Trade-Capture Process Analysis: Global Credit Products and Structure Credit Trading

A Major Qualifying Project Report
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Sponsoring Agency: Bank of America, EMEA

Submitted To:

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Note: *Some of the material in this report was removed upon the sponsor's request*

A b s t r a c t

This report, completed for Bank of America (London), captures the trading processes for seven financial products traded in both Global Credit Products and Structure Credit Trading business groups. This was done by interviewing key personnel from Front and Middle Offices of both departments. We created flowcharts to illustrate the current processes and identify areas of improvement within the flows. Lastly, a list of recommendations was developed to address the identified issues, which will help the bank improve their trading operations.

Executive Summary

Bank of America's investment banking operations currently trades fairly newer financial instruments that result in higher profits for the bank. Some of the newest products traded by Bank of America are very complex, and are difficult to handle and process. This is why the bank is continuously trying to optimize the trading processes for different financial instruments. Optimizing processes reduces operating costs and increases profits by eliminating inefficiencies.

The project's main goal was to capture the current trading processes for Global Credit Products and Structure Credit Trading business groups. There are a total of seven products researched. Three for GCP business group, these are Bonds, Credit Default Swaps, and Credit Default Swap Indices; and four for SCT business group, which are Bespoke baskets, Index Tranches, Total Return Swaps, and Perfect Asset Swaps. The project objectives were to identify weaknesses on the current trade-capture process as well as devise solutions to address the identified weaknesses. This will help the bank optimize their trading operations by reducing maintenance and operating costs as well as increasing profits.

We captured the different processes by conducting a series of interviews with Front and Middle Office personnel. After gathering all the necessary information, we created a series of flowcharts that illustrate the current trade-capture process in place. The process starts from when a trade is agreed on by Front Office and a client or counterparty, and finishes when the trade has been processed by the Middle Office. The diagrams provided a clear picture of the current trading procedures in place and helped us identify areas that can be improved.

After gathering information and identifying weaknesses, we analyzed each of the processes more carefully and generated solutions to the identified flaws. Since GCP and SCT products are handled differently, the areas of improvement identified vary between the groups. It was identified that GCP products follow a much more automated process than SCT, therefore more weaknesses were found in SCT than GCP. We are providing one major recommendation to optimize the process for GCP products and, for SCT products, we are providing a total of five recommendations.

A c k n o w l e d g m e n t s

We would like to thank our sponsors at Bank of America (London) for giving us the opportunity to participate in a project with them. Specially, we would like to thank Name 1, Name 2, Name 3, and Name 4 for their continuous guidance through out the completion of our project.

We would also like to thank Front Office and Middle Office employees for their constant help. Their knowledge on the trade-capture process provided us with all the necessary information needed to complete this project in a successful manner:

- Name 5: Associate; Trader I, GCP EMEA Credit Trading

- Name 6: Associate; Trader I, EMEA Structure Credit Trading

- Name 7: Associate; Specialist - Securities, EMEA TRS Trading

- Name 8: Analyst, EMEA Structure Credit

- Name 9: Officer; Trader Support – Analyst, EMEA GSP SCT Trade Capture MO

- Name 10: AVP; Trader Support – SR Analyst, GCP TRS Risk Position / P/L Validation MO

- Name 11: AVP; Trader Support – SR Analyst, EMEA GCP CST – Trade Support MO

- Name 12: AVP, Trader Support – SR Analyst, EMEA GSP SCT Trade Capture MO

We would also like to thank Professors Arthur Gerstenfeld and Daniel Dougherty for their guidance and support through out our project experience at Bank of America London. We are grateful for the opportunity you have given us to work for one of the best investment banks of the world.

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1.0 Introduction

Financial institutions practice investment backing by issuing and buying securities in the capital markets. Investment banks offer financial services to their clients such as the trading of different financial instruments. This includes fixed income, derivatives, foreign exchange, commodity, and equity securities. Global investment banking is continuously changing due to innovation in the global financial markets. In recent years, new financial instruments have been created by financial institutions with the purpose of obtaining higher profits. Banks are continuously inventing products with higher margins in order to have a competitive advantage over other banks. Since every bank is trying to do the same to win over more clients, banks are in continuous change and facing financial innovation. Competition results in the invention of better, more profitable, financial instruments.

Banks typically operate as either a commercial or investment bank but there are some that operate as both. Bank of America, for example, is one of the largest banks in the United States of America and it is both a commercial bank, which operates in North America, as well as an investment bank with operations in North America, Europe, Middle East, and Asia. In order to keep a competitive advantage, Bank of America's investment banking operations currently trade fairly newer financial instruments that result in higher profits for the bank.

The buying and selling of securities, also known as trading, follow complex processes that are constantly being improved. It is very important for any large successful enterprise to improve their operations in order to maximize their profits. Optimizing processes can reduces operating costs and increases profits by eliminating inefficiencies. This is where business process modelling plays an important role, since it provides tools to properly manage activities involved in confirming that procedures are in place to ensure that tasks get done properly and efficiently.

This papers purpose is to capture the current trading processes followed by fixed income trades as well as identify ways to improve on the current processes. The report focuses mainly on the processes of seven credit derivatives that are traded in two different departments – Global Credit Products (GCP) and Structure Credit Trading (SCT). The three core products investigated under the GCP department were Bonds, Credit

Default Swaps (CDS'), and Credit Default Swap Indices (CDSI's). The four core products investigated under the SCT department were Bespoke Baskets, Index Tranches, Perfect Asset Swaps (PAS'), and Total Return Swaps (TRS'). We captured the trading processes for all these different financial instruments by conducting a series of interviews to the personnel involved in the trading procedures - this was key to understanding the current procedures in place. We then proceeded to create a series of flowcharts to graphically represent the processes as well as a list of recommendations describing ways to improve them. This will help the bank optimize their trading operations by reducing maintenance and operating costs which will increase profits.

2.0 Background

This chapter provides all information researched prior to the completion of our project. This information helped us understand different concepts that we dealt with during our time at Bank of America as well as the theory behind business process modelling and improvement.

2.1. Bank of America

Bank of America is the largest bank by assets and the second largest commercial bank by deposits and market capitalization in the United States. Before acquiring BankAmerica in San Francisco in 1999, they were known as NationsBank but the corporation was renamed "Bank of America" after the acquisition (Bank of America, 2008).

Since that time, they have continued to grow in a number of financial as well as geographical sectors. The purchase of credit giant MBNA in 2005 and US Trust in 2006, the acquisition of Countrywide in 2007 and Merrill Lynch in 2008 – just to name a few. Bank of America has also opened branches in Mumbai, Chennai, Calcutta, New Delhi and Bangalore, Brazil and a number of Latin American countries, but is known as *BankBoston* in the last two. Their Global Corporate and Investment Banking divisions are spread around the globe with divisions' headquarters in the New York, London and between Singapore and Hong Kong, for their US, European and Asian markets respectively (Bank of America, 2008).

The company's strengths lie in being a universal bank, building meaningful relationships with key clients in the bank's core markets.

2.1.1. European Operations

Bank of America's European division is known as EMEA and has its headquarters in London. They employee about 2600 professionals in their European division, which includes the U.K., Belgium, France, Germany, Greece, Italy, the Netherlands, the Republic of Ireland, Spain, Switzerland and has been active in the European market region since 1922. The bank provides investment banking, capital markets, equity financing, global cash management, traded market products including money market and derivates trading,

trade finance, leasing and financial advisory services to corporations, institutional investors, financial institutions and government entities worldwide (Bank of America, 2007).

The bank covers a broad range of industries and has participated in many significant European financings including Eutelsat, Rémy Cointreau, Fresenius, British Aerospace and BHP Billiton. Building on its global strengths, Bank of America has particularly strong Financial Institutions and Finical Sponsors client coverage groups in places that are rapidly gaining market share in consumer and retail; financial institutions, sponsors and leveraged finance just to name a few.

EMEA is central business is Global Markets. By being in close coordination with Global Investment Banking, Bank of America has been able to capitalise on its product capabilities to methodically build its European business into positions of leadership by having strong sales, strategy and research groups.

EMEA's deals with a number of products, but this project will be looking at EMEA's Credit division–both structured and flow products.

2.1.2. Businesses groups of focus

This paper will focus on two different business areas that trade credit products. These areas are Global Credit Products (GCP), and Structure Credit Trading (SCT). Both of these business areas are composed by three separate offices in charge for a particular section of the trading process. These divisions are the Front Office, Middle Office, and Back Office.

The Front Office personnel are in charge of talking to clients to offer them different deals on different products and booking trades. Front office is where revenues are generated. The Middle office personnel are in charge of managing risk, and calculating profits and losses (P&L) of all trades that were booked by the Front Office. The Back Office personnel are in charge of the administration of all trades, they also provide support services to Front and Middle Offices. Because the Front and Middle office are the only divisions that are involved in booking a trade, our paper will study the processes followed by them; it will not cover the Back Office.

2.1.2.1. Products traded by each group

Global Credit Products and Structure Credit Trading business areas are in charge of trading different types of products. GCP trades single named instruments (flow) and SCT trades much more complex instruments (structured).

The different instruments traded by GCP are the following:

- **Credit Default Swap (CDS):** a bilateral contract between two parties which facilitates a synthetic transfer of credit risk between two counterparties on a specific "credit" (reference party). One party is a protection buyer and the other party is the protection seller. The protection buyer makes periodic payments to the protection seller. If the reference party suffers a credit event, then the protection seller needs to cover the losses of the protection buyer (Taksler, 2008).

- **Credit Default Swap Indices (CDSI):** credit derivate traded to hedge risks. It works the same way as a CDS but with the difference that CDSI are standardized securities and CDS are over the counter securities (Lehman Brothers, 2003).

