Deutsche Bank AG
Financial Metrics and Best Practices

A Major Qualifying Project

Submitted to the Faculty

Of

WORCESTER POLYTECHNIC INSTITUTE

In partial fulfillment of the requirements for the

Degree of Bachelor of Science

By

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Advisors:

Prof. Jon Abraham — Math Department

Prof. Justin Wang — School of Business

December 15, 2010

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Date:
15 December 2010

Report Submitted to:

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Abstract

Deutsche Bank's CIB Global Markets Finance division is adapting a proprietary program called OPAL to be able to supply their Financial Directors/Managers with financial information. The project team was asked to conduct a review of regulatory change, and a review of industry best practices to determine the most valuable financial metrics to include in OPAL Finance. Additionally, the project team was asked to evaluate how the OPAL program could be supported on a mobile device.

Acknowledgments

"The only people with whom you should try to get even are those who have helped you." – John E. Southard

We would like to thank our sponsors at Deutsche Bank, who invited us to complete our MQP project with the internationally renowned investment bank. The guidance, assistance and support offered to the project team were invaluable. In particular, we would like to thank Barry Zucker, Melody Browne, Neelam Bansal, Christian Ambruoso, Jeffrey Jones, Boris Fuzaylov, Vincent Surdi, Lydia Lopiparo, and Gary Richard. Each of them was willing to take time out of their busy days to guide us to the successful completion of our project, and we appreciate their kindness.

We would also like to thank our advisors, Professor Jon Abraham and Professor Justin Wang, who were very supportive of our efforts throughout the preparation period, and who continued to offer their advice and encouragement throughout the project term in New York City.

Finally, we would like to thank the Wall Street MQP project site director, Professor Arthur Gerstenfeld, for the continuous support, encouragement, and advice he offered to all of the students participating in the Wall Street project. We have never known a more involved site director. We are all very grateful for being allowed the opportunity to participate in such an amazing program.

Authorship

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Executive Summary

In order to effectively manage any company or subdivision of a company, managers need to be able to know all the vital information about their company at all times. Not only do they need to have access to information, but managers also need up-to-date and accurate information. The Finance division of Deutsche Bank has recently undergone restructuring efforts, and has created the role of Finance Director. However, unless the Finance Director has constant access to correct, updated and relevant information, their job will become increasingly difficult. This explains why the effort to create OPAL Finance, from the already existing OPAL Space program, will help support the role of the FD/FM. OPAL Space is a program created in 2007 by Group Technology and Operations Investment Banking IT team of Deutsche Bank. OPAL supports decision support, workflow management, data entry and collaboration.

The WPI Major Qualifying Project (MQP) team was invited to Deutsche Bank to participate in the development of OPAL Finance. The project was separated into two distinct areas of focus. One part of the project endeavored to conduct an industry best practices review of financial metrics, and to combine the results of that research with the possible effects of recent regulatory changes affecting the financial industry. That section of the project resulted in a set of recommendations for financial metrics for OPAL Finance to improve shareholder value. The other focus of the project was to support the development of a mobile version of OPAL Finance for Apple iPod/iPad, Android

and BlackBerry devices. The resulting recommendations gave design guidelines, a comparison of cross-compiling platforms, and a suggested framework for analysis of application candidates for Mobile OPAL.

In order to begin the industry best practice review, the team became familiar with Deutsche Bank's Value Based Management program which created the Value Based Metrics – a set of 14 metrics aligned to achieving shareholder value. Additionally, the team interviewed two Finance Directors to gain a better understanding of what OPAL may contribute to the Finance Director/Manager's role. The industry best practices review was then started, using the VBMs as a starting point for comparison. Twelve companies were researched, as the team read through annual reports, publications, and the investor relations portion of each company's website. While conducting the industry best practices review, the team simultaneously researched the upcoming changes to regulation, specifically the Dodd-Frank Wall Street Reform and Consumer Protection Act, and the upcoming Basel III accords.

To begin the mobile device portion of the project, the team researched four cross-compiling development platforms; Appcelerator Titanium, Qt, PhoneGap, and Adobe Flash5. These four platforms were compared according to criteria focused on Mobile OPAL's potential needs. The navigation control guidelines were then compiled from internet research and consulting Apple's guidelines. Simultaneously, a framework was created to assess the likelihood of an application functioning well in a mobile format.

When the results of the industry best practices review were considered in combination with the results of the regulatory change review, it was recommended that the Profitability metrics all be included in OPAL Finance, based on the fact that these are heavily relied on by all banks surveyed to give tangible data about their bank's performance. Additionally, several of the Growth metrics should be included; these are more varied, so to determine specifically which growth metrics would be most valuable, additional research would be beneficial. The Constraint metrics should all be included, not only because they are common among the banks surveyed, but also because these ratios are/will be required by regulations. Finally, of the Business Mix metrics section, the most consistently measured metrics were Revenues by Region and Revenues by Business, so including these metrics may assist a Finance Director/Manager's understanding of the company's performance.

Based on the results of the comparison between cross-compiling software, Appcelerator Titanium was determined to best fit the needs for porting OPAL to a mobile format. However, there is a potential that Qt will soon fully support iPhone porting. In such a situation, Qt would be the ideal porting platform. Additionally, the results of the navigation analysis indicate that hierarchical navigation, and simpler control models would be the best fit for Mobile OPAL's limitations. Finally, the assessment framework was completed, which guides designers towards making an application simple and intuitive.

