating manual intervention to investigate and rectify the trade flow via voice confirmation with counterparty. Front office are knowingly transmitting trades to the back office that results in flow failure.

Manually confirming trades with the counterparty provides the back office administration with the opportunity the request legitimate confirmation detail for future trades. However, this type of intervention is further evidence failure demand whereby front office failed to collect all relevant information at the point of onboarding. It was found that while this kind of action mitigated future failure demand it was the catalyst for further amendments to the client data profile. Also, it was discovered that there were instances where clients may choose to have more than one trade confirmation method (tailored service) and add multiple method details. Managers were swift to suggest implications for the robustness of the “Client Onboarding” process, and many commented on the practical utility of a system that allows an incomplete work item (missing prerequisite information) sent to the Client Onboarding Team and Static Data Team (back office). It appeared ludicrous to the team.

The researcher observed further discussions between the learning group and those involved in the administration activities, whose duties it is to manage the amends system and process amendment requests. Engaging with the frontline teams and keen to have the staff join the learning journey, the learning group invited them to take part in the solution generation phase of this research stage.

During these discussions administrators informed management that the SLA's were open to manipulation skewing the true performance. The teams admitted they would 'Open' (create and amend) work items which did not contain full information necessary to complete the request and then close the work item issue just to meet the SLA threshold (gaming by the team). The behaviour guaranteed the team did not breach their SLA's and receive undue criticism for poor performance. There seemed, to the managers little understanding of the dependency between teams and how the quality of the service provided was sub-optimised. The team had decided a balance between hunting of the information to do a 'quality job' (request and wait for missing information) and focusing on their productivity (time management to meet the SLA). The SLA had won and time was prioritised over quality in a system that was not robust – in essence the team were pushing dirty information around or closing and opening work for themselves).

The managers found, in order to compete the service request – of creating or amending data profiles – a new work item had to be submitted by the Trader or Relationship manager. The manual keying of such information and lapses at this level meant incomplete information but it was still passed into the system (which produces failure demand and demand amplification (Forrester, 1961; Seddon, 2008a)). Similar behaviour was found within service environments Seddon (2008a), who found that poorly designed metrics drove bad behaviour which negatively affected true service performance. In essence, people learned to survive within the system no matter how illogical it would at first appear. The admin team attitude towards performance mirrors Goldratt's (2004) work. He showed how measures drove behaviour and

stated *“Tell me how you measure me and I will tell you how I will behave. If you measure me in an illogical way… do not complain about illogical behaviour…”(Goldratt et al., 2004).*
The learning group realised an information interdependency was not being met by those requesting the static data be created or amended. In effect, they had identified that the system - and its performance - is constrained by information arriving into the process at a sufficient quality standard (complete) to allow flow to occur. The observed phenomena is consistent with Goldratt’s (2004) “the theory of constraints” which asserts organisations, and its systems and processes, can be measured and controlled through studying variations in three dimensions, Throughput, Operational Expenses and Inventory (quality is an enabler of throughput/flow) also that any poor quality information that consumes bottleneck capacity is a major loss to a system.

Researcher Reflection

This particular observed learning cycle saw managers begin to view their business as a system that required high quality inputs in order to function. The managers clearly saw the dysfunctions of poor quality data and the complete stop to process – and trade – flow where information was expected but found to be missing or inaccurate. The change in management perception was a major learning event for the team and their engagement with the real world of banking service problem-solving.

With the new understanding of system performance, the learning group mapped the current information flow and identified ‘where’ and ‘when’ information is required and ascertained the correct quality level of information required. Having a holistic appreciation of the requirements both from a customer perspective (captured in the VOC) and from an internal perspective (captured by the map), managers designed change to the IT system. In union with system changes, training manuals were produced containing procedural maps to educate Traders and Relationship managers (the initiators of create and amends work items) of the new system features*, and of the constraints produced due to poor quality or missing information within work item requests.

*IT functionality changes: auto selection of postal address within account create template abandoned, traders and relationship manager must physically select a confirmation method. Added decision logic and new routing of process pathways to assist information collection earlier in the onboarding process to ensure timely arrival of the required information (see Appendix A Figures 79 and 80).

7.6 Improvement Verification

On completion of the IT systems changes (noted in the researcher reflections) managers sought to verify the impact of the improvements to system performance. A continuation of the SPC charting of amendments within thirty days and duplicate amendments to place and was analysed alongside the original performance (see Figures 51, 52, 53 and 54). The formal closure of the learning cycle in this way allowed managers to see the impact of their interventions in the processing system.

Figure 51: SPC Chart - Amends - Before and After Change

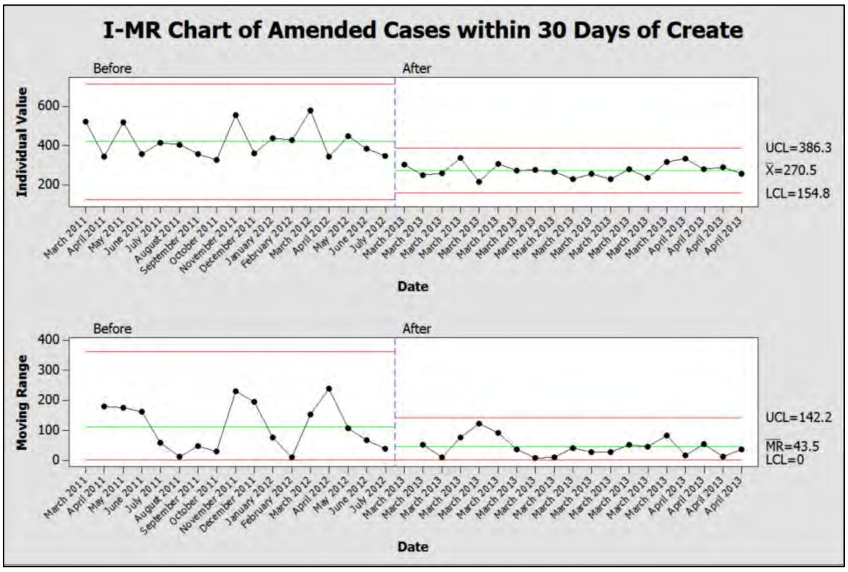


Figure 52: Proportion SPC Chart - Amends - Before and After Change

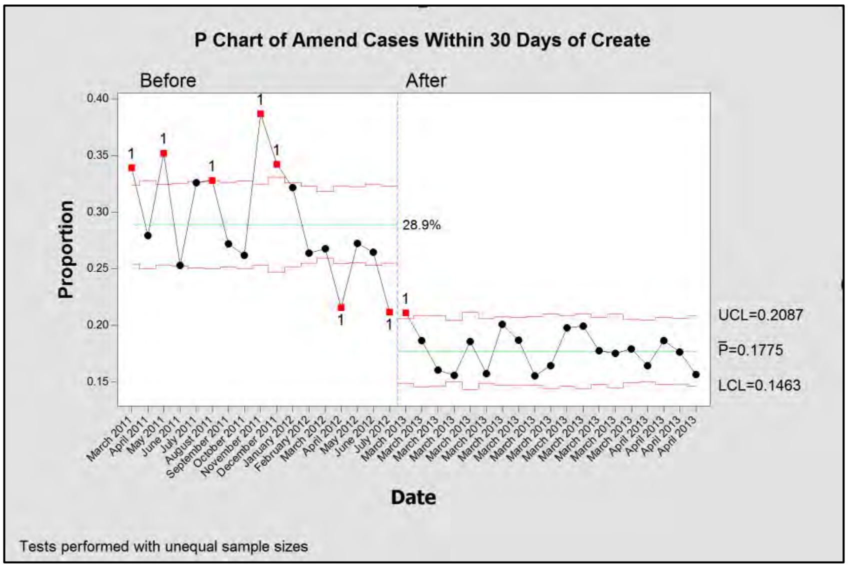


Figure 53: SPC Chart - Multiple - Before and After Change

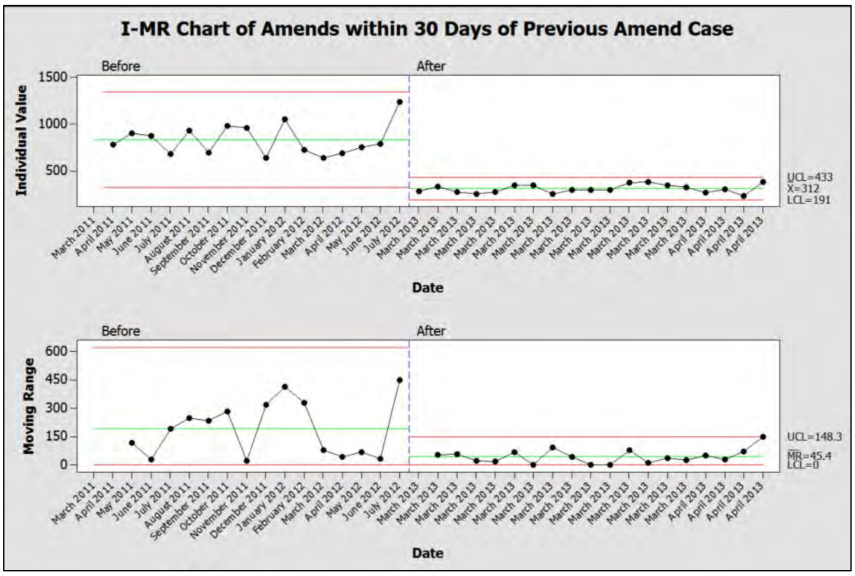


Figure 54: Proportion SPC Chart - Multiple - Before and After Change

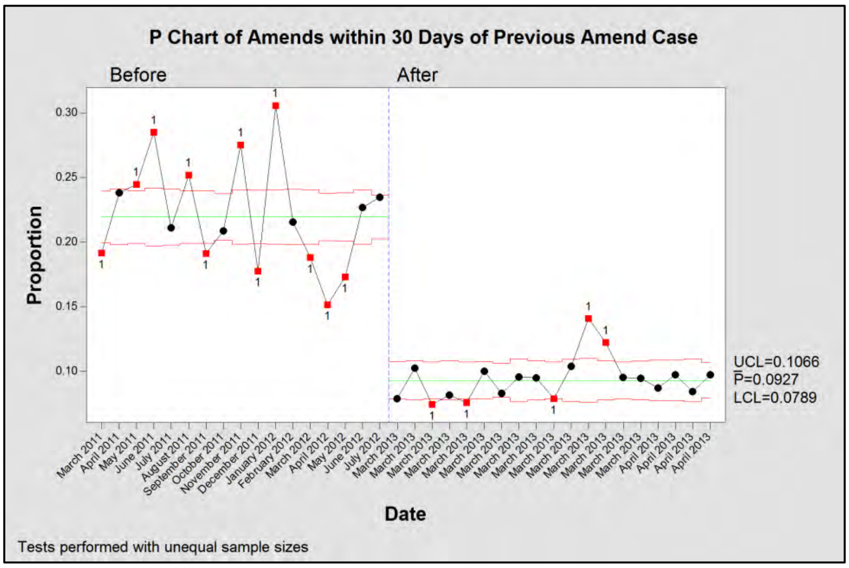


Table 55: Results Table of Improvements

Measure	Before Change (Average)	After Change (Average)	Reduction
Volume of amends within 30 days	416	270	35%
Proportion of amends within 30 days	29%	17.75%	39%
Volume of duplicate amends within 30 days	828	312	62%
Proportion of multiple amends within 30 days	22%	9.27%	60%

The improvement results show a significant reduction in the volume and proportion of amendments (see significance test in Appendix A, Figures 77 and 78) post implementation of modest changes. The SPC charts reinforced the positive feeling amongst the group – it positively reinforced that they had collaborated and made a change to their systems. The importance of the learning was not wasted – the team felt they had, as managers, produced a significant difference improving the of the working environment. The sense of altruism and the positive association of the managers supporting change was a noteworthy event.

System stability has been significantly improved under the new operating conditions through a reduction in the standard deviation (measure of variability) and lowering of the control limits. Information quality and availability had been shown to produce a tangible outcome through a reduction of failure demand. The management learning group returned to the question "does he quality of static data affect STP performance"? Having measurably improved quality and throughput speed of the Data Management Amends process the group were now able to test whether the improvement had net effect on STP performance. This stage allowed further learning to occur within the group who sought to link subsystem enhancements and performance improvements (static data quality and speed) with a direct correlation to macro system performance positively influencing STP. Verification of a correlation would represent the second positive link and direct relationship between the factors negatively impacting on static data quality, their removal, and the achievement of high performance.

The management team reconvened and were practically exposed to the technique for hypothesis testing of sample means known as a “Two Sample t-Test”. The test compared two samples of STP performance data “before” and “after” the improvement was made in static data systems. Figures 55 and 56 plot the STP sample data within a SPC chart, this is a continuation of the STP SPC charts which managers used to benchmark performance at the beginning of the investigation (see Figures 43 and 44).

Figure 55: SPC Chart of Money Market STP Before and After Static Data Improvement

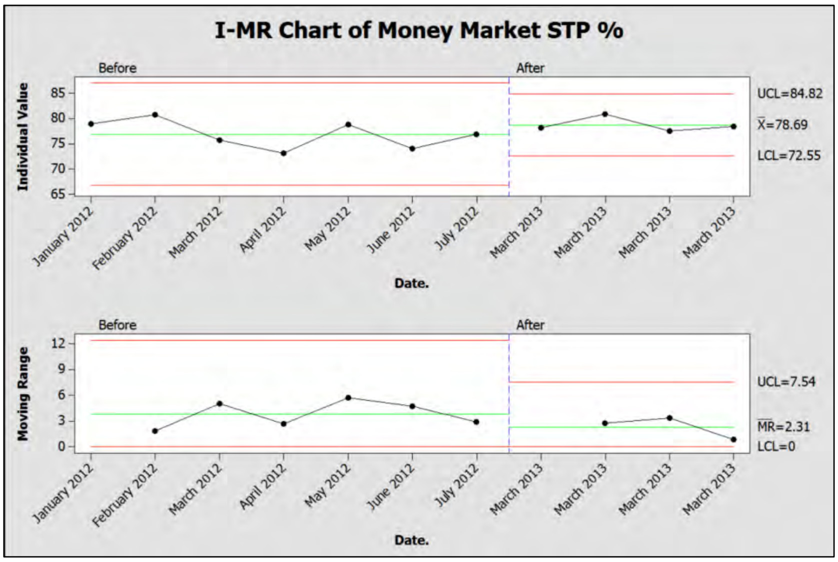
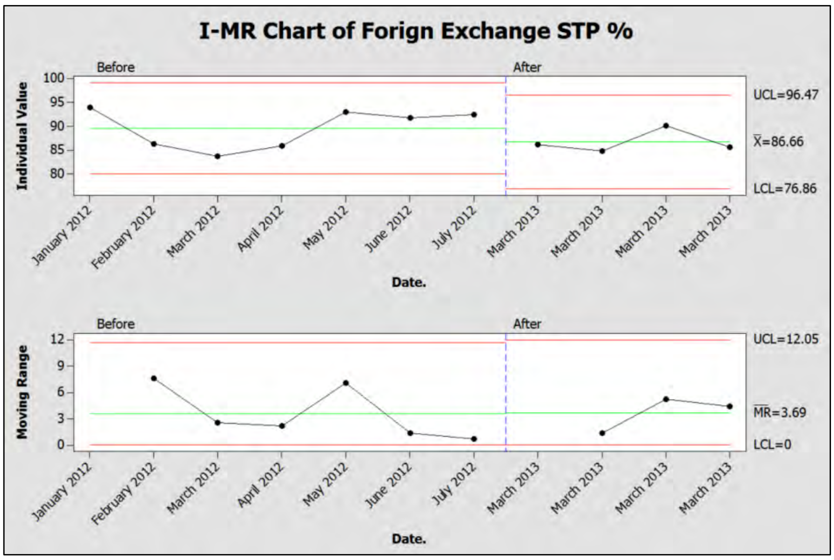
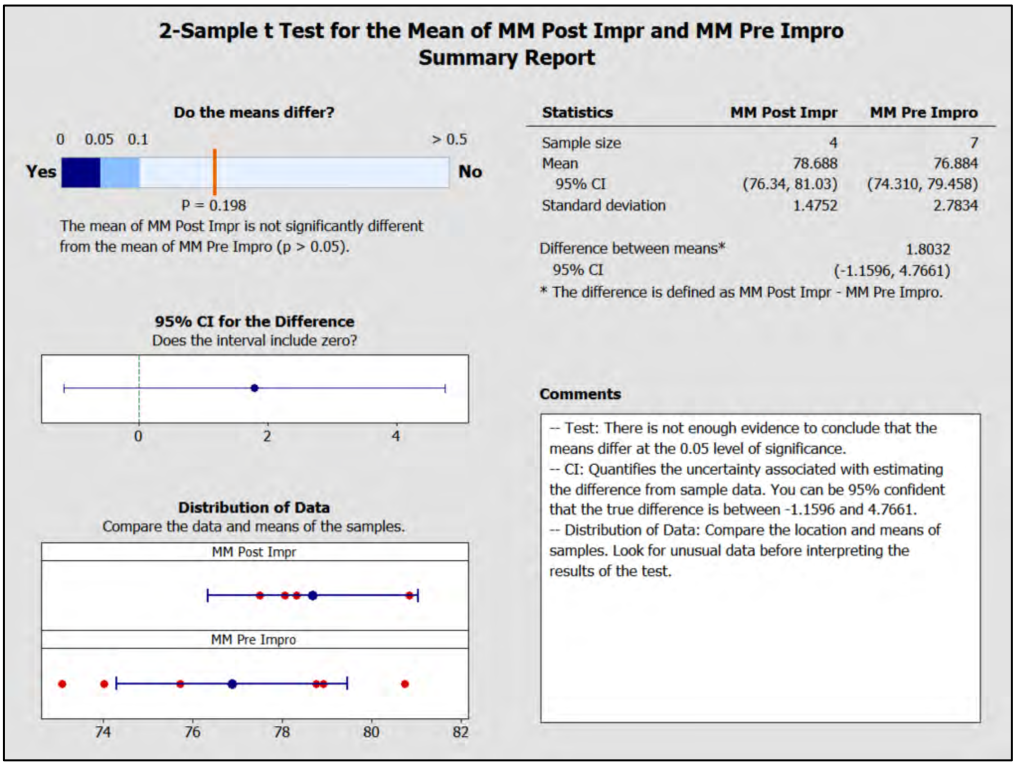


Figure 56: SPC Chart of Foreign Exchange STP Before and After Static Data Improvement



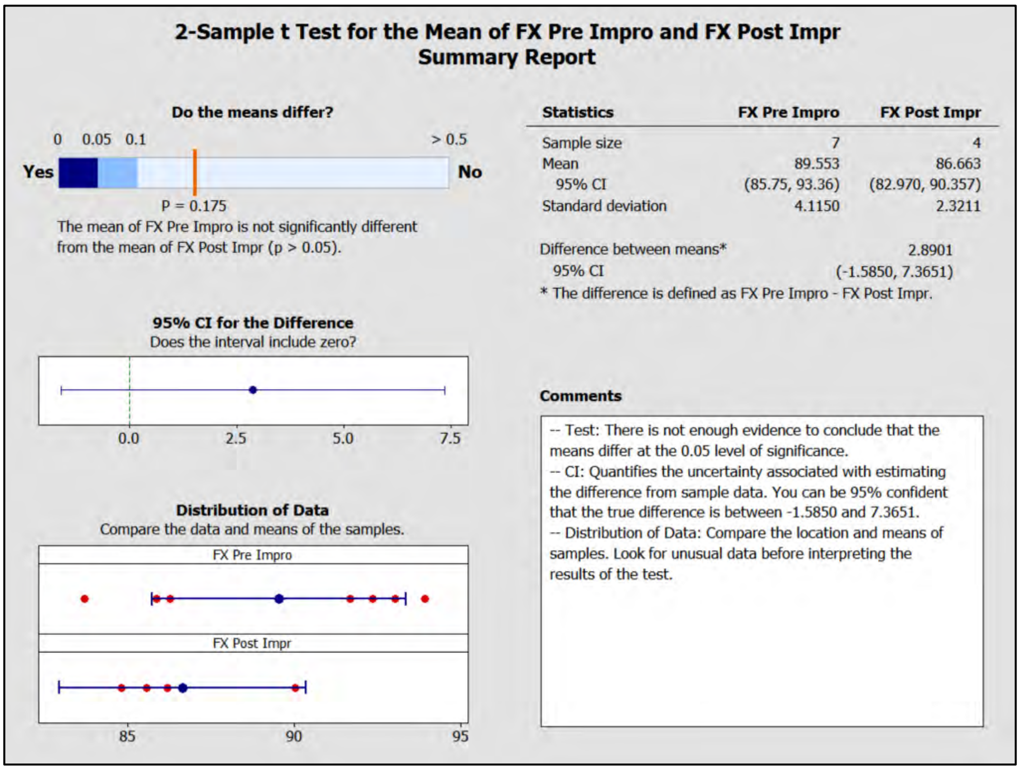
Initial interpretation of the SPC charts suggest a minor increase in the average STP of Money Market, however, there is a minor reduction in the mean STP of Foreign Exchange. The researcher reflected on the SPC analysis and doubts whether a significant change has occurred. Two Sample t-Tests results are shown in Figures 57 and 58.

Figure 57: Two Sample t Test - Money Market



The test has returned a p-value of 0.198 which is above the standard alpha of 0.05 therefore in this instance there is not enough evidence to conclude with certainty that Money Market STP has increased in the post-change environment.

Figure 58: Two Sample t Test - Foreign Exchange



Similarly, the Foreign Exchange test has returned a p-value of 0.175 which is above the standard alpha of 0.05 therefore in this instance there is not enough evidence to conclude with certainty that Money Market STP has increased in the post-change environment.

7.7 Management's Reflection

The sense of deflation within the group was palpable. Managers reflected on the success of the static data investigation but struggled to make sense of the muted effect of STP performance. The atmosphere in the room occupied many pages of writing in the researchers' day journal. Denial also existed – the managers believed the outcome was counter intuitive, they had observed a reduction in trade flow exceptions with regards to "Confirmation Details Missing" therefore logically, and intuitively, this implies that an increased number of trades where flowing without manual intervention. Manager 'A's view was "*the amount of exception cleared up by the static data process improvement may have been too small to register an effect on STP*". However, manager 'B' countered saying "*an average reduction in amendment volume by 35% (average 146 instances monthly) from 'create' and a 62% reduction (over 500 instance monthly) in 'multiple amends' must have an effect especially if managers X,Y and Z say have witnessed a reduction in exceptions (defects)*. Manager 'C' added, "*…this reinforces what I've thought all along, STP is wrong. Either the data going into the STP system is wrong or the method of calculation is wrong, or worse still – both. We should to map it out to understand more about what it is we are actually measuring and being measured against".* Far from dividing the team with the negative learning feedback against expectation, the researcher witnessed a rallying of the team. Managers now questioned the legitimacy of the complete system and wanted to understand why and how subsystem performance did not contribute to an overall system performance improvement. The behavior seemed almost contradictory or that the managers had cycled through a form of bereavement curve within the space of an hour. They had emerged with a new passion to learn and test.

The researcher considered manager 'C' comments to be a fair evaluation of the issue at hand. He secretly concurred with manager 'C' when he proposed a new approach to gaining a better understanding of the system to the learning group. However, the researcher reflects that management did not know or understand the design of the STP measurement system at this stage which concerned the researcher. Within the group, managers found dysfunctional behaviour from poor measures yet failed to challenge the industry standard – the STP measurement. At this point in the learning journey, managers had produced the first piece of evidence to indicate that STP was indeed a poor measure of performance. The researcher is reminded of the survey questionnaire, in particular, question #1 asked "does STP accuracy measure performance?" Nonetheless, managers still accepted STP as "an absolute" - until this point (but not criticising STP in open forum for the first time). The researcher notes that he is witnessing a growing in confidence in the team of managers and a willingness to challenge the status quo, learn and build new knowledge without causing inter-manager political problems (Senge, 1990). The team were now starting to perform using their new knowledge, new skills and importantly – new attitude.

The management cohort discussed the merits of the issues raised by Manager 'C' at a subsequent meeting. The opinion of Manager 'C' swiftly gained support and a majority agreement soon after. The learning group preference was to now investigate the sources and feeds of information which made up the STP metric and to challenge its sensitivity given their physical and emotional investment in the data team and the low significance of results it reflected.

Chapter 8: Third Cycle

8.1 Introduction

The previous chapter presented the first cycle of action learning where managers were able to extract and interpret system feedback using Lean Six Sigma techniques. The phase compelled managers to generate new understanding and knowledge of the system. New knowledge represented an enabler which empowered managers to perform system interventions and focus on flow improvement by reducing the occurrence and sources of failure demand. Interventions did produce improvements at the sub system level but the learning group was unable to improve the primary metric of system performance.

This chapter will now present the second cycle of organisational learning and document the pragmatic approach taken by managers as they try to identify the enablers and inhibiters of STP performance.

Background	There is a growing opinion amongst the team that the key performance metric (STP) is unfit to measure flow and detect failure demand (unresponsive to changes in system performance). There is a sense of deflation amongst team members on the assumption that performance is significantly worse than current management information systems report.
Team Learning	All 22 team members learn that their key measure of flow is incapable of accurate measurement and is heavily skewing performance feedback.
The Research	The team embark on system mapping exercises to determine the system layout and product flow.
	Management investigate the application and structure of system feedback loops
	Data driven modelling of alternative systems to measure performance through system feedback.
Analysis	Modelling and simulation of STP performance to ‘stress-test’ the fit and ability of the various models at accurately interpret flow performance. Management use the results of testing to select a new measure of performance to provide accurate system feedback.
Phase Duration	April to May 2013
Reflections	Management develop mental models to map product flow to the trade processing system architecture (Senge 1990) which unites the options of the team, building a strong consensus of system design and how the system must be interpreted – feedback design and information structure (Laudon and Laudon 2012.

8.2 Storming

In the closing section of the previous chapter, the narrative demonstrated a general and shared disbelief towards the “MGT” (mid to late 2011) report which manifested in deep emotional feelings towards the subject of poor performance and over-staffing which the report inferred. Since the beginning of the research (from the systematic literature review onwards), the researcher witnessed managers expressing varied opinions with regards to the source of their flow issues, but these assertions were based on very little beyond intuition. The learning group appear immensely frustrated which is exacerbated in the presence of the Director and also when challenged by their direct reports (heads of department). The researcher sensed a deflation in morale after the positive intervention with the “static data system” resulted in an ineffectual impact on STP and no significant or measurable effect on performance.

The team reconvened at another workshop (known as a ‘Learning Lab’) and manager ‘C’, expressing his views on the practicality of measuring STP flow and the setback from the first cycle of investigation weighed on the learning groups minds. Manager ‘C’ also argued, with passion, *“that’s us back to square one; it’s like ‘sakes and ladders’ working here”.* The researcher asked Manager ‘C’ in open forum why he felt this way. Manager ‘C’ replied, *“it’s only my opinion, it’s based on nothing else other than we have tried has worked”.* The researcher was compelled to point out to manager ‘C’, and for the benefit of the team, “*within academic circles finding nothing is actually seen as producing a result as long as the theory and the test where designed correctly. What you perhaps don't realise is you have proven by implication - if nothing else at this point - that STP can’t detect changes in performance, this is actually a significant turn of events for learning and for knowledge”*. Manager ‘C’ returned with, *“yes perhaps for the academics, however we are judged on STP performance, I feel we have proven that we cannot raise STP. To me that is embarrassing”.*

Manager 'D' swiftly countered, *"look if it makes any difference 'C', since the …[static data]… project in my area I have been able to discharge one FTE from team 'A' who has now joined team 'B' who are currently struggling to find capacity to manage their work queue. The result is that I'm signing off thousands of pounds in overtime each month to maintain SLA's. So, my plan has been to deploy team member 'K' with team 'B'. 'K' will spend half their time helping with the …[workflow]… queues and the other half I've instructed 'K' that I want them to rollout the learnt from our investigation in team 'A' as a Yellow Belt project, applying the same logic to team 'B's processes and queue. As for benefits, Team 'A' really see a difference …[in performance]… and are enjoying the kudos (they laugh)"*[82].

"So, if STP hasn't changed then STP hasn't changed, let's take what we have …[learnt]... and see if we can follow up on your idea about mapping out the system and see 'what's what'". When I go back to my office I have one team who are extremely happy that we have got together on this project and made improvements to their jobs. What can I say about STP? not a lot quite frankly other than it is crap, sorry folks, it is. I will tell them it's meaningless and they should visit my office and see what we are doing".

The expressed opinions and the last argument won the endorsement of the fellow managers of the learning group. The managers who were somewhat negative at the beginning of the meeting now seemed positively reinvigorated by the positivity flowing from manager 'D'. Manager 'D's attitude towards STP improvement was dismissive to the point where he had firmly reached the conclusion it was unfit for purpose. The researcher paused to analyse manager 'D's statements, he reflected that perhaps the managers had merely relieved a subsystem bottleneck and, as predicted by the Theory of Constants (Goldratt et al., 2004), expedited work to the next bottleneck 'quicker' which would signify a larger constraint further along the system flow.

[82] This manager has, without knowing, intuitively employed three of Kotter (1996) *eight steps to effective change* ' "empower others to action the vision, make quick wins and build on change".

Researcher Reflection

The researcher identified curious behaviour of manager 'C'. He appeared to have a pragmatist approach to improvement that is goal orientated. C's reaction demonstrated how measures drive the wrong behaviour (Goldratt et al., 2004). Perhaps not the ideal approach is exemplified by the crushing sense of failure experienced in the failed outcome to increase STP within the first cycle of action research. Nonetheless, this manager has some interesting views on system design that the researcher is interested to see how they develop or get rejected by the group.

Manager 'C' was unware of the social and cultural benefits attached with team improvement and the positivity it generates. Kotter (1996) identifies "quick wins" as a key enabler for future 'large scale change' by reducing the fear of change and building an environment which encourages organisational learning. Mangers 'C' was however a source of fascination to the researcher, he appeared to be the most pragmatic and energetic of the group. Just as the learning group were coming to terms with the outcome of the pervious learning intervention, Manager 'C' said to the group *"Let's pull together our process documentation and see what we can map and take it from there. There's something not quite right and we need to know what that is for our own safety".* Shortly after a brief planning discussion the group agreed to the proposal. The researchers' curiosity was heightened by the use of the word "Safety" - was the motive self-protection or a quest to grow system understanding?

The objective of the next action cycle was to investigate whether information feeds (system feedback) were inhibited in some way thus affecting the precision/detection of flow using the STP measure. Managers set out to collect information on their systems using to two questions (which were the result of a team scoping session) to guide their investigation.

1. Where and how is STP information collected from the system?
2. How is the STP measure calculated?

8.3 Investigating and Mapping

The first team exercise of this learning cycle was to collect information on the structure and layout of the interconnected IT systems that make up the trading architecture of the organisation. The Managers returned to the 'learning lab' with reams of official procedural documentation which described process "controls" (checks) performed by trade administration staff as part of the regulatory requirement. The researcher noted that procedural documents were five to eight thousand words long and suspected they held a low level of practical utility to the map exercise. Nonetheless, the researcher read every document to increase his sensitisation to the processes. The researcher found a large number of topics covered in the documents were specifying 'how' to manage, process, and 'document failures' of automated processes. According to one manager, *"the procedural documents were taken out once a year and checked for consistence before being given to auditors / regulators or associated external compliance officers".*

The learning group quickly realised that the current procedural documents were inadequate to meet the learning objective – merely existing as a management reference information. The documents contained little information relating to systems design, product flow and 'critically' no information on STP performance measurement. The documentation was found to be a split between regulatory reporting activities (checks) and visual "navigation" documents (screen shots) specifying how to execute task correctly. The documentation described only the task environment which brought into question the practical utility of the documentation from a systems perspective. Following a prolonged period of data collection, the managers agreed to abandon this particular approach owing mainly to the lack of systems clarity that the procedural documentation offered.

The managers learned that key reference materials provided little or no practical system information. Therefore, after a brief discussion, the team decided to contact the IT department of the commercial bank and request specialist systems support. It is noteworthy to mention that the IT department sits outside the responsibility of the Director of Operations but was recognised as a process stakeholder that could help offer insight into work flows. The learning group are starting to 'span boundaries' (Kotter, 1996) operating outside their immediate environment to achieve an overarching system goal.

At the next meeting, a systems diagram had been received from IT and was enthusiastically distributed by manager 'C' to the team (see Figure 59). The researcher had sight of this map prior to meeting with the learning group and stood astonished at its complexity with some concern that the map would add more confusion rather than clarity for the team. The group reviewed the document and, after a short while, the first vocal question by manger 'H' was *"where do we sit within this maze?"* this opened a torrent of questions from manager 'C'. Manager 'E" invited the researcher to provide some thoughts on the map from a Lean Six Sigma perspective but gave the response that he could not assist with translation of this type of map nor advise on its quality or technical accuracy. The researcher was interested to understand if the managers could build a picture of flow from this particular artefact. The researcher asked the group *"If I were to trade with Lloyds today where would my trade enter this map?"* The researchers question produced an intense study of the map until manager 'F' said *"that's it, that's what I need to see. I need to see this map unwound so that it follows the product flow. Not unlike the flow charts we produced for the static data ...[project]… we don't require tasks in sequence, we require systems in sequence"*.

This confirmed the researcher's private and unexpressed view. The self-determined objective of the learning group was to understand where in the trade flow sequence information is collected and using 'trade' product types to highlight flow seemed the most logical approach. The team requested that the researcher facilitate mapping sessions so that managers could visualise the sequential movements of products through the IT architecture. The researcher demonstrated a selection of maps from the Lea Six Sigma tool box. A simple pictorial systems flow map gained full support and was later piloted by the team (see Figure 60).