- **Bonds:** type of investment where an investor lends money to a corporate or government entity in exchange of interest rate payments. The entities then use the money borrowed to undergo different projects. The Bonds always have a maturity date that can be months, 1 year, or many years. When this date is reached, the borrower gives the lender the amount of money he originally invested.

The instruments traded by SCT are the following:

- **Indices:** these are CDS' on standardized baskets of issues. The baskets are generally defined by industry and credit quality and can contain up to 125 entries. The main indices they deal with are:

  - **ITraxx Main**: investment grade single-name European reference entries.
  - **CDX IG**: investment grade single-name US references.
  - **iTraxx Xover:** sub-investment grade European reference entities (below BBB-).

- **Collateralised Debt Obligation (CDO):** credit derivative that facilitates the credit risk exposure to a portfolio of names where risk is synthetically transferred. They also structure redistributes credit risk of underlying portfolio through trenching, cash flows and loss prioritisation. Credit

loss allocations works from the bottom-up sequentially through tranches (with equity tranches being the riskiest and super-senior tranches being the least). They are defined y attachment and detachment points –where losses on the underlying portfolio being to reduce notional of trances.

- **Index Tranches:** standardised type of CDO that represent most liquid part of the structured CDO market and are carved out of CDS Indices.

- **Bespoke:** type of CDO where client chooses to invest on a portfolio of different names that he picks himself. Instead of investing in a specific tranche of the CDO, the investor creates the entire CDO basket with the specific names he wants (Lehman Brothers, 2003).

- **Total Return Swap (TRS):** credit derivatives where two counterparties swap their returns on an underlying asset. It is done to transfer the market and credit risk of an asset. TRS's provide protection against specific credit events and are not considered to be a pure credit derivative.

- **Perfect Asset Swap (PAS):** cross-currency swaps that minimize the risk of currency and interest rates. Investors trading this product convert foreign currency fixed-rates into local currency LIBOR floaters in order to hedge currency exchange risks (Lehman Brothers, 2003).

Because SCT deals with a larger number of complex credit products and due to the time limitations of our stay at Bank of America, we will only be looking at their core products which are Bespoke Baskets, Index Tranches, PAS' and TRS'.

2.2. Business Process Modelling

A process is a set of activities ordered in a specific way across time and place that have a start, end, and defined inputs and outputs. Thus, a business process is a collection of tasks or activities that flow in a specific order to achieve a desired output for a specific business or market. A business process model is what graphically represents a business process being used to achieve a specific goal (Sparx Systems, 2004).

Business process modelling (BPM) is a discipline in itself which allows a visual understanding whether modifications must occur or whether current processes are working just fine. It also defines and outlines business practices, information flows, data stores and systems. In other words, it is a model of

similar process that shows how everything works together. As you see the process in action, one can tell if the organization is performing as efficient as possible.

The scope of BPM has changed a lot over the past few years. Originally it was used to manage and drive largely human-based, paper-driven process in a corporate department. In our current day and age, it is an Enterprise Integration Technology complementing Service-Oriented Architecture and Enterprise Application Integration.

There are a number of benefits that come with using a BPM solution to model workflow, such as formalizing the existing process and spotting areas that could be improved by forcing the business to critically thing and understand the current process which also allows them to find room for autoimmunization or elimination of unnecessary steps. It also gives process a tangible initial design, which ensures that all stakeholders are aware of how it will work.

Just like anything that's worth while, BPM does not lack standards. During our analysis, we will only relay on the Business Process Modelling Notation which is a sophisticated graphical notation language for process.
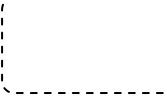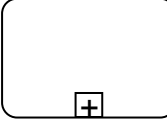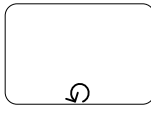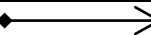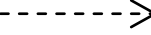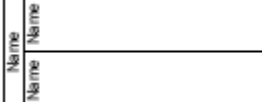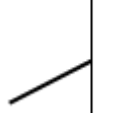
2.2.1. Business Process Modelling Notation

The Business Process Modelling Notation (BPMN) is a graphical notation that illustrates the steps and shows the end-to-end flow of a business process. This notation was created by the Object Management Group with the intention to coordinate the sequence of activities and messages that flow between different participants in a related process.

While BPMN may seem similar to the unified modelling language (UML) typically used for modelling computer systems, the main difference is the approach they each take. While UML uses an object-oriented modelling approach which is intended to aid in the design of software, BPMN takes a process-oriented one and is intended to model a business process, not the function of each piece (White, 2008).

The following are the BPMN elements that were utilized in our diagrams. For a full list and more detailed description of elements, please refer to the Objects Management Group website (www.bpmn.org)

Table 1: BPMN elements and descriptions

Element name	Description	Notation
Event	Something that 'happens' during the course of a business process. They affect the flow of the process.	○
	There are three type of events: - **Start**: shows when a process begging's (thin edge). - **Intermediate**: takes place between the start and end, but will not start nor terminate the process (double edge). - **End**: indicates where then process ends (thick edge).	Start Intermediate End
	- **Time trigger**: indicates that the flow pauses at this point until a certain time period past. - **Error trigger**: triggered when an error takes place	
Task	An atomic activity that is included in a process. It is used when the work is not broken down into a more detailed level	
Groups	Used to highlight certain sections without adding additional constraints. Typically used to separate elements for reporting or analysis purposes.	
Gateway	Used to control the divergence and convergence of multiple sequence flows. It will show forking, merging and joining parts.	◇
	Specifically shows a fork what results in parralel processing.	
Collapsed sub-process	The details of the sub-process are not visible in the diagram, which in dicated by a plus-sign in the lower-center of the shape. This implies that there is a lower level of detail.	
Activity looping	The attributes of the task and sub-proess will determine if they aer repeated or performed once.	
Control flow	Used to show the order that activites will be performed in a proess	→
	Conditional flow can be used as a substitue for a gateway.	
Association	Shows a relationship between elements. It does not directlly impact the event flow	------>
Pools	Represents a participant in a process. It also acts as a "simelane" and a graphical container for partitioning a set of activities from other Pools.	Name
Lane	A sub-partition within a pool. It will extend the entire length of the pool – either vertically or horizontally. They are used to organize and categorize activities in a Pool.	Name Name
Annotation	Method of commenting on specific parts of the diagram to provide more information to the reader.	

Colours are typically not required, but it is valid to utilize them to highlight the importance of certain elements.

Business Process Execution Language (BPEL)

This is a BPM specification with the strongest support, with backing from companies' like IBM, Microsoft and Oracle. A BPEL process is a web service with an associated process definition defined in an XML-based language. The behaviour of a BPEL process is to act on, and be acted on by, other process. Differently, a BPEL process can invoke another web service or be invoked as a web service.

BPEL is an XML-based language for describing a business process in which most of the tasks represent interactions between the process and external Web services. The BPEL process itself is represented as a Web service, and is realized by a BPEL engine which executes the process description. BPMN is a standard set of diagramming conventions for describing business processes. It is designed to visualize a rich set of process flow semantics within a process and the communication between independent processes. It is intended to support capture of sufficient detail to allow it to be the source of an executable process description. Since BPEL is currently considered the most important standard for execution languages, a translation to BPEL is specified in the BPMN standard. By design there are some limitations on the process topologies that can be described in BPEL, so it is possible to represent processes in BPMN that cannot be mapped to BPEL. There are a few concepts, such as Ad-Hoc sub-processes, that BPMN can represent that may not be implemented with any technology (White, 2008).

2.2.2. Complexity Management

Increase complexity is almost inevitable as any company pursues business growth. Either by dealing with more products, larger markets or through mergers and acquisitions, complexity is here to stay. For these reasons, companies need not to try and reduce it, but learn how to properly address it. To do so, there are six key practices for effectively doing this (A.T. Kearney, 2004):

- Understand the requirements: Identify exactly what results you would like to achieve without worrying about specifics such as how it will be done.

- Eliminate over-specification and complexity creep in design and development: When designing your system, do not add extra features until the main goal has been achieved. Make sure each piece performs its job and is not compensating for ether pieces.

- Make trade-offs based on an understanding of the cost effects of changes: If something needs to be removed from the system, make sure to fully understand how it will impact the rest of the system and how it will affect your main requirements.

- Align goals and objectives at the executive level: Ensure that all players involved are aware of the desired outcome.

- Provide visibility into complexity levels and required trade-off: Document any changes that are made to the system as they are made. This will provide an insight into how each piece of the system works as well as historical reference to how a problem was solved or a goal was achieved.

- Develop and leverage new capabilities on continuous basis: As the system grows, old solutions may no longer be adequate in reaching the original goals. Constantly inspect the system looking for places where additions or substitutions are absolutely necessary.

2.3. Process Design Patterns

Even though Business Process Modelling is known for the number of practicalities and benefits that it offers to business, it cannot succeed without good, deliberate design practices. Too many processes are implemented too quickly, high on the high on the hype that business requirements can be realized in executable digital form rapidly. Such processes are created without a strong foundation of previous experiences.

Similar to object-oriented programming, processes also have recurring design patters. Good BPM application exhibits, or implements, industry standard patterns. These control flow patterns help the process designer determine different ways to assemble activities – such as how to implement conditional logic based on a deferred choice. There are number of design patterns that the process community has identified, but we will only go in to details about those that have been identified in this project.

A 'design pattern' is a proved, reusable solution to a common problem. A well-known collection of Workflow Patterns are those proposed by Will van der Aalst, Arthur ter Hofstede, Bartek Kiepuszewski and Alistair Barros in their seminal paper titled "Workflow Patterns" (published in 2003). This collection of patterns focuses on the description of control flow dependencies between activities in a process. These patterns are divided into six general categories:

- Basic control patterns: these cover the fundamental or basic capabilities, such as running activates in sequence, splitting and joining and branching on a special condition. These are the most common patterns encountered.