The team is extremely grateful for the opportunity to work with Deutsche Bank.

Chapter 1. Introduction

Wall Street banks are among the most efficient users of business intelligence. In fact, the competitiveness of a firm can be seen as depending entirely on skillful use of business intelligence. Transforming raw data into meaningful information that can enable a firm to maximize its profit can be a difficult task.

The Financial Metrics and Best Practices Major Qualifying Project (MQP) will hopefully result in the creation of and improved access to valuable business intelligence. The WPI MQP team was invited to work on the OPAL project at Deutsche Bank. The MQP was primarily focused on a program called OPAL Finance. The OPAL Finance program, which was developed for the Global Markets Finance division of Deutsche Bank, will provide a variety of information to enable Finance Directors/Managers to make decisions. OPAL Finance, in addition to providing workflow tracking and collaboration support, will have many financial metrics to provide up to date information about the performance of the company. Financial metrics are ratios, statistics, benchmarks or other measurements that allow managers to quickly and easily understand the company's financial situation. This MQP will provide recommendations of financial metrics the OPAL Finance application may benefit from including. Including additional sources of information that can enable strong decisions will position OPAL Finance to be a primary daily source of reliable and relevant information for Finance.

Additionally, the MQP team was asked to aid the migration of OPAL Finance program to a handheld format, which will allow managers access to this vital information even when not at their computers. To assist the process of creating a mobile version of the program, the MQP team compiled recommendations focused on a variety of mobile application design focuses. Offering more ways FD/FMs can access this vital information will hopefully improve their effectiveness as managers and contribute to the productivity and growth of the company.

Chapter 2. Background

The preparation for the Financial Metrics and Best Practices MQP began in September, 2010, while the project was conducted at Deutsche Bank in New York from October 25th – December 15th. The Background section covers the information necessary to understand the project. The team primarily worked around a program called OPAL Finance, which in the future will provide data analysis and business intelligence for the Global Markets Finance division of Deutsche Bank.

2.1 Deutsche Bank

Deutsche Bank, founded in 1870, is now a leading global investment bank. With 1,995 branches worldwide, Deutsche Bank offers a broad range of services to its clients, and has become an important player in international markets. The bank is growing and has established a presence in fast-growing economies, including the Asia-Pacific region, Central and Eastern Europe, and Latin America. Deutsche Bank's mission, as displayed on their webpage, states "We compete to be the leading global provider of financial solutions, creating lasting value for our clients, our shareholders, our people and the communities in which we operate."

2.1.1 Deutsche Bank Divisions

Within the company, there are three divisions: the Corporate and Investment Bank (CIB), Private Clients and Asset Management (PCAM), and Corporate Investments (CI). Deutsche Bank offers a wide range of services to their clients,

including trading, cash management, product structuring, money market instruments, trading of commodities, and asset and wealth management. Deutsche Bank is listed on the Frankfurt and New York stock exchanges. This project was completed for Mr. Barry Zucker, of Global Markets Finance. Finance is a division of Global Markets, under the Corporate and Investment Bank division of Deutsche Bank.

2.2 OPAL Space

OPAL is a program created by Group Technology and Operations Investment Banking IT team within Deutsche Bank in 2007. OPAL stands for Operations Portal – the program supports many versions of dashboard applications for use within various divisions of the company. OPAL Space, as the entire framework is known, connects around 75 different applications together and supports data sharing and communicating within the framework. In 2008, OPAL won the "Best Back Office Project" from Financial News Trading and Technology Awards.

OPAL's main purposes include decision support, workflow management, data entry and collaboration; all while using uniform data sources so that all users in all parts of the world are being shown same information. OPAL functions on desktop, Citrix, BlackBerry and iOS devices. OPAL provides specialized programs for differing needs among Deutsche Bank's internal clients. OPAL Space supports versions of OPAL for Global Business Services, Project Management, Global Technology and Operations, and Global markets, among others. The functionality supported by OPAL varies according to the needs of each group; Global Markets

relies on an Alertboard system that displays metrics relevant to monitoring Global Markets, while Project Management requires trend and analysis dashboards as well as real-time reports available on BlackBerry devices. OPAL supports the activities of each of these distinct groups very efficiently.

During August, 2010, CIB Finance began leveraging the existing framework of OPAL for the development of OPAL Finance. OPAL Finance was created for the use of the Global Markets Finance division. This program will be the focus of this MQP project.

2.2.1 OPAL Finance

OPAL Finance provides business intelligence and workflow facilitation for CIB Finance. The program is currently in a pilot phase. The vision for CIB Finance OPAL's future includes the following criteria, taken from the workshop papers created for the CIB Finance OPAL workshop in London, September 23rd and 24th.

CIB Finance OPAL Vision

- To provide a single, scalable platform where CIB Finance can:
    - Consume & analyze data
    - Track performance & workflow
    - Distribute business intelligence and retain MIS
    - Collaborate with peers, providers and clients
    - Perform ad-hoc queries.
- Evolve CIB Finance towards a "Single version of the truth"

OPAL Finance was implemented based on existing applications in OPAL Space used by GM and GBS, as well as a new application developed specifically for Finance. OPAL Finance currently includes a Report Library, an Alertboard, multiple dashboards, and an Event Calendar.