The first flow diagram complied (one of six produced mapping all product flows over a period of several weeks and meetings) simply and accurately depicted the route through the systems architecture a trade would follow to the best of their knowledge (corroborated by the IT team and product team leaders). The team were astonished that this was achieved on 'paper'. The major 'learning' at this point was this was "*the first time I've ever seen trade flow across our system, it's just so clear to me now*" (Manager 'D'). The researcher believes this moment represents a major point in the collective understanding of management and for the first time a common mental model of trade flow pathways has been defined by the team.

The researcher attempted to draw some perspective on these claims and asked whether such a method had been used elsewhere in the bank to present workflow. Manager 'G' admitted *"I have been in the industry over thirty years, I've worked in New York, Dublin, and south east Asia. Sure, I've seen a task map before (process/logic map) but I can say that I've never seen trade flow mapped out like this before. It's so simple when you see it in front of you"*. The testimony and group agreement implied the division of the business into technical departments may have prevented the "mastery" of a system so cherished by Senge (1990). When asked why such tools had not been used historically, Manager 'G' stated *"well you only need a map if you are lost or you don't know where you're going. Although, mounting maps on walls won't be viewed as professional to some Execs!".*[83].

[83] The manager also recounted a story when his team "…pinned a poster on the wall and facilities told us we didn't have approval for it so we were instructed to take it down" and this could be regarded as part of the organisational memory that has prevented the use of such methods and a systems approach to trade flows.

Figure 59: System Architecture

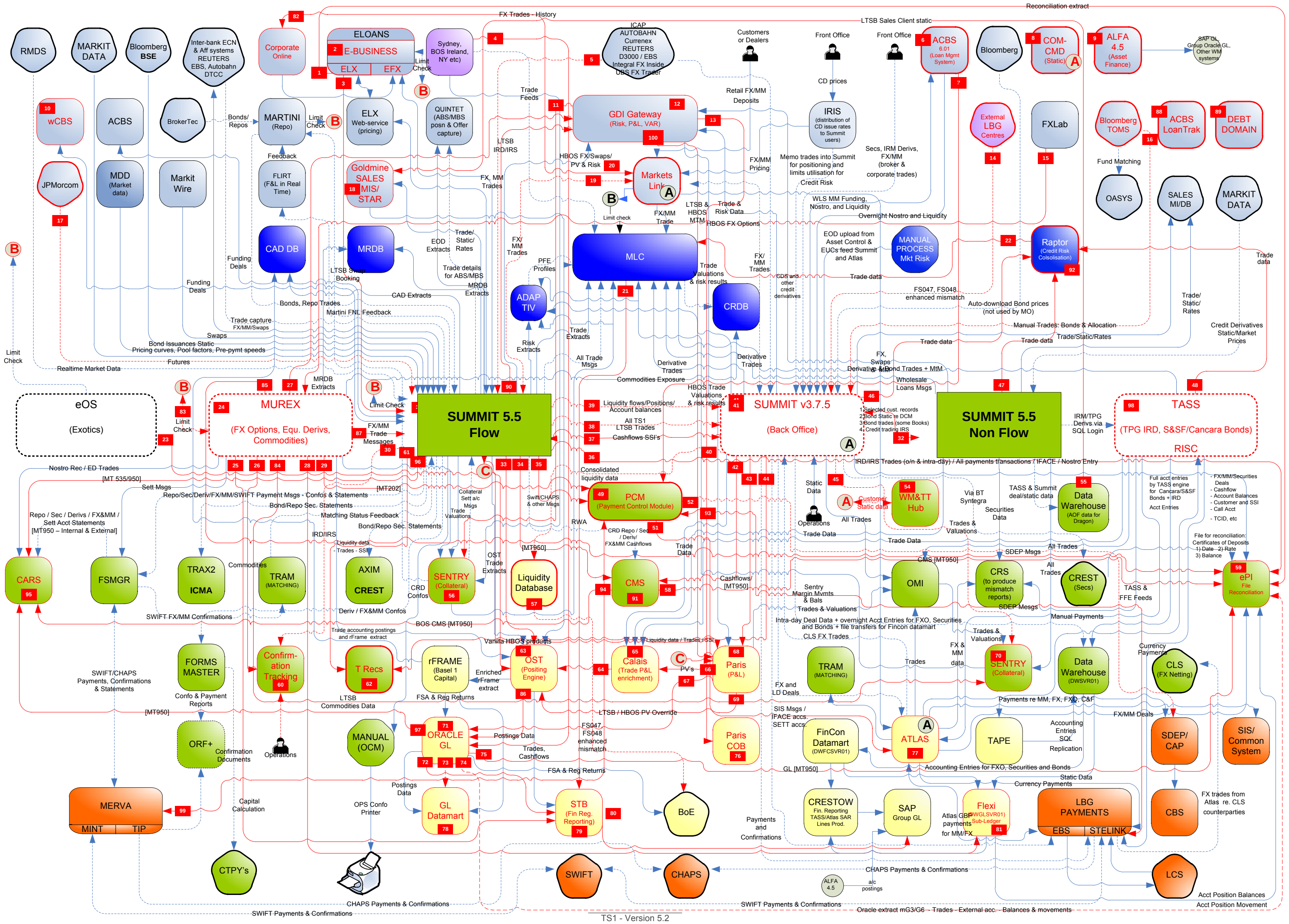
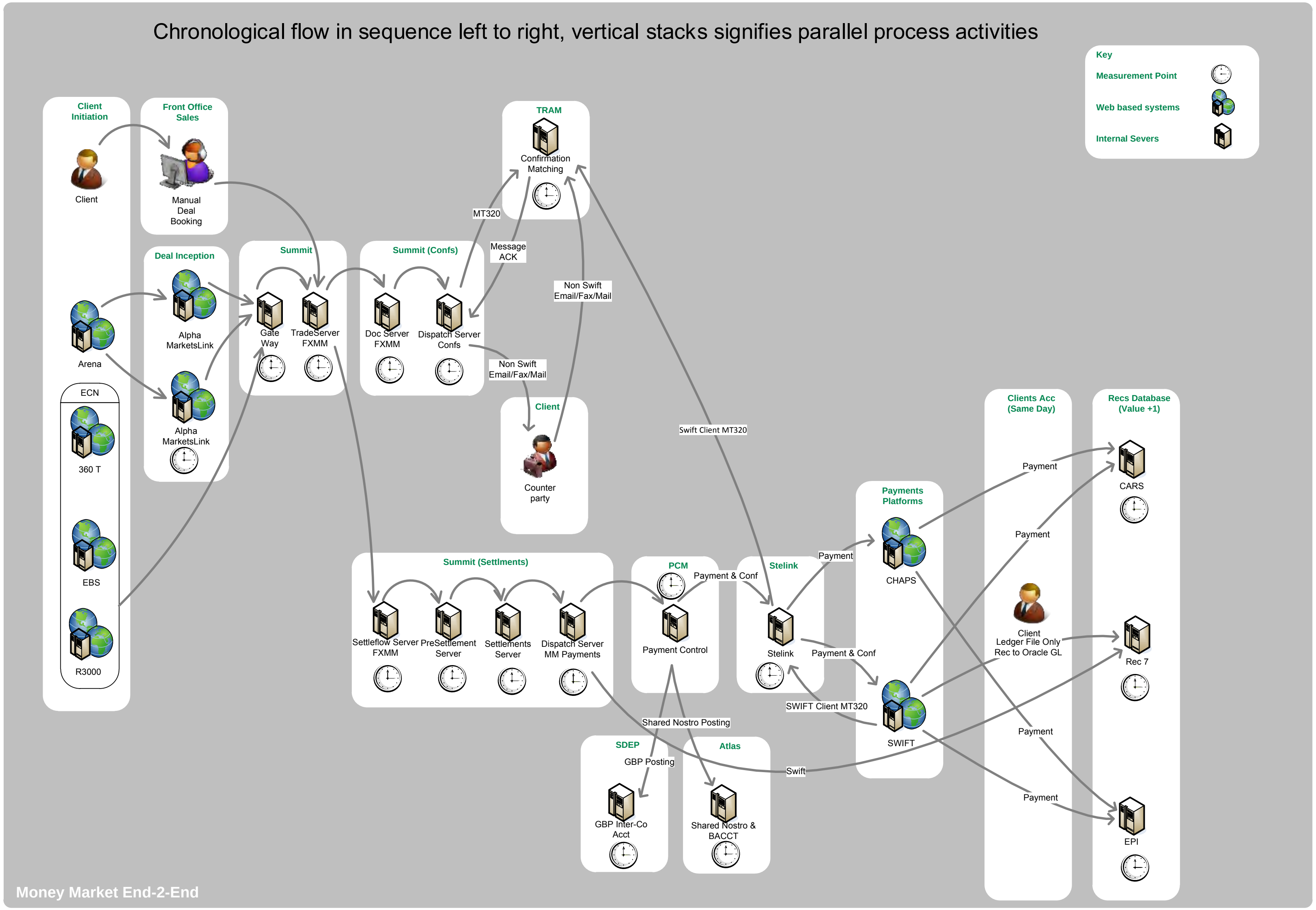


Figure 60: Systems Process Mapping



8.4 Feedback Loops

In answering the first question of this action research phase, the team quickly discovered a significant mismatch between the number of internal trade processing servers (which are the focus of this study) and the number of servers under measurement to compute the STP performance and STP reporting within performance "dash board"[84]. The STP dashboard collects performance data from three sequential trade processing servers, whereas managers mapped eight sequential servers. Therefore, system feedback was being significantly under-reported thus distorting STP performance[85]. Modern authors highlight the importance of a feedback design for management and improvement, but they tend to focus on initial system designs and not systems that have adapted over time as in this case.

The significance of this finding for the study and for the organisation was immediately understood with enthusiasm by the researcher in terms of systems learning, it was a feeling not shared by the group. The group were perplexed and resulted in denial prompting a second round of questioning whether this was true and each manager returned to their team to verify the outcome. The managers confirmed the map was accrete. The finding had the potential to become political and perhaps controversial within the senior stakeholder group (Exec's) which could lead to managerial criticism and reputational harm (Executives questioning why senior managers were not aware of the design trading system sequence).

8.5 Modelling

Before approaching the Director with the findings, the team decided to test its implications by asking "what does this mean for flow?" The team instructed the researcher to model STP using three and eight servers to assess the impact. The researcher formed a quantitative mathematical model for the next meeting of the team.

[84] The dashboard is a management tool used to assess and officially review asset class and product performance
[85] From an IT perspective, Laudon and Laudon (2012) argue the precision and accuracy of information feedback is a mandatory requirement of an effective system and so too modern STS authors from Ohno (1988) to Seddon (2008).

The model enabled variable data to be input into a pseudo-server architecture and was used to form a contingency model to test the sensitivity under variable conditions (#servers and performance. The model generated the corresponding STP performance seen in Figure 61.

Figure 61: STP Modelling

MODEL 1 Straight Through Processing 3 servers, classic model Found at case

Server 1	Server 2	Server 3	STP
82%	67%	81%	76.67%

MODEL 2 Straight Through Processing, with all servers included investigation

Server 1	Server 2	Server 3	Server 4	Server 5	Server 6	Server 7	Server 8	STP
90%	82%	80%	67%	91%	83%	81%	98%	84.00%

During the construction of the model, the researcher worked collaboratively with the learning group and asked certain managers to provide confirmation of the equation used to calculate STP (and other data regarding the flow performance at each new server point). Interestingly, once the researcher had built the STP equation into the model he noticed the equation did not follow the typical yield performance metrics as prescribed by Feigenbaum (1991) to measure yield in different scenarios.

On first appraisal, the model excited the managers as they saw an STP increase in performance when all eight servers are aligned to the full end to end (model 2 of Figure 61). The researcher presented the team with Feigenbaum’s teaching on yield metric calculation and this instantly resulted in the request to test Feigenbaum's yield metrics to understand the implications of the alterative metrics used to measure flow. What is more, there are different method to applying the STP metric to trade flow (Smith, 2009). Manager ‘F’ gave a telling account of the shortage of knowledge and skill on the subject of yield measurement *"so there's more than one way to measure process yield, this just gets better!"*. To convey the nuances of yield metrics (found in the literature) the researcher demonstrated each type and re-ran each test (with the team noting and reflecting on the differences in performance).

8.5.1 STP

STP Version 1 - Unlike manufacturing where yield metrics originated, trade processing does not produce "scrap", it may only produce defects (failure demand). Therefore, equation 4 means, as a result of team discussion, there is no need reduce the number flowing to the preceding server. All trades are reworked until the unit flows through all servers.

Equation 4: STP Calculation V1

$$STP = \frac{\left(1 - (exception\ vol\ node1 \div\ trade\ Volume)\right) + \left(1 - (exception\ vol\ node2 \div\ trade\ Volume)\right) + (N) \ldots}{\#\ Nodes\ in\ the\ model}$$

STP Version 2 - In this model there is a reductive approach to the flow of trades into each subsequent server. As and when exception/defects occur they are subtracted from the input volume of the next server (or 'node') in the flow.

Equation 5: STP Calculation V2

$$STP = \frac{\left(1 - (exception\ vol\ node1 \div trades\ entering\ node\ RFT)\right) + \left(1 - (exception\ vol\ node2 \div trades\ entering\ node\ RFT)\right) + (N) \ldots}{\#\ Nodes\ in\ the\ model}$$

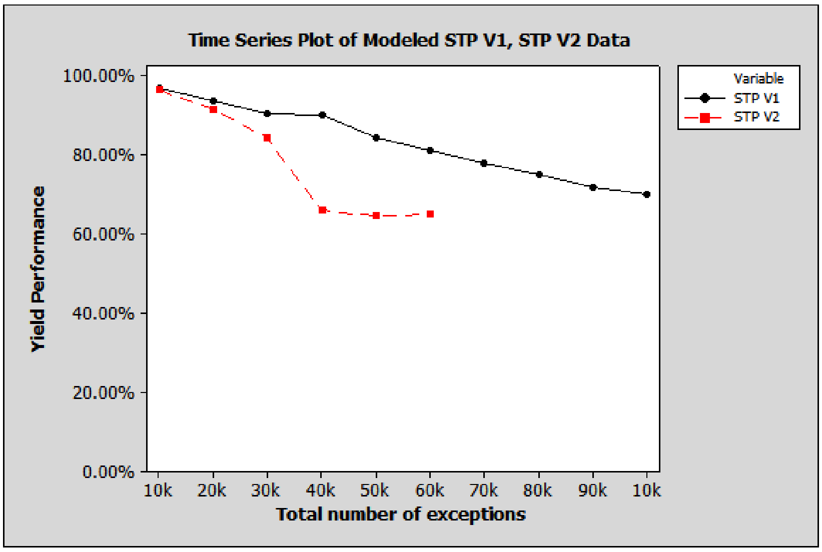
Table 56 unites both methods of STP calculation (shown side-by-side) using a consistent data source also shown in the table. In this way any difference in the reported STP performance must be due to the method of calculation.

Table 56: Table of STP Yield

Trades Vol Enter	Elements	Server 1	Server 2	Server 3	Server 4	Server 5	Server 6	Server 7	Server 8	Yield
40000	**Entering Node RFT**	40000	39987	32806	29561	29300	29145	28523	6123	
	Exceptions	13	7181	3245	261	155	622	22400	233	
	Exiting Node RFT	39987	32806	29561	29300	29145	28523	6123	5890	
	STP V1	99.97%	82.05%	91.89%	99.35%	99.61%	98.45%	44.00%	99.42%	**89.34%**
	STP V2	99.97%	82.04%	90.11%	99.12%	99.47%	97.87%	21.47%	96.19%	**85.78%**

In this example of table 56, a difference of 3.65% is apparent. However, the difference between the two metrics is 'amplified' when the number of exceptions introduced to the model increases. When the volume of exceptions is steadily increased within the model, STP V2 decays at a faster rate than STP V1 does (see Figure 62)[86]. STP V2 ceases to function well and eventually 'breaks' the model - meaning yield values can no longer be computed in a sensible form due to negative yields being produced (see Appendix B Table 59 for a closer examination of this issue).

Figure 62: Modelling of Yield Performance STP V1 and STP V2



The team recognised STP V1 as the method used to calculate system flow performance. Interestingly, In the example given in Figure 62, STP V1 ends the model with ten thousand exceptions generated from forty thousand trades entering. However, in this instance (10k exceptions) the STP yield is reported calculate to be 70%. This is due to each 'server' (node)

[86] This is due to the calculation formulae.

in the calculation using the new volume of trades (40,000) as the denominator in the yield equation. In essence, all trades new trades (40,000) will flow through each server as the system does not produce ‘scrap’ (each trade will be transacted through the system regardless of the number of defects which the trade may produce). Provide some rationale for using the volume of new trades as a detonator in calculating yield at each sever.

Alarmingly, STP V1 is the measure employed at the case study. This model produces a “noise dampening effect” (Forrester, 1961) of system feedback skewing metrics by grossly over-report performance. Moreover, the noise dampening effect provided the answer to the question raised by managers at the end the first cycle of reflection and improvement (chapter seven) - “*why can’t we detect changes in performance?”*

Disturbingly, the STP V1 metric is dominant system measure upon which strategic planning and management decision-making has been performed. In addition, the researcher found the measure was in-place for as long as twelve years prior to this study. He reflected whether other businesses had faced similar issues and whether this accounted for Smiths (2009) observations that multiple definitions existed (see Appendix B Table 61).

8.5.2 Final Yield

The Final Yield metric is a simple calculation which measures the ultimate success of flow exiting a system (see Equation 6). The design of the metric does not have the capability to detect the occurrence of rework within the system. For this reason, FY is of limited practical utility given the sequential processing system at the case study and the need to detect performance inhibitors.

Equation 6: Final Yield

$$FY = \frac{\#\ transactions\ exiting\ the\ systsm\ RFT}{\#\ Transaction\ entering\ the\ system}$$

8.5.3 Throughput Yield (TPY)

The TPY measure explores the individual yield at each node within a sequential process (see Equation 7). This metric is similar to Final Yield but with two crucial distinctions. Firstly, the equation design permits detection of rework and secondly the metrics is applied to the individual node within a sequential system. When applied to the individual node of a processing architecture it produces the detail needed at each stage of the end-to-end flow (point management). However, the measure is limited to measurement of subsystem performance and fails to give management end-to-end view of system performance.

Equation 7: First Time Yield

$$TPY = \frac{(\#\ transactions\ entering\ node - \#\ rework) - \#\ scrap}{\#\ Transaction\ entering\ the\ node}$$

8.5.4 Rolled Throughput Yield

The Rolled Throughput Yield (RTY) metric the shares all the capabilities of TPY to detect failure demand. The advantage of RTY is its application to sequential systems with each node measuring individual subsystem performance (TPY), the ability to detect and measure rework at the subsystem level and to provide an overall system yield metric (see Equation 8). RTY is achieved by simple multiplication of TPY metrics obtained from a series of process steps – as seen in the case.

Equation 8: Rolled Throughput Yield

$$RTY = TPY_1 * TPY_2 * TPY_3 * N$$

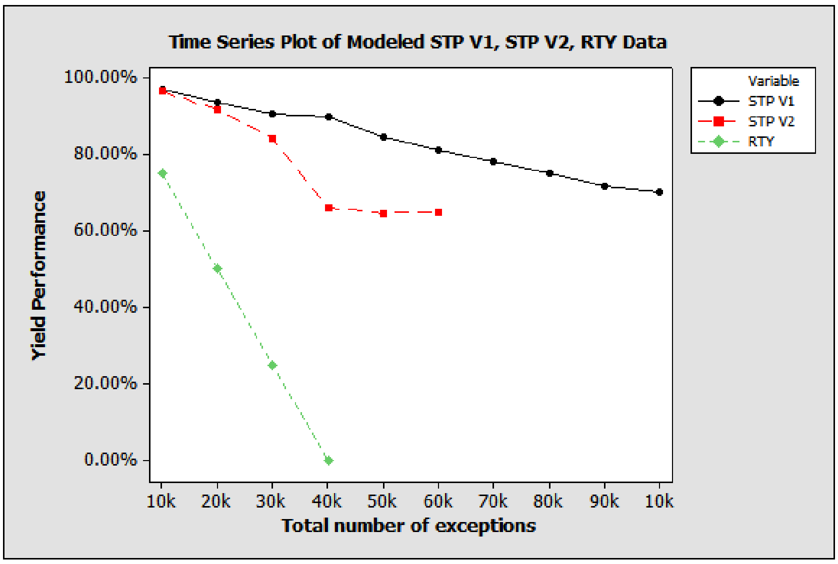
The RTY metric expresses the probability that a trade can pass through the process architecture free of defects. The inverse is therefore the likelihood that a trade entering the process will carry a defect and fail to pass 'straight through'. Through this logic, RTY represents a true measure of Straight Through Processing and one which the industry has been trying to achieve for the past two decades. Appling the RTY metric to the data used in Table 56, it was immediately apparent that RTY returns a significantly lower performance. This signified to the team (and researcher) that RTY has a heightened sensitivity and the effective ability to detect the true system performance (see Table 57).

Table 57: RTY STP Yield Comparison

Trades Vol Enter	Elements	Server 1	Server 2	Server 3	Server 4	Server 5	Server 6	Server 7	Server 8	Yield
40000	**Entering Node RFT**	40000	39987	32806	29561	29300	29145	28523	6123	
	Exceptions	13	7181	3245	261	155	622	22400	233	
	Exiting Node RFT	39987	32806	29561	29300	29145	28523	6123	5890	
	STP V1	99.97%	82.05%	91.89%	99.35%	99.61%	98.45%	44.00%	99.42%	**89.34%**
	STP V2	99.97%	82.04%	90.11%	99.12%	99.47%	97.87%	21.47%	96.19%	**85.78%**
	RTY	99.97%	82.04%	90.11%	99.12%	99.47%	97.87%	21.47%	96.19%	**14.7%**

When testing the model with the team, it was clear the RTY model performance is significantly lower than the both versions of the STP metric. The difference in measured performance is approximately 70%. RTY has the ability to translate true system performance and return a metric which is representative of the complete end-to-end system. To further demonstrate the robustness of the RTY metric it was compared in parallel with both STP metrics (see Figure 63, full data set in Appendix B Table 60). RTY plots a clear linear relationship between performance and defect volume (40000 defects equalling 0% yield performance).

Figure 63: RTY



On balance, RTY appears to be a more appropriate fit considering the objective to study performance enablers and inhibitors. Individual TPY at each step allows for an appreciation of the losses at each stage in the production system to develop. Moreover, the final RTY metric has a powerful 'reductive' form unlike the 'normalising' form of STP which essentially skews the appreciation of the percentage exiting the system without manual intervention

Equation 9: Simplified RTY Equation

$$RTY = \prod_{i=1}^{n} TPY_i$$

Source: Gygi et al. (2012)

8.6 Management Reflection

The learning group reflected on the yield metric presentation, the decision-making process was swift and unanimous. Manager 'C' exclaimed "*this presentation has described quite simply summarised my issue with STP. There's no wonder we can't detect changes in performance using STP".* Manager 'E' reinforced this point, *"I can't believe that we …[the business]… can have more exceptions ...[flow defects]… than trades and report 70% STP, it's just beyond me, it's so counterintuitive. RTY is clearly superior to STP to measure our processes".* Manager "F" went further saying *"I agree totally, however, what I want to get out of RTY is slightly more than a new metric 'which tells me my performance is now 15%'. I want the information into what is causing the 85% loss. So, if I understand it correctly RTY can give me that – right? This will give us the ability to find out 'why' and 'fix' it".*

The group set an objective to build an RTY model for each asset class to understand and contrast yield performances together with extract information on the instances of flow exceptions (defect analysis). In collecting such data, mangers aspired to apply LSS tools to identify root cause and undertake improvement initiatives, the goal being better performance.

The researcher reflected that this new enthusiasm to understand performance using RTY was a paradox - RTY significantly lowers the perceived process performance from 80% to below 20% (example Table 57). In doing so the group knowingly selected a tougher, more representative measure of performance even though it presented a ‘perceived’ performance disadvantaged to the business and the wider bank. A fact not disregarded by the team which has, in reality, caused considerable anxiety within the group. The group were overtly aware of how they would be perceived by the wider organisation, they are conscious that the latest finding will place them under intense internal scrutiny and criticism. However, their ambition in changing performance metric to RTY will undoubtedly drive new behaviours from deep within the organisation. Nonetheless, the team decided to develop RTY in parallel with the existing STP system to help stabilise the change process and allow an easy transition.

8.7 Next Cycle

RTY as a performance measure with STP was applied to all asset classes to collect failure demand information and use to assist with root cause analysis and learning so as to improve performance (Senge, 1990; Argyris, 2004; Seddon, 2008a, 2008b). The researcher reflected this stage of the research was a significant step toward in double loop learning at the management level. In the plan-do-check-act cycle, the next stages of the study would be critically important for the management team as they build and test a workable RTY framework and introduce it to the wider organisation.

Chapters 9: Cycle Four

9.1 Introduction

The previous chapter presented the reflective journey of the learning group concerning the design and suitability of the measure (STP) for trade flows. The learning group discovered a poor fit of the STP measure to describe flow performance. They explored alternatives concerning yield performance and concluded Rolled Throughput Yield (RTY) was superior metric for measuring and managing flow. The superiority for RTY lays within it ability generate feedback concerning failures - this supports an understanding of performance flow inhibitors providing the ability to learn and react to system feedback.

Background:	Management takes a systems approach to understanding their environment. They use mental models and simulation to uncover measurement error. The team are startled by the realisation that the key metric of performance (STP) is unfit to accurately measure trade flow. However, management has been experimenting with new flow measurement concepts and believe there is a more accurate measure using a Rolled Throughput Yield metric.
Team Learning	The team learn to interpret failure demand using statistical and graphical techniques to identify system constraints and inhibitors of flow.
The Research	Managers use a systems approach to understanding flow and use their new skills to define the scope for a new and purposeful measure of performance
	Rejection of STP and adoption for RTY has facilitated management and administrators to switch from single to double loop learning
	The emergence of performance targeted system interventions to increase quality and improve trade flow through the system, the key enabler for the emergence of this new organisational behaviour team learning
Analysis	Manipulation of raw data into meaningful system feedback using yield formulae. Failure demand is quantified is scrutinised using Pareto principle of stratification and patterns emerge which point to areas where system flow performance is heavily constrained.
Phase Duration	June - September 2013
Reflections	Management are empowered by quantifiable and accurate system feedback. Interventions leading to improvement is now detectable which has accelerated double loop learning. There is a growing confidence to engage in cross-functional conversations to discuss causes of defects and failure demand.

This chapter presents an overview of RTY framework development to incorporate detailed system feedback and analysis to form a practical management ‘tool’ for ‘double loop’ learning and performance improvement. The learning group were able to define the criteria for the development of a performance dashboard which was then used to drive system changes and improve flow performance.

9.2 Designing the RTY Framework

The team, over many meetings, combined their system design knowledge (mental models of system architecture, documentary evidence, etc.) to establish the requirements for a performance dashboard. At the request of management and in conjunction with the researcher, the researcher was asked to develop the performance dashboard incorporating RTY as the core measure. The dashboard must act as a diagnostic tool to interpret flow failures and allow managers to focus, plan and enact improvement interventions.

9.2.1 Quantification and Visualisation of System Demand

Outlining the RTY framework, the researcher ensured the new system flow was consistent throughout and the understanding was integrated with the dashboard. Earlier, the STP model proved to lack the necessary clarity to quantify system demand through the trade booking channels (‘inception’ channels) - see Figure 60 chapter 8. “Booking” methods represent the ‘communication channels’ through which all service transactions enter the system architecture and creates the demand for all work types and processing. Visualising the booking channels (in the dashboard) gave management an improved understanding of demand (trade volume) and appreciation of flow emanating from each trading channel.

9.2.2 Input Demand

System demand was stratified into trade initiation channels and summarised using an input table (see Table 64) which shows a series of features concerning trade booking volumes by “booking method”. Starting at position 1, the product types are shown[87]. Each product has been stratified by the inception/booking method (position 2) offering volume transparency

[87] In this example the assets class is Money Market comprised of two products - Deposits and Loans.

and further detail on the trades flowing into the system. Management view this as an enhancement to STP and the ability to trace failure demand back to the booking source[88]. Moving right of the booking methods (positions 3 and 4) display the volumes of 'new' and 're-saved'[89] trades by booking method forming the total demand on the system from the external environment (STP merely captured 'new trade' volume, not including 'resaves' downplaying the system demand). Position 5 presents the relative proportion of trade demand entering the system[90]. Position 6 presents the total demand volume of New and Resave trades for the asset class (trades processed).

Figure 64: Demand Input Table

	New & Resaved Trade Volume			(6) 50,902
(1)	(2) Booking Method	(3) New Trades	(4) Resaved	(5) %
Deposits	Manual/FO	6,100	6,588	46.34%
	Lloyds Mrktlink	7,289	298	27.71%
	BOS Mrktlink	779	57	3.05%
	Reuters	917	503	5.19%
	Voice Broker	483	4,201	17.11%
	TOMS	0	66	0.24%
	Other	4	96	0.37%
	Subtotal	15,572	11,809	
Loans	Manual/FO	1,772	2,898	19.85%
	Lloyds Mrktlink	35	0	0.15%
	Edinburgh Loans	31	2	0.14%
	Reuters	254	13	1.14%
	Voice Broker	2,497	4,146	28.24%
	ACBS	11,484	366	50.38%
	TOMS	0	22	0.09%
	Other	0	1	0.00%
	Subtotal	16,073	7,448	
	Total	**31,645**	**19,257**	

9.2.3 Failure Demand

A strength of RTY is the ability to detect instances of flow failure ('defects' – known as system 'exceptions' at the case study). Keen to preserve management's view of the sequential system arrangement, the researcher built a table representing the eight internal processing servers identified in earlier action research. Servers are arranged into two flow phases "Trade Inception" and "Trade Lifecycle" (payments) see Figure 65.

88 Booking methods represent the entry point of trade information, tractability of information quality paramount
89 A "resaved" trade is included in the total demand. Resaving a trade will re-enter transaction at the beginning of the work flow and will proceed to pass through all validation serves once more. Therefore, in this instance a resave must be seen as 'pseudo new' system demand.
90 For operational purposes booking methods that make-up less than 1% are rolled up to the category "other".

Figure 65, listed beneath each server is the Throughput Yield performance and below that again are the "Exceptions" (a table containing the volume of trades transactions which have failed to flow through automatic server validation). Each of these trades will require manual intervention (failure demand) before revalidation by the server and flow restoration can continue to the next server for further processing. Trade flow remains consistent with the booking methods established in Figure 64 and continues row by row from the input table. The intersect between server (vertical column) and booking method (horizontal row) expresses the number of "exceptions" (defects) generated at the intersect, with the 'total server exceptions' generated at the server at the foot of each vertical column.

Figure 65: Trade Inception and Lifecycle Table

Trade Inception			
BT Serv	Trade Serv	Document Serv	Dispatch Serv
99.95%	91.88%	96.12%	99.58%
Exceptions			
0	1,783	656	42
23	68	589	150
0	20	16	0
1	125	163	0
2	497	235	10
0	39	39	0
0	7	0	0
26	2,539	1,698	202
0	710	177	6
0	0	15	0
0	0	1	0
0	9	2	0
0	454	70	2
0	390	0	0
0	6	0	0
0	0	0	0
0	1,569	265	8
26	**4,108**	**1,963**	**210**

Trade Lifecycle				Settlement Payment	
Settle Flow Serv	Pre Settle Serv	Settlement Serv	Dispatch Serv	PCM	Stelink
100.00%	96.86%	94.50%	99.84%	~	~
Exceptions					
0	159	2,784	43	~	~
0	25	1,920	78	~	~
0	4	396	0	~	~
0	10	62	33	~	~
0	14	432	12	~	~
0	0	0	0	~	~
0	0	0	0	~	~
0	212	5,594	166	~	~
0	83	380	14	~	~
0	0	60	0	~	~
0	0	34	0	~	~
0	0	180	0	~	~
0	1	124	2	~	~
0	3,337	0	0	~	~
0	0	0	0	~	~
0	0	0	0	~	~
0	3,421	778	16	~	~
0	**3633**	**6,372**	**182**	**~**	**~**

9.2.4 Work in Progress

Work In Progress (WIP) is a key management metric as it quantifies the volume of transactions awaiting "lifecycle" (a payment flow yet to take place). Quantification of 'Settlement Events' is an important measure to characterise flow. Settlement volume represents the trades which have outputted from WIP and entered the lifecycle processing architecture. It is the volume of lifecycle events (and not the volume of “new and resaved” trades) which acts as the denominator for the “settlement” yield calculation (this was not the case with the STP and exposes another flaw with STP). Figure 66 captures the volume of trade moving in and out of WIP. In Figure 66 position 1 shows the total amount of ‘outstanding’ (warehoused) trades and Position 2 the total amount of Settlement events (payments and/or movement of collateral etc). Position 3 shows the subtotal of outstanding trades by booking method and Position 4 the subtotal of settlement events by booking method.

Figure 66: Work In Progress Table

WIP	
Outstanding Trades (1)	Settlement Events (2)
127,063	**109,244**
(3) WIP	(4)
12,177	15,372
14,858	14,930
462	1,571
4,050	1,956
7,380	4,611
164	76
233	57
39,324	38,573
8,603	6,021
2	72
1,828	451
184	490
17,968	9,986
59,124	53,630
28	20
2	1
87,739	70,671
127,063	**109,244**

The objective of management is to create a model which connects the end to end flow of trades through the sequential system and produce a yield metrics at three stages of the trade life cycle – ‘inception yield’, ‘settlement yield’ and ‘end-to-end yield’ (yield at each stage was not a feature of STP). To achieve this objective, the information (trades and defect volume) flowing through tables 64, 65 and 66 had to be joined to produce a . In this fashion, a linear model of trade flow was produced detailing the direct flow from booking method through to final end-to-end yield thus allowing for the computation of an RTY metric[91] (see Figure 67).