  - Sequence: the act of running steps in a sequence. This is present in every single process.

  - Parallel Split: allows a process to branch into multiple parallel paths. It is most useful when more than one work flow needs to execute at roughly the same time.

  - Synchronization: several parallel paths meet and converge on a single activity and follow the same flow from there forth. It ensures that all meeting paths have been completed before proceeding.

  - Exclusive choice: branches from a single activity to exactly one flow, depending on what condition is met.

  - Simple merge: similar to the Synchronisation pattern, it joins several exclusive conditional paths into a single activity.

- Advanced branch and join patterns: similar to the branch and join patterns in the basic group, but they become more complex due to parallel splits and synchronization mergers.

  - Multi-Choice: choose one or more parallel branches that meet the given conditions.

  - Synchronizing Merge: joins all branches into a single activity that were spawned from a multi-choice split, once they have all completed.

- Structural patterns: seen as recopies for unstructured design practices, such as jumps and termination points.

- Arbitrary Cycles: an activity or set of activities are repeated by cycling back into the process.

- Implicit termination: the designated end-point for a given process.

Multiple instances patterns: activities that run concurrently and have the ability to spawn new instances and sync merges.

- Without Synchronization: when multiple concurrent instances of an activity take place, but they have no overall synchronization.

- With runtime knowledge: perform a set number (N) of concurrent instances of an activity, when the number N is only known at runtime.

Stat-based patterns: process that are event based

- Deferred Choice: a decision is made to following one of multiple flows, except that the choice is not made immediately.

- Milestone: a specific activity is only performed when a certain condition has been met – neither before nor after.

Cancellation patterns: methods to stop a process at any given point.

- Cancel Case: stops the execution of an entire process when something is triggered.

3.0 Methodology

As mentioned before, our goal was to capture the trading processes of financial instruments in the GCP and SCT business areas as well as suggest improvements where needed. This chapter details the steps we followed to achieve our goals as well as our final deliverables.

3.1. Final deliverables

We developed a list of objectives and deliverables that we wanted to work toward in order to achieve our goal. The identified project objectives were the following:

- Capture the trading process for GCP's core products, Bonds, CDS', and CDSI's.
- Capture the trading process for SCT's core products, specifically for Bespoke Baskets, Index Tranches, PAS' and TRS'.
- Identify pain points in each of the trading processes captured above.

Our final deliverables, which are presented in the results and analysis sections, are as follows:

- Flow diagrams showing the current trade process utilized by each business group.
- List of areas that could use improvement and recommendations on how to do so.

3.2. Approach

Before we started to gather information, we did some background research on fixed income products that are traded in Bank of America as well as furthered our knowledge on business process modelling. It was important to understand how each of these products worked beforehand. Bank of America provided us with a handbook that had detail explanations about Credit Default Swaps. We spent around 2 days reading the book to understand how this product works. We then spent some time researching into more complex products that are traded in the structured business area such as CDO's. After having enough knowledge about credit derivative products, we proceeded to develop a series of questions that were then asked to Front and Middle office personnel about the trade-capture processes. The list of questions created was divided into GCP and SCT since they deal with different instruments. They were also divided into Front and Middle Office since they perform different duties. We also developed a list of general questions that we asked our

supervisor before starting our interviews with the traders (See Appendix A). After gathering the information, we created flow diagrams that show the current trade-capture process, which helped us identify the pain points of the current processes. Finally, we developed a list of final recommendations to our sponsor describing how certain aspects of the processes could be improved.

3.2.1. Interviews

In order to capture the trading process we went through a series of interviews with different personnel from both the GCP and SCT groups. Firstly, we interviewed Middle Office employees and then proceeded to interview Front Office traders. Our first Middle Office interview was with Name 11, Name 9, and Name 12. Name 11 deals with GCP products such as CDS', CDSI's and Bonds. Name 9 and Name 12 deal with SCT products such as Bespoke, PAS', and Index Tranches. We then proceeded to interview Name 10 who deals with TRS', which is an SCT product. After our first round of interviews, we developed our list of questions further and met again with key personnel from both business areas to have a better understanding of the steps they each follow. We interviewed Name 11 and Name 9 one more time, but on separate occasions, to talk about the processes of CDS's and CDSI (Name 11) and the processes of Bespoke, and Index Tranches (Name 9).

Secondly, we interviewed Front Office traders to capture the process of booking a trade. Our first interview was with Name 8 who trades PAS'. During the first interview he explained how a PAS works and time constraints did not allow him to explain the trade-capture process. This is why we decided to interview him a second time. This time he explained and showed us how to book a trade and what the important steps are in the trading process. In order to capture the trading process for CDO's we interviewed Name 6. He is in charge of trading Bespoke, and Index Tranches. He explained key parts of the trading process that we did not know before this interview. Our last interview was with Name 7, who is a Front Office trader of TRS'. He explained key aspects of trading a TRS, which are very different from all other products traded in both GCP and SCT business areas. After finalizing with all the interviews, we proceeded to analyze the data captured in order to come up with conclusions and recommendations.

3.3. Project timeline

Because we only had seven weeks to gather and analyse all the information, managing our time properly was a priority. To make sure we made the best use of our time, we developed a prospective timeline (See Appendix B). This also helped us ensure that we did not spend too much time with just one activity while neglecting the others.

- **Week 1**: devise an approach on how to tackle the project, and get acquainted with the products and applications utilized at Bank of America. Create a list of questions to be asked to Front and Middle Offices.

- **Week 2**: conduct interviews during the first half of the week then review the collected information during the other half of the week.

- **Week 3**: conduct a second round of interviews, focusing on closing any gaps left open from the first round. During the last half of the week, compile all interview results into a single document with a common format to make future analysis easy.

- **Week 4**: start working on the project documentation, specifically on the outline and background information. Also start analyzing at the interview results closer to generate flowcharts that represent the current processes used in trading credit products.

- **Week 5**: continue working on the documentation, further the background section (if needed), and work on the methodology and data sections. Look at the interview answers again, but this time to extract information about areas that could be improved and brainstorm ideas on how to improve them.

- **Week 6**: finalize our list of recommendations and compile them in a formal way.. Finalize the methodology section and continue with the conclusions.

- **Week 7**: polish the final documentation as well as prepare for the final presentation.

4.0 Data

This chapter contains a transcript of eight interviews conducted with both the Front and Middle offices of GCP and SCT groups.

4.1. Products analyzed

Since each group traded product follows a different process, we decided to focus our project on seven total products. We analyzed the processes for Bonds, CDS's and CDSI's on the Global Credit Products business; for the structured credit trading business area, Bespoke Baskets, Index Tranches, PAS' and TRS'. Both GCP. SCT deal with other products that were not included in our research due to time constraints - we had to prioritize and focus our project on the core, most traded products.

4.2. People contacted for interviews

In order to capture the trading processes for products on both GCP and SCT business areas, we conducted several interviews with Middle Office and Front Office employees. The table below shows Front and Middle Office people interviewed from SCT and GCP groups.

Table 2: List of Front and Middle Office members interviewed

Name	Business Group	Division	Times Met
Name 8	SCT	Front Office	3
Name 5	GCP	Front Office	2
Name 6	SCT	Front Office	1
Name 7	SCT	Front Office	1
Name 11	GCP	Middle Office	2
Name 9	SCT	Middle Office	3
Name 12	SCT	Middle Office	1
Name 10	SCT	Middle Office	3

4.3. Front office Interview results

The questions asked to the different employees were the same, but they all had different answers since they trade different products and work for different business areas.

1) What type of structured deals do you trade?

- **Name 8 (STC):** I deal with Perfect Asset Swaps. There are other types of deals traded by FO's in SCT such as Bespoke, ITRAXX, indices, Index Tranches, and CDS'.

- **Name 5 (GCP):** I trade Bonds, CDS's, and CDSI's.

- **Name 6 (SCT):** I trade Bespoke, and Index Tranches.

- **Name 7 (SCT):** I trade TRS'.

2) What applications do you use when capturing a trade?

- **Name 8 (STC):** App-A, and Excel spreadsheets.

- **Name 5 (GCP):** App-A, Bloomberg.

- **Name 6 (SCT):** App-J, App-A, and Bloomberg.

- **Name 7 (SCT):** App-C.

3) How do you capture the trade information?

- **Name 8 (SCT):** by manually inserting all the trade information into App-A. We also use the excel spreadsheet to keep track of all the trades.

- **Name 5 (GCP):** with Bloomberg we capture the trade information of Bonds. With App-A we capture the trade information of CDS's.

- **Name 6 (SCT):** with App-J we calculate the Risk and profit & losses (P&L), with Bloomberg we execute the trade and with App-A we capture the already executed trade.

- **Name 7 (SCT):** we use App-C to insert the information of the trade. We use a specific document to get the trade information from the clients.

4) What process do you follow to book the trade?

- **Name 8 (SCT):** I receive an email from the client with the trade's information. Then I open the excel spreadsheet that we use to keep records to find the notional in different currencies, the FX

rate, the amount exchanged, and the par amounts. After getting the initial email, I send an email back to the client with additional information about the trade. I send this email not only to the client, but to everyone involved in the trade from BofA. When the email is sent, I proceed to insert the trade's information into the excel spreadsheet (to keep records). Lastly, I book the trade into App-A inserting all the required information. From this on, MO takes care of the rest.