Report Library

The Report Library has folders set up to allow uploads, views, and edits of documents by any user who has access to that folder. Folder owners can create additional folders within root folders, and edit folder security – control who can view/edit/upload. Uploading PIPs to OPAL Finance will accomplish a lot in terms of simplifying workflow for Finance. The PIPs or Pre-Issuance Process Documents are very important in Finance. PIPs are compilations of trading data, and they must be approved and commented on by a Finance Director/Manager. In order to accomplish this, Finance Director/Managers must email PIPS back and forth multiple times before reaching an approved PIP. In addition to causing multiple back and forth emails, there are several other downsides to using email. Emails can easily be lost, because the typical sorting function is by date, so if a document is not noticed immediately, excessive time may pass before it is rated or re-written. The email format also makes it difficult for a Finance Director/Manager to keep track of PIP quality over a period of time. By using OPAL, Finance Director/Managers can avoid sending these documents back and forth in emails, and can upload, view, comment and rate (RAG) the document all

within OPAL. The PIP Dashboard shows RAG status of a PIP – Red, Amber, or Green ratings, as determined by the report rater. The PIP is rated on timing, (automatically collected from the upload date and time), accuracy, completeness and commentary. The rating is displayed as a RAG in the PIP dashboard. OPAL can display the rating of several PIPs over a period of time, and also is able to send notifications once a report has been uploaded. All of this additional information can help Finance Director/Managers more effectively manage their divisions.

Alertboard

OPAL Finance's Alertboard is another portion of OPAL that is currently in the pilot phase. The Alertboard can display information summaries from a variety of sources. The Alertboard is made up of modules of data called alertlets. The alertlet can be either a group of data displayed, or a summary of information from an alternate source. This last category would include any alertlet that has a drilldown capability. The Alertboard has drilldown capability to display the HRI (High Risk Incident) Dashboard, the VaR (Value at Risk) Dashboard, NIBBT (Net Income Before Bonus and Taxes) Dashboard, the PIP Dashboard, the Trade Volumes Dashboard, and the Dart Dashboard. The Alertboard also links to the Report Library and to the Balance Sheet Report in the Report Library.

Event Calendar

The Event Calendar allows users to view events, search events according to set criteria, and to create, edit, cancel, and delete events. The application is linked to email, so users invited to an event will be notified by email. The Event calendar was developed in response to requests by CIB Finance, because the application was not in the versions of OPAL used by any other division. OPAL Event Calendar is in the testing phase now. The addition of the OPAL Event Calendar demonstrates how when a division's needs are not met by OPAL's existing functionality, it is relatively painless to add an application to support the new requirements.

The OPAL Finance workshop in London, led by Mr. Barry Zucker, outlined specific improvements to the application that would be made in the coming year. Among these, two goals relate directly to this MQP; Select relevant financial metrics for inclusion in OPAL Finance, and start the process for porting OPAL to a mobile device.

2.3 Financial Metrics for OPAL Finance

Financial metrics are measurements of financial performance. Performance measurement, when done carefully, can efficiently help an organization grow and improve. Improvement can be defined in many ways; for DB Finance, improvement would be increased growth, increased profitability, and creating shareholder value. Financial Metrics allow managers to see summaries of financial information or data that would otherwise require a lot of searching and calculating to know. Metrics can give an indication of the overall health of a

company. Values that indicate the costs of future projects, potential risks of investments, and many other factors can all be considered metrics.

As can be seen in the CIB Finance OPAL Workshop in Appendix A, OPAL Finance will support a variety of metrics to assist management. Determining which metrics, one of the goals of the MQP, will assist managers decision-making and ensure that Deutsche Bank remains competitive. Metrics can be useful for a variety of reasons. All companies have huge variances in the volume of business they conduct, so comparisons between companies can be difficult. Financial metrics can allow meaningful comparisons so managers know how the company is doing compared to past performance, and compared to the industry as a whole. Having access to a variety of metrics is valuable, but metrics can have their negative side as well. Because a metric is a summary tool that displays complicated information in a more simple form, if they are unilaterally relied on to make decisions, poor decisions may result. Metrics all have their drawbacks, because in certain situations, the information given by a metric could be misleading.

Value Based Management is part of a program started in 2009, and one of the key initiatives is to support value creation and reinvigorate performance culture. In April 2009, the Board mandated CFO Stefan Krause to develop VBM concepts. Enabling OPAL Finance to incorporate new relevant metrics will hopefully enable the Global Markets Finance division to continue their successes within Deutsche Bank.

2.4 Financial Regulation

Regulation of the financial industry extends as far back in history as money lenders have existed. However, the first dramatic and overarching regulations in the U.S. to affect the financial sector came into play in the 1930's as an attempt to rectify the problems causing the Great Depression. Since then, there have been several important changes to the regulatory system, which have resulted in the creation of a multitude of regulatory agencies governing the financial industry.

Examining the list of regulatory agencies that currently govern the activities of Deutsche Bank makes this clear; the list includes fifteen agencies. These are Deutsche Bundesbank and German Financial Supervisory Authority (BaFin), Securities and Exchange Commission (SEC), National Association of Securities Dealers Inc (NASD), Municipal Securities Rulemaking Board (MSRB), New York Stock Exchange, Federal Reserve Board/Bank (FRB), Federal Deposit Insurance Corporation (FDIC), National Futures Association (NFA), Commodity Futures Trading Commission (CFTC), US Treasury Department (Treasury), Financial Crimes Enforcement Network (FinCEN), Office of Foreign Assets Control (OFAC), State Banking Departments, State Securities Regulators, and State Insurance Departments.