Figure 67: End-to-end Flow and RTY

Booking Method	New Trades	Resaved	%	Exceptions					Yield
Manual/FO	6,100	6,588	46.34%	0	1,237	614	63	~	84.91%

WIP		Exceptions						Yield	E2E RTY
12,177	15,372	0	153	2,673	23	~	~	81.47%	69.18%

Thus far, the researcher has presented a compartmentalised quantification of flow performance in each of the key phases of trade flow through the system architecture; the remainder of this chapter will present the combined model of end-to-end flow measurement. The chapter move to describe the new RTY matrix[92] which shows demand, flow failure, and yield performance (using the asset class Money Market as the example).

Figure 68 presents the full end-to-end RTY matrix comprising of all booking methods, products and stages of trade processing. Full aggregation of subsystem yields produces an 'end-to-end' yield metric and quantifies failure demand at each processing server (Position 1 shows full end-to-end asset class RTY, Positions 2 and 3 shows end-to-end product RTY and Position 4 shows asset class Sigma score)[93].

[91] A major failure of STP assumed that all trades entering the model exited the model within the same reporting period (a month). This was not that case which tainted the final yield metric produced by this system. In contrast, the RTY model splits inception and settlement stages of trade processing allowing for computation of individual yield metrics by booking type, by product type, by processing stage and by end-to-end flow.

[92] This matrix will later be termed the McLafferty RTY Matrix to distinguish his contribution to professional practice.

[93] At the request of management, the researcher has included "Tram Confs" and "Settlement Payments" servers however he has purposefully left these nodes blank as no information was attainable from external servers. However, management wish to work towards technical solution information in the future.

Figure 68: End-to-end RTY Matrix

1.1) MM END-TO-END PROCESS ARCHITECTURE

		(4) Sigma Score
Money Market RTY	**83.32%**	3.68
Deposits E2E RTY	**73.77%**	
Loans E2E RTY	**90.01%**	

					Trade Inception						WIP		Trade Lifecycle				Settlement Payment				
					BT Serv	Trade Serv	Document Ser	Dispatch Serv	Tram Confs Matching	Inception RTY	Outstanding Trades	Settlement Events	Settle Flow Se	Pre Settle Ser	Settlement Se	Disptach Serv	PCM	Stelink	Settle RTY	Booking Method E RTY	
	New & Resaved Trade Volume			50,902	99.95%	92.66%	96.63%	99.26%	~	88.82%	127,063	109,244	100.00%	99.76%	94.13%	99.90%	~	~	93.81%	83.32%	(1)
	Booking Method	New Trades	Resaved	%	Exceptions					Yield	WIP		Exceptions						Yield	E2E RTY	
Deposits	Manual/FO	6,100	6,588	46.34%	0	1,237	614	63	~	84.91%	12,177	15,372	0	153	2,673	23	~	~	81.47%	69.18%	
	Lloyds Mrktlink	7,289	298	27.71%	25	60	409	173	~	91.21%	14,858	14,930	0	10	1,906	52	~	~	86.82%	79.19%	
	BOS Mrktlink	779	57	3.05%	0	27	16	0	~	94.86%	462	1,571	0	5	268	1	~	~	82.56%	78.31%	
	Reuters	917	503	5.19%	0	66	109	1	~	87.61%	4,050	1,956	0	10	69	10	~	~	95.45%	83.62%	
	Voice Broker	483	4,201	17.11%	2	534	232	140	~	80.61%	7,380	4,611	0	25	591	9	~	~	86.45%	69.69%	
	TOMS	0	66	0.24%	0	33	33	0	~	0.00%	164	76	0	0	0	0	~	~	100.00%	0.00%	
	Other	4	96	0.37%	0	12	0	0	~	88.00%	233	57	0	0	0	0	~	~	100.00%	88.00%	(2)
	Subtotal	15,572	11,809		27	1,969	1,413	377	~	86.72%	39,324	38,573	0	203	5,507	95	~	~	85.06%	73.77%	
Loans	Manual/FO	1,772	2,898	19.85%	0	623	217	0	~	82.01%	8,603	6,021	0	60	375	8	~	~	92.64%	75.98%	
	Lloyds Mrktlink	35	0	0.15%	0	0	32	0	~	8.57%	2	72	0	0	127	0	~	~	0.00%	0.00%	
	Edinburgh Loans	31	2	0.14%	0	1	1	0	~	93.94%	1,828	451	0	0	45	0	~	~	90.02%	84.57%	
	Reuters	254	13	1.14%	0	11	5	0	~	94.01%	184	490	0	0	165	0	~	~	66.33%	62.35%	
	Voice Broker	2,497	4,146	28.24%	0	447	49	2	~	92.50%	17,968	9,986	0	1	194	9	~	~	97.96%	90.61%	
	ACBS	11,484	366	50.38%	0	681	0	0	~	94.25%	59,124	53,630	0	0	0	0	~	~	100.00%	94.25%	
	TOMS	0	22	0.09%	0	5	0	0	~	77.27%	28	20	0	0	0	0	~	~	100.00%	77.27%	
	Other	0	1	0.00%	0	1	0	0	~	0.00%	2	1	0	0	0	0	~	~	100.00%	0.00%	(3)
	Subtotal	16,073	7,448		0	1,769	304	2	~	91.28%	87,739	70,671	0	61	906	17	~	~	98.61%	90.01%	
	Total	**31,645**	**19,257**		**27**	**3,738**	**1,717**	**379**	~		**127,063**	**109,244**	**0**	**264**	**6,413**	**112**	~	~			

Measurements contained within the RTY matrix:

- Trade inception yield by booking method
- Trade lifecycle yield by booking method
- Trade lifecycle yield
- Trade inception yield
- Rolled throughput yield end-to-end product type – example Loans and Deposits
- Rolled throughput yield end-to-end asset class – example Money Market
- Quantification of all exceptions (failure demand) impacting flow by booking trade booking method and by server
- Sigma Score performance of asset class

9.3 Graphical Analysis

To build the RTY matrix required an extraordinary amount of detailed failure demand data collected directly from the processing servers. Failure demand information was then assigned 'reason codes' by the team and interpreted using simple quantitative analyses[94]. In doing so, managers could understand which types of flow errors were affecting performance by rank order (focus). For the first time managers had a quantitative account of the inhibitors of flow. And where within the system sequence flow failures manifest, permitting a strategic focus on the "critical few" rather than "trivial many". Visualisation and quantification of flow failure assists managerial planning to enact improvement interventions to reduce the causes of failure demand (see Figure 69, sections 1.2 and 1.3). The detailed data analysis enabled the researcher to extract further meaning from the inhibitors of flow and build a visual record of historical performance and trend analyses. Graphical outputs of performance measures allow the group to visualise the effectiveness of double loop learning communicating system performance to the wider organisation through descriptive graphical analysis.

A summary of the graphical techniques used to engage and drive improvement:

Table 58: Graphical Tools

Measurement	**Graphical Technique**
RTY performance – Asset Class & Product	Line Plot
Trend analysis of new and resaved trade volume	Line Plot
Trend analysis of exception volume per month	Time Series Plot
Trend analysis of exception volume by processing phase	Time Series Plot
Exception time – time of defect and time of reworked	Time Series Plot
Exceptions volume by work type	Pareto Table
Top ten exception types	Pareto Table
Asset class FTE resourcing model	Resource Table
Continuous Improvement & Change initiative	

See Figure 69 for a full representation of the graphical tools underpinning the RTY matrix on the bottom half of the 'dashboard'.

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94 Techniques such as Pareto analysis were used to rank the occurrence of failures by volume.

Figure 69: RTY Dashboard and Graphical Analysis Tables

1.1) MM END-TO-END PROCESS ARCHITECTURE

Money Market RTY	**83.32%**
Deposits E2E RTY	**73.77%**
Loans E2E RTY	**90.01%**
Sigma Score	3.68

					Trade Inception						WIP		Trade Lifecycle				Settlement Payment			
					BT Serv	Trade Serv	Document Ser	Dispatch Serv	Tram Confs Matching	Inception RTY	Outstanding Trades	Settlement Events	Settle Flow Se	Pre Settle Ser	Settlement Se	Dispatch Serv	PCM	Stelink	Settle RTY	Booking Method E RTY
	New & Resaved Trade Volume			50,902	99.95%	92.66%	96.63%	99.26%	~	88.82%	127,063	109,244	100.00%	99.76%	94.13%	99.90%	~	~	93.81%	83.32%
	Booking Method	New Trades	Resaved	%	Exceptions					Yield	WIP		Exceptions						Yield	E2E RTY
Deposits	Manual/FO	6,100	6,588	46.34%	0	1,237	614	63	~	84.91%	12,177	15,372	0	153	2,673	23	~	~	81.47%	69.18%
	Lloyds Mrktlink	7,289	298	27.71%	25	60	409	173	~	91.21%	14,858	14,930	0	10	1,906	52	~	~	86.82%	79.19%
	BOS Mrktlink	779	57	3.05%	0	27	16	0	~	94.86%	462	1,571	0	5	268	1	~	~	82.56%	78.31%
	Reuters	917	503	5.19%	0	66	109	1	~	87.61%	4,050	1,956	0	10	69	10	~	~	95.45%	83.62%
	Voice Broker	483	4,201	17.11%	2	534	232	140	~	80.61%	7,380	4,611	0	25	591	9	~	~	86.45%	69.69%
	TOMS	0	66	0.24%	0	33	33	0	~	0.00%	164	76	0	0	0	0	~	~	100.00%	0.00%
	Other	4	96	0.37%	0	12	0	0	~	88.00%	233	57	0	0	0	0	~	~	100.00%	88.00%
	Subtotal	15,572	11,809		27	1,969	1,413	377	~	86.72%	39,324	38,573	0	203	5,507	95	~	~	85.06%	73.77%
Loans	Manual/FO	1,772	2,898	19.85%	0	623	217	0	~	82.01%	8,603	6,021	0	60	375	8	~	~	92.64%	75.98%
	Lloyds Mrktlink	35	0	0.15%	0	0	32	0	~	8.57%	2	72	0	0	127	0	~	~	0.00%	0.00%
	Edinburgh Loans	31	2	0.14%	0	1	1	0	~	93.94%	1,828	451	0	0	45	0	~	~	90.02%	84.57%
	Reuters	254	13	1.14%	0	11	5	0	~	94.01%	184	490	0	0	165	0	~	~	66.33%	62.35%
	Voice Broker	2,497	4,146	28.24%	0	447	49	2	~	92.50%	17,968	9,986	0	1	194	9	~	~	97.96%	90.61%
	ACBS	11,484	366	50.38%	0	681	0	0	~	94.25%	59,124	53,630	0	0	0	0	~	~	100.00%	94.25%
	TOMS	0	22	0.09%	0	5	0	0	~	77.27%	28	20	0	0	0	0	~	~	100.00%	77.27%
	Other	0	1	0.00%	0	1	0	0	~	0.00%	2	1	0	0	0	0	~	~	100.00%	0.00%
	Subtotal	16,073	7,448		0	1,769	304	2	~	91.28%	87,739	70,671	0	61	906	17	~	~	98.61%	90.01%
	Total	**31,645**	**19,257**		**27**	**3,738**	**1,717**	**379**	~		**127,063**	**109,244**	**0**	**264**	**6,413**	**112**	~	~		

1.2) EXCEPTIONS TYPES

Exception Work Type	Exception Volume	% Total	RAG
Settlements	6,989	55%	●
Front Office	4,687	37%	●
Static	704	6%	●
Confirmations	270	2%	●

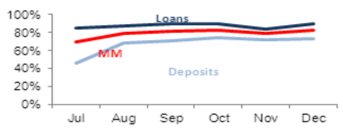
1.3) TOP 10 EXCEPTIONS

Exception Description	Exception Volume	% Total	RAG
Confirmation not matched	4,961	39%	●
Amended trade - approval required.	1,281	10%	●
Amended payment/receipt - approval required.	704	6%	●
Trade has assigned Customer Cash SSIs - app required.	536	4%	●
Trade is backdated, see Start Date.	438	3%	●
Non-economic change to the trade - approval required.	431	3%	●
Trade does not have Customer SSIs set.	318	3%	●
This is a ECN MM trade coming from MarketsLink - app req	315	2%	●
Comments found on envelope.	308	2%	●
Trade has assigned Our Cash SSIs - approval required.	303	2%	●

1.4) HEADCOUNT

Total Head Count	**14.2**
Management	1.4
Middle Office	1.5
Back Office	7.4
Change	2.7
Time Zone	0.0
Business Control	1.2

3.1) RTY BY MONTH



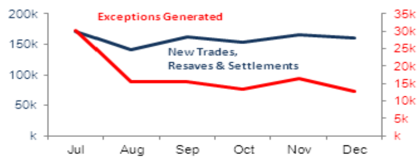
2.1) C.I & CHANGE INITIATIVES

Initiative: Removal of three MM exceptions from BAU
Status: In flight
Owner: Jason Bowers
Improvement: Removal of non added exceptions while trade in life cycle
Closure date: Jan / Feb 2014

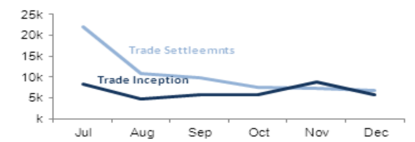
Initiative-: Cont Improvements from MM GB Belt – Conf Not matched
Status: Open
Owner: Nick Rouse
Improvement: Removal of exception flag for MM Deals entered before 5.5 migration – accounts for 5,000 forward exceptions
Closure date: TBC

Yellow Belt : 10% Reduction in Money Market Exceptions
Status: In-flight
Owner: Daniel Ralph
Improvement: Reduce manual process
Closure date: 31st March 2014

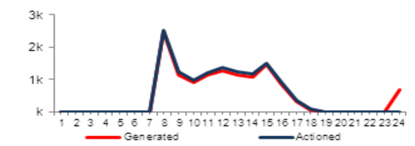
3.2) EXCEPTIONS & WORK VOLUME BY MONTH



3.3) EXCEPTIONS VOLUME BY MONTH & PHASE



3.4) EXCEPTIONS VOLUME BY HOUR



9.4 Improvement Interventions

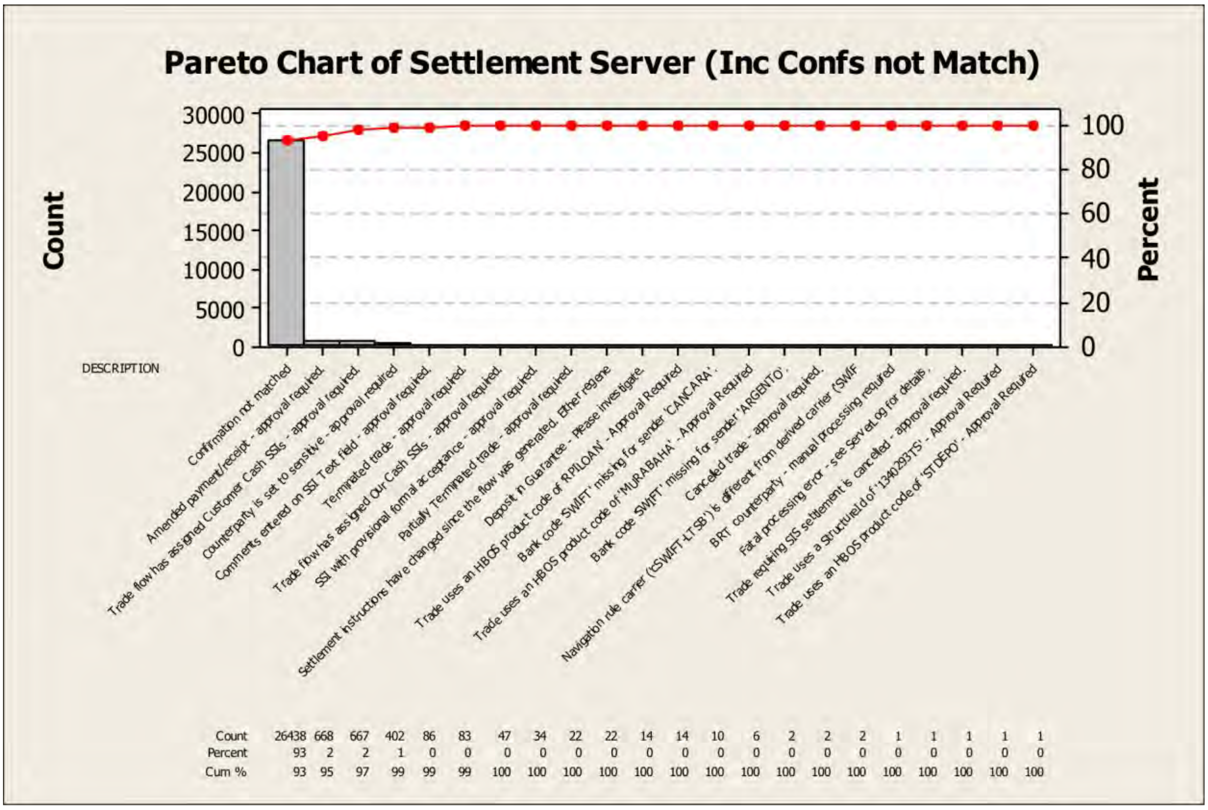
Deployment of the RTY matrix had an instantaneous effect on management decision making (within days). For the first time during the study the researcher observed structured decision-making based on factual management information that was neither disputed nor contested by managers. The learning group were now operating as a cross-functional team mobilised to reduce or eradicate sources of failure demand (system dysfunctions). The team had increased their capacity and were driving multiple improvement initiatives in tandem rather than single ad hoc improvement initiatives (a characteristic of the STP era of performance measurement). The improvement strategy adopted by the team followed the principles of Goldratt et al. (2004) which targeted improvement to most constrained areas of the system. “Elevating bottlenecks” meant maximum benefit for the end-to-end system performance.

The researcher observed that the introduction of the RTY dashboard compressed the time taken for double loop learning to occur thus providing faster and detailed feedback. The key enabler for such precise feedback allowed much greater abnormality detection (Laudon & Laudon, 2012) whereas with STP responses were muted with very little learning taking place as a result.

9.4.1 Double Loop Leaning and Intervention (Pilot Trial)

Over the course of a four-week period the researcher observed the team engaging with the information and diagnostic output from the draft RTY framework. Managers identified recurring ‘exception’ types (defects) in the graphical summary of the RTY dashboard using the “top 10 exception types” display. The team obtain a data extract from the Systems IT dept and using a Pareto chart identified a major inhibitor of flow impacting one particular server in the process architecture. The inhibitor accounted for over 90% of the failure demand, over 26,000 occurrences of the defect type “confirmation not match” in one month.

On further investigation, which included conversations with administrator' the learning group found that in each instance of the defect it caused a small amount of manual intervention to be undertaken by staff to allow the trade to flow to the next stage in the process sequence (see below Pareto chart).



The learning group 'workshopped' the flow inhibitor (system defect) with administrators who devised a procedural and IT changes to the system. System and procedural update reduced the occurrence of the defect from 26,000 instances per month to less than 5000 (see reduction in Figure 69 section 1.3), representing a reduction 80% which consequently reduced manual intervention on a similar level. The month on month benefit of this improvement intervention can be seen on Figure 69, section 3.2 which shows a time series plot of "exceptions generated". The improvement represented the first in a series of cyclical learning loops performed by management throughout all asset classes and product types. The strategy of management was to identify improvement opportunities which did not require funding or investment (the case was being "costs managed" by board level executives restricting investment). The researcher observed that this strategy purposefully avoided tackling the larger more significant system constraints inhibiting flow to the detriment of performance improvement and continued learning (which will be made visible in the analysis chapter 10).

The learning are no longer fearful of exposing system failure. Instead they are concerned with data collection and turning data into information upon which to make decisions, plan and improve the operation. This marks a significant shift from the management style witnessed in pre-study environment (chapter six) where decision-making appeared to suffer from a blurred perception of the organisational environment compounded by managerial inertia due to varied opinion – this alone was a major inhibitor now alleviated by organisational learning at the management level. Management now viewed the trading operations using new lens, a system lens, aided by the visual display of the sequential system flow of servers and the network of interconnected activates from trade booking through to settlement and reconciliation. The fundamental enabler, transitioning from one environmental state to next, was the development of mental models which made tangible the digital product flow and the inhibitors encountered within the IT system (Senge, 1990).

9.5 Chapter Summary

The development of the RTY Matrix is a major contribution to the management and learning processes at the case study. It has added quality of data, speed, and dependability of feedback which would suggest the matrix supports a ‘sand cone’ effect in the financial services(Ferdows & De Meyer, 1990). The crystallisation of the model and its utility underpins all future improvement work at the case, and this will be explored in the next chapter.

See Appendix C for a full layout of the systemised asset class RTY dashboards.

Chapter 10: Analysis

10.1 System Approach

The literature identified a systems approach as a legitimate lens through which to view a complex banking organisation. System theory asserts that the case study is an open IPO system, exposed to its environment, dependent on efficient aggregation and conversion of resources, self-regulating and must be agile in order to adapt in sync with its environment to ensure survival - a living system (Von Bertalanffy, 1950, 1969; Miller, 1978). The researcher found this to be synergistic with the modern view of organisations as socio-technical systems as per Daft (2013). The case study is goal orientated towards cost optimisation and efficiency. It uses deliberately designed IT and sociotechnical structures to accumulate and convert information and resources into quality products and services by means of a sequential IT-led sociotechnical IPO system. This type of system must cope (regulate) with the demand exposure placed upon it by the global market trading conditions - the environment (Daft & Weick, 1984; Daft, 2001a, 2013). The Commercial and Investment system at this point in time operates under extremely turbulent conditions, exposing the organisation to unparalleled uncertainty and chaos – potentially even the failure of the system itself (Hübler & Wotherspoon, 2009) making this study of critical importance to operations managers and the banking industry in general.

The case study exhibits high-volume, high-variety and extremely complex workflows which are a particularly rare OM design according to Slack et al. (2010; 2011). This banking setting has added to the originality and uniqueness of this study which seeks to provide insight into performance management of information processing organisations as they head towards dematerialised products and service in the "digital services age". The study confirms the utility of studying the modern banking organisation as a socio-technical system.

The next section will answer the guiding research questions that have focused this study since its beginning.

10.2 First Research Question

The first critical research question is stated as **How efficient are CB and IB trade processing systems?**

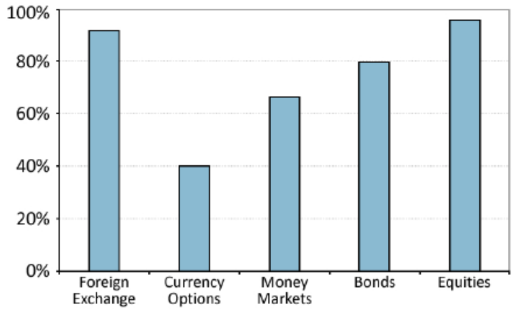
At the outset of this study, the executive leadership of the case study measured their business performance through “cost efficiency” (cost per trade, cost per head, departmental costs ratios (see Table 48). Deming (1986) was openly critical of using costs as a performance measure asserting that costs will increase when they are the used in this way. However, costs fall when quality is used as the primary measure of performance improvement and quality is regarded as an enabler of flow supporting the views of Ferdows and DeMeyer (1990). Nonetheless, the case study was found to be aligned to the industry standard cost performance KPI which was promoted by “MGT Consultants”. The researcher struggled to find any OM literature which endorsed “costs efficiency” as a legitimate measure of operational performance in a service environment except in this banking sector.

The imbedded research identified STP as a key operational measure of trade flow performance (Cost) and this finding was reinforced by further literature reviews into the use of STP within the industry. The researcher found management periodicals by consultancy organisations such as McKinsey & Co (Bremner et al., 2011; Dietz et al., 2014) and McLagan (Smith, 2009) both supported the uncontested use of STP although McLagan highlights multiple definitions (see Appendix B, Table 61) of STP in operation at different banks. In essence, STP and Cost as systems drivers remain unchanged, yet the case study has challenged this notion, and through rounds of action learning has rebuilt the logic and practices it operates focused on RTY. This research holds high significance as an alternative to the traditional STP approach.

Benchmarking STP within the case study found performance to be circa 80-90% STP to provide the first answer to the research question (See Appendix D, Figures 89 and 90). However, this is an incomplete answer and the field research found this figure to vastly over-estimate true performance (as a result of its amalgam of averaged points in the system in the system sequence). A more accurate view of system performance was later identified by the research. At the product classification (asset classes) level STP performance varied (between the individual classifications) at levels between 65% and 95% STP. Performance benchmarking at the asset class level enabled the researcher to gain greater insight into performance and efficiency. At this point the basic performance of the system has been determined, but research confirmed large system failures were present and these contradicted high levels of STP performance achieved.

The testing of RTY and later introduction of the RTY McLafferty Matrix fundamentally reset the "measurement" of the system. Its "measured performance" of the system decreased STP levels by almost 50%, and it provided the case management team with a measure that could be believed and with which the system could be managed and improved (a quality first approach). The management attitude toward the use of the McLafferty RTY Matrix for systems improvement has proven effective. The industry believes, courtesy of the MGT report 2011 and others such the McLagan report (Smith, 2009), that industrial processing efficiency (STP) operates between 40% and 90%. The application of the McLafferty RTY Matrix would seriously question these claims if all systems being equal, a figure of 21% maybe a closer reflection of the truth.

Figure 70: Average STP Performance by Product



Source: Smith (2009)

To complete this review of industrial efficiency, using a different angle of analysis, an expert interview was conducted with James Karat (originator of the STP system/measure). This will now be presented as a narrative to enrich the findings thus far.

10.2.1 Initial System Design Intent

During the interview Karat confirmed, STP was both an essential system and a specific measure that were designed to solve a problem – calibrating flow. He commented *"When we were originally building the very first confirmation system back in 1992… it was the first for inter-brokers, and at the time we actually used it for clients as well, for confirmation side of things… What I did when I was managing the operations office is I asked the guys "when a trade is booked get the confirmation sent out to the client, and get it back the same day, I want to see the confirmation, I want to know that we have got confirmation back".* For Karat, time compression was essential for STP performance and that "*For the business, these trades are accepted, and settlement can take place within the system on T0 – front to back in one day hopefully full STP".*

Karat's design intent was to produce flow at speed and also to minimise risk. He stated… "*as time moves on… the three-day settlement risk increases. T0, you have got fifty-fifty chance the trade is accepted. On a T1, you have got a 40% chance, T3 you've got a 30% chance. The likelihood of settlement reduces the closer the trades gets to value date"* (when is trade remains unconfirmed by the counterparty). Karat's view supports the transmission of trade information across interconnected processing systems utilising technology to mitigate financial risk and human error. In his view, such transactions are mechanistic and should be without fault.

He proposes the ideal trade processing system is *"essentially, what we were aiming to do, and what we did build in the early days, was that we had to have a golden source of information, or what they call now 'fully dressed Trade'".* Karat refers to fully dressed trades - being trade transactions which contain all relevant information at an acceptable quality to allow for uninterrupted inception and settlement (STP).

10.2.2 Measure & Interventions

The primary measure introduced by Karat was Straight Through Processing (STP) as a means to measure the success of sending a trade from the Front Office to the Back Office seamlessly without manual intervention. *"Essentially you should always get 95% or even greater 100% hit rate …there is no reason why we should have failed transactions in the industry"*. However, this is not the reality of CB and IB. Karat acknowledges there is a lack consistency and systems approach to the measurement of STP, he highlights *"The interesting thing is that each area …[FO, MO, BO]… has its own calculation…[of STP]"*. This shows an emphasis on the subsystem performance over the interest of the supra-system (the business). The approach is akin to Taylorism (1911) which focused on scientific management practices but resulted in the actual sub-optimisation of workflow through constant interruptions through poor quality. Sub-optimisation where key inhibitors of flow performance according to Womack and Jones (2003) when studying complex socio-technical systems. However, Karat argues "*I think it would be very very unfair to do it from complete end to end. The reason I say that is because obviously, there are so many different facets with the transaction and it depends on which transaction as well ...it's a very* *difficult thing to do a full front to back, bearing in mind you've got these little facets where you know obviously, things happen".* In this context, Karat identifies product variety and complexity as inhibitors to the accomplishment of full end-to-end STP. As a result, his work has stopped far short of attempting to measure full STP which remains - through his own admission – disconnected, thus unable to measure the complete trade flow (systems approach).

10.2.3 Flow & Quality

The objective of STP, summarised by Karat, is "*the whole process of STP is we want to get the transaction from the front to the back without anyone touching it, so you reduce the settlement risk"*. Karat's STP model does not actually identify poor quality as inhibiting STP. However he suggests "*The quality of the data however, in those ...[trade]… feeds is probably where the real crux of where the matter lies ...In order to have a fully dressed trade one is expecting that you're going to have to have certain criteria …[quality criteria]… to meet that objective. So, you're going to have, trade date, value date, you'll have your net value, your settlement instructions, your counterpart, you know, the real crux of what is actually going to get this trade settled".* However, he does indicate that full STP is achievable *"I don't understand in my head, when I go to these places, they shouldn't be getting these exceptions on transactions".* His model misses the issues that negatively impact on trade flow and he regards sub-optimisation as human error.

In Karat's belief, there are a number of inhibiting factors for flow and STP which are"

- Lack of staff skills to interpret system performance and failure demand
- Lack of accountability
- Failures across the IPO system as a result of poor quality
- Continuous amendment of information - both trade and static data (see chapter 7)

The major theme of the interview, which was consistently repeated, focused on quality impeding flow capabilities and Karat's answer was, on each occasion, to increasingly automate the system to eliminate human error.

10.2.4 Automation

Karat cited the evolution of information technology as the impetus to change to an automated system which regarded speed and cost management as the primary objectives. "*Computers can do things better than humans can. They can do them quicker, they can do much more, and they are much, much cheaper, but most importantly they can do them more accurately than any other human. Obviously, it is only as good as the information you give it, that is the key, what information you are giving it to work from".* Highlighting a key dependency on quality as an enabler of successful automation and flow, Karat candidly states *"if there's shit going in, there's shit going out"*. The implication of this view is that people are deliberately or unwittingly causing dysfunctions within the system. Karat's answer is to further automate where possible, stating *"if… the architecture (systems) you have built isn't able to accommodate that particular asset type we need to go away and build a more 'stronger world for it'".* Karat overlooks a key point and fails to identify and interpret the system of work as a socio-technical system. As such all employees remain in a task focused mode with a clear distinction of duties but lacking a systems approach to managing and improving workflow.

10.2.5 Learning STS

One of the few weaknesses identified in Karat's approach to high performance is the subordinate role of staff to technology. As such, Karat believes a well-designed system is an automated IT system, designed and created by subject matter experts and technology specialists. This exposes a major weakness in his logic which is carried through to the physical system design. This system design devolves the responsibility of poor performance to those interacting with the system (quality of data input). Managers are held accountable for poor performance even though the system does not provide the means to collect and interpret system feedback, therefore denying managers and systems users the ability to learn and develop knowledge which, according to Senge (1990); Neely (2007) and Seddon (2008a), leads to improvement.

The only aspect of a system that is capable of learning is the social element. This is exemplified by Karat's view *"there are only two reasons why people complicate things. First is because they do not understand the product or secondly they don't understand the system".* The implication of this statement being staff need to understand how to do things correctly (which is doing it right – single loop learning), and secondly there is a break in the learning cycle because Karat's model does not provide the mechanisms through which staff are able to interpret feedback which is a key enabler of learning/improvement.

10.2.6 In Summary

Reflecting on the interview with James Karat it is obvious that his contribution to flow measurement is the primary measure within a global industry. His impact on industry best practice has been profound. His essential model is exactly what the industry required, however, the implementation and abuse of his STP measure (including its benchmarking) has led to many adaptations - see Smith (2009). These adaptations take the model well beyond Karat's original design intent. Despite his fascination with technology, he does recognise that many of the weaknesses are as a result of system design (Deming, 1986). He acknowledges that to improve the system, information feedback must be collected, interpreted and acted upon. He states, *"at 'Global Bank[95]' all exceptions would be accounted for in a table and each one would have a reason code behind it so we would understand exactly what had happened".* This is essentially single loop learning – to detect, code and

[95] This is a disguised name of a peer institution to Alpha Bank

repair failures. It stops far short of double loop learning and management engagement with system improvement.

In comparing Karat's STP model with the McLafferty RTY matrix, it is apparent that the RTY model has overcome many of system inhibitors to learning and performance of Karat's STP model. In the researchers' view, had Karat integrated contemporary management thinking of the mid 1990's into his work - such as mental models and double loop learning of Senge (1990); Senge and Sterman (1992) together with the thirst for automation – perhaps he may have developed a model much closer to the RTY model of systems flow and of the McLafferty matrix.

10.3 Second Research Question

While working to provide an answer to the second research question, **"what are the enablers and inhibitors to performance"**, the researcher discovered STP to be a poor fit in the modern context of automated semi-sequential trade processing systems.

10.3.1 Fit and Design

The accepted model of STP uses a "normalised yield" formulae which is the average yield of a set of "first pass yield percentages". Through this method, the true performance was blurred (skewed - artificially inflating performance) and masking the actual efficiency (or inefficiency of the system and its ability to detect changes performance). This finding was the first major design weakness of the organisation – making a decision on an incorrect measure.