Name 5 (GCP): The process for trading a bond starts with talking to the client. The next step is to book the trade manually into Bloomberg. This is usually very quick. Bloomberg then feeds Cumulus. This process is fairly automated and not many errors are made. The settlement of the trade takes place after it is reflected in Cumulus. Before the trade can be settled, the details of the trade in Bloomberg and Cumulus have to match the details of the trade generated by the broker. This doesn't happen very often. If there is no match, the Back Office handles these issues in order for the trade details to match in both systems. When trading a CDS, the process also begins when talking to the client to settle a deal. The trade is then manually booked into App-A which then feeds APP-B. Middle Office is in charge of the next steps of the process.

Name 6 (SCT): First we look on the street for a buyer. If we are unable to fine one our self we then turn to a broker. Once we find somebody to trade with, we first check to see if the trade is worthwhile by using APP-J to calculate the Risk. To do this, we manually copy the reference numbers from the portfolio we are trading into APP-J as well as update the information depending on the correlation. I then create a ticket in App-A with the information that APP-J generated and e-mail the other details to MO. MO then magically links the single trench to a basket and e-mails me the entire basket back in an excel file. If the numbers match I simply import into App-A and I'm done, but if they do not match I have to check and see if the error is on my side or what caused the number to not match

Name 7 (SCT): The process is very straight forward. We have a document that we send the clients so that they put the information about the TRS. Firstly, the client sends us this document filled out with the trade information. We then have to approve it, so if we agree with what the client sent, we sign it and send it back to the client and to the operations department as well.

Some of the information that we need in this document from the client is initial amount of the trade and the spread. The second and final step is to manually insert the trade into loan track. We input the loan into loan track, not the TRS itself.

5) What do you consider to be some weak points in the existing trade process?

- **Name 8 (SCT):** N/A

- **Name 5 (GCP):** In the existing process, trade information is sometimes mismatched between the ticket we create in Bloomberg and what the broker indicates. This mismatch results in a profit loss for the company. These errors are caught once the trade has already been fed to Cumulus, which then indicates the mis-match during the settlement process when the Back Office runs a certain report

- **Name 6 (SCT):** N/A

- **Name 7 (SCT):** It's very inefficient to have a document that we have to email the client back and forth.

6) What is it that you don't like about the applications/processes and how can it be improved?

- **Name 8 (SCT):** I don't like it that App-A does not have specific text boxes to insert notional, FX rates, or any of that. All this information I have to insert in a free entry text field which can lead to human error when typing everything up. It would be nice if App-A had a specific text field for every single value that has to be entered for a trade. Less error would be made.

- **Name 5 (GCP):** I don't like that Bonds and CDS's do not follow the same process and do not use the same applications. It would be better if every product used the same applications. I think it would be easier for the technology group to maintain the applications and it would cost the company less money – since they would only have to develop solutions for one product

- **Name 6 (SCT):** N/A

- **Name 7 (SCT):** It would be more efficient to have a website that the client can access instead of having to send them a document. The website could be accessed by clients and traders. The client could insert the trade information into the website and then the trader can take a look at it

and approve it directly in the website. It would be ideal if this website had STP so that it could feed Loan Track automatically with the trade information. They are actually doing that now in Equity Prime Brokerage. They have a website for the client and traders to access when booking trades

4.4. Middle Office interview results

Our first interview with Middle Office was with a group of people from both GCP and SCT business areas. We wanted to get a general idea of how things worked first. After gaining a general knowledge on how trades are captured by Front Office, we proceeded to conduct separate interviews with personnel from GCP and SCT areas that deal with different products.

General Interview - *Name 11, Name 9, and Name 13 (Both GCP and SCT):*

1) Which are the core products traded in the business?

   The most traded products traded by Structure Credit Trading are Bespoke, TRS, Index Tranches, Index Options, FX swaps and PAS. The most traded products traded by Global Credit Products are CDS, CDSI, and Bonds.

2) What is the process you follow to analyze each type of trade?

   Once we receive a trade from FO on App-A, we manually book the trade into APP-B. For some trades, we run the risk instantly to check if its PV is positive or negative. Sometimes we do not want to wait until the next day to see if a trade is not profitable. Overnight, App-Q is run to calculate the risk for each trade booked during that day. All this information is then passed into Back Office so that they can administrate the trades.

3) What applications do you use during each process?

   We use APP-B to book trades and App-Q to calculate risk

4) How do you calculate risk?

   We us App-Q, an outside application that is utilized enterprise-wide.

5) Is the calculation process for risk and P&L the same for every product?

Yes, every product uses App-Q.

6) What is the most common error/obstacle you run into? How do you deal with it?

APP-B was not originally created to deal with complicated structured deals, so it takes a long time to book a structure deal on APP-B. This is a problem we are facing daily. Another problem is that Bespoke baskets have many trade tickets that have to be booked in only one trade. APP-B only has one field for trade tickets so it makes it very hard for us to input this type of deals into APP-B. We often have to trick the system in order to make it work.

7) How long does it typically take to process information received from the Front Office?

It depends on the product. TRS's usually take 30 minutes, Bonds take 10 to 15 minutes, CDS's and CDSI's are very quick and take no longer than 30 seconds (if everything goes right), and baskets take around 2 hours to book since they are the most complicated ones

8) On average, how many trades do you process in a month?

It also depends on the product. We usually trade around 700 CDS's a month, 10 CDSI options, 500 CDSI, and around 5 to 10 baskets. The volume of trades also depends on market fluctuations.

9) What is it that you don't like about the applications/process?

We don't like the fact that APP-B is very slow when we are booking complex deals. We also don't like that we have to manually insert the information from App-A (trade information from FO) to APP-B. There is a lot of room for human error in this manual process.

Individual Interviews:

1) What type of products are you in charge of?

- **Name 11 (GCP):** I deal with Bonds, CDS's, and CDSI's.
- **Name 9 (SCT):** I deal with Bespoke, Index Tranches.

Name 10 (SCT): I am in charge of TRS's

2) What applications do you use?

Name 11 (GCP): I use App-A, APP-B, App-P

Name 9 (SCT): APP-E, APP-B, App-P, App-G, App-Q.

Name 10 (SCT): I use App-C, APP-D, App-M, APP-B, and App-F.

3) What process do they follow?

Name 11 (GCP): Bonds are booked differently. CDS and CDSI have similar flows but some differences. When booking a bond, we get the information from FO in the App-A and then we have to manually insert all trade's information into APP-B. Before we book the trade into APP-B, the trade ticket (and all the trade's information) of the trader and the broker/sales have to match. Once they match, then we book the trade into APP-B. APP-B then feeds App-Q and its ran at night to calculate risk. CDS's are also received from FO on App-A. After the trade's information of the trader and the broker/sales match, then the trade is automatically booked into APP-B (nothing is manual). If there is a mismatch, I have to contact both the trader and the broker/sales to see who has the correct information and then make the corrections on App-A. When there is match, then the trade is booked automatically into APP-B. CDSI work same way as CDS but the only difference is that CDSI, after match, are booked into App-P and not APP-B (automatically also).

Name 9 (SCT): When trading Bespoke, FO sends us an email with an excel spreadsheet detailing all the basket names involved in the trade. APP-B also shows the names involved in the basket; it gets this information from APP-E. We then manually insert all this into APP-B. Since baskets/Bespoke consist of around 125 names, and we have to manually insert all of them, it can take around 2 hours to insert this information into APP-B. We then proceed to run App-Q for the current trade to get a preliminary idea of what the P&L for this trade is. Since FO also does preliminary P&L calculations, our numbers have to match. If they don't match, we have to contact FO to see what the problem is and why they are not matching. At the end of the day,

App-Q is run overnight to calculate the official P&L for every trade booked during that specific day. The process for PAS is the same as Bespoke. The process for Index Tranches is the same but it uses different applications. Instead of APP-B, the trade is inserted into App-P. App-P is fed by App-G. APP-E is not used for these products. App-Q is used to calculate P&L for these products.

Name 10 (SCT): As follows:

a. Trade is booked in App-C

b. It then waits until it settles (usually 10 days)

c. This is the point in time when errors are detected

d. On day 10, it is added to APP-D

e. On day 11, a report is generated by App-M

f. App-M then feeds APP-B which then feeds App-F to calculate the Risk and P&L.

4) What are the most common errors that you face and how often do they occur?

Name 11 (GCP): Not very often. These trades are very straight forward and automated. We sometimes face errors when booking Bonds because they are not automated. These mistakes are not very hard to fix since a bond is not a very complex product. We also face mismatches, but not frequently.

Name 9 (SCT): since it is a manual process, errors can always happen. FO employees make more mistakes inserting info into the computer than MO since they work under a lot of pressure. I don't usually make many mistakes since I have a lot of experience; but they can always happen.

Name 10 (SCT): Human error is very common. Front office people tend to make many mistakes when they manually insert trade information into App-C.

5) How do you correct the errors?

Name 11 (GCP): For mismatches, I have to contact both the trader and broker/sales to find out who has the correct information on the trade and then I fix it on App-A.

- **Name 9 (SCT):** If my P&L numbers don't match the FO ones, then we have to contact them and see why they do not match.

- **Name 10 (SCT):** Every time this happens, I have to contact FO so that they can correct their mistakes. I am not allowed to change the trade information myself. This is because it is always good to have segregation of duties.

6) Is there anything you do not like about the applications/processes? Any suggestions for improvements?

- **Name 11 (GCP):** There is nothing wrong with the applications/processes of CDS and CDSI because they are automated. Mismatches do not happen frequently and when they occur, they are easy to fix. For Bonds, I think some improvements could be made. It would be much easier do deal with Bonds if they were automated

- **Name 9 (SCT):** N/A

- **Name 10 (SCT):** I do not like anything in this process. The process of booking TRS's has many areas of improvement. App-M is just an intermediary application that should not be needed. There has to be a way to eliminate the usage of this application by improving other applications or by simply start using the applications that the other products use, such as App-A, APP-B, and App-Q. Also, I do not like that every booking has to be compared manually and that there is no global reference number that is used across all applications.