Financial regulations coming into play this year and next, most notably the Dodd-Frank Act and Basel III accords will have long lasting effects on the

financial industry and the world economy. The intent of each is to stabilize the financial sector and prevent any future crisis. The Dodd-Frank Act, passed in July 2010, is considered to be the biggest change in financial regulation to have passed since the 1930's. With regulations that apply to a wide range of areas in the financial industry, the entirety of the law makes up over 2,300 pages. One of the most controversial features of the Dodd-Frank Act is the creation of many new regulatory agencies with new authority to write and enforce regulations. Because this simply grants to the new agencies the 'ability to regulate' certain areas, the final effect of the law is exceedingly difficult to determine now. The Basel III accords also have their share of controversy.

The Basel reforms originated with the Group of Ten, who created the Basel Committee on Banking Supervision. The Committee has an oversight body consisting of the Group of Central Bank Governors and Heads of Supervision. The Basel Committee was formed in 1974 by the central bank governors of the Group of Ten. The Committee publishes supervisory standards and guidelines, but does not have legal force and no country is obligated to adopt the standards. By allowing the central bank governors to represent their country, the committee intends to encourage international regulatory standards towards convergence. The supervisory standards are intended to be broad, in the expectation that member countries would implement the standards and best practices in the manner best fit to their own national systems. In formulating these standards, the committee attempts to close gaps in international regulations. The committee adheres to two important principles, as summarized by the BIS: that

"no foreign banking establishment should escape supervision; and that supervision should be adequate."

Basel III, an update to the Basel II reforms, will come into effect in 2012. The reforms are intended to make banks stronger and improve their ability to withstand stress. The crisis of 2008 showed weaknesses in the existing regulations. The weaknesses that were exposed are those which Basel III will attempt to fix. The general framework was agreed on in 2009.

2.5 Mobile OPAL

Mobile OPAL is a version of OPAL that will be capable of running on a mobile device, most likely an iPad, and/or an iPhone. Compared to a normal desktop program, a mobile version generally supports less functionality, requires less user input and most importantly, can be powered by and used on a mobile device. The process of converting the existing OPAL ecosystem to a mobile version is called porting, which is explained in more detail in section 2.5.1. Porting the desktop OPAL to a mobile platform is intended to allow access to OPAL while away from a computer. In addition, Mobile OPAL can also be a great tool for communication during meetings. For example, during a meeting, a Finance Director could use Mobile OPAL to easily pull up important data. Currently, for a Finance Director to accomplish this in a meeting, there are only a few existing methods they could use. The most common would be using a laptop or printouts. Both of these alternatives can achieve the same goal, but not without limitations. Portable laptops generally have a size over 10 inches and

weigh over 3 pounds, which is at least 3 inches larger and 1.5 pounds heavier than an iPad. While printouts tend to be less cumbersome than laptops, they don't offer users the ability to view any additional documents a Finance Director may want to have access to at any point in time.

2.5.1 Porting

Porting is the process of adapting an existing software or application so that it can be run on another platform. Generally, this adapting process involves new functionality design and new user interface design. When porting to mobile platforms, developers need to consider what functionality to include on a mobile version, as well how to re-design the user interface.

Developing a successful mobile system involves several steps, including functionality identification, human interface design and final coding implementation. Mobile OPAL development is currently focused on human interface design, particularly user navigation and control experiences modeling. Navigation style defines how a user can go back and forth within the application and find the desired file or application. Control modeling is about how a user performs actions within the application. Common control models include pressing a button, moving a slider, spinning a wheel item picker and typing text in a text field.

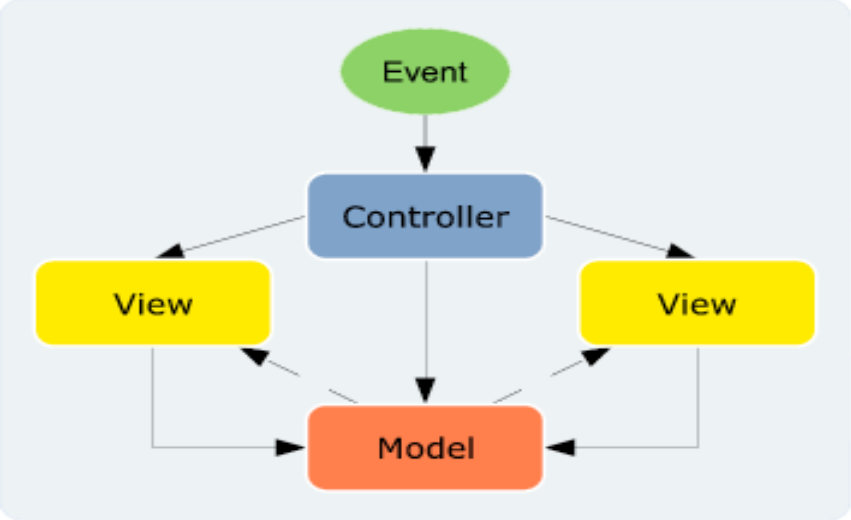
2.6 Mobile Platforms

Mobile platforms, or mobile systems, are operating systems that are run on mobile devices. Sometimes they are also called embedded systems. Cell phones are the most widely used mobile devices. For example, the currently popular iPhone runs on Apple's iOS mobile platform, and various Android phones run on Google's Android mobile system. Besides iOS and Android, there are many other mobile platforms, such at Nokia's S60 and Microsoft's Mobile 7. In addition to cell phones, other non-phone devices such as the iPad can also run on mobile systems. Currently, there are three mobile platforms being considered for development at Deutsche Bank. These are Apple iOS devices, BlackBerry, and Android.