Furthermore, the research design (realist approach using inductive cycles of question and answer) was crucial to unearthing a severe and fundamental flaw of the case study's application of the STP metric. Action research gave the researcher flexibility to investigate "how and why" data feeds and feedback loops were structured. The study discovered that more than 60% of the processing nodes (servers) were omitted (missing) from what was thought to be an end-to-end measure of performance and efficiency (STP). An interview with James Karat provided perspective into the current design of STP adopted by many if not all CB and IB organisations Karat has consulted with in the past twenty years. He states *"I have never come across a full amalgamation of all of those …[sequential processing nodes]… I have always seen it …[STP]… broken down into area …[FO, MO, BO]… in terms of the feeds themselves. If you can look at how many transactions are physically settled, using the STP system I think you would get a very good indication overall as to how good you are".* Karat recognises that building a full STP measure is a technical challenge that has not yet been solved. He acknowledges that a complete end-to-end (inception through to settlement of trades) would be a major step forward and a beneficial measure of flow performance for the industry.

The design and fit of the STP performance feedback system were found to be lacking in coverage at the case with regards to the system processing architecture and insufficient to accurately provide a complete the end-to-end account of system performance and efficiency. The second design weakness found within the case study and perhaps the principal weakness of the STP model in the wider industry context (given the context offered by Karat).

Interestingly, the case study organisation had received consultancy advice and participated in performance benchmarking surveys in the past. Through this study, it was the first time that questions were raised concerning the fit and practical utility of the STP metric to allow management of process performance and efficiency. On this realisation, the researcher was confident he had identified a tangible gap in professional practice as well as having implications within the academic context (new knowledge and perspective).

Exploring the gap in professional practice the researcher reflected on the OM and quality management literature which identified alternative performance measurement metrics suitable for sequential processing systems design. The researcher adopted Feigenbaum's (1991) use of the Rolled Throughput Yield metric to quantify the quality output of sequential manufacturing processes. The "fit test" of RTY within a financial services setting was studied by Hayler and Nichols (2007, p. 32) which examined the "objective" of straight through processing concerning international trading activities. Hayler and Nichols identified RTY as an appropriate metric for throughput performance of multi-stage transactional processes, with the emphasis on measuring flow performance (straight through processing without defect). Unlike Karat's normalised STP, these authors have selected RTY correctly but have failed to interpret the defects that interrupt flow at each of the sequential stages (IBM Investment Capital case study). The researcher adopted the general concept of RTY described by Feigenbaum (1991) and tested by Hayler and Nichols (2007) and expanded the general concepts further developing them into a framework for the specific context of the case study. The development takes into account the nuances of the semi-sequential lifecycle of trade processing and settlement into the framework design. The framework takes a systems approach exemplified in OM by Emery (1969), it was expanded to incorporate the learning dimension of Ackoff (1971) and later by Senge and Sterman (1992) with the inclusion of Seddon's (2008) systems thinking/failure demand. The researcher incorporated diagnostics of systems feedback into the draft framework to quantify and interpret sources of systems dysfunction which identified the existence of a significant quantity of Seddon's failure demand/rework (2007; 2008a; 2011). The RTY framework's ability to accurately measure flow performance and efficiency enabled management to estimate rework activities consumed as much as 40% of available capacity. The result is a striking parallel with Feigenbaum's (1991) estimation of capacity consumed by rework in manufacturing in the 1960's. He called this the "hidden factory". The application of the RTY framework measured a yield of between 40-50% consuming 40% of administration capacity. The researcher proposes this is the modern banking “hidden office” (rework/failure demand which went unrecorded until the introduction of the RTY framework).

10.3.2 Flow Transparency

Deploying the RTY metric and building into a quantitative framework had many advantages. Firstly, RTY is a more ‘aggressive’ measure of yield performance compared to Final Yield, First-pass Yield or Normalised Yield metrics used in operations and quality management circles (McCarty et al., 2004; Slack & Lewis, 2011). The design of the RTY framework is deliberately sensitive to noise (an advantage of the system) which has the ability to detect and measure all trade flow failures (failure demand) and represent true performance grounded in a “right-first-time” philosophy. The immediacy of RTY to determine flow performance eliminated information time lags (information bottlenecks) that were found to be detrimental to learning. The researcher is able to draw parallels between Argote (2013) who asserts organisational learning is linked to the speed in which information is transferred within the organisation and with Argyris (1976); Argyris and Schön (1996) who assert information feedback, and its speeds, are essential for double loop learning to occur.

The Management at the case study are an example of a unification of both theories. Increasing information feedback speed through the RTY framework enabled managers to undertake double loop learning through cycles of purposeful system intervention and reflection. Furthermore, the scope of the implemented RTY covered all internal processing servers. In this instance, both effectiveness (quality) and efficiency (rate of flow) were now measurable, whereas in the pre-change state (using STP) the model was fractured and limited to subsystem improvement at very best. In the post-implementation state, RTY has the ability improve macro performance through strategic and targeted enhancement to subsystem interventions to raise performance through the eradication of sources of dysfunction. RTY is therefore considered a full systems approach to measurement and intervention based on the principles of STS.

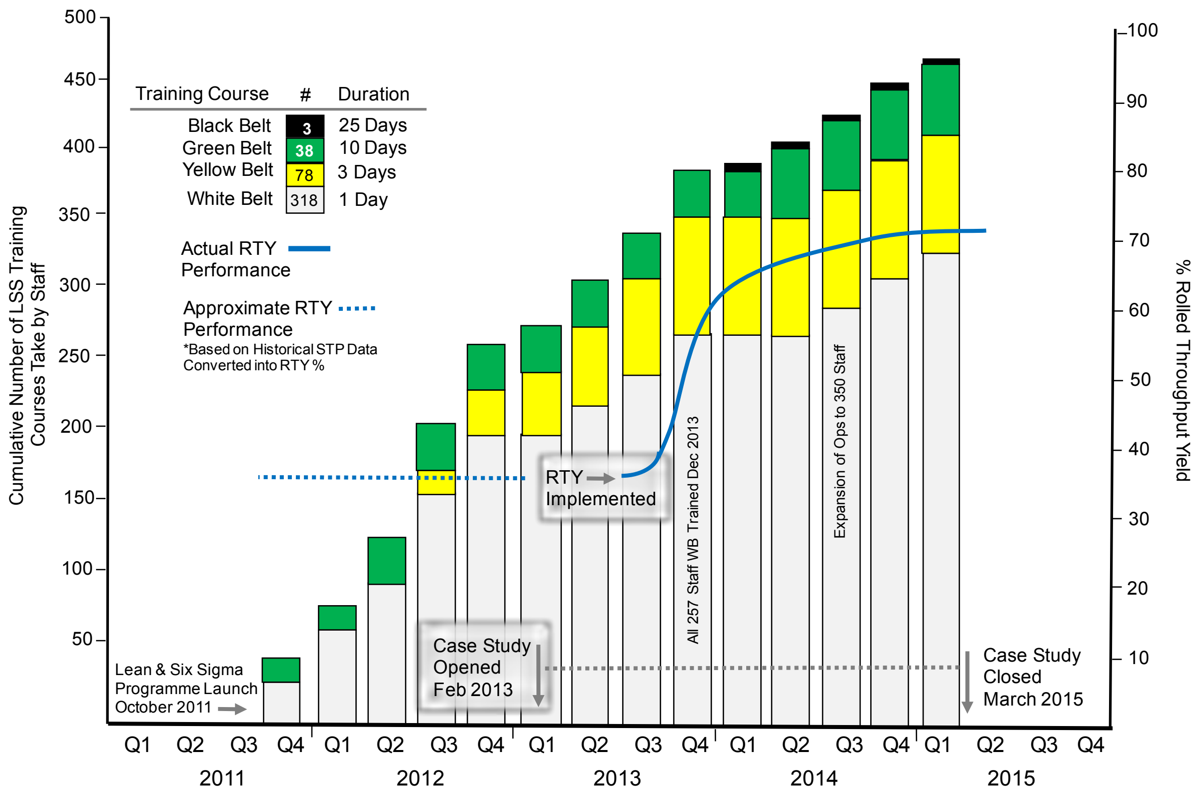
Establishing and applying an appropriate metric of flow performance was able to drive out management anxiety (fear) towards system performance appraisal (Deming, 1986) which was an enduring negative feature of STP and the focus on cost optimisation (job losses). In the post-implementation phase, the first instance of RTY introduction created a significantly lower performance measure than STP. However, no negative views were recorded, and the RTY measure drove new behaviours to "trouble shoot" problems (diametrically opposed the previous tactic which was to resource and deal with failure demand and not to eliminate it).

The superior design of RTY holds the ability to, 1: detect flow failures, 2: indicate where failures are manifest within the process sequence and 3: specify the failure classification. Combining these three elements of system feedback identifies the system constraints. Understanding system constraints is in keeping with the work of Goldratt et al. (2004) on sequential processing systems. The authors assert performance improves when a bottleneck is identified and then alleviated thus raising flow. The RTY framework fully supports and is compatible with this view.

10.3.3 Linking Learning to Performance

The researcher sought to understand whether or not organisational learning had occurred within the case. Figure 71 provides a graphical analysis of the learning activities together an overlay of RTY performance pre and post study.

Figure 71: Linking Learning to Performance



Strikingly, the graphical analysis shows a significant lag between organisational learning activities and performance improvement. Over fifteen months of LSS training[96] was undertaken by staff at the case study at the inception of this research. This equated to over 190 staff undertaking a one-day White Belt course to sensitise them to the LSS methodology and introduce basic tools and techniques of process improvement; 27 staff undertaking a three-day Yellow Belt courses which taught staff to act as process improvement facilitators, possessing a user appreciation of tools and techniques to improve processes. A further 24 staff undertaking a ten-day Green Belt course which taught staff to act as 'improvement change agents' given thorough training on leading change, root cause identification, statistical tools and improvement techniques (predominately management level up to and including the Director of Operations).

[96] An aim of this programme was to train all 260 (later 300+) members of staff to White Belt level.

Improvement initiatives during this period were selected by managers and focused on the "hot topics" within their functional silos. Action learning only extended as far as task optimisation with subsystem arrangements and this failed to increase flow performance within the system (a result of single loop learning and point improvements). Seddon (1992, 2003, 2008a, 2012) argues that many improvement initiatives fail to deliver on their strategic intent due to focusing on subsystem and task performance as opposed to focusing on the flow of value from a customer's perspective (end-to-end value stream). The researcher finds synergy with Seddon's view that many financial services businesses 'speak' improvement and will take action but that it is not always on the right activity or part of the system. The latter can only be assured when organisational learning is embedded in a systematic process to identify system wastes. In this instance, the researcher has identified a narrowing of scope/focus as the first inhibitor organisational learning, failing to identify the macro level issues that are affecting system flow (thus no improvement can be made).

The approach to organisation learning changed with the commencement of this case study. Instead of managers working in isolation within their subsystems, they came together as a cooperative partnership aligned with a systems approach to improvement (encompassing the complete end-to-end value stream per product class). Forming a collaborative team of management-level change agents opened up new lines of communication. This was witnessed in chapter six and seven when managers reflected on outcomes of analysis and investigation. The researcher has demonstrated that a collaborative management team is fundamental enabler to a system approach to effective and be translated into performance improvement.

As per Figure 71, there is an observed plateau to RTY performance which implies a "glass ceiling" to improvement where skilled staff are capable of more improvement activities but lack the necessary resources/investment. This graph also indicates there is a direct linkage to experiential learning, a sophisticated flow measure (the McLafferty RTY matrix) and a proactive attitude towards the identification of failure demand (and its root cause eradication). This finding supports the work of Deming (1986); Feigenbaum (1991); Seddon (1992, 2003, 2008a, 2012) from a quality and flow perspective to effective systems improvement. This study has extended the work of Seddon who merely called for multi-tasking. From a learning, perspective this also supports the work of Neely (2005) who called for measuring performance and learning simultaneously to create a true learning organisation improving the systems of work[97].

This study confirms the arguments by Antony et al. (2012) that LSS is an accelerant to problem-solving. Note the trajectory of the RTY “S-curve”. The researcher believes that the catalyst for acceleration was a function of an accurate and representative system measure (RTY). It is the researcher’s belief that no such rate of improvement would have been achieved if STP had remained the dominant measure. Reflecting on these findings, it is argued that the universal rejection of STP and acceptance of the McLafferty RTY matrix has allowed all managers to focus on a meaningful measure of system performance. Providing a meaning model of performance following a systems approach supports Senge (1990) and the importance of a management-level common mental model (in this case of systems flow). These findings support the importance of communication for systems control.

Again supporting the work of Antony et al. (2012) who found that in dematerialised transactional environments communication was a critical enabler for flow allowing efficient distribution of information promoting effective decision-making (speed and quality).

[97] This finding supports the work of Argote (2013).

The preceding account provides a narrative of the essential elements of the new model and outcome of the research. The next section will present the implemented features that support the system of flow performance and their role.

10.3.4 Review of Socio-Technical System Changes (Narrative Account)

The change in key performance measure, based on management learning, witnessed a departure from tradition and the rejection of STP in favour of RTY. The STP measure, as seen in chapter 8, was regarded by the management team as a false measure of performance and was associated with cost management (with the implied threat of job losses to raise national productivity). The next sections will explain 'why?' the socio-technical system has changed and resulted in a new level of higher performance.

The information provided under the new RTY measurement and the new management endorsement of it as the primary flow measure **allowed greater transparency** to be achieved (at the system and at the individual team levels). Also, the **mapping** exercises undertaken by the management team and rejection of STP allowed a **common mental model of the future** of the 'back office' to emerge from the learnings of the management team itself. The new measure was less threatening in terms of job loss but a more effective and transparent indicator of the **true performance of meaningful system flow**. The endorsement of the measure and goal of **performance improvement held meaning for all managers and staff**.

The concept of 'team' has also emerged. The critical level was the continued '**close working of managers'**. As a collective, the management team are a significant force for system learning, and also these **managers determine the rate of change in the socio-technical system** element under their control. These **managers assign meaning (for staff)** to measures and working practices to reinforce good behaviours and also **'learning'**

as a team has **dismantled the silo mentality** (of not criticising other managers' departments). The **organisational charts remain unchanged,** and job roles unthreatened (to show departmental responsibilities on paper) but **learning has followed the process** and this is not the responsibility of any single departmental manager. One manager cannot be wholly responsible for product quality for instance – it is a system issue owned by many managers whose staff touch or work with the product.

In effect, the researcher reflects that **the dependencies of internal subsystems have tightened**. Where once information was hidden in computer reports (access restricted to selected staff) the **information processing is now visible and transparent**. **Individuals can see their performance** and that of their peers. Teams can see trends in their performance and become motivated to achieve more or recover lost ground when performance dips.

The sense of fear generated by STP and the futility of any effort expended to try and improve STP was frustrating. The shock to the system of initial RTY measures represented a "new beginning" at the Director, management team and staff levels. The **RTY measure has sufficient sensitivity to engage staff** in the **identification of abnormalities. The formalisation of team reviews** also supported regularisation and formality of **measures that were less time lagged.** The new 'dashboards' published in each physical team workplace (for each asset classification) provided greater, more formalised and comprehensive management information.

These dashboards **engage staff interest** and are **modern artefacts of the new way of working**. Implementation of new methods reinforces the **commitment of management** to visible data to focus improvement. Thus, the new system as a result of this study is a learning system. The organisation may also be regarded as a **learning organisation** too in

that it has the system **knowledge, skills, and attitude to constructively question its own ways of working**. While the case study's investment budget is constrained and new investments will take a considerable length of time to be awarded, **the capacity for improvement** in the business remains high (albeit currently at a plateau). If this glass ceiling remains in place for the medium term, it is likely to lead to frustrations however it is not all about investment in IT and much is to be gained by **collaborating with the front office to reduce human error** to break through the glass.
Within the published dashboards 'around the building', the historic system performance, trend analysis and Pareto analysis of top errors supported on-going learning cycles. Such data also exposed where failures in transactional flow occurred pinpointing areas requiring improvement. The new democracy and **respect for Operations staff** resulted in a waves of improvement initiatives engaged in organisational learning. The awareness and **'dampened noise' in the flow** of work has generated new learning and prevented traditional chaotic behaviour and allowed time for staff to think through issues and engage in structured improvement using various cyclical techniques such as **the DMAIC and PDCA disciplines of Lean and Six Sigma**.

The theory of planned behaviour suggests that staff will only engage in such a system if there is a payback to them. The provision of lean six sigma training, therefore, **heightens the situational awareness of staff to sources of failure**. They have received an investment in skill development and, through practice, can master these methods (for a lifetime of repayment of that investment). The previous STP system was operated under, what Karat would perceive, as a "techno-dominance" where the computer determines worker behaviour. Whereas today the system favours an equality of power with staff who now see their role as diagnostic – not keyboard tapping to achieve a number that not even their managers would their place faith in. The case is a good example of the dysfunctions generated by applying an incorrect and inappropriate measures to a transactional business

– albeit with the caveat that the STP measure could be reengaged but only when the current system has stabilised and maintained its high performance. And crucially when the system flow analysis includes the front office operations. Joining with the front office staff to form the extended socio-technical system offers huge benefits (when these staff are ready) as it means new issues of failure (found in the back office but originating from the front office) can now be tackled and learning extended. Solving questions like why do most automated channels of data entry at the bank have zero errors whilst all manual and trader entered data has significant errors. The latter would suggest that Karat is partially right – he highlights skills but looks mainly at the back office whereas today it is the front office where such improvement needs to occur (and when it does it will further improve the performance of the back office). The task is to **make working practices 'easy to do right'** so that information fidelity is intact when data passes from office to office.

The **new openness and transparency of measures** is therefore a solid foundation and has allowed a full cycle of learning, experimentation and improvement to be seen visually through the dashboards. The permanency of the dashboards was supported by 'storyboards' and A3 lean reporting cards (these show the status of improvement projects and all data collected to justify the change in the system at the team level). The lean six sigma training therefore **provided the skills locally** to each team and this capability (skills) allowed teams to engage in learning in a self-sufficient manner and enact local learning cycles where the fault and improvement remain the responsibility of one senior manager. The intellectual capital investments have therefore **created a new organisational capability** and **capacity to adapt**. The challenge now is to transcend offices.

In this manner, the researcher has found a real tightening of the system. Performance data has shown a radical shift in performance – this is not luck – it has sustained. Staff are also engaged in the process to form a virtuous circle of learning – improvement – measurement and new learning. At the heart of the research contribution are two major items:

1. The evolution and codification of the new McLafferty RYT matrix as a methodology for learning and change and importantly
2. The offering of a new financial services operations management concept – Information Fidelity.

10.4 Summary of Socio-Technical Changes

The summary will show the system changes from the major STS lenses of the learning organisation literature, change management literature, quality management, systems theory and operation management literatures.

Figure 72: Table Alpha Bank as a Learning Organisation

	Technical Features	Before	After	Authors	STS Outcomes
Learning	Common Mental Models (Management)	No	Implemented	Senge (1990)	Team Learning, Learning Organisation, Learning Labs, Skills Development, Problem Solving, and structured experimentation for improvement.
	Common Mental Model (staff)	No	Implemented	Senge (1990)	
	Personal Mastery (management)	No	Growing	Senge (1990)	
	Shared Vision	No	Growing	Senge (1990) Argyris (2004)	
	Team Learning	No	Implemented and growing	Senge (1990)	
	Systems Thinking	No	Implemented and growing	Senge (1990)	
	Double Loop Leaning	No	Implemented and growing	Argyris (2004)	
	Meaning, Management and Measurement	No	Utilised during study	Garvin (1993)	
	Management Cooperation	Moderate	High collaboration	Senge and Sterman (1992)	

The synopsis shows evidence, based on the field research findings that a learning organisation has developed based on the emergent approach of management engagement with the RTY measure. The researcher proposes that the quality improvement process has not faltered and ceased – the fate of most TQM activities and thus the methodology and wider corporate engagement is embedding.

Figure 73: Alpha Bank and Change Management Capability

	Technical Features	Before	After	Authors	Outcomes
Change	Sense of urgency	No	Yes	Kotter (1995)	The features necessary to move to sustainable change from initial event and initial current state. Boundary spanning.
	Management Coalition for change	No	Implemented	Kotter (1995)	
	Form a vision and key initiatives	No	Yes Tactical planning	Kotter (1995)	
	Enlist support	Experts	Teamwork Partnership	Kotter (1995)	
	Enable and remove barriers	No ability	High ability	Kotter (1995)	
	Generate short term wins	None existent	Learning focus vs wins	Kotter (1995)	
	Sustainability	Struggling	Yes but at plateau	Kotter (1995)	
	Institute change	Difficult	Easier	Kotter (1995)	
	Management as a learning group	No	Yes as a collective	Senge (1990)	
	Empowered teams	No	Yes 'Can Do' attitude	Balogun et al (2005)	
	Continued urgency		Less with focus on customer	Kotter (1995), Deming (1986); Hübler and Wotherspoon (2009)	
	Form of improvement	Expert SEM	Deployed	Deming (1986); George (2003)	
	Change Inhibitors	Skills and knowledge	Financial Resources		
	Attitude to change	Done to me	Done with me	Balogun et al. (2005)	
	Promotion of change	Dictated	Co-Managed	Womack and Jones (1996)	

The case study adaptive capability shows the business has also added new capabilities and features whereby learning can be converted into actual change (as such linking knowing and doing). It must be noted that the initial “MGT” Consultants report caused a sense of urgency and the new mode is less chaotic and more focused.

Figure 74: Alpha Bank Systems for Flow

	Technical Features	**Before**	**After**	**Authors**	**Outcomes**
Lean & Six Sigma	Flow	Partially	Higher Flow	Seddon and Caulkin (2007); Seddon (2008a)	The conversion of learning into effective change with improvements to the flow of work. Inductive problem solving. Systems Control. Focus on Quality. Failure Prevention. Commination Planning. Workforce Engagement.
	Accurate Measures	No (STP)	Yes (RTY)	Feigenbaum (1991); Hayler and Nichols (2007)	
	Focus of Measure	Cost and productivity	Flow and Quality	Ferdows and DeMeyer (1990) Feigenbaum (1991)	
	Formalisation of measure	No	Yes	Pasmore (1994); Hayler and Nichols (2007)	
	Timely measures	Lagged	Yes	Forrester (1961); Hayler and Nichols (2007)	
	Presence of Failure Demand	Yes but hidden	Yes but transparent	Seddon (2008)	
	Situational Awareness of failures	Understood	Heightened	Emery and Trist (1965)	
	Process focus	No Departmental	Yes Product	Deming (1986) Seddon (2008)	
	Crosby’s journey point	Unawareness	Enlightenment	Crosby (1996)	
	Systematic improvement methodology	No	Yes	Hayler and Nichols (2007)	
	Improvement opportunity based on data	No	Yes	Deming (1986); George (2003)	
	Improved Feedback from process	Initial state	Yes	Forrester (1961)	
	Improved communication from process	Initial State	Yes	Antony et al. (2012)	
	System IT reliability	Good	Good	Loughlan	
	Dependency between teams	Low (department focus)	Higher and mutual understanding	Balogun and Hailey (2008)	
	Cost of Quality Awareness	Low	High	Juran (1988)	
	Ability to	Low	High	Imai (1986); Juran	

	identify root cause			(1988)	
	Constraint Awareness	Unaware of Bottlenecks	Aware of Bottlenecks	Goldratt et al. (2004)	
	Understanding of System Dynamics	Not understood	Understood and measured	Forrester (1961)	
	Understanding of Variation	Poor	Aware	Shewhart (1931); Juran (1988)	

The synopsis of the socio-technical flow system shows significant changes to structures, policies, and practices engaged at the case attributable to the action learning cycles.

10.5 In Conclusion

This chapter has presented the analysis of the learning cycles and shows how and why the case study has changed. The changes made to the case has increased the “quality” of the ‘inputs’ entering the system. It has improved upon the feedback and management information system (STP to RTY) enhancing system “dependability”. It has improved the flow and thus “speed” of trades through the production system. Moreover, the case’s ability to adapt its systems has shown the emergence of a flexible capability. Through the combination of these outcomes to system performance the case study will, according to Ferdows and De Mayer (1990), cost efficiencies will result. Cost efficiency of operations is the primary focus of the industry benchmarking surveys of “MGT” Consultants (2011), McKinesy & Co (Bremner et al., 2011) and McLagan (Smith, 2009) which influenced the case to believe its underperformance (in terms of costs) must be addressed through management of costs. However, as can be seen from this study the influencing factors leading to operational costs can be influenced through organisational learning and performance improvement through the betterment of Quality and Flow. This study highlights a fundamental shift in management thinking from costs management/accountancy to systems thinking.

The next chapter will look towards what has been learned and where the research process will travel next.

Chapter 11: Conclusions

11.1 Introduction

This chapter represents the final chapter in this learning journey. The previous chapters have outlined the research gap from the systematic literature review, defended the research strategy and methodology and presented the field research before analysing and reflecting on the findings. This chapter will conclude the study and reflect upon the whole journey.

11.2 Key Findings

The research has found many areas of contribution to improved professional practice in commercial and investment banking operations management.

The main findings are that the industry, despite its current attachment to STP, has vastly overestimated its flow and yield performance. The STP measure is an inadequate means of calculating system flow performance. The measure presents a performance level of 80%+ for most asset classes. The McLafferty RTY matrix would recalibrate existing system performance at a much lower rate – possibly as low as 20%.

The answer to the second research question as to what enables or inhibits flow reveals that the following system design features and practices have been shown to support flow:

1. Engage people as intellectual capital to improve a “socio-technical” system, rather than a source of dysfunction within a “technical” system
2. Speed and accuracy of management information systems
3. Valid performance measures and metrics
4. Common mental models of system arrangements and transparency of dependencies
5. Double loop learning using cross-functional teams
6. A strategy for continuous improvement involving each member of the organisation
7. Emancipation from performance measures which drive dysfunctional behaviour

8. Detection and elevation of failure demand
9. Performance Information Dashboards – focus on what's wrong, not what's right
10. Focus on quality as a means of performance improvement, not costs performance as feature of improvement

Conversely, the inhibitors to flow:

1. Information Fidelity – data degradation and data distortion causing system disruption
2. Poor communication networks and feedback loops
3. Believing faster means flow within a constringed system
4. Believing there are proxy measures for flow performance – there isn't, measure it
5. Believing IT and Automation are the only enablers of flow improvement
6. Thinking that the system cannot be changed, or allowing yourself to believe the same
7. Manipulation of workflow systems to mask failure demand and demand amplification
8. Double checking and verification loops
9. Employing SLA's and Queues as a means of managing and measuring demand
10. Falling to capture information and data required by the system to transact services

It must also be noted that the inhibitors do change over time and there is a maturity effect associated with this study. At the current juncture, Alpha Bank is constrained by its inability to invest to "unfreeze" its rigid IT systems (bound by bureaucratic 'change forums') despite its active and latent capacity to undertake more improvement to quality, flow and failure cost.

11.3 Additional Findings

The first obvious finding is that the case study has made significant improvement and has achieved a status as a learning organisation demonstrated by double loop leaning,

knowledge generation, intervention and performance improvement. The principal enabler was to break with convention and remove STP and installing RTY and the McLafferty matrix. The McLafferty RTY matrix is a methodology that has been applied to support performance improvement within a complicated trading system networked to the global markets.
Many people working within the system had little functional knowledge of the system design or a practical knowledge of the end-to-end product flow. Staff rarely worked outside of the functional hierarchy/subsystem processing environment which was found to be an inhibitor to organisational learning but was alleviated through working in cross-functional partnerships and team orientated problem-solving.
Performance management of commercial and investment operations focuses on ‘cost’ as the metric by which all performance and improvement are measured. Juxtaposed to the Sandcone model of improvement which follows the logic of cost performance relies on the cumulative improvement of quality, dependability, speed and flexibility.

11.4 The Identification of a Hidden Office

By focusing on flow, the study has identified losses in a service context. Most quality gurus have stopped short of quantifying losses other than Feigenbaum who proposed 40% of manufacturing capacity was lost as a result of poor quality and its secondary impacts (consumption or resources for rework, additional checking, failure cost etc.). This study, in the process of making trade flows transparent, has identified the existence of a “Hidden Office”, where losses are equally significant yet this is an organisation that transacts £550billion in Sterling equivalent per day through its systems.

The hidden office is directly related to the work of Seddon and his main interest in failure demand. This study finds failure demand is present at the commercial and investment banking case. The presence of failure demand is seen as a major contributor to the losses of the hidden office. The study, however, does not agree with Seddon - that the answer to failure demand is to absorb it through multi-tasking. This study finds multi-skilling of staff to work more effectively across the organisation in different capacities and more productive and beneficial ways.

11.5 Reflections on the Learning Journey

It is customary for a researcher to reflect upon what they would do differently if the opportunity arose to undertake the study again. Reflecting on the journey at the case study, the researcher would request that managers keep a blog during the course of the study to collect feeling and emotions of the individuals as they experience the learning journey. Much like the PDP blog the researcher kept during his learning journey (PDP in annex). The researcher would request the case study allocate investment money giving the study a greater opportunity to witness more system development and change to performance. In doing do it would allow deeper IT system changes and establish a new performance benchmark for best in class – raise and set the bar high. The study has been a very enjoyable and significant part of the researcher's life. During this programme the researcher as experienced many life events that posed many professional and personal challenges. The researcher has learnt a great deal about managing complexity, ambiguity and stress.

Lean Six Sigma provided a structure for learning, the 'toolbox' provided practical tools that engaged and inspired. Management enjoyed the rigour of the methodology and approach. People who follow systems and procedures feel comforted by guidance the LSS framework offers. The researcher felt supported by the management coalition which took part in the case study. Each member of the study, the researcher included, was learning at every step of the journey. It is rare to find such a motivated cohort dedicated to change while managing the burden of day jobs and all that this implies in the largest British banking institution.

The researcher would not change the systematic literature review which underpin the study.

11.6 Implications of this study

The next section will reflect upon the implications of this study for the banking sector, education and teaching in this subject area and for government policy.

11.6.1 Implications for the Banking Sector

This study has a profound impact on management practice at commercial and investment banks, with generalisability to banks of similar technologies and processing systems, around the world. The research has clearly demonstrated a new model that is linked clearly related flow, quality, feedback and learning. The researcher has also presented the McLafferty RTY Matrix which shows how a change in system measurement can unlock significant levels of learning and system improvement. Such organisational capabilities are a key differentiator and strategic weapon to survival and to compete for market share in the modern banking world.

The researcher also believes that CB and IB organisations must educate staff (Operations and Systems Designers) in a systems approach to OM and Lean Six Sigma. The evidence clearly indicates this catalyses improvement, and therefore the researcher believes this should be taught to staff at an early stage in their careers.
Chapter one presented the backdrop to the CB and IB industry. Banks have increased the number of staff in compliance roles by as much as 200% after a series of heavy fines and penalties. Resource funding for such roles has been at the expense of profit and shareholder dividend (UK government are significant shareholders of Banking organisation). Reducing failure demand will decrease dependency on resources to perform rework (rework absorbing as much as 40% of available capacity). A capacity release will help self-fund the expansion of the compliance roles reducing or perhaps mitigating additional resource costs and maximise profit potential.

The study also shows that rigid IT systems inhibit trade processing and that 'input control' is a key success factor leading to high information fidelity. Information fidelity remains a major threat, but also an opportunity to be exploited by banking institutions. To its logical extreme, the importance of information fidelity is being accelerated by the dematerialisation and digitisation of products and services (Internet of Things - IoT) will become an issue for every production and service system throughout the world.

A bank that unites information flows from Front-to-Back will outperform any other peer and hold the lowest system throughput costs, especially where double loop learning is engaged (Argyris, 2004). Moreover, as the study has proven, reflection and discussion are key parts of the management learning process that could be extended to the front office. Concentrating on system failures than system improvement opportunities will move the system from trying to do things 'right' to doing things 'differently' challenging the status quo presents the greatest opportunity to flow improvement in transactional service environments.

11.6.2 Implications for Academic and Professional Teaching

The teaching of service industry management has a myopic focus on 'back office' operations in very repetitive task environments such as changing customer information (account data) and the failure demand recognised by Seddon and Caulkin (2008). However, it has failed to understand the contextual specificities of commercial and investment banking. The latter can only be taught through "case studies" and not in the traditional "lecture" format. These environments are diametrically opposed (and some operations management textbooks present the argument that high-volume and high-variety contexts do not actually exist!) that case studies are the best ways to decipher such complex environments and test the quality of knowledge generation and of decision-making. Extending the arguments further, it would be beneficial for professional bodies in the banking sector to reinforce 'service improvement', quality and the basics of operations management theory as subjects to study when undertaking professional qualifications (updates to ACI Operations Certificate). Professional learners would, therefore, at the very least, be aware of modern approaches to flow, quality and the language of systems thinking and improvement. The power of these professional bodies cannot be underestimated as these organisations tend to lead thinking on a global scale – especially the British Bankers Association and American Bankers Association.

11.6.3 Implications for the UK Government

The UK Government plays an extraordinary role in the banking system today – it is a regulator, an owner and a benefactor of tax revenues/employment. Therefore, there are profound implications for government in supporting the "roll-out" of improvements in the sector and promoting the use of Lean Six Sigma with the McLafferty RTY matrix to show businesses where to invest their time and resources. Maximising efficiency and creation of capacity to accommodate growth will uphold London's position as the financial centre of Europe, maintaining the UK's closely guarded service sector of the economy.