5.0 Analysis

After collecting all the data, we analyzed the information in order to understand how the trading processes worked. We then identified current problems that the Front and Middle Offices are facing when trading different products. We also created flowcharts that represent each identified process according to the information analyzed. This chapter presents the analysis of the information gathered, such as a description of the trading processes and their flowcharts. It also describes the main computer applications that are being used by Front and Middle Offices along with theirs functions.

5.1. Application descriptions

The Front and Middle Offices use different computer applications that allow them to capture a trade. Almost all applications are used by both GCP and SCT business areas, but they play different roles depending on the area. The main applications are the following:

- App-E: holds static reference data. In order to book a trade against a reference entity in App-A, the entity must be present in App-E first. This application feeds App-A and APP-B. It is used for all credit products except indices and options.

- App-G: Same functionality as App-E, but with the difference that App-G is used for indices and options only.

- App-A: captures the trades along with all their details. Every trade has a reference entity. App-E and App-G feed App-A with reference entities. The App-A feeds APP-B automatically for GCP products only. STC trade details are taken from App-A and manually inserted into APP-B within SCT (See Appendix C).

- APP-B: official book of records used for all credit products except indices and options. It is a risk/settlement system.

- App-P: official book of records system used for indices and options only. It is a risk/settlement system.

- App-L: allows traders to updates and publishes credit curves for all credit derivatives except bonds. It only holds the current value of the curves. Historical curve data is stored in App-K (See Appendix E).

- Credit Trader: updates and publishes credit curves only for Bonds.

- App-Q: calculates daily risk and overnight profits & losses (P&L). It is used for all credit products. It gets the trade details from APP-B or App-P and market data from App-K (See Appendix D).

- App-K: it is the source of market data for App-Q. It stores historical data of all trade's credit curves, base correlation curves, bond prices, and volatility grids (See Appendix F).

- APP-H: risk database fed by App-Q risks and P&L results of all trades. APP-H feeds other applications, such as App-O, App-N, and APP-I, so that the stored information can be seen in a more appealing and understanding manner.

- App-N: database that shows risk and P&L results. It gets the information from APP-H. It can be used to obtain very specific information of a specific trade, on a very specific date (See Appendix G).

- APP-I: reporting system or data browser, used by SCT group, which links in with App-Q and App-L to show trade details.

- App-O: reporting system used by GCP group that shows trade details.

- App-C: captures trades for TRS' along with its details. It has the same functionality as App-A, but it is only used for TRS'.

- App-M: intermediary system used for TRS' products to house static data about the loan and send reports with trade information to Middle Office.

- App-F: used to calculate risk and P&L. It has the same functionality as App-Q but it is only used for TRS'.

- APP-D: used to look up the underlying loan asset as well as settle the loan. It then feeds this information to App-M.

- App-J: used by Front Office to calculate preliminary risk and P&L.

5.2. Application matrix

Table 3: application matrix

Application	Function	Area of use	Product
App-A	Electronic blotter system to book trade information in Front Office. Provides STP functionality to Middle Office for CDS' and CDSI's	Front Office, Middle Office	CDS, CDSI, bonds, bespoke, index tranches, PAS
App-C	Electronic blotter system	Front Office, Middle Office	TRS
App-E	Hold static data and feed it to App-A and APP-B	Middle Office	CDS, bonds, bespoke, TRS, PAS
App-G	Hold static data and feed it to App-A and APP-B	Middle Office	CDSI, Index tranches
App-K	House historical data about trade curves from App-L and feed it to App-Q	Front Office	CDS, CDSI, bespoke, index tranches, PAS
APP-B	Official book of records for certain products. Houses all trades executed in a particular day and feeds them to App-Q	Middle Office	CDS, bespoke, index tranches, PAS, TRS, bonds
Bloomberg	Execute and book grades	Front Office	Bonds, Bespoke
App-L	Mark trade curves and hold the current value	Front Office	CDS, CDSI, bespoke, index tranches, PAS
APP-D	Settlement systems	Operations	TRS
App-M	Hold static data and generates reports used by Middle Office	Operations, Middle Office	TRS
App-F	Calculate risk and P&L	Middle Office	TRS
APP-I	Reporting system that stores trade details	Middle Office	All SCT products
APP-N	Reporting system that stores and shows risk and P&L results	Middle and Back Office	As needed
App-O		Middle Office	All GCP products
App-P	Official book of records for certain products. Houses all trades executed in a particular day and feeds them to App-Q	Middle Office	CDSI

App-J	Calculate preliminary risk and P&L	Front Office	All SCT products
App-Q	Calculate risk and P&L and holds current value. Is fed data from App-K about trade curve information. Historical results are saved in APP-H.	Middle Office	All SCT and GCP products

5.3. Processes identified

The trade-capture process, as expected, is not the same for GCP and SCT business groups. There are also variations within each group depending on the product itself – this is more prominent within SCT, due to the complexity of the products they deal with. The GCP products that we investigated follow the same process but differ on the applications utilized - CDSI's are booked using different computer applications than those used for Bonds and CDS'. Two out of the four SCT products investigated follow similar processes but different computer applications as well - These are Bespoke and Index Tranches; PAS'and TRS', on the other hand, follow a completely different process and they use different computer applications as well.

5.3.1. Flowcharts of current processes

It was identified that the flows for different products vary. The trading capture for GCP is fairly automated while the trading capture for SCT products is manual., but both groups still had three major stages that were the same: trade execution and booking, error detection and correct, risk and P&L calculation.

- Front Office books trades and corrects errors.

- Middle Office detects errors as well as books the trade in the official book of records.

- The official risk and P&L is always calculated overnight.
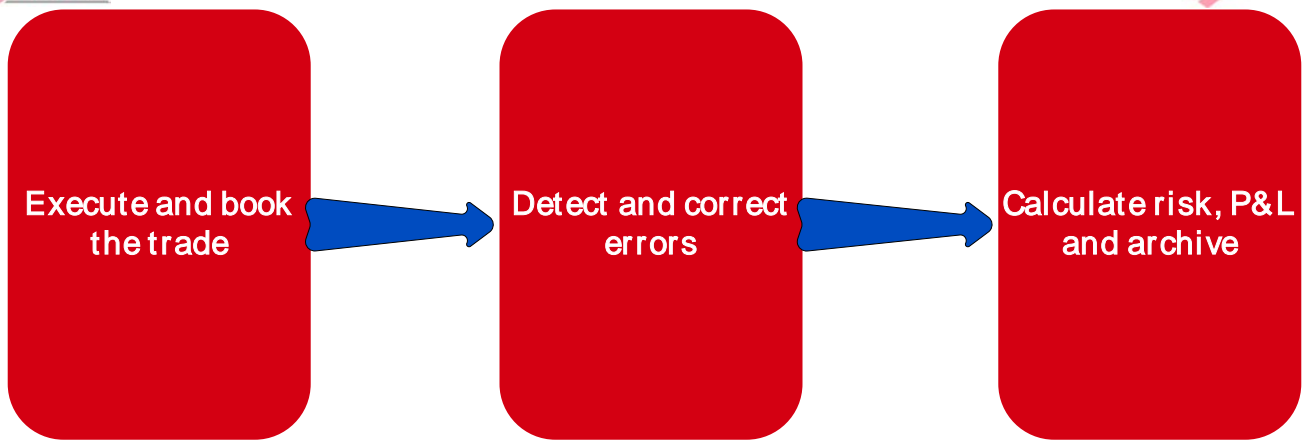
Figure 1: the three major stages in the trade-capture process

The following diagram shows the generic work flow, regardless of the group or product.
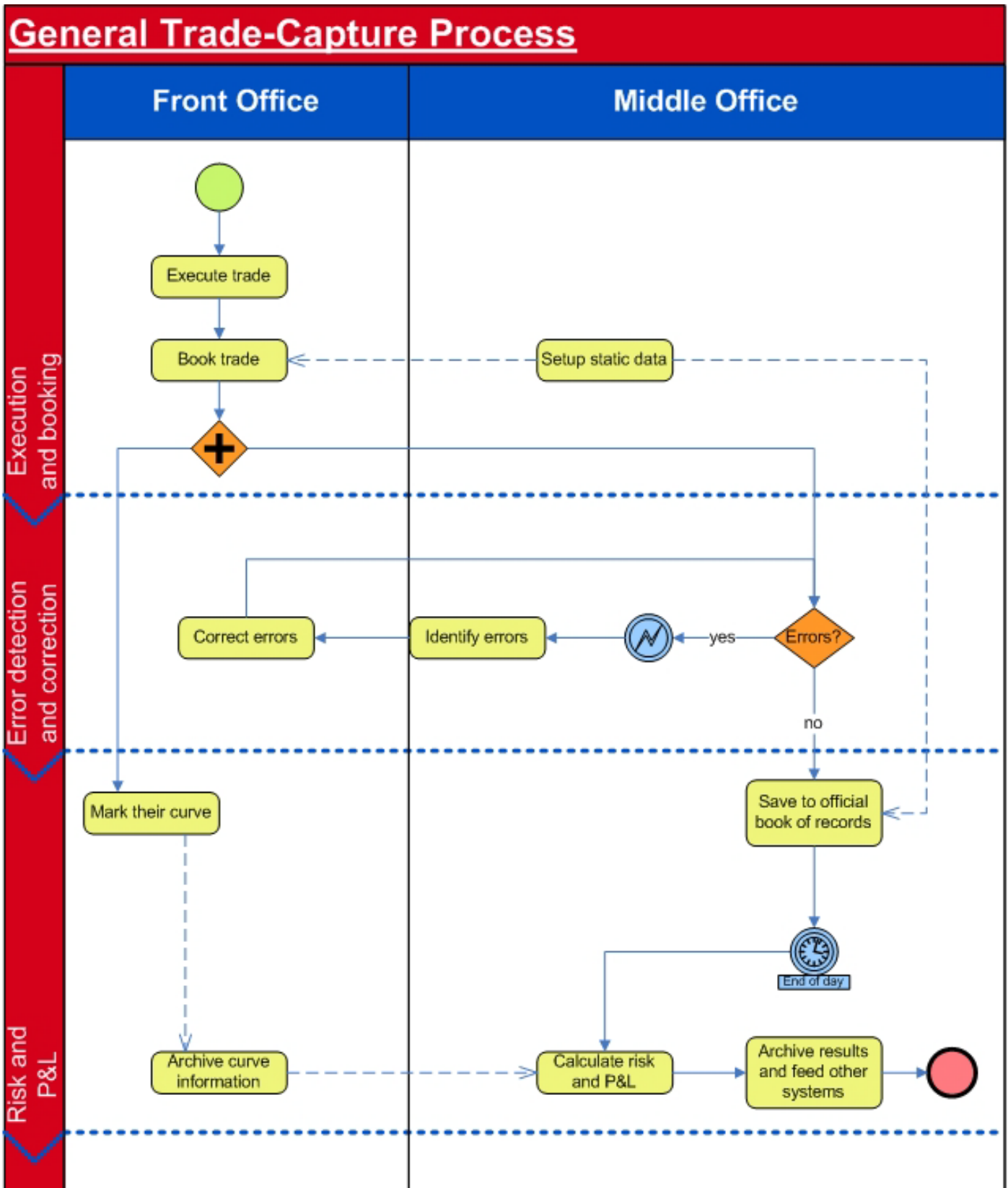
Figure 2: Generic process followed by both groups, regardless of the product