IOS is developed by Apple Inc. and is currently used in iPod Touch, iPhone and iPads. The main developing language for iOS is objective-C, although other languages can also be used for development using language binding and other techniques. To develop applications for iOS devices, a developer needs to have Mac OS installed, which means they need to have a Mac machine.

To develop applications for iOS devices such as iPhones and iPads, a developer can use Xcode for designing, coding and testing. Xcode is a full-featured Integrated Development Environment (IDE) including source code editor, integrated builder and compiler and a graphical debugger. The most important model in iOS programming is called Model-View-Controller (MVC) pattern. That means that every object involved in iOS programming must be a model object, a

view object or a controller object. Figure X shows the relation of the MVC architecture.



During this project, the view objects were of main interest as they were the topic of human interface design, while the other two types of objects were more programming concerned. Some common view objects that may be familiar to users include a button, a label or tab bar. In fact, every visible object that is displayed on the screen is a view object.

BlackBerry 6 is developed by Research in Motion Limited (RIM) and used in various BlackBerry cell phones. RIM provides a plug-in for Eclipse for the BlackBerry 6 application development. Eclipse is a very widely used IDE for Java, so Java developers would find Eclipse a simple way to set up the developing environment and start developing applications.

Android is an open source project and is developed by Google Inc. In contrast to iOS and BlackBerry 6 platforms, Android is not tied to a specific hardware manufacturer. Currently it is used in a variety of cell phones such as HTC's EVO 4G and Motorola's DROID PRO. A developer can also use Eclipse for applications

development. Before using Eclipse, users must install the android Software Development Kit (SDK) on the machine.

2.6.1 Guidelines for Mobile Device Design

Human computer interaction is defined as the way in which a user communicates with a computer. This describes how a user provides input to the computer and how the computer responds to the input. Application users are no longer satisfied simply by what an application can do to satisfy their needs. They are also concerned with the experience of using the application. The interactions required in order to get a desired response should be minimal and should be intuitive. Mobile human interaction can be more complex because of the limited screen size, as well as the limited interaction methods. For example, a user cannot use a mouse with a cell phone. Because of these and other limitations, the human interaction design could be more crucial for the design of an application for mobile devices. A mobile user would not want to spend a lot of time learning to use the application. If the interaction appears frustrating, the user may never use the application again. Because of these limitations, designing human interface and user control models for mobile devices requires more attention and ingenuity than for a computer. The main concern of HCI is the design of interfaces. Three key components of interface designs consist of user requirements, resource and environment constraints and evaluation metrics.

2.7 Cross Compiling

As the mobile application market is drawing more and more attention from both developers and companies, many IT giants such as Microsoft, RIM, and Nokia are trying to establish their own mature platforms. As an example, RIM has recently previewed its new under-developing platform called BlackBerry@ Enterprise Application Middleware that will enable corporate developers to build an enterprise application more easily.

An important consideration for application developers is the fact that there are so many platforms that they would like to be able to run the programs with. With more application markets available, and more choices as a result, avoiding the need to code an application multiple times for multiple platforms is very important. One solution that can help developers avoid coding multiple times is called cross compiling.

The essential idea of cross compiling is that it allows developers write source code in a certain language, which it then compiles and builds into multiple outputs suitable for different platforms. Titanium, developed by Appcelerator, is a good example of a cross compiling platform. A developer can use Titanium to write codes using HTML, CSS and JavaScript, and then Titanium can compile and build the code into both an iOS application and an Android application.

Although cross compiling software is often appealing and useful to developers, the resulting application can sometimes be of poor quality compared to another application built using native Application Programming Interfaces (API). For

example, iOS SDK and Android SDK may have some proprietary APIs. By using a generic set of APIs provided by a cross compiling platform, the saving of developing resources could be at the cost of sacrificing the power of those native APIs. Another disadvantage of cross compiling software is that Apple's new user license agreement (3.3.1) explicitly restricted the use of cross compiling software calling private APIs. It is possible that applications written using a cross compiling technique may be banned in the future.

Chapter 3. Methodology

The Methodology was organized and completed in order to satisfy the goals of the MQP. The project consists of two separate goals, each with several underlying requirements. The two goals were to develop recommendations for including financial metrics in OPAL Finance, and compile recommendations for moving OPAL Finance to a mobile device. In order to develop recommendations for additional financial metrics, an industry best practices review was performed, comparing the performance metrics used by competitors to the Value Based Management project's metrics. Additionally, the team analyzed the current VBM's metrics by researching current articles and papers dealing with performance metrics. The team also reviewed regulatory changes recently enacted, and collaborated with the FD Agenda's workgroups to determine metrics that can assist Finance Director/Managers most effectively. The second goal, compiling recommendations for moving OPAL Finance to a mobile device, required that the team research current standards for mobile application development. In addition to satisfying the above mentioned objectives, the project team was also asked to evaluate the current OPAL program's usability and make recommendations for improvement.