The researcher also argues that the revenues generated by punitive fines for non-compliance could be returned to the banks to allow them to reinvest in improvements especially where these investments support IT developments and end-to-end removal of failures (especially the mistake proofing of static data and improvements to trade flows). Government bodies which are involved in financial services such as HMRC and DWP can benefit of from adopting the McLafferty RTY matrix. Government and public services are the famed "hunting-ground" of Seddon who is unapologetically critical of government services. A pilot study in this sector has the potential to discover the true performance of Government financial services which would provide an interesting and novel comparison between private and public sector financial service organisations.

11.6.4 Contributions

The contributions of this research to theory and practice claimed by the researcher are summaries in Table 59.

Table 59: Contributions

Contribution	Applicable to
Infinity loop of organisational learning (p.g.94).	Theory: visualising organisational learning.
Performance measurement framework (p.g.126).	Practice: a framework to measure performance in the context of performance improvement.
Identification of ten enablers and inhibitor of flow performance within commercial and investment banking operations (p.g. 257-258).	Practice: a guide to locate and alleviate flow inhibitors by adoption of the enablers of flow performance.
Proven relationship between double loop learning and improved flow performance (p.g. 246).	Theory: how managers learn to improve performance by action learning through experimentation and adaptation of their environment.
The McLafferty Matrix (p.g. 229).	Theory: the design of learning systems utilising systems feedback of failure demand to promote organisational learning. Practice: a framework to measure flow performance of complex sequential information processing systems.
Highlighting the existence of the "hidden office" which is conducive to capacity loss as per Feigenbaum's (1991) report of 40% (p.g. 244&259).	Theoretical: Service environment are susceptible to the same capacity drain as manufacturing environment due to poor quality and rework activities (failure demand).
The concept of "Information Fidelity" - the 'degradation' and 'distortion' of information and data quality over time and the impact this has on Quality and Flow capabilities (p.g.262).	Theory: the quantised concept that information quality (its practical utility to the system) will deteriorate over time reaching a point where the information resource entering the system will affect its performance (dysfunction). Practice: quanta given to the types of information quality loss over time ('degradation' and 'distortion'). Managers can now take precautionary measures to maintain suitably high level of information fidelity using 'time' as a trigger to assess and enrich information quality.

11.7 The New Research Agenda

This research is theory building and therefore will naturally lead to new areas of investigation. The researcher would like to propose that the following activities be undertaken:

1. A comparative case study employing similar methods and approach as Alpha Bank to test the generalisation of this work and also to include international banks of foreign ownership to test for cultural (national) differences in a sector (approach to information fidelity) that has common skills and technology employed (differences in socio-technical systems).

2. An acknowledged and deliberate limitation of this study (by design) was the exclusion of traders and the 'front office' from this study. As such, a researcher should be deployed to assess the cause and effect relationship occurring at the vital trade capture element of the Front Office role. This will be to evaluate the flow performance of RTY specifically concerning information reliability captured and flowing from front to back office. Moreover, the researcher would like to propose that the application of the Kingsman's formula is tested in this front office environment. The justification for the addition of Kingman's formula to research in this area is to further understand the system effects of queuing, trader utilisation, service duration (time take on the dealing call with counterpart traders) and trade availability. Time pressures placed on both trading counterparties during the dealing call has the ability to reduce the quality of information captured by the front office.

3. A cross-case comparison of an organisation that is highly dependent to information fidelity and ones that have yet to master this capability would allow the 'S' curve of accelerated Lean Six Sigma to be reviewed and even contrasted with other competing models of service improvement. This work would continue to refine the learning organisation concepts and how an organisation can pass through a 'glass ceiling'.

4. In the modern world where IT is becoming more intelligent, and the IBM Watson computer has beaten humans in an American Quiz Show. It should be possible for

computers to learn from failure demand and this study would be a worthy investment of time. The computerised systems would then have the situational awareness, attention to deviation and learning capability to find patterns in failure data (to update heuristics). This is perhaps Karat’s ultimate dream and worthy of future research.

5. Online gambling follows similar online trading principles of CB and IB institutions. The similarities are striking. In both settings products and service are dematerialised. The client/customer has a user profile containing static data which may contain multiple external bank account details and payment mechanisms. A bet is a contract much like a trade contract. These contracts each have ‘risk and reward’ feature which results in a payment or deposit. Gambling Like CB and IB the investor will place money into various financial instruments which the gambler or trader must make financial decisions where to ‘mature a trade’/’cash-out a bet’ or ‘bet in-play’ or ’buy securities’ in a fluid market. The online gambling market is projected to generate $45billion in 2016 increasing to $56billion over the next two years.

Any piece of research will generate new questions, and the list above is not exhaustive, but a series of highly valuable future projects for professional and academic researchers.

11.8 Publications and Dissemination

The investment in the doctoral study programme has confirmed that there is much to disseminate and the researcher has a plan of outputs to satisfy this requirement (Figure 60).

Table 60: Publications

Output / Dissemination	Purpose
International Journal of Operations and Production Management (ABS 4*)	An academic paper to capitalise on the research involving a structured literature review of flow in the financial service sector.
Production Planning and Control (ABS 3*)	An academic paper using the Alpha Bank case study and flow performance.
American Society for Quality	A practitioner article to show the relevance of the Lean Six Sigma methodology for financial services businesses.
Quality World	A practitioner article exploring the definition of quality for investment and commercial banking.
Lean Management Journal (ABS2*)	Paper presenting inhibitors to leaner flow/waste in the Commercial and Investment banking system.
Institute of Banking	A 'thought paper' presenting the skills needed by 'back office' staff in the future.

11.9 Final Remarks

The DBA learning journey is a long pathway, over many years, which culminates in a single document. The journey has its highs and its lows. The hours of research, self-criticism and fieldwork that has been invested in this document is huge and therefore the researcher hopes that it will provide the basis for future research and new investigations in this poorly explored area of operations management. There are few industry sectors that have the capability to generate so much national value, and the journey that has begun with this document will, it is hoped, occupy many more years of the researcher's career. He hopes it helps fellow researchers to make sense of the sector and its organisational complexities.

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Appendix A

Figure 75: SIPOC Mapping Tool

SIPOC						
Suppliers	**Inputs**	**Process**		**Outputs**	**Customers**	
Providers Of The Required Resources	***Resources Required By The Process***	***Process Requirements From The Inputs***	***Top Level Description Of Activity***	***Deliverables From The Process***	***Customer's Requirements Of The Outputs***	***Anyone Who Receives A Deliverable From Process***
Client	Static data that needs to be added/amended	-Accuracy -Completeness -Provided in a timely manner	**<u>Start:</u>** Client notifies Case Study that static data needs to be amended	Correct and Valid client static	Client static is amended accurately and in a timely manner	Client
Client & Sales Support Front Office Case Study Legal Case Study Confirmations dept Case Study Finance dept	Request sent to Data Management with client details to be amended (e.g. Name, Address, Confirmation instructions, SSI details, BoE codes)	-Accuracy. -Completeness. -New details have been verified as correct.	**CLIENT STATIC DATA AMENDED**		Consistent request format; All client details are provided; Changes have been verified as being correct;	Data Management
		-Auto-generated email sent to initiator of WMO Hub request		Notification that client static amendment has been completed	Notification sent as soon as the amendment is completed; Contains trading record Short ID/WWID;	-Client & Sales Support Front Office dept -Case Study Finance dept -Case Study Legal dept -Case Study Confirmations dept
Case Study Banking Group	Hub System	-Data Management to manually send notification when amendment successfully completed				
	Microsoft Outlook		**<u>End:</u>** Notification received that client static has been amended correctly			

Figure 76: Process Flow Map - Amendments

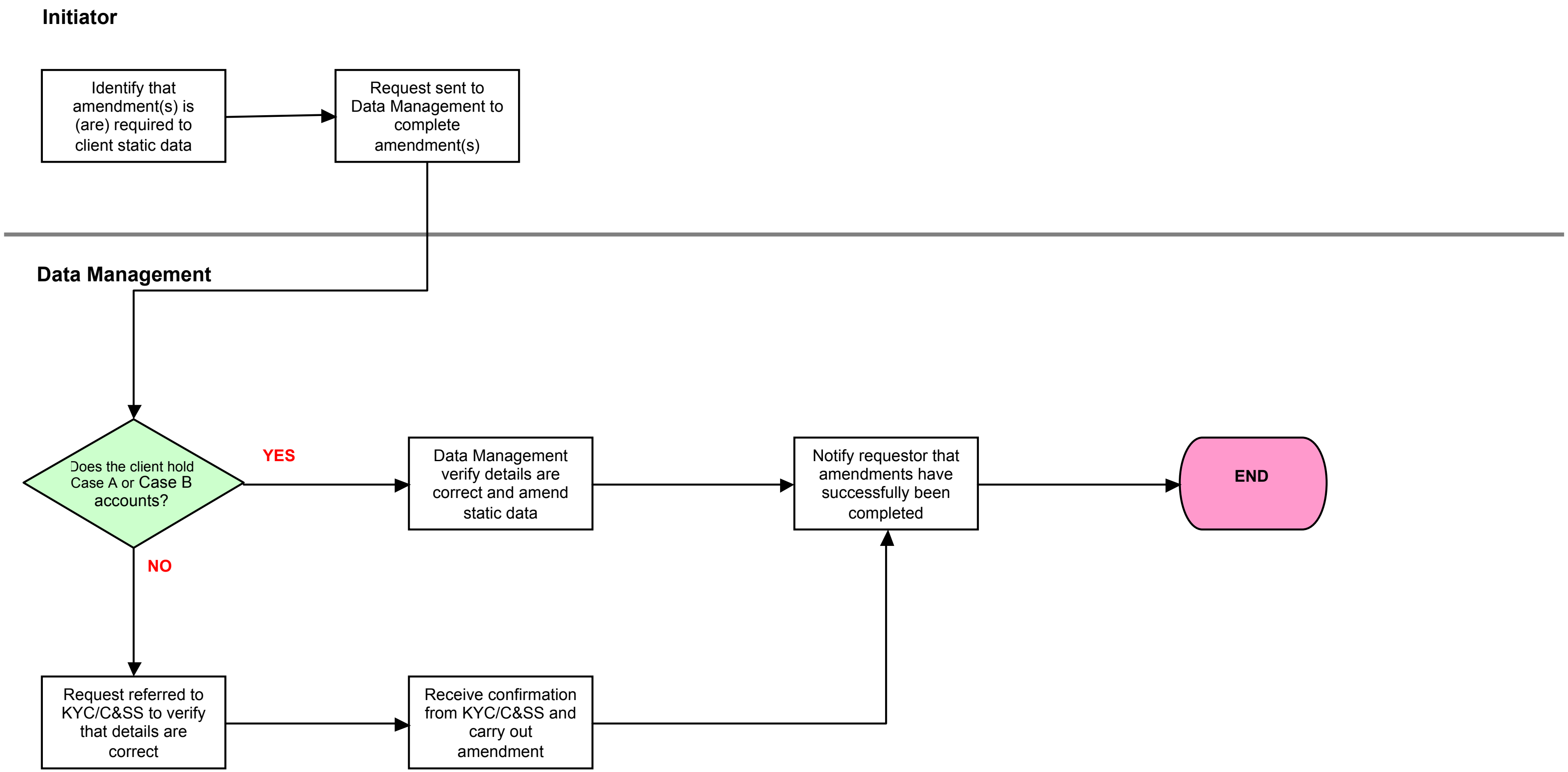


Figure 77: Voice of Customer Drill Down

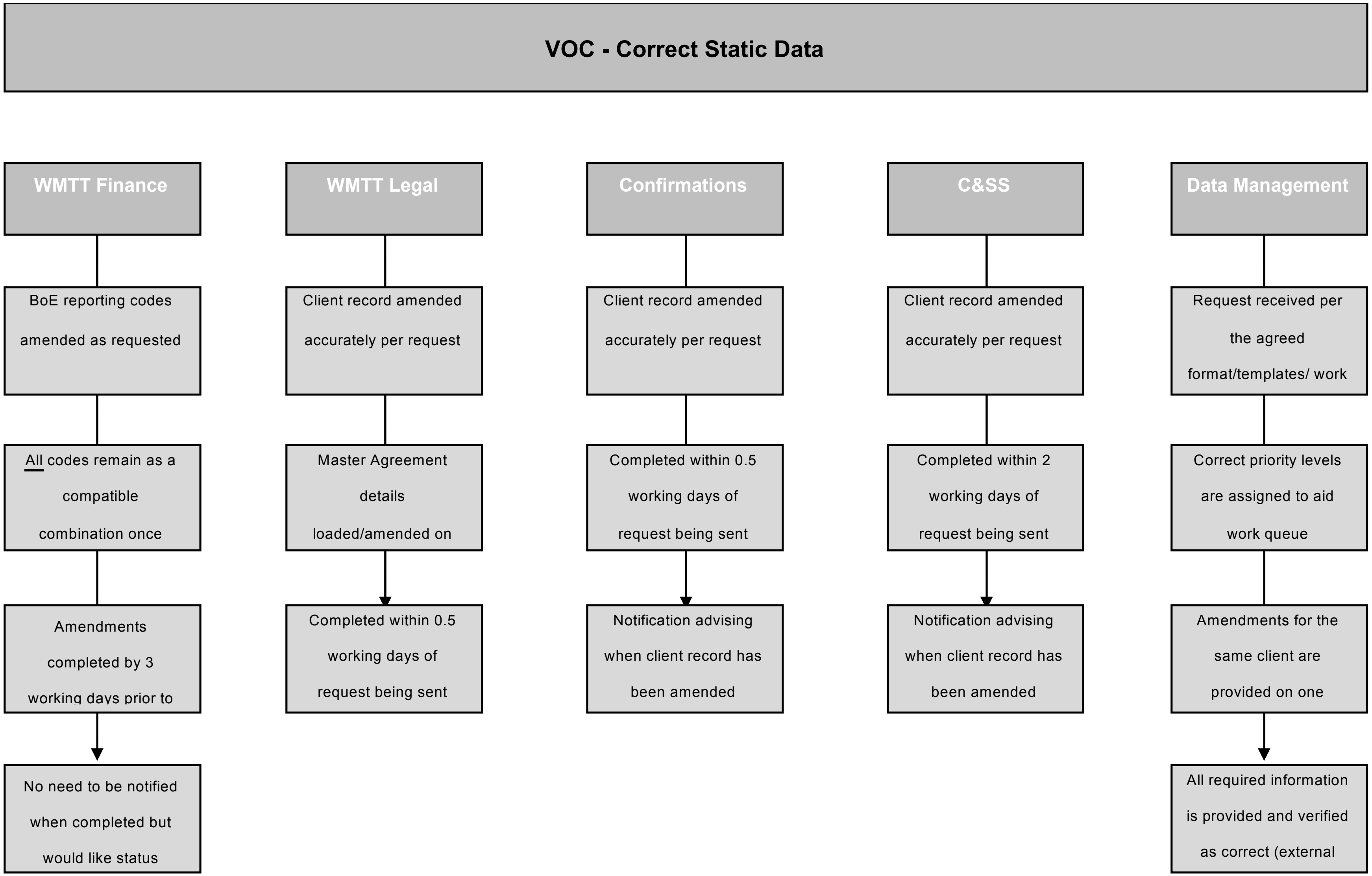


Figure 78: Fishbone Diagram

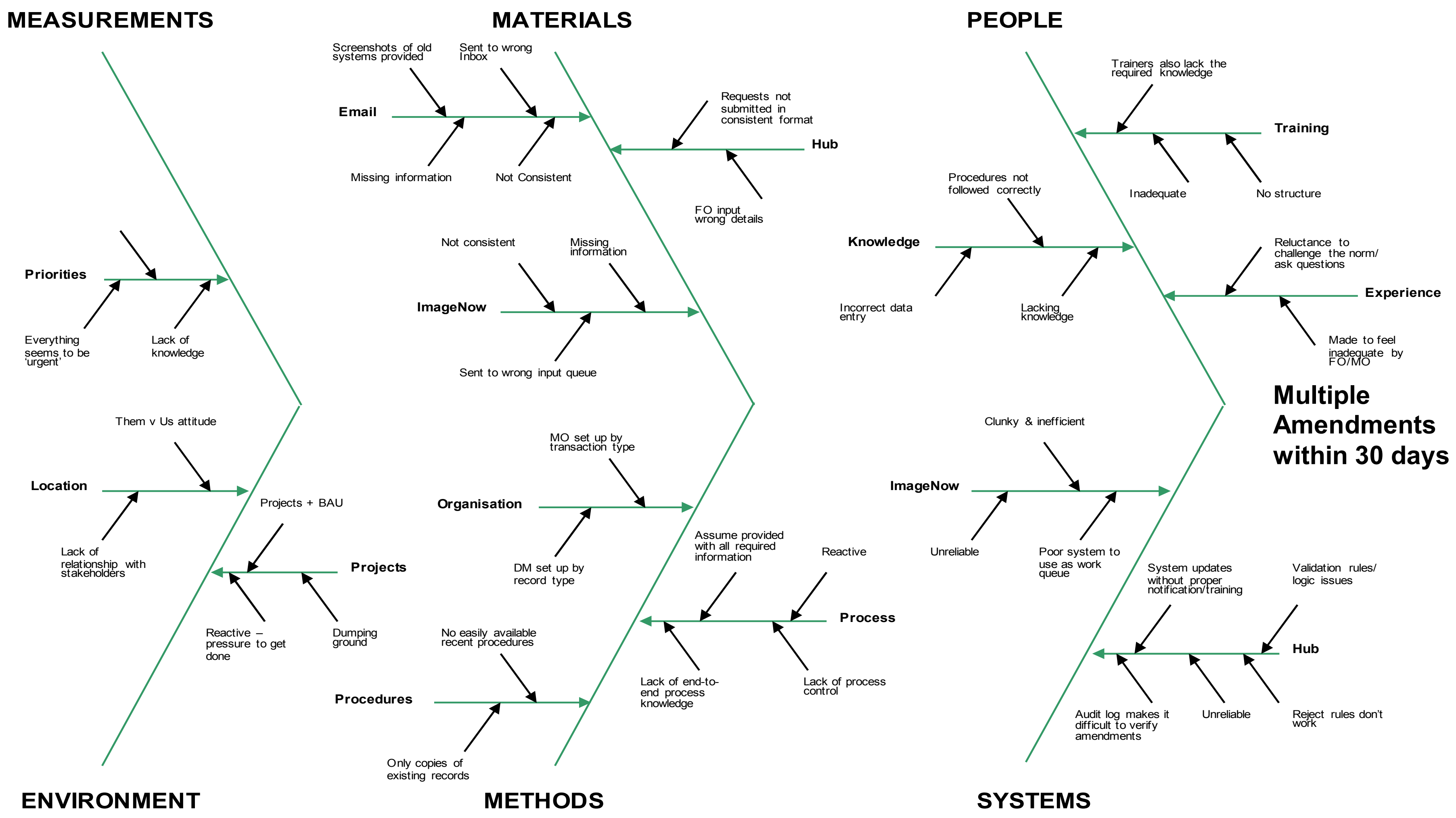
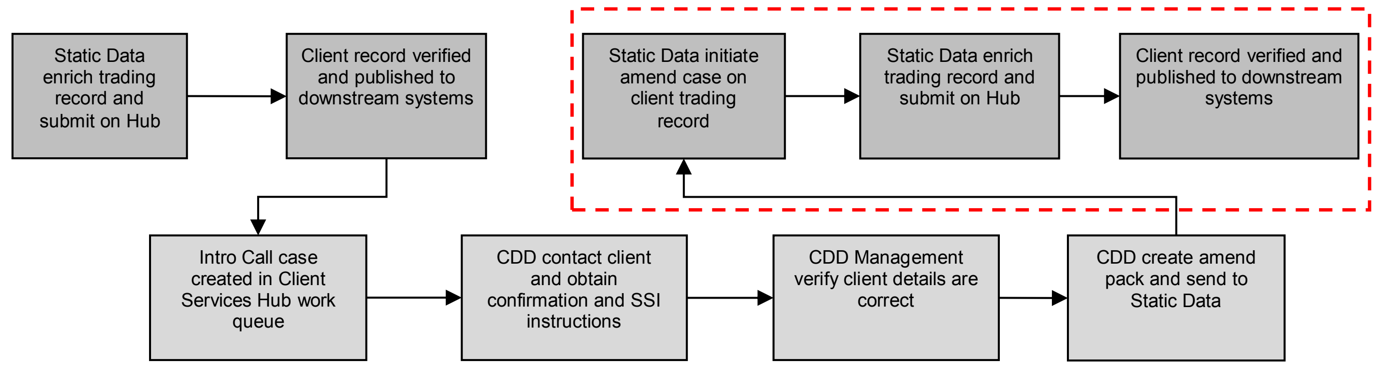
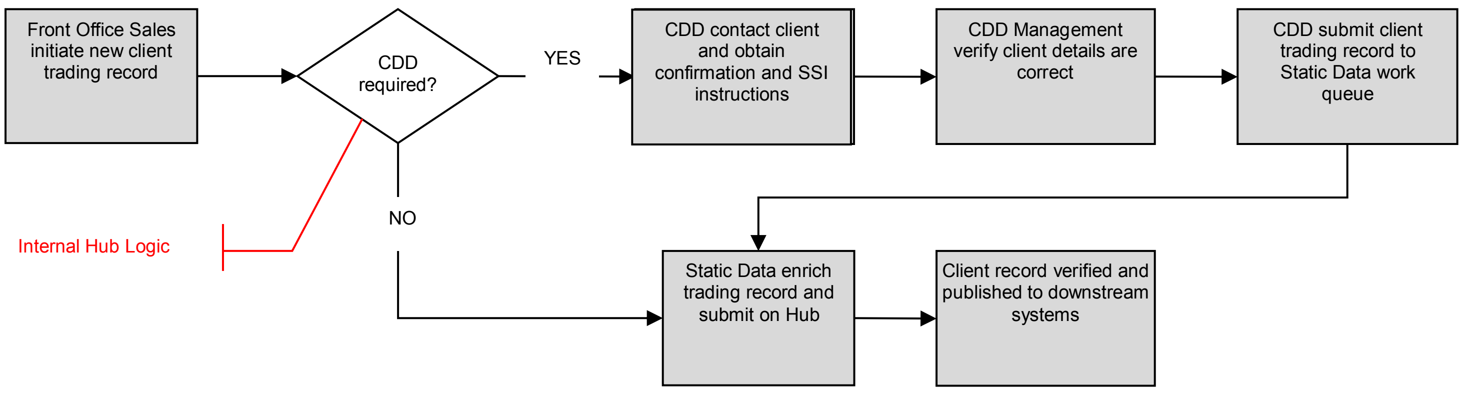


Figure 79: Client Onboarding Workflow - Current State



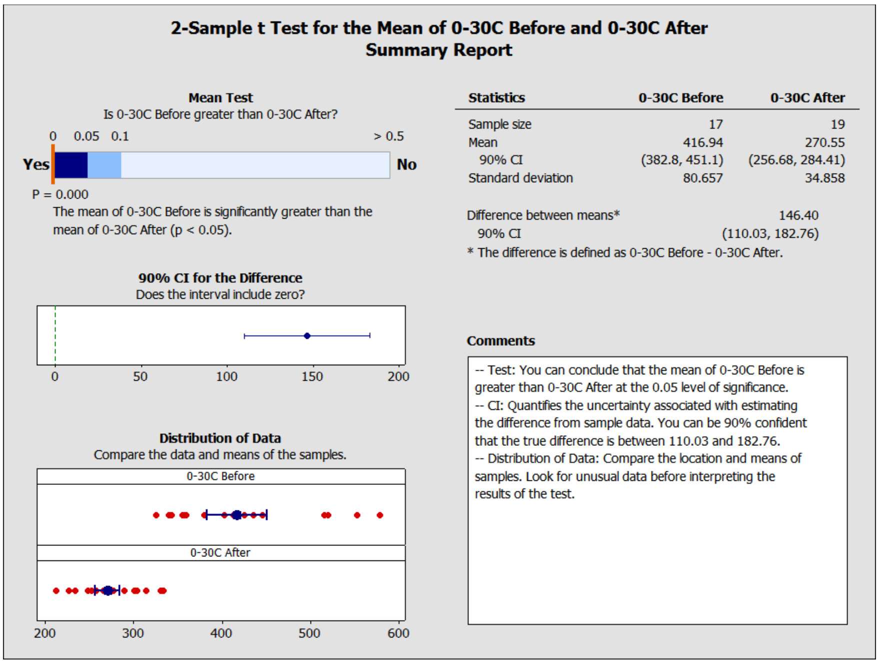
Client Onboarding workflow showing the initial creation of the client trading record and subsequent amendment (highlighted in red) that is required to add confirmation and settlement instruction details.

Figure 80: Client Onboarding Workflow - Redesign



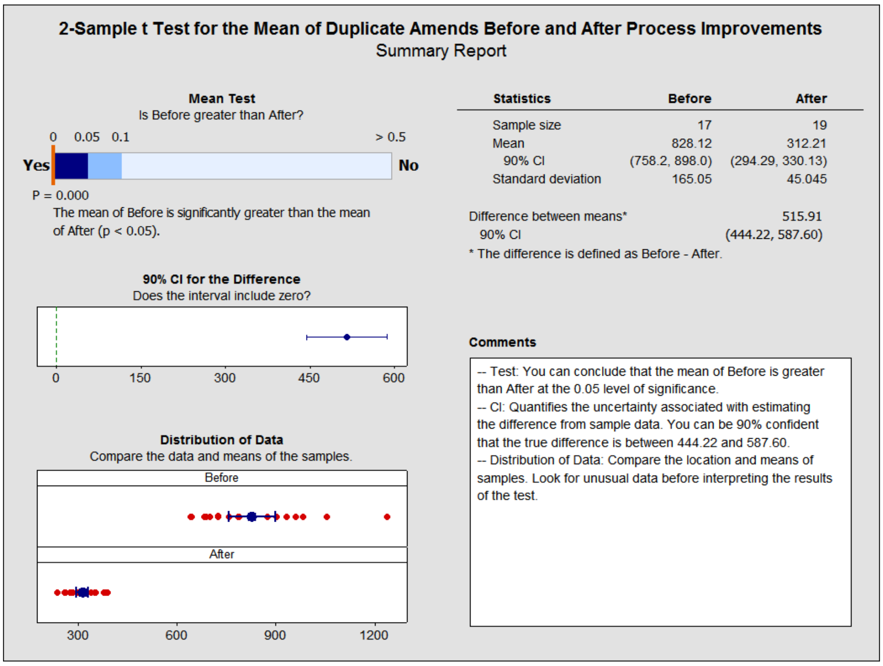
High-level process map of new Client Onboarding workflow showing automated trading record workflow driven by internal WMO Hub logic.

Figure 81: Significance Testing - Amends 0 - 30 days



Test is significant, p-value below the alpha of 0.05. Reject the null and accept the alternate that the volume of failure demand is less after system intervention (amendments).

Figure 82: Significance Testing - Multiple Amends 0 - 30 days



Test is significant, p-value below the alpha of 0.05. Reject the null and accept the alternate that the volume of failure demand is less after system intervention (multiple amendments).

Appendix B

Table 61: STP Metric Dysfunction

Trades Vol Enter	Elements	Server 1	Server 2	Server 3	Server 4	Server 5	Server 6	Server 7	Server 8	Yield
40000	Entering Node RFT	40000	33750	27500	21250	15000	8750	2500	-3750	
	Exceptions	6250	6250	6250	6250	6250	6250	6250	6250	
	Exiting Node RFT	33750	27500	21250	15000	8750	2500	-3750	-10000	
	STP V1	84.38%	84.38%	84.38%	84.38%	84.38%	84.38%	84.38%	84.38%	**84.38%**
	STP V2	84.38%	81.48%	77.27%	70.59%	58.33%	28.57%	-150.00%	266.67%	**64.66%**

STP metric dysfunction at 50000 defects affecting server 7 returning a negative value.

Table 62: Yield Modelling Data

# of Exceptions	STP V1	STP V2	RTY
10k	96.88%	96.47%	75.00%
20k	93.75%	91.71%	50.00%
30k	90.63%	84.29%	25.00%
40k	87.50%	66.03%	0.00%
50k	84.38%	64.66%	
60k	81.25%	65.04%	
70k	78.13%		
80k	75.00%		
90k	71.86%		
10k	70.00%		

Table 63: Industry Definitions of STP

Version	STP Interpretation
Bank 1	A trade is STP if, and only if, it is not manually touched across the whole processing lifecycle. The lifecycle includes all activities after the trade capture in the front office towards the generation of the booking entries after the successful exchange of confirmations, clearing, settlement, and reconciliation.
Bank 2	Trades which do not require operational intervention
Bank 3	An STP transaction should be considered as one which runs straight through settlement systems without any manual intervention whatsoever. This applies only to the actual settlement process, not including any previous manual intervention for example during the confirmation matching and or subsequent manual handling of a resulting inquiry/investigation.
Bank 4	All trades coming from the front office system (so manual entry of trades by front office people is allowed) processed, confirmed, matched, settled and reconciled without any human intervention
McLagan	A tighter definition might be, ***"A trade is STP if it is processed without human intervention from trade capture to settlement with automatic generation of all confirmations, accounting entries and feeds to ancillary systems"***. **Measurement of STP.** STP is normally measured as a single percentage of trades **NOT** requiring manual intervention, i.e. a 95% STP rate implies that 5% of trades have had to be touched manually.