5.3.1.1.   GCP trade-capture process

The image on the following page (figure 3) describes the trading capture process for GCP products, which is mostly an automated or straight through process (STP). The steps below are intended to complement the flow diagram and provide further details and information about each step.

1. The process begins as soon as a trade is executed, either via an e-mail, or using Bloomberg.

2. The trader then books the trade information in App-A in the form of a trade ticket. App-A is fed reference data about indices and options from App-G, while CDS' and Bonds are fed from App-E.

   a. The trader then marks their curve information in either App-L (CDS' and CDSI's) or Bloomberg (Bonds), which saves that information to App-K for historical purposes and to feed other systems such as App-Q.

3. App-A will automatically indicate the error in a ticket.

   a. If an error is found, Middle Office opens the ticket, identifies the specifics of the error, and sends an e-mail to Front Office with the details.

   b. Front Office looks up the ticket in question, corrects the indicated errors, and saves the ticket again.

4. If no errors were found, Middle Office copies the information over to the official book of records depending on the type of product – Bonds and CDS' are booked in APP-B while Indices and Options, in App-P - this process is completely automated. APP-B is also fed static reference data to complete the booking from either App-E or App-G (similar to step #2).

5. At the end of the day, the aggregated trade information is fed to App-Q, which runs over night and calculates the official risk as well as P&L, using information from App-K.

6. Results are saved in the Results Database (APP-H). This is because App-Q can only hold current value, but for auditing and historical reasons a record of these results need to be kept. APP-H is then referenced by other programs which allow users to slice the data according to their needs– these applications are App-N and App-O.

Figure 3: GCP trade-capture process for Bonds, CDS' and CDSI's.

5.3.1.2. SCT trade-capture process

The images below describe the trade-capture processes followed by SCT products, which is mostly manual. These products are TRS', PAS', Bespoke, and Index Tranches. Similar to the GCP section above, the list of steps before the diagrams is intended to complement the diagrams by providing detailed information about each step.

Total Return Swaps (TRS') follow the following process:

1) The process starts when the trader is contacted by a client looking for a loan. The trader then sends the client a blank template for them to fill out the details of the trade. Once the client sends back the document, if the trader agrees on the terms, he will then send the form to operations for settlement and a signed copy back to the client. This is all done via e-mail.

2) The loan information is then booked in App-C, in the form of a trade ticket.

3) At this point the loan goes in to the settlement period, which typically lasts about 10 days. Once the loan has settled, Operations adds both the loan and settlement information to APP-D. They then send an e-mail to Front Office with the settlement date so they can add it to the loan ticket .APP-D then feeds App-M, who generates a report.

4) The following day, the report generated by App-M is received by the Middle Office. They manually extract the information from that report and book the TRS information in APP-B.

5) At the end of the day, the aggregated trade information is fed to App-F, which runs over night and calculates the official risk, P&L, and generates general ledgers reports.

Figure 4: SCT trade-capture process for TRS'

Perfect Asset Swaps (PAS') follow the following process:

1) The process initiates when the trader finds a dealer or a client to trade with. This can take place via e-mail or over Bloomberg.

2) The trader calculates the trades' profitability. If the profits are low, the trade does not take place and the process ends.

3) If the trade is profitable, the trader will execute the trade and type in all the trade information into App-A. The static client information is fed to App-A from App-M.

   a) The trader then marks the trade curve using App-L, which saves the data in App-K for historical reasons and to feed other applications (such as App-Q).

4) App-A will automatically indicate the error in a ticket.

   a) If an error is found, Middle Office opens the ticket, identifies the specifics of the error and sends an e-mail to Front Office with the details.

   b) Front Office looks up the ticket in question, corrects the indicated errors and saves the ticket again.

5) Middle Office then manually copies the trader information into APP-B, which also gets fed static information from App-M.

6) At the end of the day, the aggregated trade information is fed to App-Q, which runs over night and calculates the official risk as well as P&L, using the trade curve information from App-K.

7) Results are saved in the Results Database (APP-H). This is because App-Q can only hold current value, but for auditing and historical reasons, a record of all results needs to be kept. APP-H is then referenced by other programs which allow users to slice the data according to their needs– these applications are App-N and APP-I.

Figure 5: SCT trade-capture process for PAS'

Bespoke baskets and Index Tranches follow the following process:

1) The process begins when the trader finds a counter party to trade with, typically over Bloomberg.

2) The trader then calculates the profitability on the potential trade using App-J.

   a) If the trade is not beneficial to the bank, the deal is cancelled and the process ends.

3) If the deal is profitable, then a single tranche from the basket is booked in App-A.

   a) The trader then marks his curve in App-L, which saves that data to App-K for historical purposes and to feed other systems.

4) At this point, there are two courses of action depending on the type of basket that was traded.

   a) For a Bespoke basket, Middle Office needs to look up the basket information by running a series of reports using APP-I. This step is not needed for Index tranches because, as the name suggests, it is based on an Index and the information is readily available.

   b) Once all the basket information is gathered, each tranche needs to be booked in APP-B. With Bespoke baskets, Middle Office needs to manually create the basket in APP-B then manually input each name in the basket into the system. With Index tranches, the basket already exists (App-G feeds this static data) and only a specific tranche will need to be modified.

   c) Once all the names are in APP-B, a preliminary risk calculation is done using App-Q. If dealing with an Index, skip to step #6, else continue to 4d.

   d) If it was a Bespoke basket that was traded, Middle Office then pulls information out of APP-I and manually compiles an Excel sheet (with a particular format that can be read by App-A) that contains the information of all the CDS' that were in the basket and sends it off to Front Office.

5) Front Office then checks that the CDS' information matches their calculations from App-J.

   a) If they match, the CDS' are booked following the normal CDS process.

    b) If they do not match, then Front Office has to work with Middle Office to solve the

       differences.

6) At the end of the day, App-Q calculates the official risk and P&L on the aggregated trades for that

   day. It utilizes the historical curve information for that particular trade that is saved in App-K as part

   of its calculations.

7) The results are saved to the Results Database (APP-H), which then feeds a number of other systems

   (such as App-N and APP-I).

Note: *These were removed upon the sponsor's request*

Figure 6: SCT trade-capture process for Bespoke, and Index Tranches.

5.4. Difference between identified processes

The most significant difference we found between GCP and SCT trade-capture process is that GCP is much more automated than SCT. Because of the complexity of SCT products, these follow a more manual process. CDS' and CDSI's have a straight through process (STP) where the trade's information is initially entered manually into the blotter, but the rest is automatically fed to other systems.. Bespoke, Index Tranches, PAS' and TRS', on the other hand, follow a very manual process where every step of the way requires a high level of human involvement.

Because of the different levels of automation, the time it takes each group to book and process products varies a lot. On the GCP side, the quickest products are CDS' and CDSI's since the entire process is automated; it takes Middle Office personnel about 2 minutes to process them. On the SCT side, the quickest are TRS'. While having a manual component, it only takes about 15-25min to process (not taking in to consideration the 10-days settlement period). Both Bespoke baskets and Index Tranches take the longest out of any group – about 2 hours each. This is because APP-B does not handle this type of products natively, and every name in the basket has to be booked individually.

The level of involvement that the Middle Office has within each group is also different. On the GCP side, Middle Office is in charge of identifying booking errors and informing Front Office, who is in charge of making the corrections. On the SCT side, Middle Office has the same responsibility as those in GCP but they are also responsible for moving the trade information into the official book of records.

5.5. Issues identified

This section describes all the problems identified with the current trading process for products traded in both Global Credit Products and Structure Credit Trading groups.