3.1 Objectives

The project this MQP team was asked to complete encompasses two main goals, each with several underlying objectives. The goals were set as follows:

- Assist in determining financial metrics to be included in OPAL Finance.
- Develop guidelines for the creation of a Mobile OPAL Finance program.

The two objectives required very different talents and expertise, so the team divided the work according to the background and abilities of each member. Elizabeth Lapinel, a student in Management Engineering, had taken several finance and accounting courses as well as classes that acquainted her with the foundation of performance measurement. With this background, she was able to complete the objectives necessary to recommend the financial metrics to be included in OPAL Finance. Xing Jin, as a Computer Science major, was familiar with programming requirements and was able to use his years of experience with Computer Science to contribute guidelines for a Mobile OPAL. Despite the fact that the two goals frequently required the team members to work separately, the team worked together on as many occasions as possible. However, when working together was not possible, the team members nevertheless benefited from each other's comments, critiques, and encouragement.

3.2 Prior Knowledge

During the preparation phase of the project, from September to October 2010, the team researched background information in order to become as knowledgeable about the project subjects as possible. The team utilized the extensive resources available in the Library, as well as used the document search

engines available through WPI. General internet searches were performed as well, which were especially useful for the Mobile OPAL objective. The mobile device market and mobile applications for the devices is a new field of knowledge because of the constant change and innovation. As a result, internet sources rather than books and research papers were the most relevant information sources found. The team researched performance metrics for the financial industry, and recent regulatory reforms surrounding the financial industry. The team also considered possible platforms for a mobile device, and researched mobile application guidelines published by device manufacturers. The background knowledge developed during this preparation period was invaluable to the success of the project.

3.3 Value Based Metrics

The project team was asked to assist with determining financial metrics aligned to achieving shareholder value. Once at Deutsche Bank, the team developed an understanding of the FD Agenda and the Value Based Metrics project within Finance. The team then began an industry best practices evaluation, and simultaneously reviewed the possible results from regulatory change surrounding the financial system.

3.3.1 FD Agenda & Finance Director Interview

Deutsche Bank's FD Agenda outlines the areas of a division a Finance Director/Manager has responsibility over. The FD Agenda was a useful tool for development of OPAL Finance, because seeing the clearly laid out

responsibilities of a Finance Director makes it simpler to determine which areas OPAL may be able to assist Finance Directors with in the future. It was deemed necessary to understand the FD Agenda to allow the team to develop an understanding of how OPAL may help the Finance Directors, and what function the metrics should serve. To this end, the team interviewed two Finance Directors: Gary Richard and Lydia Lopiparo. The interview contributed to our understanding of what information the Finance Directors would require from OPAL Finance.

3.3.2 Industry Best Practices Review

Exactly which metrics will provide the most useful information can not be known until after they are in use, but conducting research to discover which metrics are most commonly relied on by the majority of financial companies can indicate which metrics may provide valuable information. To evaluate the current situation of performance measurement in the financial industry, Deutsche Bank competitors were researched to determine which performance metrics (of the VBM or similar to the VBM) they use. The twelve competitors evaluated were determined by consulting Deutsche Bank's internal web page. The news section of the DB intranet contains a section displaying competitors' earnings. The twelve competitors listed are

Bank of America
BNP Paribas
Citigroup
Commerzbank

Credit Suisse
Goldman Sachs
JP Morgan Chase & Co.
Morgan Stanley
Royal Bank of Scotland
Santander
Societe Generale
UBS

Each company was researched using a variety of techniques. Initially, the Annual Report for each company was read, to gain an understanding of which metrics companies would like to have their shareholders see to understand the performance of the company. Many of these annual reports gave a wealth of information about performance measurement, but several companies neglected to explain their techniques in their reports. If the annual report did not reveal a large number of performance metrics, the research was continued, going through press releases and supplementary financial statements as necessary. The information was transmitted in a variety of ways, and so the guidance of many within Deutsche Bank was integral to completing this project. While researching this information, a chart displaying the metrics was initially compiled. These charts, separated by type of metric according to the VBM categories, can be found in Appendix C and Appendix D. Once these initial charts summarizing information were completed, the data was reviewed with several people in Deutsche Bank. This was done in order to get feedback and opinions about which information is likely published and should undergo additional searches. In addition to reviewing the Annual Reports, 'Google-ing' the financial

metric categories along with the company name was employed to search for additional in-company programs or campaigns that would not necessarily be included in Annual Report discussions. After the initial charts were compiled, a chart for each company was created to facilitate an additional detailed search. These charts can be found in Chapter 4: Results. When creating these charts, special attention was paid to whether the metrics found were identical in terminology as those used by Deutsche Bank, or if they were similar but slightly different. The comparison of these two criteria is demonstrated with graphs in Chapter 4: Results. The exact match graphs show the frequency with which the surveyed banks published the exact same metric, and the other graphs show all metrics that present similar information. An example of this is how most banks published their cost/income ratio, but some banks chose to call it the efficiency ratio. Because the cost/income ratio is an efficiency ratio, it presents similar data to a manager, but because the terminology was different, there is the possibility that the bank measures something different. The banks that measured cost/income ratio would be indicated in the exact match graph, but the banks that measure efficiency ratio would be included in the 'all metrics' graph as an acknowledgement that the metric is very similar or possibly the same.