Source: Smith, (2009)

Appendix C

Figure 83: Money Market RTY Automated Dashboard

MM | END-TO-END PROCESS ARCHITECTURE | May 2015

Money Market RTY	**84.48%**	**Sigma Score 3.7**
Deposits E2E RTY	**74.23%**	
Loans E2E RTY	**92.70%**	

					Trade Inception						WIP		Trade Lifecycle				Settlement Payment			
					BT Server	Trade Server	Document Server	Trade Dispatch Server	Tram Confs Matching	Inception RTY	Outstanding Trades	Settlement Events	Settlement Flow Server	Pre Settlement Server	Settlement Server	Lifecycle Dispatch Server	PCM	Stelink	Settle RTY	Booking Method E2E RTY
New & Resaved Trade Volume				**36,953**	99.93%	92.65%	95.75%	99.92%	-	88.58%	117,128	95,883	100.00%	99.74%	95.67%	99.93%	-	-	95.36%	84.48%
Product	**Booking Method**	**New Trades**	**Resaved**	**%**	**Exceptions**					**Yield**	**WIP**		**Exceptions**						**Yield**	**E2E RTY**
Deposits	HBOS MarketsLink	648	339	4.54%	1	45	121	0	-	83.08%	2,745	1,371	0	5	39	11	-	-	95.99%	79.75%
	Lloyds MarketsLink	6,048	273	29.07%	12	92	480	0	-	90.76%	10,790	12,220	0	67	714	28	-	-	93.38%	84.75%
	Manual/No ECN	6,541	4,885	52.55%	13	1,232	663	3	-	83.27%	8,107	14,303	0	89	2,202	14	-	-	83.88%	69.85%
	Other	232	276	2.34%	0	98	18	0	-	77.17%	539	635	0	0	106	0	-	-	83.31%	64.28%
	Voice Broker	296	2,207	11.51%	0	460	143	10	-	75.51%	8,693	2,336	0	34	407	5	-	-	80.91%	61.09%
	Subtotal	13,765	7,980		26	1,927	1,425	13	-	84.41%	30,874	30,865	0	195	3,468	58	-	-	87.94%	74.23%
Loans	ACBS	7,102	128	47.54%	0	104	0	0	-	98.56%	63,308	53,290	0	2	0	0	-	-	100.00%	98.56%
	Manual/No ECN	2,086	1,938	26.46%	0	297	101	0	-	90.11%	6,902	5,577	0	50	348	5	-	-	92.77%	83.60%
	Other	109	52	1.06%	0	22	21	1	-	72.67%	1,808	499	0	0	215	0	-	-	56.91%	41.36%
	Voice Broker	1,810	1,983	24.94%	0	365	23	15	-	89.38%	14,236	5,652	0	1	117	0	-	-	97.91%	87.51%
	Subtotal	11,107	4,101		0	788	145	16	-	93.76%	86,254	65,018	0	53	680	5	-	-	98.86%	92.70%
	Total	24,872	12,081	36,953	26	2,715	1,570	29	-		117,128	95,883	0	248	4,148	63	-	-		

TOP 10 Exceptions

Description	Volume	% Total	RAG
Confirmation not matched	3,228	45.32%	●
Amended trade - approval required.	1,101	15.46%	●
Non-economic change to the trade - approval required.	526	7.38%	●
Trade has assigned Customer Cash SSIs - approval required.	523	7.34%	●
Trade does not have Customer SSIs set.	389	5.46%	●
Amended payment/receipt - approval required.	330	4.63%	●
Trade flow has assigned Customer Cash SSIs - approval required.	277	3.89%	●
Trade has assigned Our Cash SSIs - approval required.	251	3.52%	●
Comments found on envelope.	250	3.51%	●
Flow XXX does not have any settlement instructions. It cannot be released.	248	3.48%	●

Exceptions Types

Description	Volume	% Total	RAG
Confirmations	3,303	37.54%	●
Settlements	3,090	35.12%	●
Front Office	1,823	20.72%	●
Static	452	5.14%	●
Other	67	0.76%	●
IT	64	0.73%	●
Total	8,799	100%	

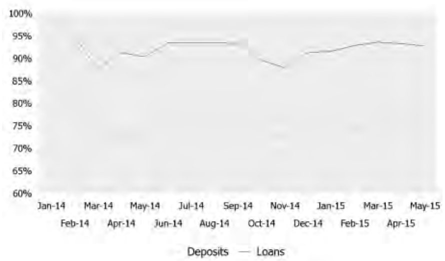
Headcount

Division	Value
Management	1.4
Middle Office	1.5
Back Office	7.4
Change	2.7
Time Zone	0.0
Business Control	1.2
Total	14.2

Exception Capacity

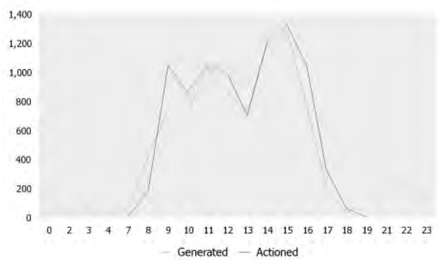
Metric	Value
Volumes	8,799
Effort (in Min)	28,784.99
FTE Needed	3.46
FTE Allocated	8.9
Exception Utilisation %	38.90%

RTY



Work Volumes & Exceptions

Exceptions Volume By Hour



Phase Volumes & Exceptions

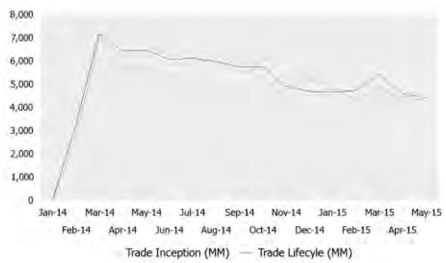


Figure 84: Foreign Exchange RTY Automated Dashboard

FX | END-TO-END PROCESS ARCHITECTURE | May 2015

FX RTY	49.67%
FX Spot E2E RTY	72.09%
FX Forward E2E RTY	50.54%
FX Options E2E RTY	21.69%
FX Swap E2E RTY	-1.41%

				Sigma Score 3.82	Trade Inception				Inception RTY	WIP		Trade Lifecycle		Settlement Payment		Settle RTY	Booking Method E2E RTY
					FO To Validate	BO To Validate	Conf To Validate	Matching Server		Outstanding Trades	Settlement Events	Settlement Validation	Events Server	PCM	Stelink		
New & Resaved Trade Volume				134,391	99.80%	99.00%	99.83%	99.92%	98.57%	71,552	41,963	50.48%	99.84%	-	-	50.40%	49.67%
Product	**Booking Method**	**New Trades**	**Resaved**	**%**	**Exceptions**				**Yield**	**WIP**		**Exceptions**				**Yield**	**E2E RTY**
FX Spot	360T	1,891	0	2.08%	0	3	0	0	99.84%	183	675	212	0	-	-	68.59%	68.48%
	EBS	27,748	0	30.53%	0	78	0	0	99.72%	2,732	269	0	0	-	-	100.00%	99.72%
	Manual/No ECN	19,470	121	21.55%	31	45	7	0	99.58%	2,098	586	712	0	-	-	0.00%	0.00%
	Marketslink	29,691	0	32.66%	0	1	0	0	100.00%	3,310	6,812	1,340	0	-	-	80.33%	80.33%
	Other	7,476	430	8.70%	30	23	0	0	99.33%	951	1,544	464	0	-	-	69.95%	69.48%
	Reuters	4,066	7	4.48%	2	56	0	0	98.58%	460	200	65	0	-	-	67.50%	66.54%
	Subtotal	90,342	558		63	206	7	0	99.70%	9,734	10,086	2,793	0	-	-	72.31%	72.09%
FX Forward	FXLab	427	382	4.31%	5	6	0	0	98.64%	670	511	1,141	0	-	-	0.00%	0.00%
	Manual/No ECN	1,456	44	8.00%	0	256	35	0	80.60%	5,534	845	1,067	0	-	-	0.00%	0.00%
	Marketslink	15,720	0	83.83%	0	256	8	0	98.32%	14,126	19,502	7,524	0	-	-	61.42%	60.39%
	Other	692	31	3.86%	0	40	0	0	94.47%	3,861	1,604	998	0	-	-	37.78%	35.69%
	Subtotal	18,295	457		5	558	43	0	96.77%	24,191	22,462	10,730	0	-	-	52.23%	50.54%
FX Option	Broker	153	61	33.70%	0	0	0	0	100.00%	2,296	308	6	0	-	-	98.05%	98.05%
	FXLab	293	64	56.22%	186	177	67	6	0.00%	1,975	150	153	68	-	-	0.00%	10.47%
	Manual/No ECN	62	2	10.08%	7	18	0	1	59.38%	529	16	0	0	-	-	100.00%	59.38%
	Other	0	0	0.00%	0	0	6	0	0.00%	351	1,129	54	0	-	-	95.22%	0.00%
	Subtotal	508	127		193	195	73	7	26.30%	5,151	1,603	213	68	-	-	82.47%	21.69%
FX Swap	360T	809	0	3.38%	0	9	0	0	98.89%	2,399	884	1,446	0	-	-	0.00%	0.00%
	FXLab	373	373	3.12%	0	0	0	0	100.00%	57	0	0	0	-	-	0.00%	0.00%
	Manual/No ECN	6,327	116	26.93%	2	48	11	0	99.05%	8,526	1,115	1,352	0	-	-	0.00%	0.00%
	Marketslink	13,371	0	55.88%	0	14	0	0	99.90%	16,526	1,817	2,984	0	-	-	0.00%	0.00%
	Other	1,433	19	6.07%	0	40	0	0	97.25%	3,279	1,380	1,085	0	-	-	21.38%	20.79%
	Reuters	1,086	20	4.62%	2	86	0	0	92.04%	415	1,709	136	0	-	-	92.04%	84.72%
	Subtotal	23,399	528		4	197	11	0	99.11%	31,202	6,905	7,003	0	-	-	0.00%	0.00%
FX NDF	Broker	4	0	2.33%	0	0	0	0	100.00%	41	5	0	0	-	-	100.00%	100.00%
	Manual/No ECN	147	16	94.77%	0	44	62	0	34.97%	831	56	34	0	-	-	39.29%	13.74%
	Other	1	0	0.58%	0	0	0	0	100.00%	209	3	0	0	-	-	100.00%	100.00%
	Redi	4	0	2.33%	0	0	0	0	100.00%	4	7	0	0	-	-	100.00%	100.00%
	Subtotal	156	16		0	44	62	0	38.37%	1,085	71	34	0	-	-	52.11%	20.00%
FX Hybrid	Manual/No ECN	5	0	100.00%	0	0	0	0	100.00%	189	0	0	0	-	-	0.00%	0.00%
	Subtotal	5	0		0	0	0	0	100.00%	189	0	0	0	-	-	0.00%	0.00%
Simple Cashflow	Other	0	0	0.00%	0	0	0	0	0.00%	0	184	0	0	-	-	100.00%	0.00%
	Subtotal	0	0		0	0	0	0	0.00%	0	184	0	0	-	-	100.00%	0.00%
NETTING	Other	0	0	0.00%	0	0	0	0		0	576	0	0	-	-	100.00%	100.00%
	Subtotal	0	0		0	0	0	0		0	576	0	0	-	-	100.00%	100.00%
Commodity	Other	0	0	0.00%	0	143	30	94	0.00%	0	76	8	0	-	-	89.47%	0.00%
	Subtotal	0	0		0	143	30	94	0.00%	0	76	8	0	-	-	89.47%	0.00%
	Total	132,705	1,686	134,391	265	1,343	226	101		71,552	41,963	20,781	68	-	-		

TOP 10 Exceptions

Description	Volume	% Total	RAG
Random netting	15,335	67.77%	
Waiting for contract matching	5,269	23.29%	
Contract Is Back-Dated	655	2.89%	
Deliverable Cut Off Date Is Passed	417	1.84%	
Front Office Comments	271	1.20%	
Trade To Be Validated	239	1.06%	
Check missing SSI	153	0.68%	
Confirmation Comments	105	0.46%	
Match The Trade With The Counterpart Confirmation	101	0.45%	
Master Agreement Is Not Correctly Defined	83	0.37%	

Exceptions Types

Description	Volume	% Total	RAG
Settlements	15,341	67.24%	
Confirmations	5,505	24.13%	
Front Office	1,695	7.43%	
Static	243	1.07%	
Middle Office	32	0.14%	
Total	22,816	100%	

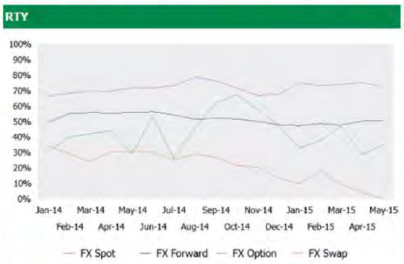
Headcount

Division	Value
Management	2.30
Middle Office	7.60
Back Office	16.78
Change	3.44
Time Zone	0.00
Business Control	1.17
Total	31.29

Exception Capacity

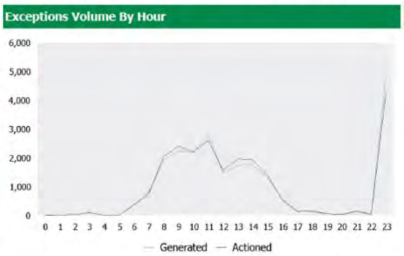
Metric	Value
Volumes	22,816
Effort (in Min)	38,334.5
FTE Needed	4.61
FTE Allocated	24.38
Exception Utilisation %	18.91%

RTY



Work Volumes & Exceptions

Exceptions Volume By Hour



Phase Volumes & Exceptions

Figure 85: Primary Bond Issuance RTY Automated Dashboard

PRIMARY ISSUANCE | END-TO-END PROCESS ARCHITECTURE | May 2015

Primary Bonds RTY	50.13%
MTN E2E RTY	100.00%
CDs / CPs E2E RTY	88.94%
Primary E2E RTY	21.58%
Lifecycle MTN E2E RTY	100.00%

				Sigma Score 3.39	Trade Inception				Inception RTY	WIP		Settlement Events				Settlement Payment			Settle RTY	Booking Method E2E RTY
					Summit Loader Adapter	Trade Server	Document Server	Dispatch Server		Outstanding Trades	Settlement Events	Settlement Server	Pre Settlement Server	Settlement Flow Server	Trade Publisher Server	PCM	Stelink	Central Depositary		
New & Resaved Trade Volume				1,437	100.00%	50.94%	100.00%	99.47%	50.67%	9	937	98.93%	100.00%	100.00%	100.00%	-	-	-	98.93%	50.13%
Product	**Booking Method**	**New Trades**	**Resaved**	**%**		**Exceptions**			**Yield**	**WIP**				**Exceptions**					**Yield**	**E2E RTY**
MTN Issuance	Manual/No ECN	20	5	100.00%	0	0	0	0	100.00%	8	34	0	0	0	0	-	-	-	100.00%	100.00%
	Subtotal	20	5		0	0	0	0	100.00%	8	34	0	0	0	0	-	-	-	100.00%	100.00%
CDs / CPs	Manual/No ECN	197	366	97.74%	0	56	0	0	90.05%	1	338	5	0	0	0	-	-	-	98.52%	88.72%
	Other	0	13	2.26%	0	0	0	0	100.00%	0	0	0	0	0	0	-	-	-	100.00%	100.00%
	Subtotal	197	379		0	56	0	0	90.28%	1	338	5	0	0	0	-	-	-	98.52%	88.94%
Primary Bond Issuance	Other	0	5	0.60%	0	5	0	0	0.00%	0	2	0	0	0	0	-	-	-	100.00%	0.00%
	TOMS	438	393	99.40%	0	644	0	5	21.90%	0	563	5	0	0	0	-	-	-	99.11%	21.71%
	Subtotal	438	398		0	649	0	5	21.77%	0	565	5	0	0	0	-	-	-	99.12%	21.58%
	Total	655	782	1,437	0	705	0	5		9	937	10	0	0	0	-	-	-		

LIFECYCLE COUPON PAYMENTS

Coupon RTY	**100.00%**	**1,979**		**6.00**	100.00%	100.00%	100.00%	100.00%	100.00%	37	1,897	100.00%	100.00%	100.00%	100.00%	-	-	-	100.00%	100.00%
	Coupons	**DRP's**	**Resaved**	**%**		**Exceptions**			**Yield**	**WIP**				**Exceptions**					**Yield**	**E2E RTY**
Lifecycle	Repo Coupons	1,712	26	87.82%	0	0	0	0	100.00%	0	1,692	0	0	0	0	-	-	-	100.00%	100.00%
	Issuance Coupons	205	36	12.18%	0	0	0	0	100.00%	37	205	0	0	0	0	-	-	-	100.00%	100.00%
	Total	1,917	62	1,979	0	0	0	0		37	1,897	0	0	0	0	-	-	-		

TOP 10 Exceptions

Description	Volume	% Total	RAG
Trade is back valued.	296	41.11%	●
Customer SSI missing on Physical Del/Rec.	292	40.56%	●
Trade has assigned Customer Security SSIs - approval required.	61	8.47%	●
Trade has assigned Our Security SSIs - approval required.	32	4.44%	●
Comments found on envelope.	24	3.33%	●
Trade xxxxx requires phone swapping	5	0.69%	●
Cust Sec SSI not found for trade xxxxx - needed for MT54x messages.	4	0.56%	●
Document not created - ISIN not found. Please update ISIN and resubmit.	4	0.56%	●
A settlement document was previously sent for this trade. Please approve if this docum	1	0.14%	●
Cust SSI AWB Account missing for trade xxxxx (needed for MT54x REAG party field 95F	1	0.14%	●

Exceptions Type

Description	Volume	% Total	RAG
Settlements	400	55.56%	●
Static	296	41.11%	●
Front Office	24	3.33%	●
Total	720	100%	

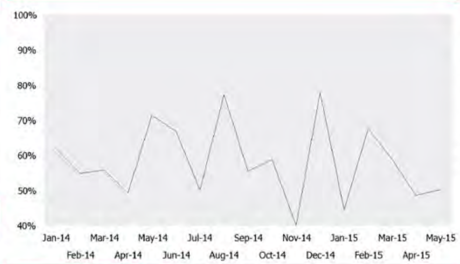
Headcount

Division	Value
Management	4.45
Middle Office	21.50
Back Office	15.20
Change	4.25
Time Zone	0.00
Business Control	0.90
Total	**46.30**

Exception Capacity

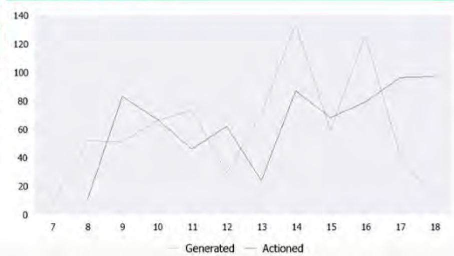
Metric	Value
Volumes	720
Effort (in Min)	729.33
FTE Needed	0.09
FTE Allocated	36.7
Exception Utilisation %	0.24%

RTY



Work Volumes & Exceptions

Exceptions Volume By Hour



Phase Volumes & Exceptions

Figure 86: Secondary Bonds RTY Automated Dashboard

SECONDARY BOND | END-TO-END PROCESS ARCHITECTURE | May 2015

Secondary RTY	**85.24%**
Secondary Bonds E2E RTY	**58.84%**
Repo E2E RTY	**91.68%**
Govt Bonds/Gilts E2E RTY	**79.10%**
Secondary MTN E2E RTY	**85.37%**

					Trade Inception					WIP		Settlement Events				Settlement Payment				
				Sigma Score 3.86	Summit Loader Adapter	Trade Server	Document Server	Dispatch Server	**Inception RTY**	Outstanding Trades	Settlement Events	Settlement Server	Pre Settlement Server	Settlement Flow Server	Trade Publisher Server	PCM	Stelink	Central Depositary	**Settle RTY**	**Booking Method E2E RTY**
New & Resaved Trade Volume				**80,907**	100.00%	88.17%	100.00%	98.27%	86.65%	6,142	84,302	98.37%	100.00%	100.00%	100.00%	-	-	-	98.37%	85.24%
Product	**Booking Method**	**New Trades**	**Resaved**	**%**	**Exceptions**				**Yield**	**WIP**		**Exceptions**							**Yield**	**E2E RTY**
Secondary Bonds	Market Axess	363	102	3.46%	0	298	0	2	35.48%	53	607	8	0	0	0	-	-	-	98.68%	35.02%
	Other	699	88	5.85%	0	23	0	0	97.08%	67	312	7	0	0	0	-	-	-	97.76%	94.90%
	TOMS	6,775	3,914	79.50%	0	3,908	0	883	55.18%	768	10,579	488	0	0	0	-	-	-	95.39%	52.63%
	Tradeweb	1,503	1	11.19%	0	10	0	50	96.01%	142	83	1	0	0	0	-	-	-	98.80%	94.85%
	Subtotal	9,340	4,105		0	4,239	0	935	61.52%	1,030	11,581	504	0	0	0	-	-	-	95.65%	58.84%
Repo	BROKERTEC	2,577	0	4.33%	0	10	0	0	99.61%	257	5,972	0	0	0	0	-	-	-	100.00%	99.61%
	Martini	3,279	53,620	95.55%	0	3,686	0	522	92.60%	4,336	58,359	757	0	0	0	-	-	-	98.70%	91.40%
	Other	73	0	0.12%	0	1	0	0	98.63%	25	157	98	0	0	0	-	-	-	37.58%	37.06%
	Subtotal	5,929	53,620		0	3,697	0	522	92.92%	4,618	64,488	855	0	0	0	-	-	-	98.67%	91.68%
Govt Bonds/Gilts	BGC	184	0	2.36%	0	0	0	0	100.00%	11	195	0	0	0	0	-	-	-	100.00%	100.00%
	Dowgate	217	0	2.79%	0	0	0	0	100.00%	8	223	0	0	0	0	-	-	-	100.00%	100.00%
	Fidessa	455	4	5.89%	0	11	0	0	97.60%	30	470	0	0	0	0	-	-	-	100.00%	97.60%
	ICAP	349	0	4.48%	0	0	0	0	100.00%	10	366	0	0	0	0	-	-	-	100.00%	100.00%
	Other	126	20	1.87%	0	3	0	0	97.95%	5	132	0	0	0	0	-	-	-	100.00%	97.95%
	TOMS	3,435	483	50.30%	0	717	0	0	81.70%	187	4,021	9	0	0	0	-	-	-	99.78%	81.52%
	Tradeweb	1,442	544	25.49%	0	887	0	0	55.34%	220	2,192	3	0	0	0	-	-	-	99.86%	55.26%
	Tullett	531	0	6.82%	0	0	0	0	100.00%	20	617	1	0	0	0	-	-	-	99.84%	99.84%
	Subtotal	6,739	1,051		0	1,618	0	0	79.23%	491	8,216	13	0	0	0	-	-	-	99.84%	79.10%
SIPs Secondary MTNs	Manual/No ECN	7	0	5.69%	0	0	0	0	100.00%	1	0	0	0	0	0	-	-	-	0.00%	0.00%
	TOMS	17	99	94.31%	0	18	0	0	84.48%	2	17	0	0	0	0	-	-	-	100.00%	84.48%
	Subtotal	24	99		0	18	0	0	85.37%	3	17	0	0	0	0	-	-	-	100.00%	85.37%
	Total	22,032	58,875	80,907	0	9,572	0	1,457		6,142	84,302	1,372	0	0	0	-	-	-		

TOP 10 Exceptions

Description	Volume	% Total	RAG
Customer SSI missing on Physical Del/Rec.	3,168	26.55%	
Multiple SSI have missing instructions.	2,304	19.31%	
Trade is back valued.	1,456	12.20%	
Trade xxxxx requires phone swapping	1,452	12.17%	
Trade has assigned Customer Security SSIs - approval required.	1,359	11.39%	
A settlement document was previously sent for this trade. Please approve if this docum	594	4.98%	
Trade has assigned Our Security SSIs - approval required.	519	4.35%	
Triparty Trade Correct SSI Assignment required	510	4.27%	
Cust SSI POS CodeValue missing for trade xxxxx (needed for MT54x PSET party field 9	408	3.42%	
Comments found on envelope.	163	1.37%	

Exceptions Type

Description	Volume	% Total	RAG
Static	6,183	49.86%	
Settlements	5,964	48.09%	
Front Office	229	1.85%	
Other	19	0.15%	
IT	6	0.05%	
Total	12,401	100%	

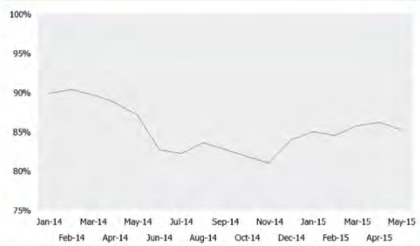
Headcount

Division	Value
Management	4.45
Middle Office	21.50
Back Office	15.20
Change	4.25
Time Zone	0.00
Business Control	0.90
Total	**46.30**

Exception Capacity

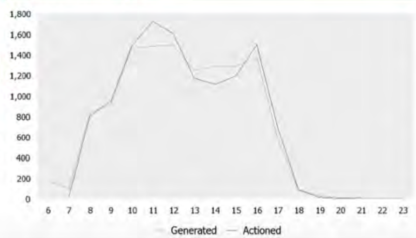
Metric	Value
Volumes	12,401
Effort (in Min)	20,490.1
FTE Needed	2.46
FTE Allocated	36.7
Exception Utilisation %	6.72%

RTY



Work Volumes & Exceptions

Exceptions Volume By Hour



Phase Volumes & Exceptions

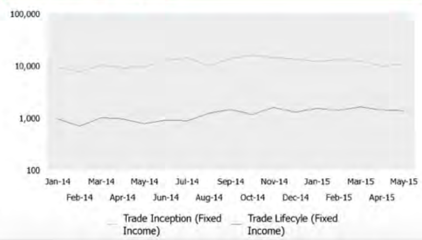


Figure 87: Derivatives RTY Automated Dashboard

DERIVATIVES - FLOW | END-TO-END PROCESS ARCHITECTURE | May 2015

Flow Derivatives RTY	**92.61%**
Cap/Floor E2E RTY	**6.51%**
FRA E2E RTY	**100.00%**
Futures E2E RTY	**100.00%**
Swaps E2E RTY	**77.08%**
Swaptions E2E RTY	**44.16%**

Sigma Score 4.19

Product	Booking Method	New Trades	Resaved	%	BT Server	Trade Server	Document Server	Inception Dispatch Server	Tram Confs Matching	Inception RTY	Outstanding Trades	Settlement Events	Settlement Flow Server	Pre Settlement Server	Settlement Server	Lifecycle Dispatch Server	PCM	Stelink	Settle RTY	Booking Method E2E RTY
					Trade Inception						**WIP**		**Trade Lifecycle**				**Settlement Payment**			
New & Resaved Trade Volume				**161,904**	100.00%	96.82%	98.66%	99.99%	100.00%	95.52%	100,438	77,256	100.00%	99.81%	97.15%	100.00%	-	-	96.96%	92.61%
Product	**Booking Method**	**New Trades**	**Resaved**	**%**	**Exceptions**					**Yield**	**WIP**		**Exceptions**						**Yield**	**E2E RTY**
Cap/Floor	Manual/No ECN	15	96	85.38%	0	35	84	0	0	0.00%	1,033	724	0	5	38	0	-	-	94.06%	0.00%
	Markitwire	7	12	14.62%	0	1	1	0	0	89.47%	126	10	0	0	1	0	-	-	90.00%	80.53%
	Subtotal	22	108		0	36	85	0	0	6.92%	1,159	734	0	5	39	0	-	-	94.01%	6.51%
FRAs	Manual/No ECN	3	224	6.88%	0	0	0	0	0	100.00%	1,221	642	0	0	0	0	-	-	100.00%	100.00%
	Markitwire	519	2,554	93.12%	0	0	0	0	0	100.00%	4,480	3,611	0	0	0	0	-	-	100.00%	100.00%
	Subtotal	522	2,778		0	0	0	0	0	100.00%	5,701	4,253	0	0	0	0	-	-	100.00%	100.00%
Futures	Futtoms	123,238	0	99.92%	0	0	0	0	0	100.00%	0	0	0	0	0	0	-	-	0.00%	0.00%
	Other	90	6	0.08%	0	0	0	0	0	100.00%	0	0	0	0	0	0	-	-	0.00%	0.00%
	Subtotal	123,328	6		0	0	0	0	0	100.00%	0	0	0	0	0	0	-	-	100.00%	100.00%
Swaps	Manual/No ECN	1,095	16,889	52.63%	0	2,762	1,901	10	0	74.02%	54,550	69,942	0	134	1,717	0	-	-	97.35%	72.06%
	Markitwire	1,349	14,840	47.37%	0	2,283	64	0	0	85.50%	35,158	1,979	0	4	298	0	-	-	84.74%	72.45%
	Subtotal	2,444	31,729		0	5,045	1,965	10	0	79.46%	89,708	71,921	0	138	2,015	0	-	-	97.01%	77.08%
Swaptions	Manual/No ECN	18	410	44.26%	0	63	118	0	0	57.71%	1,984	176	0	2	25	0	-	-	84.66%	48.86%
	Markitwire	122	417	55.74%	0	8	0	0	0	98.52%	1,886	172	0	4	126	0	-	-	24.42%	24.06%
	Subtotal	140	827		0	71	118	0	0	80.46%	3,870	348	0	6	151	0	-	-	54.89%	44.16%
	Total	126,456	35,448	161,904	0	5,152	2,168	10	0		100,438	77,256	0	149	2,205	0	-	-		

TOP 10 Exceptions

Description	Volume	% Total	RAG
Comments found on envelope.	1,483	19.29%	●
Trade has missing resets - approval required.	1,347	17.52%	●
Trade is Customised.	1,159	15.08%	●
Confirmation not matched	866	11.26%	●
Amended payment/receipt - approval required.	721	9.38%	●
Comments on the envelope - approval required.	607	7.90%	●
Trade is backdated, see Start Date.	547	7.11%	●
Trade has customised leg - approval required.	338	4.40%	●
Notional schedules do not match on every leg - approval required.	327	4.25%	●
Trade has customised leg - Please check.	293	3.81%	●

Exceptions Type

Description	Volume	% Total	RAG
Front Office	4,206	43.43%	●
Settlements	2,748	28.38%	●
Static	1,783	18.41%	●
Confirmations	947	9.78%	●
Total	9,684	100%	

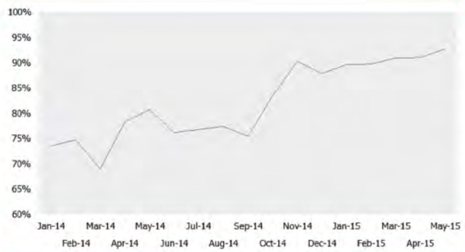
Headcount

Division	Value
Management	2.07
Middle Office	11.00
Back Office	17.90
Change	1.13
Time Zone	0.00
Business Control	0.50
Total	**32.60**

Exception Capacity

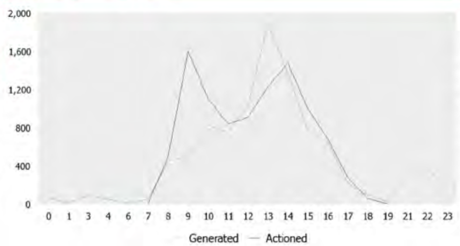
Metric	Value
Volumes	9,684
Effort (in Min)	13,950
FTE Needed	1.68
FTE Allocated	28.9
Exception Utilisation %	5.81%

RTY



Work Volumes & Exceptions

Exceptions Volume By Hour



Phase Volumes & Exceptions

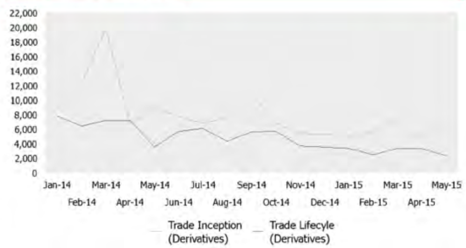


Figure 88: Derivatives RTY Automated Dashboard

DERIVATIVES - NON FLOW | END-TO-END PROCESS ARCHITECTURE | May 2015

Non Flow Derivatives RTY	19.93%
Inflation Link Swaps E2E RTY	33.25%
Structured HPC Code E2E RTY	20.02%
Total Return Swaps E2E RTY	0.00%
SIPs E2E RTY	75.13%
DCD E2E RTY	0.00%
CDs E2E RTY	42.35%
MTN Swaps E2E RTY	21.49%
CMS E2E RTY	70.37%

				Sigma Score 3.19	Trade Inception					Inception RTY	WIP		Trade Lifecycle				Settlement Payment		Settle RTY	Booking Method E2E RTY
					BT Server	Trade Server	Document Server	Inception Dispatch Server	Tram Confs Matching		Outstanding Trades	Settlement Events	Settlement Flow Server	Pre Settlement Server	Settlement Server	Lifecycle Dispatch Server	PCM	Stelink		
New & Resaved Trade Volume				4,452	100.00%	80.39%	49.87%	100.00%	100.00%	40.09%	6,141	726	99.72%	98.48%	50.69%	99.86%	-	-	49.71%	19.93%
Product	Booking Method	New Trades	Resaved	%	Exceptions					Yield	WIP		Exceptions						Yield	E2E RTY
Inflation Linked Swaps	Manual/No ECN	37	124	25.72%	0	71	90	0	0	0.00%	1,414	80	0	0	48	0	-	-	40.00%	0.00%
	Markitwire	74	391	74.28%	0	31	0	0	0	93.33%	1,866	18	0	0	3	0	-	-	83.33%	77.78%
	Subtotal	111	515		0	102	90	0	0	69.33%	3,280	98	0	0	51	0	-	-	47.96%	33.25%
Structured HPC codes	Manual/No ECN	0	74	100.00%	0	11	45	0	0	24.32%	334	5	0	0	2	0	-	-	60.00%	14.59%
	Other	0	0		0	0	0	0	0		4	0	0	0	0	0	-	-	0.00%	0.00%
	Subtotal	0	74		0	11	45	0	0	24.32%	338	5	0	0	2	0	-	-	60.00%	14.59%
Total Return Swaps	Manual/No ECN	180	635	100.00%	0	494	727	0	0	0.00%	362	400	0	2	97	1	-	-	75.00%	0.00%
	Subtotal	180	635		0	494	727	0	0	0.00%	362	400	0	2	97	1	-	-	75.00%	0.00%
SIPs	Manual/No ECN	60	134	98.48%	0	47	0	0	0	75.77%	378	2	0	0	0	0	-	-	100.00%	75.77%
	Markitwire	0	3	1.52%	0	2	0	0	0	33.33%	0	0	0	0	0	0	-	-	0.00%	0.00%
	Subtotal	60	137		0	49	0	0	0	75.13%	378	2	0	0	0	0	-	-	100.00%	75.13%
DCDs	Manual/No ECN	35	0	100.00%	0	0	0	0	0	100.00%	4	0	0	0	0	0	-	-	0.00%	0.00%
	Subtotal	35	0		0	0	0	0	0	100.00%	4	0	0	0	0	0	-	-	0.00%	0.00%
CDS	Manual/No ECN	73	2,317	100.00%	0	53	1,066	0	0	53.18%	669	54	2	9	0	0	-	-	79.63%	42.35%
	Subtotal	73	2,317		0	53	1,066	0	0	53.18%	669	54	2	9	0	0	-	-	79.63%	42.35%
MTN Issuance Swaps	Manual/No ECN	8	89	31.70%	0	84	104	0	0	0.00%	289	100	0	0	183	0	-	-	0.00%	77.87%
	Markitwire	17	192	68.30%	0	80	198	0	0	0.00%	742	46	0	0	23	0	-	-	50.00%	0.00%
	Subtotal	25	281		0	164	302	0	0	0.00%	1,031	146	0	0	206	0	-	-	0.00%	21.49%
Constant Maturity Swaps	Manual/No ECN	0	9	100.00%	0	0	2	0	0	77.78%	79	21	0	0	2	0	-	-	90.48%	70.37%
	Subtotal	0	9		0	0	2	0	0	77.78%	79	21	0	0	2	0	-	-	90.48%	70.37%
	Total	484	3,968	4,452	0	873	2,232	0	0		6,141	726	2	11	358	1	-	-		

TOP 10 Exceptions

Description	Volume	% Total	RAG
Comments on the docs field - action accordingly	1,034	34.72%	
Comments found on envelope.	445	14.94%	
Trade uses an HBOS product code of 'TRSSOVGN' - Manual Confirmation Requ	402	13.50%	
Trade uses an HBOS product code of 'TRSILSOV' - Manual Confirmation Requir	305	10.24%	
Confirmation not matched	167	5.61%	
Trade uses an HBOS product code of 'EMTN' - Approval Required	165	5.54%	
Trade uses an HBOS product code of 'EMTN' - Manual Confirmation Required	159	5.34%	
Trade is Customised.	143	4.80%	
Trade has customised leg - approval required.	91	3.06%	
Cancelled trade - approval required.	67	2.25%	

Exceptions Type

Description	Volume	% Total	RAG
Front Office	1,434	41.24%	
Other	1,040	29.91%	
Settlements	678	19.50%	
Confirmations	232	6.67%	
Static	88	2.53%	
IT	5	0.14%	
Total	3,477	100%	

Headcount

Division	Value
Management	1.83
Middle Office	5.10
Back Office	18.91
Change	1.13
Time Zone	0.00
Business Control	0.50
Total	27.47

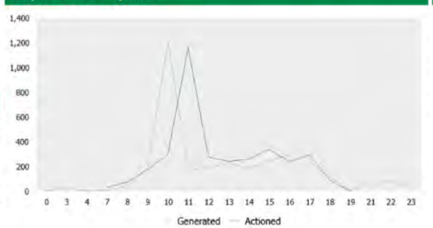
Exception Capacity

Metric	Value
Volumes	3,477
Effort (in Min)	1,285.5
FTE Needed	0.15
FTE Allocated	24.01
Exception Utilisation %	0.64%

RTY

Work Volumes & Exceptions

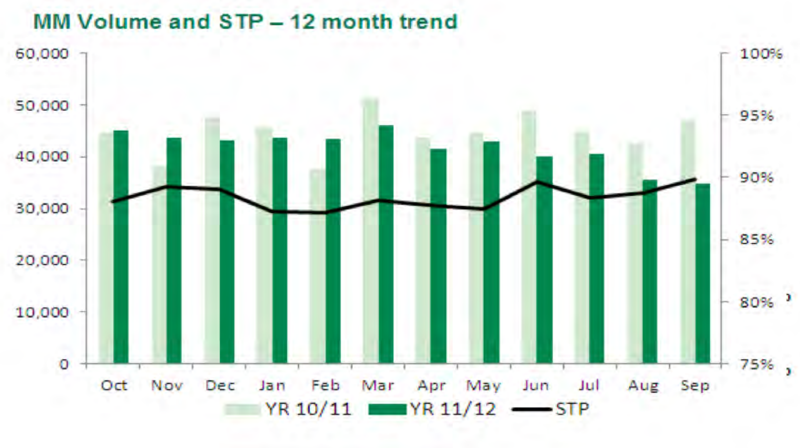
Exceptions Volume By Hour



Phase Volumes & Exceptions

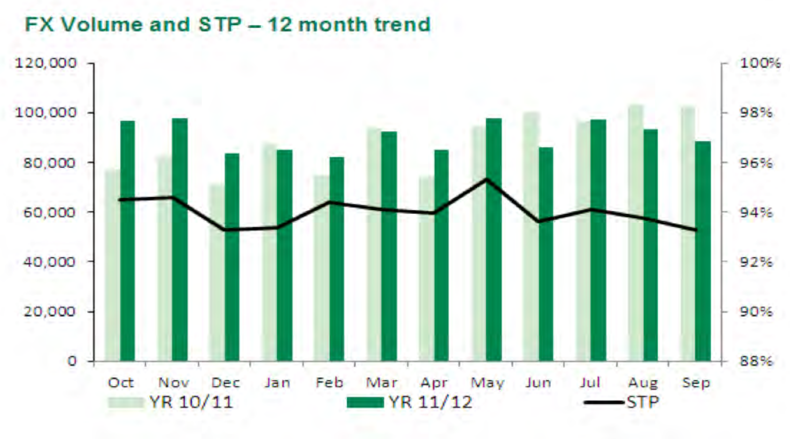
Appendix D

Figure 89: STP Bench Mark - Money Market (pre study)



Source: The Case

Figure 90: STP Bench Mark - Foreign Exchange (pre study)



Source: The Case

Appendix E

Professional Development Portfolio

of Kevin McLafferty

Introduction

This paper documents the growth and evolution of a Prof Doc student focusing on the development and acquisition of professional skills necessary to undertake research in a highly professional banking environment located in the city of London. This paper spans a period of two years covering the significant milestones along a professional doctorate research journey (such as case study scope, project selection, project management/ execution and organisational change). The paper is a reflective 'free thought' account (journal writing style) laying down the thoughts and experiences as they occurred throughout research journey. The paper is a critical review which tests previous held beliefs and assumptions, responds to thoughts, feelings, and emotions over the study and the experiences that have enabled the student to develop his understanding of professional development.