5.5.1. Global Credit Products

From a Front Office point of view, Credit Default Swaps and Credit Default Swap Indices follow the same process and use the same applications. Bonds, on the other hand, have a different booking procedure

and use different computer applications. This means the processes are inconsistent within the same business area. CDS' and CDSI's, for example, are booked using App-A while Bonds are booked in Bloomberg. For CDS' and CDSI's, credit curves are created and published using App-L, while for Bonds the curves are generated using Bloomberg. These are clear examples that show the inconsistency between the trade-capture process of a Bond and CDS' and CDSI's. Having inconsistency among products that are traded in the same business area can create confusion among personnel. Also, training new employees could take a longer time since they have to get acquainted with different applications and processes.

Another issue identified was that while CDS' and CDSI's follow a fairly automated process, Bonds still follow a manual process. CDS' and CDSI's are manually inserted into App-A, and the rest of the process is automated. Bonds are booked manually into Bloomberg and the following steps of the process are manual as well. This degree of human interaction increases the chances of human error to occur, which results in a mismatch between the trade information inserted in Bloomberg by Front Office and the trade information described by the broker/client. The trade-capture process is stopped until the mismatch is identified by Middle Office. Correcting mismatches require extra time and effort by Middle Office and Front Office.

5.5.2. Structure Credit Trading

Different issues were identified in the current trading process of SCT products. Since TRS' follow a very different process, the areas of improvement are also very different. That is why this section is divided into two: one subsection describes the issues for TRS, and the other one describes the problems for Bespoke, Index Tranches, and PAS'.

5.5.2.1. Total Return Swaps

A prominent issue identified was that, when a new deal starts, Front Office traders have to send a blank document template to the client so that they can complete it with the loan details. When the client fills it up, they send it back to Front Office for their approval. If Front Office approves, they have to sign the document and send it back to the client as a confirmation that the trade was approved and will be booked. This process is time consuming since it is all done via e-mail. From our research, we found that the traders

are not happy with this process since they have to repetitively send the document to different clients. Another area of improvement in the Front Office is the manual booking. When the deal is approved by trader and client, it has to be manually inserted to App-C. Since Front Office personnel normally work under a lot of pressure, they tend to make mistakes when typing details into App-C. Every mistake made by Front Office is caught by Middle Office and it takes additional time and effort from both departments to correct errors.

Another weakness identified in the TRS' trade-capture process is that some of the applications used in the process may have an overlap in functionality. These are APP-D and App-M and they are used by the operations department in order to settle the loan involved in the TRS'. Middle Office obtains the trade information from a report generated by App-M in order to insert the trade manually into APP-B. App-M is just an intermediary system between APP-D and APP-B. The problem is that App-M may not be needed, since APP-D has the same functionality and could also generate the reports that Middle Office needs. The use of App-M needs to be evaluated in more detail in the near future. Due to time constraints, we could not look into these applications in any more detail.

The last major issue identified for TRS process is that it is still a manual process. Front Office manually books trades into App-C and Middle Office manually inserts trade in APP-B. Both Front and Middle Offices are using their time in a less efficient manner since they spend lots of time just typing details into a computer. This time, instead of being spent typing, could be used more efficiently by performing other value-added work, such as talking to clients to offer deals.

5.5.2.2. Bespoke, Index Tranches, and Perfect Asset Swaps

The most prominent issues identified with the current trade-capture process for Bespoke, Index Tranches, and PAS' is that the entire process is manual. Front Office manually books the trade into App-A and Middle Office manually inserts the trade information into APP-B, which leaves significant room for human errors. Since Front Office works under a lot of pressure, mistakes tend to happen often when they input the trade information into App-A, especially if it is a complex deal – such as Bespoke and Tranches.

Because of the custom nature of a Bespoke, they become difficult to book. Middle Office has to manually input every individual name in the Bespoke into APP-B, which is a very repetitive process. Index Tranches take less time than a Bespoke, since they are based on a popular index, but they are still input manually.

Another area with difficulties was with App-A. Currently, the application does not contain specific text fields tailored for each product for Front Office to enter certain information about trades, such as the return rate, FX rates, and any other important information that Middle Office needs from Front Office (See Appendix C). To compensate for this, a free entry text field is utilized by traders to input any details. The trader has to type everything up in what ever fashion they deem the most correct. When Middle Office reads the trade information from App-A to input it into APP-B, they have to carefully sort through the free entry text field in search for additional details. For example, the return rate can be typed before the FX rates in one trade, but in another the FX rate could show up first. This requires extra time and effort for both Front and Middle Office personnel since Front Office has to type every number up along with a description of what it represents, and Middle Office has to read everything carefully since there is no agreed-upon order to insert this information.

The third issue that we identified through our research is that APP-B is not efficient for structure and complex deals. Originally, APP-B was created to deal with simple deals such as CDS, Bonds, and CDSI. Currently, APP-B is also used to book more complex deals such as Bespoke and Index Tranches. Since it was not originally created to handle complicated deals, the application has a hard time processing them. According to Middle Office personnel, every time they input a structure deal into APP-B, the system either crashes or is very slow. Booking a structured deal into APP-B adds time to Middle Office employees' daily work. Booking a Bespoke into APP-B arises problems too. Since a Bespoke is composed by a list of CDS names, and every CDS has its own trade ticket, they have to manually insert all the CDS trade tickets into one Bespoke deal. Since APP-B only contains one trade ticket entry field for every deal, all the trade tickets involved in a Bespoke have to be inserted as only one trade ticket.

5.5.3.　Shared Weaknesses

The limited functionality of APP-B affects all SCT products, since it does not handle structured products very efficiently. A change to this system will impact both groups as well as all products, except for CDSI's, but this is an issue that is common among legacy systems.

APP-B is currently built on a platform called NextStep, an environment which has been out of production for about 13 years. APP-B can only run in this environment which requires the user to have an additional computer on their desk. Not only does this occupy unnecessary space on the user's desk, it also increases the amount of equipment that needs to be purchased per user.

Support and development for APP-B is also very limited because it is written in Objective-C, a language that in our current day and age is only used at an enterprise level on Apple platforms, in conjunction with Apple's proprietary libraries and frameworks. The effect of this is that it is difficult to add new and much needed functionality to APP-B that certain products require. An example of this is the lack of autoimmunization for any SCT products or proper support for Bespoke baskets.

6.0 Recommendations

After finishing our research and identifying the areas of improvement on the current trading process, we created a series of recommendations that could improve the issues we identified. Our recommendations to the bank as to how to improve their trading operations are explained in this section.

6.1. Global Credit Products

In order to improve the current trading process of Bonds, CDS, and CDSI, the inconsistency present among them needs to be addressed. As mentioned in the analysis section, Bonds are currently being marked using Bloomberg as well as their risk is calculated using Bloomberg. CDS and CDSI use App-L for these functions. Our recommendation is to mimic New York's bond capture process, where all GCP products are marked in App-L and there is no inconsistency between GCP products processes. Maintaining multiple programs that perform the same tasks creates confusion among traders as well as a larger amount of effort and budget from the technology group. If just one application was used, the technology group would only have to perform maintenance on a single application instead of multiple ones, which also results in lower maintenance costs for the bank. Lower costs mean higher profits for the bank as well. Switching from Bloomberg to App-L, would also decrease the amount of training needed for a new employees, since they would only need to get familiarized with a single application.

The frequency of humane errors can also be addressed by automating the process for Bonds, using Bloomberg as the starting interface. The New York GCP group currently implements an automated process which, once the booking is done in Bloomberg, it will automatically feed App-A. Middle Office then only has to click a button in App-A that automatically moves the trade information into APP-B. Updating the process from manual to STP would decrease human error, decreasing the amount of mismatches that occur. This would reduce the extra time and effort that Middle Office personnel have to go through when correcting errors.

6.2. Structure Credit Trading

This section lists the recommendations made to improve trading operations for Total Return Swaps, Bespoke, Index Tranches, and Perfect Asset Swaps.

6.2.1. Total Return Swaps

The applications used by the operations department to settle the loans can be improved. Currently, APP-D is used to settle the loans and then it feeds App-M, which is an intermediary system between APP-D and APP-B. We would recommend an evaluation of the importance of App-M, since there is a possibility that the process could be made more efficient by eliminating the use of App-M completely. After settling the loan in APP-D, Middle Office could get the report from APP-D directly instead of App-M. They could input the trade into APP-B, as soon as they get the information from APP-D. Eliminating the use of App-M would cut maintenance costs for the bank. Technology would not have to give support for App-M anymore, which would give them more time to perform other important tasks.

The method that is currently used for settling deals between traders and clients is also inefficient. A PDF document is e-mailed between the trader and the client until they reach an agreement. Because of the large amounts of e-mails that Bank of America employees deal with every day, this method of exchanging documents can lead to missing an important message which becomes berried in the trader's inbox. As a solution to this, we recommend creating a web portal, which would allow both the trader and the client to settle deals. The client could access the web portal, input the information about the deal they want to trade, and then the Front Office personnel could access it to see what the client is requesting. This would eliminate the need to exchange redundant documentation back and forth. It would also reduce the excessive amount of emails Front Office receives when starting a new deal. The creation of a web portal would also decrease the time it takes the trader to respond, as he does not have to be wasting sorting through his e-mail. This web portal would also eliminate the need to e-mail the operations group when an agreement has been reached, since they could be automatically notified about it. By implementing this recommendation, the trader would have more time to obtain more deals and the operations group would be able to identify errors quicker as well, all which would lead to increased profits for the bank.

The last identified issue with the current TRS process is that it is manual. In order to reduce human error, moving data to and from the blotter needs to be automated. The web portal that we are recommending could be programmed so that, once the deal has being settled between the trader and client, it could automatically feed App-C with the trade information. This way the trader does not have to manually input all the details into the blotter again. Equity Prime Brokerage department already has an automatic web portal for this purposes. A similar portal could be implemented for TRS'. An STP should be implemented so that once the trade has been automatically booked into App-C, it would then feed APP-B. If an STP was implemented, then neither App-M nor APP-D would be needed since App-C would feed APP-B directly. There would be no need for intermediary systems.