3.3.3 Review of Global Regulatory Change

The regulatory changes occurring in the United States as a result of the Dodd-Frank Act, and the changes that are expected to result from the Basel III accords are important for banks and all the divisions within a bank to stay aware of. To ensure that the recommended metrics are relevant within the context of new

regulations, the team was asked to review the changes and report on which new regulations may affect the metrics being recommended. During the preparatory period starting in September 2010, the team researched the Dodd-Frank Wall Street Reform and Consumer Protection Act. The Act is more than 2,300 pages in length, and many of the clauses reference other previous laws. Because of these factors, reading the law to gain an understanding of the changes seemed an impractical approach. Instead, the overview of the law published by Congress, and reviews published by the Harvard Law Blog were relied on for summary information. The review of changes likely to result from Basel III followed a similar structure, with summaries relied on, rather the text of the guidelines. Although some guidelines have been released, they are published for public comment and changes are expected. The Basel III review had to rely on summaries and articles discussing what regulations will most likely be agreed on. Basel III will most likely be implemented in December 2012, and is still under discussion. While reviewing both regulations, any changes affecting capital ratios were given special focus for this portion of the project. The regulatory review portion of the report can be found in Chapter 4: Results.

3.4 Mobile OPAL development

Mobile OPAL design must take into account many different criteria and design requirements. In order to adequately review these requirements, the project considered several areas of design. Platforms that could support Mobile OPAL were compared, an assessment framework for applications was created, and a

best practices overview of navigation techniques for mobile devices was performed. Finally, the MQP team was asked to create a tentative prototype design for three Mobile OPAL applications: PIP-Dashboard, FI-Calendar and FI-Control Dashboard. Before starting the design, the team became more familiarized with these three OPAL applications. In particular, more attention was paid to their main supported functionalities and interface layouts. Then a list of functions suitable for being ported to mobile version was created. While developing the prototype mockups, Balsamiq Mockup and Interface Builder in Xcode were used to create the mockup interfaces. While both of them shared the same purpose, the detailed level and diversity they provided were different.

3.4.1 Platform Comparison

This objective was to compare some of existing mobile developing platforms, particularly cross compiling platforms. One comparison method specifically suggested was to create a matrix displaying strengths, weaknesses, supporting mobile systems and programming languages for each developing platform. To achieve this objective, the online research was combined with results from experimentation with Titanium Mobile and Qt. At first, online sources were gathered in an excess way to gain a comprehensive understanding about the available platforms. Then some popular cross compiling platforms were chosen for more detailed analysis and comparisons. In addition to these online resources, the platforms were installed and experimented with by writing and running several programs in them.

3.4.2 Development of Assessment Framework

This objective was to develop a framework for assessing existing and new requirements for an application. The framework was essentially a checklist that showed both pros and cons. The framework was constructed in two perspectives: the functional perspective and the aesthetical perspective. Apple's HIG provided very important information. By summarizing all the contents throughout the guidelines, the framework represents a comprehensive understanding of what features result in a good iOS application.

3.4.2 Navigation Research

The MQP team was asked to compare different navigation and control models for mobile devices and to recommend the best options for Mobile OPAL. The analysis for this objective was divided into two categories: cell phones and tablets. To accomplish this, instead of having a broad study for all cell phone and tablet platforms, the analysis was focused on iPhones and iPads, and was then extended to Android and Blackberry devices.

To achieve this objective, three steps were taken for both navigation and control design. The first step was to examine currently implemented models. Next, based on the compatibilities with Mobile OPAL, some unsuitable models were removed from consideration or ranked as avoid-if-possible. At the last step, the results obtained in the second step were compared to the built-in Mail application and the analysis was further leveraged. Although the examination for navigation design was carried out for iPhones and iPads separately, the control design was analyzed jointly. The information for the three-step analysis came from Apple's

Human Interface Guidelines (HIG), personal user experiences and online researches. Research for relevant navigation and control design and common industry practices commenced as soon as this objective was established and was worked on with highest priority.

3.5 OPAL Finance User Experience Evaluation

The MQP team was asked to identify possible issues for users in the existing desktop OPAL system. The applications experimented with were Finance Alertboard, Finance PIP Dashboard, Finance Event Calendar, GBS Control Dashboard, GBS Trade Volume, GM DART Dashboard, GM VaR Dashboard, GBS HRI Daily Escalation and Report Library. To achieve this objective, each application was tested by trying to perform all available actions. All the atypical user experiences identified during this process were summarized after all experiments were done.

Chapter 4. Results and Analysis

This MQP had two separate goals. One was to conduct an industry best practices review in conjunction with a review of regulatory changes to the financial industry, and make recommendations based on these reviews for which financial metrics might be best to include in OPAL Finance. The other was to complete an analysis of best practices for mobile applications and compile recommendations for the future Mobile OPAL program, and to create a framework to assess which OPAL applications would best fit in a mobile format. These recommendations for both portions of the project were completed with the assistance of many people at Deutsche Bank. This chapter explains the results of the two parts of the project.