The composition of this paper contains both reflective narrative and tables documenting important meetings, conversations, activities and events that have generated a meaningful contribution to the student's development towards a career as a professional management consultant. The researcher's field of professional expertise is operations and quality management within the context of global financial services. Most recently, working with organisations such as Bank of America, BlackRock, and Lloyds Banking Group in the capacity as a consultant, has highlighted the opportunities for professional and personal development.

1.0 Identifying professional practice

Identifying professional practice is easier said than done. The question "what is professional practice?" seems enigmatic and hard to pin down when the question is first asked. Moreover, professional practice has distinctive and contrasting meanings within differing professional service settings (Hospitals, Banks, Law firms, Architects). Therefore, the macro question is likely to return only vague answers contributing little understanding for my personal development process.

Narrowing the scope by concentrating specifically on the UK banking sector (the case study) opened up a multitude of possibilities where professional practice can be found (Chartered Institutes, Banking Associations and Professional Codes of Conduct are all present in this management setting). I reflected on the sector and found that there was too high a diversity of 'professional bodies' in operation – each setting their own standards (see Table 1).

Table 1: Professional Bodies

Professional Bodies
Chartered Institute of Bankers
Chartered Institute of Credit Management
Chartered Insurance Institute
Chartered Institute of Management Accountants

In this context, if the researcher were to focus professional development activities in the general banking context (a medium level of inquiry) it would dilute the professional development process. It would also risk the under-development of my specialist skills and knowledge and so I rejected researching at this level of the industry.

Decomposing the sector further allowed me to identify the specific professional skills and challenges facing banking organisations undergoing transformational change (the micro level) and this I considered relevant to the nature of my study (business administration) and professional interests. Developing skills, at this level, contextualises the researcher's professional background in Quality Management, Systems Thinking and Organisational Change. Examples of practising professional bodies are:

Table 2: Practicing Professional Bodies

Practicing Professional Bodies
Chartered Management Institute
Association of Corporate Treasures
Association of project managers
British Standards Institute
Society of Quality Assurance
Institute for the Management of Information Systems

The development of professional practice, my personal motivation as a researcher, and contribution were best served by working at this level using a case study approach (the specific organisational context was Treasury and Trading activities) and the contribution I hope to make to professional management practice. In so doing I also hoped to improve my expertise further and engage in a wider professional debate concerning service improvements as well as to use the systematic approach of the DBA to ground my work as an academic in this field.

Also, the skills required to operate within the case study further opportunities for personal and professional development exist such as refining my skills for project management, quality systems implementation and change management. Arguably these co-requisites are required to effectively investigate the change in an organisational context where people and systems must be managed as one single entity.

1.1 Identifying Professional Styles

A large part of the Prof Doc programme is reflective in nature and designed to help capture both sides of the learning process (the academic student and the working professional views). The self-reflection process is perhaps the main differentiator between this Prof Doc programme (linking academic theory and debates with professional practice) and the classic Ph.D. doctoral programme (philosophical debate and theory). Before setting out to acquire new skills and honing existing ones, the researcher thought it pertinent to conduct a recognised professional psychometric profile.

In looking into the various profiles one thing is apparent, there is no shortage of alternatives, but the selection criteria were easy to establish in my case. I want to understand how my skills, my non-technical skill or specialist knowledge, compared with others in my peer group (senior manager and upwards). Various providers and their assessment profiles were reviewed for fit and practicality. Of three shortlisted providers, the Glowinkowski's 'Blue4' application was selected.

Glowinkowski's Blue4™ is a behavioural style of leadership that is built upon a model of successful change leadership which he claims generates "… a quality of engagement between people both internal and external to an organisation … [that] … strengthens collaboration". Reflecting on my undertaking with the case study, engagement is of paramount importance to build social bonds and quickly establish relationships with stakeholders and participants. Collaboration is of significant importance to project execution because I have designed the research strategy to be a single embedded case study following a realist approach based on an 'inductive' logic where I would work alongside bank employees who will inform my understanding of the current service improvement phenomena and drive change from within the system. Therefore, the Blue4 approach will be an insightful technique to measure these two aspects along with many other management skills that I have.

1.2 The Blue4 Model

The Blue4 test is comprised of 240+ psychometric questions. My results are compared with a group of over 4000 senior managers and executive results held within Glowinkowski's database. The output provides information on motives, preferences, needs and talents.

Given the nature of the assessment ('self-appraisal'), my results reflect my "self-perception" typifying my natural styles offering an insight into how I am likely to function in a professional working environment (see Figure 1).

Figure 1: Summary of Professional Psychometric Report (Part 1)

	Competency Description	Potential	
Thinking	**Conceptual Thinking** Exploring Possibilities (10); Generating Ideas (9)	10	**Extremely High** higher potential than about 99% of the comparison group
Thinking	**Analytical Thinking** Interpreting Data (9); Documenting Facts (9); Adopting Practical Approaches (8)	10	**Extremely High** higher potential than about 99% of the comparison group
Thinking	**Forward Thinking** Managing Tasks (4); Meeting Timescales (3)	3	**Low** higher potential than about 10% of the comparison group
Thinking	**Customer Understanding** Seizing Opportunities (6)	6	**Average** higher potential than about 60% of the comparison group
Thinking	**Strategic Thinking** Developing Strategies (5)	5	**Average** higher potential than about 40% of the comparison group
Influencing	**Relationship Building** Interacting with People (5); Establishing Rapport (5)	5	**Average** higher potential than about 40% of the comparison group
Influencing	**Interpersonal Awareness** Understanding People (3); Valuing Individuals (2)	2	**Very Low** higher potential than about 5% of the comparison group
Influencing	**Concern for Impact** Impressing People (9); Showing Composure (6); Resolving Conflict (3)	6	**Average** higher potential than about 60% of the comparison group
Influencing	**Strategic Influencing** Conveying Self-Confidence (8); Convincing People (7); Articulating Information (7)	8	**High** higher potential than about 90% of the comparison group
Influencing	**Developing Others** Empowering Individuals (4); Managing Tasks (4); Team Working (2)	2	**Very Low** higher potential than about 5% of the comparison group

1.2.1 Reflective Thinking

Under headings Conceptual Thinking and Analytical Thinking, which captures my innate ability (and liking) to work with problems, analytical data, abstract concepts and developing conceptual solutions, a positive result was achieved which was considered good for undertaking investigatory research of a doctoral nature. Customer Understanding and Strategic Thinking has heightened my awareness of the need for customer awareness and to treat the case study organisation -and its participants of the study- as customers. I must be mindful that people are both participants and recipients of the study and therefore devise a strategy to ensure participants are treated like customers, to understand their needs, wants and concerns and ensure their voice is captured acted upon.

Strategic Thinking appears to be an area that requires a diligent approach throughout the duration of the project as my pertinacity to build strategy is average and far from where my expectation lay. I am aware that while (selfishly) I possess my own academic aims and objectives regarding case study execution, I must enrich the quality and value for the organisation at each step of the process (deliver shared benefits).

Reflecting on the experience of my peers, a fellow researcher shared some practical insights from his study recently that “didn’t go as well as expected” from the viewpoint of the organisation while being an extremely useful study for the researcher. The study investigated how and why a particular system phenomenon occurs (input-process-output), and many experiments were conducted and results collected. The researcher was satisfied with the data collected and the study aims and objectives were satisfied. However, for the case study organisation, the study was deemed unsuccessful and failed to achieve their strategic objectives (it failed to identify the influencing factors to generate improvements). The valuable lesson I have learned is the academic objective of generating new knowledge is a contribution that is not necessarily shared by commercial business as a satisfactory conclusion (lacking utility). A business objective is one which is focused on producing a beneficial outcome in whole or in part that can produce some form of commercial advantage. My learning in this instance is to ensure that strategic objectives are clear, mutually agreeable, discuss possible outcomes and rationalise the effect each outcome has for the joint members of the study. Reflecting on this conversation has prompted me to cite a quote I once read from Thomas Edison regarding the development of the light bulb.

“I have not failed 1000 times to produce a working light bulb. I have successfully discovered 1000 ways how not to produce a light bulb".
As such, even if an experiment fails to produce the desired outcome, it does not mean that research has failed to produce valid knowledge - try selling that to General Electric.

Reflecting on the lowest score from this section Forward Thinking, I was surprised by this result because, as a seasoned project manager of over ten years this is part and parcel of the job. I am unsure whether the psychometric test is designed such that a balancing mechanism is at play, lowering weaker scores to enable strong performing scores to surface easily, the aim being the ability to produce a contrast of skills. Perhaps this is my challenge moving forward, “balancing” my penchant for analytics and fostering new skills which are generally speaking out of my natural comfort zone in normal practice.

1.2.2 Influencing Reflection

When first receiving the feedback on this section, I was completely and utterly surprised with the results. It appears that my soft skills ‘interpersonal awareness’ and ‘developing others’ presented an opportunity to develop in this area as part of my learning journey. I reflect that I should devote time to review the relevant literature in the field of interpersonal awareness.

Moving on to cover the next two sections “relationship building” and “concern for impact”, I was slightly relieved to find I scored well on “relationship building” in comparison to 4000 other senior executives. Within the “concern for impact” section, I scored well again. I have an ability to impress people (having a very high score) but achieve a lower score for “resolving conflict”. I think this reflect my personal awareness and a development opportunity from the DBA. As such literature equip me with greater awareness but my learning experiences will be much more valuable for my “personal awareness”. Scoring over 90% on “strategic influencing” was an exceptional result. I’m happy with the score as a great deal of strategic influencing has to occur when dealing with the case study organisation and its stakeholders.

Figure 2: Summary of Professional Psychometric Report (Part 2)

	Competency Description	Potential	
Achieving	**Concern for Excellence** Checking Things (7); Following Procedures (3); Providing Insights (8)	6	**Average** higher potential than about 60% of the comparison group
Achieving	**Results Focus** Directing People (8); Making Decisions (9); Meeting Timescales (3); Producing Output (4)	6	**Average** higher potential than about 60% of the comparison group
Achieving	**Initiative** Taking Action (7)	7	**Fairly High** higher potential than about 75% of the comparison group
Achieving	**Critical Information Seeking** Examining Information (9); Interacting with People (5)	7	**Fairly High** higher potential than about 75% of the comparison group
Self Managing	**Independence** Challenging Ideas (10)	10	**Extremely High** higher potential than about 99% of the comparison group
Self Managing	**Flexibility** Embracing Change (7)	7	**Fairly High** higher potential than about 75% of the comparison group
Self Managing	**Self Development** Developing Expertise (8); Inviting Feedback (3)	6	**Average** higher potential than about 60% of the comparison group
Self Managing	**Tenacity** Pursuing Goals (7); Thinking Positively (5)	6	**Average** higher potential than about 60% of the comparison group

1.2.3 Achieving Reflection

The section 'Achieving' determines how I benchmark across ten features. In this section, there are two outlying features that lower my average score. 'Following Procedures' and 'Meeting Timescales' returned a result of 3 out of 10. I rationalise why this may be the case, procedural tasks such day-to-day chores I find monotonous, mundane and generally unsatisfying to me. I find it extremely difficult to self-motivate in these instances. Moreover, I sense repetition stifles my natural ability for creativity and self-expression which is why I can reflect that ‘Procedures’ and ‘Meeting Timescales’ is a lesser part of my natural temperament. I place importance and gain enjoyment from new challenges and if they take additional time than originally allotted in that instance they are of worthy intellectual pursuit. Reflecting on my rationale, the academic side of me places emphasis on knowledge and thoroughness rather than time operating to strict time dependencies. However, in contrast, I am aware that the pursuit of knowledge within an expansive time frame is not the primary intention (which may cause conflict) when working with a commercial business. I have learnt that I must raise my awareness of my environment and adapt my natural style becoming altruistic to understand and take into account the needs of the organisation before my own personal interest.

The strong positives from this section are ‘Providing Insight’, ‘Making Decisions’ and ‘Directing People’. These high-scoring dimensions are extremely versatile skills that I feel benefit both my academic and professional progression. ‘Providing insight’ is a strong influencing technique I use to engage and aspire confidence in my leadership of teams. My challenge is to learn how to exploit my strong personal attributes while developing the weaker skills, striking a balance that satisfies academic and professional objectives. In closing this discussion, I have taken comfort that I am on par with my peer group and through this reflective process I have developed an awareness and plan to address my professional challenges.

1.2.4 Self-Managing Reflection

In this last section ‘Self-Management’, I find myself satisfied that my results reflect a strong self-starting personality. This result implies someone who is motivated and ambitious in most, if not all, of my professional activities. I express an extremely optimistic and confident outlook on life in general. Assessing my highest score in the section ‘independence’, I can reflect that I’ve always been fiercely independent, never one to let anyone do something that

I can do myself (a core component of my leadership qualities). However, in the context of this category ‘Independence’ is about challenging ideas a dimension of my personality that has a strong prowess from the academic viewpoint (debating the status quo). However, I need to ensure challenging ideas within the professional environment is not seen as ‘maverick’ behaviour and nonconformist when in fact the opposite is true. I am again faced with a delicate balancing act between the professional and academic views. I feel striking a balance may be my greatest personal challenge, yet it could also develop into one of my greatest personal achievements of my Prof Doc journey.

The penultimate point I want to address this in this section is ‘Self-Development’ in which ’Inviting Feedback’ was the lowest score on this entire section. Given that the Prof Doc programme is structured around professional self-development, a core component of which is reacting and learning from feedback, I am acutely aware through the assessment process I will be required to develop better mechanisms to openly invite feedback and criticism from my peers and senior stakeholders.

This last section ‘Tenacity’ shows that I pursue my goals with vigour and that I am a positive and proactive thinker. It may be for these very reasons (positivism and pro-activeness) why I have chosen the Prof Doc DBA programme as opposed the philosophical PhD programme. These results demonstrate that I possess the core strengths needed by a theory building and theory testing researcher. Strengths that are arguably more suited towards DBA programme which will provide me with the challenges that will develop my skills into core strengths.

1.3 Cultural Fit & professional Environment

The last section of the psychometric assessment reports on the ‘predicted’ culture and professional environment (profile fit) that I am best suited to perform within. Figure 3 presents a very strong positive correlation with the requirement of a DBA researcher and how my strengths when combined with the rigour of systematic research, will contribute to better management practice.

Figure 3: Profile Fit – Enhancers

Performance Enhancers
where the development of theoretical ideas and concepts is encouraged
where heated debate is valued and people are encouraged to challenge ideas, argue and voice disagreements openly
where creativity and innovation are encouraged and radical ideas and solutions welcomed
where there is an emphasis on analysing and solving problems and problem solving ability is really valued
where people are encouraged to assume responsibility for important decisions and decisiveness is a valued characteristic
where there is an emphasis on comprehensively researching and recording the facts and communicating them clearly in writing
where there is an emphasis on quantification and the use of information technology and decisions are based on hard objective data
where there is the opportunity to be the centre of attention and people are aware of one's achievements and status

Reflecting on the table above validates my liking for academic debate at the theoretical level and at the 'real world' problem level - where problem-solving and solution identification are necessary. The previous results show that I possess the tenacity to challenge the norm and with my ability to manipulate data, assists colleagues in identifying patterns, implications and learning from data (process consultancy).

I feel the first four lines of the table above epitomises the academic side of my character which I can put to expert use within the case study organisation. Bringing points view and skills, that to my knowledge, are not currently found within the case study organisation. The subsequent three lines in the table indicate professional qualities and values such as leadership responsibility, ability to make critical decisions, establishing the facts and reporting them information to a committee utilising information technology to present complex information in a digestible manner for executives (those employees tasked with making system improvements). The last line in the table is a surprise, and while I do not enjoy being centre of attention I like to be recognised for my achievements (task focused and goal orientated). However, on balance, I believe I modest compared to the feedback suggested by this report.

Figure 4 outlines issues that could be considered performance inhibitors, factors which may impact performance when conducting the research. On reflection, they are almost the antonym of the enhancers.

Figure 4: Profile Fit – Inhibitors

Performance Inhibitors
where there is little interest in the application of theoretical ideas and models and people are given little time to explore different options and possibilities
where dissent is frowned upon and people are discouraged from challenging ideas and voicing disagreements
where conventional attitudes prevail, traditional approaches are preferred and people are discouraged from generating new ideas
where there are few opportunities for analysing and solving problems
where the responsibility for major decisions rests with other people and there is little opportunity to influence the outcome
where little value is attached to exploring all the facts and communicating them well in writing
where decisions are largely subjective, and people make little reference to hard facts and figures
where one is in a low profile position and achievements go unrecognised

The table implies my natural liking for academic theories to deliver a practical result. As a systems thinker, my natural ability is to develop mental models that describe and assist others in seeing the complex relationship contained within data (sense making) I can visualise abstract systems and processes which are a strength when conducting a DBA.

My case study is built on industrial IT systems that are complex and within which people cannot readily visualise how information (data – the ‘product’) flows through the organisation to add value.
I do not see any immediate concerns with challenging ideas and opinions insofar as the case study organisation is concerned, as I have been invited, to help staff understand the operational challenges they face. Suggesting that the organisation is welcoming of new ideas and challenges to the status quo. Interns of line three are and four I will not be opinions formed in the minds of the managers from the case study organisation.

The design and application of my case study methodology and the cyclical inductive approach allows me to develop opportunities for learning and building new knowledge. The application of which can be used pragmatically by the managers of the organisation to produce performance benefits. Uniting the last four lines of the table, in summary, I do not sense any immediate clashes between the cited performance inhibitors and the manner in which I have come to understand the case study organisation. For the reason that they are sponsoring an academic research study supported by facts, decisions made by committee and based on quantitative analysis of secondary data. I will note however that the same is not true of all working professional environments, from my experience of organisations that operate in strict hierarchical meritocracies, often limits the amount of freedom and challenges to the status quo that a researcher can undertake.

2.0 Research Objectives

This past week I am feeling more like a politician than a researcher. I have been in consultation back and forth between my case study organisation and my Director of Studies. The debate is to agree the research objectives. This has been a good experience for me to evaluate my negotiating skills. What I mean by way of negotiation is helping different parties to come to an agreement on the way forward and obviously my input was crucial to the decision-making process and the agreement itself. I can reflect and say that this was a good experience as I got to see two different perspectives come together as one through mediation and brokerage. However, if the situation arose again I would take a different strategy than brokering (man in the middle). I would instead get both parties together for a 'round table' discussion as I believe this would provide the opportunity for each party to provide more meaningful context for everyone involved and perhaps accelerate the discussion and produce an agreement and conclusion sooner.

The agreed (first draft) aim of the research case study:

1. To research and analyse system efficiency of industrialised processing systems within commercial/investment banking operations.
2. To develop an integrated model (framework) for the quantitative analysis of commercial/investment banking trade processing systems within a British financial institution.

2.1 Project Scope

The past two weeks have been testing for me, it feels there was a lot of talk but not much forward motion. I have been involved in a lot of debate and negotiation with regards to the case study 'boundaries'. My discussions have been testing, many of which have played towards my key strengths, yet there have been one or two instances that have given me opportunity to test my weaknesses. Before I reflect on the challenges I have faced during this period I feel better starting with my successes.

Over the course of the past two weeks, I have delivered four presentations to stakeholders from around the bank which I can quite happily note that I really enjoyed. The stakeholders are engaging on the detail that I am providing on the academic structure of the case study and the linkages I am looking to build. The engagement I received while providing a reasonable level of detail during the presentations has offered me a great sense of comfort and the assurance that I have -at this point at least- I have won the buy-in from the stakeholder demographic. To reflect on my sense of foreboding before the presentations, my fears were, in fact, unfounded. The quality of the question and answer discussions that followed confirmed that my audience was engaged and understood implications my study objects and can see a benefit in engaging with me and the study.

I have previously mentioned I feel that literature is only part of a solution as knowledge ‘of’ influencing and interpersonal awareness is, for me, not the same as having any level of practitioner skill. My reading so far on the topic suggests that I must recognise that people see situations differently and that the use of listening skills is the best tool to identify feelings - uncovering different are perspectives from the audience. In this specific learning process, I have recognised a theme that interpersonal skills are the basis for building and maintaining positive relationships with others - central to the success of a team. Listening and developing the awareness of subtleties of individual’s and collectives is going to be a key part of my development and the success or failure in the next phase of this project which is to build out the working group who will execute the project on a day to day basis.

2.2 Leadership

Leadership is both a philosophical concept as well as a practical skill. Many theories of leadership exist varying extensively in approach and content. Most professionals, at some point in their career, will have had leadership training, the majority of which being formalised training delivered by professional training agencies. Other methods are less formal and could be described as a blended approach, one in which managers develop skills over time and also learnt through experiential relationships with leaders they have chosen to follow or indeed aspire emulate. To assist with strengthening my knowledge and indeed my leadership skills for practical deployment throughout the case study project I want to understand in what context leadership is used and how it is defined at the case study (sensitising myself to the local style of leadership).

The Association of Project Managers (APM) defines the role of leadership (highly relevant in this particular setting) as being the *"ability to establish vision and direction, to influence and align others towards a common purpose, and to empower and inspire people to achieve success".* The information that I have absorbed from researching the APM body of knowledge on the topic is that leadership is essentially the capacity to influence people, by means of personal attributes and/or behaviours in pursuit of a common goal. Influencing stands as a core component of how leaders operate and by and large how leaders achieve their individual objectives through the combined effort (input and output) of others. The mechanisms leaders choose to deploy to achieve their objectives vary from leader to leader. The Chartered Institute of Personnel Development (CIPD) suggests that successful leaders do not behave in identical ways. Leaders may act very differently in similar situations and have rather different personalities profiles. This is a welcome reinforcement that not all leaders must be of the one mould. Moreover, my reading has helped me understand that different leadership qualities may be dissimilar in comparative circumstances. On balance, it appears to me that leaders approach comparative situations using different methods and tactics and that there is no one true way to behave as a leader in a given situation. An example is Winston Churchill who was a magnificent wartime leader but less successful in peacetime this suggest that one leadership style in contrasting situation produces distinctly different results. I feel more at ease that my further reading on the subject of leadership and more specifically leadership in the context of influencing strategy and outcome is correct. It is clear that individual traits and behaviours cannot fully explain leadership effectiveness. In fact, the literature suggests that it is as much to do with the followers as it is to do with leaders, specifically the relationships between the leader and the follower. My reading in this field suggests that there must be a balance between leadership, context and organisational culture (the system).

2.3 Winning Buy-in

Taking a uniquely systems perspective of leadership, Senge (1990) promotes the use of visualisations to engage and influence people from within the organisational system. These visualisations are referred to as 'mental models' and can be both models of the 'current state' and proposed 'future state' work system. Senge's recommendation of mental models as a stimulus and baseline for change has close links to the APM's published project management resources in which they devote considerable attention to building "vision and direction" as mobilising factors for teams. My learning from these points of view in relation to the case study project has led me to the conclusion that I must provide a rich visual context of the current state situation (as-is) and invite the participants of the case study to reflect and scrutinise a visual contextual understanding of trade processing operations.

I went in search of current state process maps as I would have imagined the organisation would have some form of 'layout' demonstrating how products are processed. Over the course of two or three days consisting of various conversations with people from IT, Data Management, Product specialists etc. I came to the understanding that the operation office has no visual models of product flow. To say that I am surprised that I found no product flow maps existed was out shadowed by yet another revelation. I found that out of the twenty or so people I spoke with not one person could describe product flow from Front Office to Back Office. In moving forward if the operation is to decide that mental maps (process maps) of the product flows are required then in some respects I will have led them into new and uncharted waters. The question is, 'will my new understanding of leadership, self-awareness -of my natural style- and convincing others to follow characterise me as a leader'? This is yet to be seen.

2.4 Structures

Three months into the study and my next entry into this reflective paper is to link some of my thoughts from the literature review with the operational and organisational observations of product flow and structures. Lately, I have been enjoying the writings of John Seddon and Taiichi Ohno, each contends that an understanding of product flow and the demand on the system is of paramount importance to the flow of value to the customer. Four weeks ago I asked the management a simple question “do you have product flow maps?” the answer turned out to be “no”. I believe that I have uncovered a significant void in the organisation’s ability to describe and understand product execution from a full end-to-end perspective of ‘trading’ operations (a lack of a common mental model – the basis of a learning organisation). That is not to suggest that the organisation is lacking coordination or has substandard skills to execute trading activities. However, I can draw a comparison from the literature on organisational theory - namely Burns and Stalker (1961) - and contextualise their observations with my own in relation to the case study organisation.

My initial thoughts on organisational structure had categorised the operation as mechanistic and somewhat -Max Weber- bureaucratic structure (rigid procedures and overarching policies executed under command and control management). However, I have subsequently changed my view since discovering there is little in the way of comprehensible procedures and anything resembling end-to-end (overarching) maps describing product flow. I am now describing the operation as more or less as a functional hierarchy of specialisation. Characterised by a high degree of vertical separation that includes leaders, senior managers, managers, assistant managers, senior analysts, analysts and interns. My observations also detected a low degree of horizontal communication in that no one could adequately describe anything more than his or her immediate processing tasks. Managers struggled to describe the process what they receive from their peers (inputs) and what their team spent significant amounts of time ‘chasing’ and ‘correcting’ to facilitate task execution.

I then enquired how their peers view the quality of their team's tasks execution (outputs), to which I received the answer "when they have any problem they will come back to us". I can reflect on more than a decade of experience and quite confidently predict that task and process execution is struggling from the presence of 'failure demand' (poor quality information). My concerns with raising this topic are, 'is the organisation ready to hear this news'? How will I be perceived if I deliver the message.

2.5 Relationships

My relationship status with people from the organisation continues to develop at various levels of maturity and speed as I embark on the research project. I am as yet undecided whether my being 'external' to the organisation and performing the case study will be to my advantage or perhaps a disadvantage. My fear is that being an 'external' will in some way pose a disadvantage as an existing member of staff will hold pre-existing social relationships, trust, mutual respect and candour. I find myself asking the question 'how long will it take before I'm no longer a stranger'? Moreover, 'will 'familiarity' result in people becoming less helpful and perhaps less polite'? My hang-ups are deepened by the feedback from the psychometric assessment I took some months ago and the fact that I only have one case study organisation. Meaning that I have but one opportunity to conduct and complete my study. The question at the forefront of my mind at this point in time is, 'will people endeavour to grow the necessary bonds and connections supporting me and the project'?

A week or so has passed since my last entry, and my optimistic side has emerged which has given me a welcome boost of self-confidence, almost to say 'what was my concern'? In the previous few of weeks. Yes, there has been relationship development in this space which has been good for morale, clearing the haze, facilitating a focused perspective on the topic. The perspective I have gained draws on previous experience as an external consultant, reenforcing that this situation (being external) can be worked as an advantage if I am able to leverage my strengths and experience. As consultancy goes my relationships are generally horizontal in nature (groups usually comprised of 1 to 5 people). This embedded study requires multi-directional management. I am required to manage upwards to the sponsor and his executive group, horizontally with senior managers and managing downwards to the collective workforce of the operation (some 350 people).

My tactics to swiftly establish relationships will be through one-to-one conversations. I believe this to be the best way for me to explore the interpersonal landscape, getting to know one another and building up familiarities. I have undertaken a light literature review of materials and resources contained on professional websites such as the Chartered Management Institute and the Chartered Institute of Personal Development. The resources have helped me contextualise ‘what has to happen’ and ‘how best to approach it’. This has enabled me to set out my tactics, which are:

- Identify relationship needs
    - What I need from my relationship?
    - What others need from a relationship with me?
- Schedule time to build relationships
    - Devote a portion my day toward relationship building
- Focus on emotional intelligence
    - Recognise my own emotions and understand how they affect others
- Appreciate others and ensure everyone feels appreciated
    - Appreciate that participation in the study is extra work for participants
    - Ensure I demonstrate courtesy towards all participants on their work load
- Manage boundaries
    - Ensure I do not obstruct productivity
    - Ensure I don't cause ‘change anxiety’

- Allow people to understand the aims and objectives of the study

3.0 Understanding the Culture

My one-to-one tactics offer the opportunity to for both parties to ask probing questions that wouldn't necessarily surface under formal conditions such as receiving a presentation or holding a group Q&A session.

Within this setting, I plan to note down a couple of the questions that have really challenged me, those that have made me pause in the moment. I will provide an account of both the question and answer delivered and I will use the Q&A to reflect on the experience in a quiet moment re-running both the Q&A to understand in reflection whether I would have answered the question differently.

3.1 Q&A Reflection

Question: What is it exactly you hope to get out of your study?

Answer: *I hope I can make a difference, first of all to the organisation. I'd like to think I can offer some benefit in reciprocation for their time, effort and resources that have been made available. Secondly, I hope to meet the aims of the case study, providing answers to the research question, contributing to new Academic knowledge and hopefully advancing best practice from a professional point of view.*

Reflection: I feel as though my answers were very scripted. I spoke about doing something for the organisation in meeting my own personal objectives however I did not mention anything for the workers, the personnel, the people on the 'desks'. I asked myself how much of a connection did my answer make with the individual who was face-to-face asking me this question. If asked this question again I would position it differently. I would let the person know that I wish to deliver a framework that helps the individual learn and improve his/her own working environment and together we can document the journey so that others may benefit from our experiences.

Question: Do you think you can help us improve our operational efficiency?

Answer: *I definitely believe there will be advantages in conducting the case study however the actual operational efficiency changes are the responsibility of the management, I am limited to the type of advice I can offer within the scope and nature of my remit.*

Reflection: Recalling the tone of the question it was one of desperate optimism however my answer did not make any connection to the emotive use of words such as “help”, “us” and “our”. In my response, I feel has though I delivered a fragile if not empty promise. However, upon reflection but I understand the rigour required to be a researcher is distinctly different to that of a commissioned process consultant. I believe they will enjoy the learning journey much more than being given (my view of) the solutions.

4.0 Project Selection

I have been on site at the case study organisation in my research capacity for many months now in an observational capacity, becoming familiar with the business, the people, the environment and the activities that take place on a daily basis.

Project selection is proving harder than I first imagined. Not for the reasons that one would first imagine. My consultancy background in operational and quality management has helped me to identify many improvement opportunities from experience. However, I need to restrain myself, I’m not here to improve the processes of the business. I am however here to study the efficiency of the complete and overarching trade processing system (objective 1).

I must refrain from falling into the detail, where I am most relaxed, and going straight to problem-solving mode (my core strength).

I will position myself such that I am taking a macro view of the operation, and in doing so, I should have the ability to appreciate the complete end-to-end product processing flow. This is where I believe I will generate a rich contextual understanding of the poorly studied environment trading operations from an efficiency perspective.