6.2.2. Bespoke, Index Tranches, and Perfect Asset Swaps

The current manual process is an important area of improvement identified for these products. Currently, a trade is manually booked into App-A by Front Office and then Middle Office manually inserts the trade into APP-B. Since Bespoke, Index Tranches, and PAS are complex products, it takes a long time to insert them into APP-B by hand. Manual processes result in a longer booking time, which decreases the amount of trades that can be traded/booked in one day. This is why we recommend that the systems must be updated to a STP. The process of booking an SCT product must be automated in order to reduce human error and reduce trading time. This would result in an increase in profits for the bank, since more deals could be traded in one day. Although is it important to automate the processes for all products, the most important one is PAS'.. PAS', on the other hand, still have a high demand. Automating Perfect Asset Swaps should be first on the list, since they will create a higher return on investment. Bespoke and Index Tranches are also important and should be automated, but the return on investment will be seen in the long run when demand for these products increases again.

App-A is another area that could use improvement because it does not have specific text fields to input specific information about a trade. Instead, it consists of a free entry text field where anything can be typed

into it. Front Office has to type all the important information into this box, but there is no specific order. It is very easy to make mistakes when typing all this information up, especially since Front Office works under a lot of pressure and are often rushing. Updating App-A so that it contains specific fields for specific information depending on the product is a must. Also, some text fields that are currently in the App-A for Bespoke are unnecessary. The ones that are not used at all should be removed to make the form simpler to fill out and to read. Although many fields have to be removed, there are three text entry fields that should be added. One text field that should be added is to insert the correlation curve used for the Bespoke. The other two text fields that should be added are for the insertion of an attachment and detachment point. The attachment point is just the upper percentage of the Bespoke tranche while the detachment point is the lower percentage of the Bespoke tranche. For PAS', a total of six text fields should be added to the App-A. These are the following: EUR Notional, Non-EUR Notional, FX rate, Paid Spread, Received Spread, and Next Payment Date. Also, some of the current text fields in place are not being used for booking the trade. These should all be removed from the application so that it looks somewhat simpler.

The last weakness identified for SCT products is the APP-B platform

6.3. Shared Weaknesses

In order to address the issues presented by APP-B, it is necessary to move away from a legacy platform and port it over to one with better support and increased flexibility. Although doing so would involve the creation of large intensive effort from multiple groups. There are still a number of issues that could be addressed on a smaller scale before completely moving APP-B to a new type of technology.

To eliminate the need for additional hardware just to run APP-B on NextStep, APP-B's Objective-C source code could be recompiled on a Windows-based machine utilizing the GNU Compiler Collection (GCC) with the help of Cygwin (a collection of tools that provide Windows with UNIX functionality). By doing this, users would run APP-B natively on their machine, eliminating the need for a second machine and reducing the cost of equipment per users.

Another short-term fix that would create an STP process to book the trades in APP-B would be to have App-A generate an XML or text file that contains the basket information as well as all the CDS names. APP-

B would then parse out the information and book the trade automatically. This would not require many changes to be done to APP-B, since it already supports importing names into a basket form of a text file, but the basket creation ability will have to be implemented. In order for this information to be automatically fed to APP-B, App-A first needs to have enough text fields to capture the complete set of details for PAS', Bespoke and Index tranches; since at the moment some details are inserted into the free-text field.

Both of the above suggestions can address two of the issues caused by APP-B with a short turn around time. But they do not address the larger issue of APP-B being built on a legacy system with limited support and difficulties to implement new features. This can only be solved by moving APP-B to a new type of technology which will allow easier support and ability to implement new features when needed. Since APP-B is built on Objective-C, which is popular known for encouraging Object Oriented program design from early on, Java seems like a natural platform to move to. Java has great support for objects, which means that it would not be too difficult to translate Objective-C objects into Java objects. Java could also support the flexibility needed to support new products. Lastly, there would be very little or no change to the way data is stored. Currently, APP-B uses a Sybase database to store all of its information and it does so utilizing stored procedures. These same procedures can be reused with Java with either little or no modification, since Java has good support for stored procedures. During this intense overhaul of APP-B it would be the ideal time to revisit the short-term fixes and evaluate if they need to be replaced with a more robust solution.

7.0 Conclusions

From our research, we can conclude that some products within the same business groups follow different processes and use different applications. CDS' and CDSI's, which are Global Credit Products, follow the same process but use different applications. Bonds, on the other hand, follow a different process as well as use different applications. Structure Credit Trading products investigated all follow different processes but some of them are similar. Bespoke and Index Tranche, for example, follow the same process but use different applications. Perfect Asset Swaps and Total Return Swaps each follow a unique process that is not the same as any other SCT product researched.

Another conclusion is that there are major differences between Structure Credit Trading and Global Credit Products business groups. SCT products follow a much manual process while majority of GCP's products are fairly automated. As a consequence of this, SCT products take a longer time to book since everything is typed in manually. Also, there is a higher level of involvement by Middle Office for SCT products since they have to insert all the trade details manually into APP-B. For GCP products, on the other hand, is very easy for Middle Office because it is a straight through process where they do not have to manually insert information.

8.0 Future Research

Our project has left room for future research. This is because time constraints did not allow us to investigate other products that can also need improvement. A similar project could be made to capture the trade process for FX Cash Interest Rate Swap on the Global Credit Products group, and CDO^2, n-t Default Baskets, First to Default Baskets, and Index Options on the Structure Credit Trading group.

Another research project could be created to evaluate the need of App-M and APP-D. It is believed that there is functionality overlap between these two applications. The project could focus on the evaluation of the functionality of the applications. This evaluation would then permit the bank to optimize the process for booking a TRS', since they would decide if App-M is needed or not. The research could also help to find other solutions to improve the current applications used to book TRS'.

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Appendices

This section provides different documents used throughout our project at Bank of America.

Appendix A: Original list of questions

List of questions created for our interviews to gather information.

Table 4: List of interview questions

General	1. How are the Front and Middle office divided?	
	2. What division is larger in EMEA? SCT or GCP?	
	3. Should we be looking at the Back Office to?	
	4. Who uses APP-B and what is it for?	
	5. Who uses STAR and what is it for?	
	6. Who uses APP-J and what is it for?	
	Are there any key contact points for each office/division	
Front Office	**SCT**	**GCP**
	What type of clients do you have? Most valuable?	
	What type of structured deals do you trade?	What is the process for trading a bond or CDS?
	What process does each one follow? (if different)	Do you trade anything else?
		Do they follow a separate process? (describe it)
	What trades do you do against street or desk?	
	How do you capture the trade information for each type?	
	What different applications do you use when processing a trade?	
	On average, how many trades do you make in a day?	
	What do you consider to be some weak points in the existing trade process?	
	What is it that you don't like about the applications/process?	
Middle Office	What is the process you follow to analyze each type of trade?	
	What applications do you use during each process?	
	What is your risk calculation process?	
	Is the calculation (risk, p&l) process the same for all structured deals?	Is the calculation (risk, p&l) for Bonds and CDS's calculated differently?
	What is the most common error/obstacle you run in to? How do you deal with it?	
	How long does it typically take to process information received from the Front Office?	
	On average, how many trades do you process in a day?	
	What is it that you don't like about the applications/process?	

Appendix B: Timeline

Timeline followed to complete our project on time.

	🛈	Task Name	Duration	Start	Finish
1	✓	Question Brainstorming	1 day	Tue 28/10/08	Tue 28/10/08
2	✓	Questions review	0 days	Wed 29/10/08	Thu 30/10/08
3	✓	NYC meeting	1 hr?	Thu 30/10/08	Thu 30/10/08
4		Meeting review	1 day?	Thu 30/10/08	Fri 31/10/08
5	🖳	Interviews - round 1	1 wk	Mon 03/11/08	Fri 07/11/08
6		data review - round 1	2 days?	Mon 10/11/08	Tue 11/11/08
7	🖳	Interviews - round 2	4 days?	Tue 11/11/08	Fri 14/11/08
8		data review - round 2	2 days?	Mon 17/11/08	Tue 18/11/08
9	🖳	flowchart generation - cur	2 days	Thu 20/11/08	Fri 21/11/08
10	🖳	data analysis	3 days	Mon 24/11/08	Wed 26/11/08
11	🖳	suggestion compilation	2 days	Thu 27/11/08	Fri 28/11/08
12	🖳	flowchart generation - sug	1 day	Fri 28/11/08	Fri 28/11/08
13	🖳	work on final report	1.5 wks	Mon 01/12/08	Wed 10/12/08
14	🖳	final presentation - prep	4 days?	Mon 08/12/08	Thu 11/12/08
15	🖳	final presentation	1 day	Fri 12/12/08	Fri 12/12/08

Appendix C: App-A application

Snapshot of App-A, which is used by the Front Office to keep records of trades and to pass the trade information to Middle Office.

Note: *These were removed upon the sponsor's request*

Appendix D: App-Q application

Snapshot of App-Q, which is used to calculate P&L for all financial products.

Note: *These were removed upon the sponsor's request*

When a trade has an error and it is clicked, the window shown below appears. It shows the issues identified and the information of the trade that has the issue.

Note: *These were removed upon the sponsor's request*

Appendix E: App-L application

Snapshot of App-L, which is used by traders to update, publish, or look up credit curves.

Note: *These were removed upon the sponsor's request*

Appendix F: App-K application

Snapshot of App-K, which is used to look up credit curves, base correlation curves, and bond prices

volatility grids for any trade.

Note: *These were removed upon the sponsor's request*

Appendix G: App-N application

Snapshot of App-N, which is used to create tables showing risk and P&L.

Note: *These were removed upon the sponsor's request*