4.1 Finding My Catalyst

The director of operations has shared with me a commercial banking industry report compiled by the world leading management consultancy organisation “MGT & Co”. This report entitled “Trade Processing Benchmarking Survey” is a survey of medium to large banking institutions in the city of London participating in the global financial markets. The report focuses on organisation performance utilising the metric Cost Per Trade (CPT – measure of unit processing costs front to back). The director has invited me to read the report and feedback my thoughts.

The report focuses on ‘costs’, there is little or no mention of system processing efficiency. Reflecting on the report the content does not reflect the intention of the survey - process benchmarking versus cost benchmarking. I understand this to be an ‘all-in’ cost taking into account ‘Run the Bank’[98] costs, Premises costs, IT and Infrastructure costs, Professional fees and ‘Change the Bank’[99] costs. All of these costs are apportioned to the various asset classes (products) divided by trade volumes. Ultimately producing a cost per trade price. Benchmarking occurs utilising a curve chart demonstrating the bank’s position relative to peer institutions cost per trade.

[98] Day-to-day staff costs

[99] Project staff and specialist contractor’s costs

I have a distrust for CPT as a legitimate measure of efficiency. My gut feel tells me that is an unworthy measure, perhaps even a ‘self-serving’ measure. A measure that exists only because managers believe they need to be able to demonstrate how much ‘work’ each worker has undertaken; some very ambiguous long division is performed resulting in a cost being attributed to a single piece of work. Drawing on my experience of operations and quality management, CPT appears to serve as a proxy for an efficiency metric. It is of limited practical utility to understand the performance of the system which it is trying to describe. The most influential thinker I have come across who challenges management thinking in terms of costs versus performance is W Edwards Deming. Deming (1986) argues that system performance is intrinsically linked to quality performance. At this stage in the investigation, I fail to see how the primary metric of performance CPT has any linkage to the physical performance of the system. This a major cause for concern.

I am aware that the authors Crosby and Juran have written extensively on the topic of quality and its relationship to system performance (efficiency). My next stop is to engage with the work of both of these authors in an attempt to rationalise theory with my immediate concerns regarding the use of CPT as a comparative efficiency and performance metric.

The question I am grappling with today is, is the director of operations ready to hear my views on CPT. Firstly, I do not wish to cause any upheaval by challenging what I am told is a well-established metric across the industry in the fear that I am seen to be a boundary-shaker or worse a ‘maverick’. Yet my heart is telling me to listen to my feelings and to follow this thread some more. I have decided to follow instinct. However, I will tread carefully I have chosen not to confront the project sponsor or anyone from the steering committee with my suspicions until I have a more robust understanding of the matter. Instead, I have chosen to solicit information through informal conversations with managers from the operation.

My suspicions are transforming in the best possible way. Evaluating body language and the tone of responses was subtext enough to give anyone the impression that the operational managers did not view CPT as a performance measure. Then came the narrative. Managers were sceptical regarding the “implications” and “connections” that CPT exerts on the performance. In fact, many voiced fears that have grown out of previous experience of enforced FTE reduction to align with the performance curve without any further understanding of the systems conditions or performance drivers.

I am sure that I have identified a shortcoming in this report in that the report merely covers cost apportioning and doesn’t fundamentally address Trade Processing abilities of the participating institutions. It merely benchmarks their cost structures. Moreover, I believe the report is heavily biased towards staff costs (run the bank and change the bank) and makes a little reference to actual trade processing efficiency attained by the organisation. Merely concerning how many trades the business ‘transacts’ divided by how many Full Time Employees (FTE) it has as the measure of how well the operation is at “sweating the assets” quoting John Seddon. The report concludes with a suggestion that a 33% reduction in costs could be achieved. It provides information into which trading asset classes can be targeted but the report falls way short of identifying how this saving can be achieved. This potential saving could in effect save the case study organisation approximately £10 million alone if the report is to be believed.

Delivering my thoughts to director of operations, he seems to agree with my point of view regarding the MGT & Co report. However, he did add that CPT is a standard metric used within commercial banking to measure performance, and that costs are (in the directors’ view) an “indication” of efficiency (I’m not sure I necessarily agree with that view). The director has suggested that I evaluate an internal operational efficiency measure of Straight

Through Processing (STP) which is also an industry standard metric derived from actual system performance, or so I am told.

In the past week, I have been reviewing the application of STP internally within the case study organisation and also from a literature point of view. I have found STP to be a metric that is applied to all trading asset classes. The intention of STP to measure the success of trades flowing through the IT driven operational processes without causing an 'exception' (I understand an 'exception' to be non-conformance to system logic or rules, ergo a 'defect'). Reflecting on a previous conversation I reported on which I held with managers regarding input-output process, failure demand did emerge in conversation. However, it was quickly dismissed (perhaps through lack of understanding). Reflecting on my literature review specifically the writing of W Edwards Deming, his attitude to production costs are quite clear. When an organisation seeks to reduce costs of production by targeting costs alone it invariably drives costs up. Deming argues that increasing quality and the systematic reduction of waste from within the system is the fundamental means by which to reduce the cost of production.

Taking the arguments of Deming, Juran and Crosby in the context of operational costs and quality costs, together with the questionable utility of CPT and STP's implied ability to express system performance has implication on the design of my study. I have the opportunity to focus the aim of my study on the fit and application of STP to benchmark the enablers and inhibitors of performance within the system of trade processing. Through this specific line of inquiry, I believe that I will satisfy both research objectives and also produce new knowledge and insight into the system conditions that enable and/or inhibit performance which may help better the understanding and appropriate fit of a CPT model. I feel this is my contribution to best practice which could have global significance throughout the commercial and investment banking industry.

5.0 Information

A number of challenges arose early on in the case study project as I got to understand the organisation and the business. Initially, my evaluation of the business resembled that of an automated IT driven processing environment, suggesting to me that the information I required for the study would be exclusively obtained from IT system sources (effectively making the study quantitative in focus). However, as I got to understand the organisation and its people, I found a richness of context existing within the minds of the staff. I have been forced to pause and to reflect on designs of qualitative studies and the importance that has on the project thus far. I must admit that qualitative study is less attractive to me as an individual than quantitative which fits my statistical positivist nature. Nonetheless basing my study on purely qualitative information (interviews) seems undeserving of the rich secondary data that is in abundance. Following several hesitant conversations on the topic, I have chosen to retune the design to include qualitative aspects and embrace a mixed methods approach. In doing so I feel that I will add layers of context to the study project which only serves to enrich my output.

5.1 Qualitative Data

As a data driven individual embarking on qualitative data collection, I feel slightly insecure having an evident lack of hard numerical data at this point. I have always sought to make the subjective "objective" through measurement and testing hypotheses, in a way taking the grey and categorising it either as black or white. My most favourite quote is from W Edwards Deming (1986) in what he says *"if you can't measure it - you can't manage it, if you can't manage it you can improve it"*. I feel qualitative techniques are a leap into the darkness - they somehow feel less solid, less tangible (methodology) than statistical quantitative approaches that I am used to.

My week has been consumed by planning activities ahead of the qualitative in-depth interviews. I have been comforted by the fact that there is a significant amount of structural planning to qualitative research, more than I initially understood, not least the ethical considerations to be satisfied which are a little bureaucratic. However, I note that I have learnt a considerable amount of new understanding in the dimensions of confidentiality and anonymity protecting the information collected from informants/participants. David Silverman's book Interpreting Qualitative Data 3rd edition has not been out of my hand these past two weeks. I was able to quickly navigate to the sections discussing in-depth interviews however the abundance of the methods and techniques this book provides has brought qualitative research into a new perspective in my mind. Structures play to my core strength of analytical thinking which I have come to understand is how I learn and make sense of my environment. I have come to polarise the different camps with a simple mental model. In the red corner is quantitative research using instruments in a rigid fashion, and, eliciting and categorising responses to questions. And in the blue corner, qualitative research using instruments in more flexible and interactive ways to understand participant observations. Qualitative research in the form of in-depth interviews at my case study organisation will access a huge amount of experiential data supporting the systems theory approach to the study and helping describe the environmental conditions of the system which may represent a significant amount of understanding and relationships of performance enablers and inhibitors.

5.2 Core Systems

IT systems configuration and database construction is a highly complex area and is instrumental to the operability and performance of the bank. I have recently been thrust into conversations with IT developers and database experts in search of secondary historical data. A term that has been used a lot in recent conversations is 'Data Warehousing', or the lack of data warehousing of trade performance information. I have reached out to a subject matter practitioner specialising in system configuration specifically focusing on the core system configuration and layout.

My contact (Andy) is best positioned to help me understand the core systems layout and the data that can be easily obtained. In the early 90's Andy worked for the IT company that designed and implemented the core system at the bank. Having Andy in proximity acting as a sounding board is a welcome addition to my support network. Andy brings with him a vast amount of consultancy experience in the field of systems IT together with a solid understanding of the trading processes (a valuable commodity and as an external to the bank he, like me, can be seen to be impartial). I have been challenging Andy and the system IT people to "lay out" the system flow of a trade so that a simple flow diagram can be constructed to visualise in which sequence a trade flows - through which system servers - with the view to developing a data collection strategy. Andy's knowledge and support of my study provided me with confidence and increased the legitimacy of my project in the eyes of the IT community and served to lower the resistance to change from this professional group.

My learning within this situation is to use other people's power and influence to assist with low levels of conflict where different attitudes and goals are apparent to help steer and focus on the commonality that furthers systems understanding and performance improvement.

Andy's passive endorsement of the study has worked with fantastic effect in this situation keeping motivation and focus higher than ever.

Last week the development team hit a wall that meant that no retrospective performance data could be obtained from any of the databases due to a restructuring of the databases and a 'design freeze' for six months. Secondly, IT budgets had been cut and some IT contractors were having their engagements terminated at the end of the week. The contractors were being used to “back fill” the proportion of the fulltime developers I have been using in the project thus far. The reason behind this inconvenient delay is, as yet, unclear. No-one can articulate how this came to pass in the middle of my research. Some of the developers on the team have given their personal views in what could be happening, namely a cyber security update to the banking platforms (hence the selective silence - even keeping the database developers in the dark for security reasons). Perhaps a sound rationale, however, I am extremely concerned about the impact that a six-month delay will have on the longevity of the project. My frustration is compounded by the fact that the “design freeze” was unforeseen. Undoing the strategic preparation work which I led with the project steering committee (following Kotter’s (1996) eight stage model of major change). I have reassessed our alignment with Kotter’s model with the director to determine if any weaknesses existed in the planning phase. Thankfully none were discovered which reinforced the fact this was an unforeseen design freeze. Nonetheless, I can’t help but feel a sense of deflation due to this roadblock.

Just as I was beginning to disappear, my research study suddenly regained momentum. The very IT community that I suspected would block my request for system data had been actively seeking ways to collect my data despite the design freeze. This restored my faith in the IT team and confirmed the significance and benefits of my study not only to the Operations team but also the IT team, and as a vehicle to understand system and process performance. Given the current climate within the business (design freeze and cutbacks), and the internal perception of the IT community (maintainers of the status quo) the support I have garnered in the last few weeks was a hugely flattering endorsement (going above and beyond). Moreover, I learnt, and demonstrated, that my influencing and negotiation skills have developed significantly in the period after the psychometric appraisal to this point and were instrumental in navigating a tumultuous political landscape involving the IT community.

Three of the IT team members have been extremely creative in the last three weeks. Going ‘above and beyond’ in the face of an imposed design freeze, to collect trade performance data from the core system. The significant turning point came when the IT team designed a program to interpret information flowing through the core system. This was in effect a “work around” in light of the design freeze nonetheless, it appears to satisfy the data collection criteria. I attribute the determination and steadfast manner in which the IT developers have approached these seemingly impassable challenges as nothing short of extraordinary teamwork considering they are not the primary beneficiaries of my research.

6.0 Data Disruption

The first full month of performance data arrived last week, and delivered a significant blow to the operations team – the data did not meet the expectations of the managers. The team struggles to make sense of the data. The data did not fit the accepted view of STP performance (long-standing management information that the business based strategic planning and decision-making upon) and accepted product flow pathways. This represented an extremely delicate situation for the majority of functional managers on the team. The dissatisfaction ran deep to the point that the data integrity came under question and was rejected on quality and accuracy grounds. At this point I found myself in “self-preservation” mode concerned for the integrity of my study and that express and harsh opinions were catalysts for emerging factions – the believers and disbelievers. Before the matter escalated out of hand (and before the steering committee hear of the divergent data appraisal), a period of due diligence was offered to both Ops and IT to individually assess their point of view in better detail.

Reflecting on my feelings of the last week, I felt emotionally embedded and supporting the veracity of the data due to the extensive effort and tenacity demonstrated by the IT team. Since my psychometric evaluation, I have developed an acute awareness of my weaknesses specifically Interpersonal Awareness ("Understanding People" and "Valuing Others"). Having regained emotional clarity on this topic, I quickly re-established my objectivity to the argument between Ops and IT (Ops being the defenders of the status quo in this instance). My personal challenge in this particular situation is to find value in the opinions on both sides of the argument. In doing so I will unlock the cultural drivers that form opinions (and the subsequent decision-making processes) leading to actions that affect operational performance.

In the past few days, I have been informally meeting with managers to understand their concerns with the data. The main fear and concern of the functional managers is not the data but their perception and reputation in the eyes of senior managers in light of the ill fit with performance expectations. I believe that the managers are exhibiting the symptoms of Kubler-Ross's grief curve. Currently, functional operations managers are demonstrating either shock or denial towards the implications that the new data brings. In some respects, the surfacing of emotions by the managers is self-preservation (fight of flight), this may well be a product of the uncertainty within the current organisational environment (job security).

6.1 Data Diplomacy

My last entry in this log provided an account of a turbulent situation comprised of high anxiety and emotional frustration (I will include myself in that appraisal). I happily note that most if not all of the anxiety has been alleviated through a consensual and collaborative approach, understanding and acknowledging each parties concerns, un-packaging concerns in such a way that allowed the crux of the matter to surface and for an agreement to be reached. There were two main issues from the operations managers' point of view, data veracity and peer/senior perception of worsening performance. The discussion regarding veracity was somewhat easily quenched when, at my request, the IT team took the Operations team on a data collection 'walk-through' of the protocols and techniques used to collect performance information at various significant points in the trade flow process. Together with contextual data on trade flow error messages (defect categories), and through a process of thorough and concise dialogue, using demonstrations and practical examples, the veracity concerns of the Operations Managers were quickly and significantly abated.

Tackling remaining and lingering concerns of managers took all the strength and mediation dexterity I could muster. My tactic was to gain the collective buy-in of the functional managers where I would point out the limitations of the current data collection systems (MIS and STP) to the Director of Operations. My intention is to present the dataset and demonstrate the insight that the current management information system, and its measures, places managers at a disadvantage whereby they cannot identify failures in flow or performance. The reason for this tactic, over and above the Director being the sponsor of the study, was to gain executive understanding -and in a sense sympathy- for the lack of clarity and precision the current systems afforded the functional managers. If this could be achieved at the Director level, it would offer functional managers' political protection (the director being three grades/levels above functional managers) from their own line manager (senior managers), whom it was suggested would reprimand functional managers. This was again a political position due to the supposition that if Senior Management were not seen to take 'action' (towards the functional managers) it would imply Senior Management 'involvement' having to share some of, perhaps the majority of, the 'responsibility' for the shortcomings uncovered. This was clearly not the case as the technical design far outstretched the time frame of any of the incumbent managers. Nonetheless, people were in fear of being disciplined as "scapegoats" at different levels, hence, the director could offer amnesty and protection. The proposal was debated and duly accepted to be the appropriate action. It was now up to me to deliver the message and achieve the result, to say that I did not feel anxiety would be to suggest that a professional prize pugilist feels no anxiety facing his opponent.

7.0 Post-match Reflection

Reflecting on the experience and emotions, I felt during the meeting with the Director of Operations. I wanted to start with the good news and quickly win the good favour with my sponsor. When the new and enriched dataset was presented, I noted that the director had a definite liking towards the richness of the trade information (the detailed trade flow measurements) that the IT team were able to collect even with the obvious political and technical challenges (Ops Director acutely aware of IT challenges). While talking through the dataset with the director I knew the time to deliver the 'not so good news' news was approaching. My strategy was to start with a quote of my favourite quality guru W Edwards Deming. I knew the Director was familiar with his writing, "*don't blame the person, blame the process*". My tactic was to disarm the Director and deflect any blame from the functional manager onto the management information system, the design of which was found to be nearly twenty years old according to my investigation.

The news was not received well. I expected this, and that is to say who would enjoy hearing "a significant proportion of the operational performance metrics are inaccurate due to inadequate information". I had demonstrated that STP was an ill fit for end-to-end performance measurement and when I introduced the new dataset performance levels dropped by some 42%. The body language of the Director and his initial reaction spoke volumes, elbows on the table, head in hand, then sweeping back to look up to the ceiling, now with his hands clasped behind his head. This pose lasted about a minute, which felt longer, while I continued to speak. However, I sensed my voice was all but 'white noise' in the room while the Director digested what this meant to him and his operation (and probably what it would mean to his front office trading stakeholders). My positivist side lurched forward, my mind turning the same words over and over while still managing to speak about data "influence the outcome, stay positive and make this message an opportunity".

When the Director came back into the room, he asked me “what else could this data explain”? I continued that the new calculation would account for a significant proportion of the “above peer group” Cost Per Trade price disadvantage calculated by MGT & Co. The speculation of the MGT report proposed that the above peer group average FTE headcount were underutilised (fewer trades processed per FTE and peers) and that ‘savings’ (FTE reduction) could be realised to reduce costs in line with other banks. However, the new data implies a totally different scenario. The data implies that the FTE headcount is required to process trades manually through the now verified existence of failure demand which consumes resource capacity and is ironically seen as a legitimate workflow according to normal practice. I reflect, in the moment, I may have delivered yet another thought provoking, slightly controversial, implication as the director resumed his earlier pose.

Sensing that I was rapidly losing my audience, I changed my tactic to one of reassurance. I offered my reassurance that the current Management Information System configuration (the fit and depth of data collection) was found to be a long-standing legacy design across all asset classes and products, as opposed to a modern design implemented by the ‘current’ Operations team. My tactic appeared to offer a considerable amount of comfort to the director, changing the body language and brought him back into the room.

Further reassurances were given on the topic of STP. The calculation of which is also an ill fit (failing to describe the end-to-end flow performance of modern sequential system configuration), a position that my research supported and it is likely to be found in all commercial or investment banks that use STP.

The Director invited a third person to join the meeting who had numerous experiences of like-for-like trading organisations. I believe this act was to facilitate ‘searching for additional experience’ (bargaining with another) to reinforce or to perhaps refute the meaning that has been uncovered. The third person confirmed that the case study organisation was similar and in many cases the same as other trading institutions. The Director took further comfort in the understanding that peer institutions were, on the account of an expert, facing the identical situation as the case study organisation. Many institutions may or may not be aware of the extent of the issue that STP causes, and again according to the expert, it was certainly the case that if the shortcomings of STP were indeed known no-one has yet acted upon this understanding.

Continuing to add positivity to the occasion, I proposed that the case study have a true opportunity to bridge the gap in professional practice by developing an alternative performance framework to STP. My optimism was partly shared when the director offered, "*it's better to present a problem when we have the solution*". I sensed that the Director was walking himself through future conversations he was preparing to have with his line manager - the Managing Director of the commercial bank together but only when we had a solution.

Reflecting on this meeting, the interactions, the body language and the tone of the conversation. For the first time in my career I believe that I have witnessed a person experience the five stages of Kübler-Ross and Kessler (2005) grief curve (AKA Change Curve of Denial, Anger, Depression, Bargaining, Acceptance) in one meeting. I ask myself 'could I have done anything to soften the blow'? Perhaps I could have segmented the discussion, split it between two different meetings addressing STP and data integrity individually, effectively reducing the "tidal wave" of controversial information the team faced.

However, a positive result was produced through the discussion. The Director shared my opinion on the position that functional managers, or any other managers for that purpose, were not to be held responsible for the gaps identified in performance management. However, the Director did convey a message that signalled the importance of my research with emphasis on working together to improving the knowledge and understanding of the system capabilities. Reflecting on the message, I have defined this moment as my **single most meaningful and significant achievement** which granted “political licence” to take responsibility for ‘learning’ and ‘improvement’ of their working environment.

8.0 Professional Development

Once again I considered my psychometric evolution, focusing specifically on the dimensions of Resolving Conflict and Team Working (ranking of low preferential style). Reflecting upon the scores, and the position I have assumed in dealing with the delicate situation as a result of new data and all that it implied. I believe that my lower preference for resolving conflict and team working was an aversion/deflection mechanism which originated from an atrocious experience very early in my career (circa 2002). Through the reflective process of the Prof Doc, I now realise the basis for my preference to abstain from contentious environments. My journey to this point has however changed my view. I have found it easier to deal with delicate contentious situations and how to mediate and drive positive outcomes. I attribute my new found skills in this context to working in close proxy with influential people (in my view) from both academic and professional environments, absorbing their experiences, observing their techniques, assessing their individual styles and witnessing their effectiveness to help me improve. However, I mentioned earlier in my reflections that management styles are enigmatic, complex to understand, and where good management seems more of an “art than a science”. I learnt that management style has got much to do with the ‘person’ as it has to do with the techniques they choose. The setting of my case study has much improved my understanding of management and helped me recognise leadership and management abilities in different scenarios and occasions. Furthermore, the case study has afforded me the opportunity to flex my existing management skills, test new ones and help make my weaker skills stronger for my future.

So far in my journey, I have come to recognise that my professional development has been less to do with absorbing information on how to grow from management editorials, practitioner meetings or from being part of a subject matter expert group. Which I have engaged in but to a lesser degree - not to say they are not legitimate sources of development. However, in my case I have found my development to be in the dimension of "professional diplomacy". Some may argue this is "office politics" but in this situation I feel as though I have developed an immense skill that has, and will, continue to prove extremely useful moving forward in my professional aspirations to become a high-value management consultant.

9.0 Forming Storming Norming Performing

Four weeks have passed since my last update and a second dataset has been collected and fed-back to both functional and senior managers for collaborative discussion. I sense that the managers now feel, and act like, they are an essential part case study – which they are of course. I also sense that I have manage to demonstrate the potential impact of the research has and its prestige as the utmost important programme of work undertaken markets operations. I am encouraged by the level of teamwork demonstrated not only between operational staff but also between Ops and IT. Recently I have demonstrated the partial use of and application of quality management techniques and tools for interpreting system feedback (data). Managerial training has proven worthwhile and fresh insight was achieved through applying Pareto principles (80/20 rule) to trades that have failed automatic system processing/validation (failure demand). For example, one particular error type occurred 20,000 times in a month on one product type alone, accounting for 60% of the total failure demand. The specific trade processing error was later discussed with subject matter experts who, on looking at an example of trade data, established a root cause to 76% of the defect population. Within two days a 'profile update' was in place the outcome of which avoided the reoccurrence of 15,300 instances of failure demand within the next monthly reporting period alone. This is a significant improvement to the performance of the operations team.

Reflecting on my experience of the staff within the case study, I have witnessed first-hand the behaviours of an emerging learning culture that never existed until cultivated through enhanced data transparency (information design and its quality) and enhanced visual understanding of system architecture (product and systems flow). I have also detected an improvement in the collective ability of operational staff to learn about their environment, produce new knowledge and understand how it can be applied to the system to generate a performance improvement. I find a resonance in this instance with the work of Senge and Sterman (1992) and the cyclical nature of improvement observed within learning cultures. I sense that the organisation should encourage more of this behaviour. To this end I have chosen to demonstrate the learning behaviour to the Director with the recommendation he publicly acknowledges the recent achievements with the strategic intent of inspiring more of this behaviour through positive reinforcement. Reflecting on the past three weeks, I have witnessed the transformation of managers from frightened individuals (in self-preservation mode) to managers who are actively seeking opportunities to learn from systems failures and managers who are now working across functional disciplines to provide knowledge and skills that benefit other areas of the operations office. This behaviour is a complete situational reversal from the earlier self-protection.

10.0 Expanding Scope

Over the last three months, I have observed the teams learn from system feedback and develop new knowledge and understanding that has influenced system improvement. I have a prevailing sense of pride in reaching this point in the journey, both for the team and for myself as a researcher. A significant amount of pride can be taken from the inclusion of four additional asset classes (product classifications) to the initial scope of the data capture research exercise, now involving some 30 different products (originally two products). The pace of learning and knowledge building can be described as exponential. Due to the pace of the project my personal challenge in these last weeks has been keeping pace with knowledge development whilst allowing managers sufficient freedom from a project control and governance perspective to explore and experiment. My objective was to strike a balance between controlled data collection and creativity/freedom from the managers' perspective. Engaging with project management literature and best practice design by the Association of Project Managers (APM, 2008). I chose to incorporate workstream leaders into the project structure, one lead for each asset class acting as a conduit to facilitate the speeding up of communication flow to and from the project office (myself) and the decision-making processes controlling the sequence of experimentation proposed.

Reflecting on my personal development, I sense that I am more comfortable managing tasks than my original psychometric preference demonstrated more than a year ago now. In this timeframe, my preference for managing tasks and team working has grown. I attribute my liking to the collaborative and cohesive environment that was established early in the study to Kotter's (1996) steps 2 and 5 ("creating a guiding coalition" and "empowering broad-based action" respectively). Kotter's book (1996) "Leading Change" has been, for me, the most influential book on change management not just because it provides a framework to follow but because it places practicalities (do's and don'ts) in specific context – powerful and insightful, corresponding to how I typically learn.

11.0 Building the Model

Since my last entry into this log the data collection phase has concluded for the study but that is not to suggest there has been a cessation of performance data collection for the benefit of the managers and organisation. In fact, the complete opposite is true. There is a bewildering amount of data being collected and shared across trading operations. However, I have observed various levels of skill in interpreting the raw performance data which is comprised of tables containing textual information as well as numerical information. This amount of data presents a significant risk of being left to individual interpretation and their extract meaning. I am compelled to intervene however I must ensure that I operate within my remit (study methodology) so not to bias the integrity of the study results. I am unsure on how to proceed, it is a concern that I will raise with my Director of Studies and take guidance on.

Professor Rich has signalled that I can, while remaining safely within the case study methodology, freely develop a technique to summarise the performance data. Moreover, that in doing so I may use this opportunity to satisfy my second objective of the study, while remaining safely within the case study methodology. Which is to ‘develop an integrated model (framework) for the quantitative analysis of commercial/investment banking trade processing systems within a British financial institution’. This is welcome news to me personally. It allows me to exercise my talent preferences for ‘conceptual thinking’ and ‘analytical thinking’.

My approach to meeting this objective is to benchmark and understand which tools and techniques have been used to interpret feedback (quality tools)(Feigenbaum, 1991; Oakland, 1995). From this position, I should be able to determine the practical utility of the methods managers have used to learn. Moreover, using the managers as consultants, I hope to use their latest experience as a design verification and assurance that the selected tools translate data into meaningful management information. So far my plan has worked to great effect. Managers have participated in the selection process, identified the tools that represent performance data in such a way that cycles of learning, action, and improvement can be understood.

However, the STP metric still poses an issue in achieving a true end to end understanding of flow performance (right first time). My quality management background suggests that a yield metric may suit the occasion however from memory I believe there to be four or five different yield metrics. Again, I will take the topic of yield into consultation and allow the managers to experiment with the different scenarios.

11.0 We Have Grown Together

It has been six weeks since my last entry into this log, not for the lack of reportable occurrences - far from it. The advancements the team has made over the intervening weeks has been astounding. I am thoroughly enthused by what I have witnessed. There has been a breakthrough on the application of a yield metric. After a process of experimentation, Rolled Throughput Yield has proven to be a suitable match to summarise end-to-end performance such that it has provided further clarity regarding end-to-end 'right first time' automation. Moreover, the conceptual framework design was agreed. I am extremely satisfied with the result of this piece of work. I am especially pleased to report on the enthusiasm which continues to build due to the progress the team is making on this journey. This week has witnessed the delivery of the new performance dashboard for operations. This visual management system includes a variety and matrix of trade flow demand (and failure demand) as well as critical assessment tools to prioritise and trend information from data collected from the continued collaboration between operations and IT. This is a significant point as the teams have, through this research, entered a stage of self-sustaining and the generation of self-improvements.

Exiting this case study and disbanding the project team has drawn mixed emotions. I will address the professional development experience first and then reflect on the overall journey.

My journey started with discovery. The psychometric appraisal focused on my natural styles in key dimensions of management abilities and assessing my preference against a peer group of senior managers and executives across Europe. I can reflect that the feedback it generated offered positive reinforcement of my strengths producing a deeper insight by the scores that were repeated in contrast to my peer group. There was invariably weakness or ‘opportunities for improvement’, I have considered the latter to be “management speak”, a sensitive method of delivering what can be construed as negative feedback. However, in this instance, I have found myself believing that identifying my weakness truly did give me the opportunity to tackle them head on.

In many cases taking the direct approach placed me outside my comfort zone and in some respects in dangers way. I believe I rise to challenging occasions, however in this context I have placed myself in challenging occasions and circumstances that has forced me to explore my self-belief, test my abilities (in the sense of my weaknesses), operate outside of my comfort zone and face my fears. In the process of doing so, I have discovered that ‘only’ through this process of reflection (encouraged by the reflections of the Prof Doc programme) could I have hoped to identify my attributes and formulate a plan to develop my professional practice. I have showcased my journey through my personal reflections in this document. I have enjoyed many self-improvements in most areas and, of equal importance, I have gauged the areas that remain opportunities for my further improvement. I can take comfort in my new understanding that my professional profile will require constant tuning and adjustment throughout my career as no one true unifying example of a manager or leader exists for each and every occasion. I believe I have reached a significant stage in my professional development having developed the ability to identify the areas of my natural style and constitution that require development as I grow as a person, and as a professional, as I continue my journey beyond this Prof Doc programme.

In closing, I cannot help but reflect on the team I worked with at the case study organisation. I an appreciative for their time, patience and support. I believe that each member of the team embarked on a journey of discovery. Not merely in the sense of the case study project. But in the sense that each person has taken away a new understanding of how we act in an environment that presents real challenges to our preconceptions and also that they understand the environment in which they live every day – as well as how, through systematic analysis, each person has the ability to change their environment. This would not have been the case if this study had not been undertaken.

12.0 Growth Outside of the Project

A catalogue of my professional activities is set out in Table 3. This table forms a list the professional development activities that I believe have helped shape the successful outcome of the research project, in the sense that the project went full term through successfully project management within a highly professional dynamic environment.

Table 3: Professional Activities and Conferences

Date	Event / Conference	Reflection	Action / Decision
7/2/12	APM Event: Earned Value Analysis and PRINCE2	Completed Project can earn additional value through a duplicating and sharing benefits and capabilities. Capabilities can be realised during project execution and not merely on or after the benefit realisation phase.	Have case study organisation assess new capabilities for added value across the organisation. Apply PRINCE2 principles to managing case study project
6/3/12	APM Event: The Future of Project Management Profession	The APM seeks to achieve chartered status elevating and recognising the skills and capabilities of project professionals	Review the APM's 'Body of Knowledge book which sets out governance and execution standards and code of conduct

23/10/12	APM Event: 5 Secrets for Creating a World Class Team	Attitudes of individual team members affect the group dynamic, working on and with the individuals is a key constituent of building a world class team. However, my concern is that my team has been assembled for a period of months and will be disbanded, therefore I'm unsure whether knowing this fact may affect the homogeneity of the group.	Apply best practice principles with the view to creating the best possible team dynamic, monitor progress and remain aware of individual attitudes affecting overall group dynamic.
21/5/13	APM Event: Governance and Collaborative Working	Collaboration is not just co-operating its co-creating a mutual benefit through joint objectives and clarity of purpose. I find an affinity between the presentation material and J. Kotter's 8 steps of successful change.	Review project objectives and verify aims align with case study organisation expectations. Establish the shared benefit in the direction and outcome potential of the project.
11/713	Internal Banking Presentation:	Obtained a grounded appreciation Money Market Loans and Deposited trading, this is one of the more basic products traded in the market.	This particular asset class appears to be a reasonable fit (easy and simplicity) to be the first subject of performance data collection
4/9/13	Internal Banking Presentation: Primary & Secondary Bond Markets Trading	Obtained a grounded appreciation of the Government and corporate Bond Market as well as Secondary Market syndication, corporate debt, wholesale funding vehicles and liquidity management processes.	Key note speaker added to my project team to act as a subject matter expert in Bond market trade flow.
15/10/13	Internal Banking Presentation: Credit Default Swaps	Complex products bought and sold without being listed on an exchange – huge settlement risks and thus an inhibitor of flow and performance.	Understand the product complexity. Understand the flow through the banks architecture. Identify the 'hot spots' impeding flow.
27-28/2/14	European Financial Management Association Conference: Operational Efficiency	The majority of improvement initiatives within major banking institutions focus on procedural improvements and searching for economies of scale (aggregation of tasks into large processing centres. Out of 16 speakers and 37 banks attending no-one is investigating measures of flow performance	I have extended my professional network collecting business card and add people of senior level to my linked-in. I may call on these people for interview and/or assessment of my findings
5-6/3/15	European Financial Management	Huge focus on costs and cost cutting exercises. More	Again I expanded my network of Operations and

	Association Conference: Operational Efficiency	centralisation with the aim of creating economies of scale. No mention of utilising system feedback loops or how feedback could be used to understand and then improve. I sense that banks replicate each-others improvement initiatives. I conducted a survey during this event on the topic of STP, most feel STP is an adequate measure of flow performance.	directors and Change Directors (responsible for system improvement) of major world banks. The survey results are huge contribution, assisting me position my study findings within global banking operations management

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