4.1 Financial Metrics and Industry Best Practices

This portion of the MQP requested that an industry best practices review be conducted based on Deutsche Bank's VBMs, and that a review of the changes in financial regulations be performed. Before the project was narrowed down to the VBMs, the team first considered how OPAL Finance might help Finance Directors/Managers, and interviewed two FDs. Once the focus of the project was determined to include only the Value Based Metrics, the team began an industry best practices review of twelve Deutsche Bank competitors to determine which of the competitors depend on similar metrics. The following sections represent the results of the work done to satisfy those objectives.

4.1.1 FD Agenda and FD Interview

To enable OPAL Finance to support the Finance Director/Manager role, understanding the responsibilities of a typical Finance Director/Manager was vital. The team became familiar with the FD Agenda, and attempted to determine areas of responsibility that might benefit from inclusion in OPAL Finance. The Finance Director/Manager role, as described on the Group Finance webpage, is

> "to act as the principal point of contact with the business and to partner with stakeholders, provide validated data, develop business solutions, and provide regulatory coordination and translation".

The FD Agenda was created to assist Finance Director/Managers to better perform their roles and to allow them to determine where they need support. The FD Agenda is not a list of areas that OPAL should be able to assist the FDs performance, so some of the requirements cannot easily be assisted by applications in OPAL.

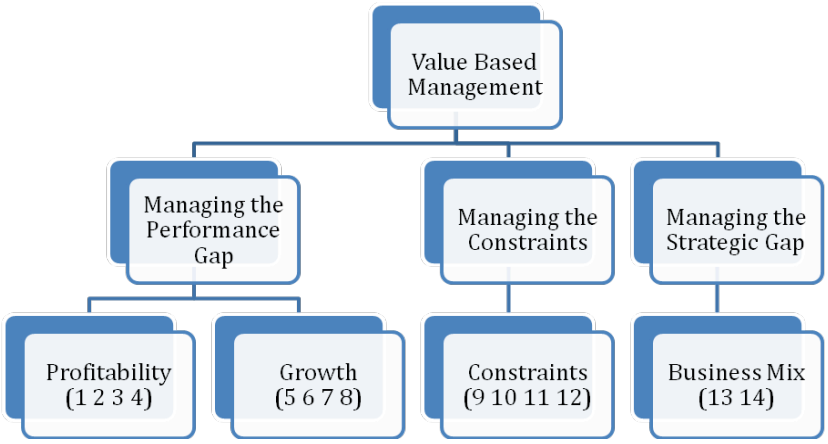
The MQP team members interviewed Lydia Lopiparo, and Gary Richard. The intent of the interview was to discover areas of an FD's responsibilities where OPAL Finance might be able to assist. The tasks that FDs must complete are outlined in the full FD Agenda. The MQP team selected tasks that could be assisted by adding applications to OPAL or by implementing new functionality into already existing applications. The resulting chart can be found in Appendix B – FD Interview. The interview with Finance Director/Managers Lydia Lopiparo and Gary Richard allowed a better understanding of what information Finance Director/Managers need in order to accomplish their goals and it also

contributed a better understanding of the varied ways OPAL has the potential to help them in the future.

4.1.2 Value Based Management

After a period wherein the team members became familiar with the FD Agenda and the OPAL Space program, it was decided to narrow the focus of the project to one specific section of the FD Agenda. The team was asked to assist with determining the financial metrics from the Value Based Metrics project for inclusion in OPAL. It was expected that inclusion of these metrics would help Finance Directors track performance and manage more efficiently

The Value Based Management program created Value Based Metrics; the team was asked to evaluate these metrics for eligibility to be included in OPAL Finance. The Value Based Management program, sponsored by CFO Stefan Krause, is a part of the initiative to 'reinvigorate the performance culture' of Deutsche Bank. The program identified a set of core metrics that best support the goals of increased shareholder return. The chart below demonstrates how these metrics have been categorized. Managing the performance gap, managing constraints, and managing the strategic gap are three areas of focus that can help managers understand the performance of their business. Managing performance has two sub-categories; measuring profitability, and measuring growth. The metrics for each section are key performance indicators that support understanding the profitability, growth, compliance with constraints, and current strategic business mix.



Profitability

1. Return on Equity
2. IBIT
3. Cost/Income ratio
4. Economic profit

Growth

5. Revenue growth
6. IBIT growth
7. Asset growth
8. Economic profit growth

Constraints

9. Tier-1 ratio
10. Leverage ratio
11. Liquidity (in %)
12. Economic capital usage

Business Mix

13. Share of classic banking
14. Revenue from growth regions

Metric Definitions:

Profitability Metrics

RoE – Return on Equity (in %) = $\frac{\text{IBIT Attrib. to shareholders}}{\text{Average Active Equity}}$

RoE indicates relative profitability in relation to a scarce resource

EP - Economic Profit = IBIT – Cost of capital x AAE

EP indicates risk-adjusted profitability in absolute terms

IBIT – Income Before Income Taxes

IBIT indicates bottom-line profitability in absolute terms

CIR – Cost-income ratio (in %) = $\frac{\text{Non interest expenses}}{\text{Net revenues}}$

Growth Metrics

Net Revenue Growth: Top-line growth to show change of sizing

EP Growth: Risk-adjusted growth to monitor only risk-fueled growth

IBIT Growth: Bottom-line growth to include cost aspects

Asset Growth: Additional focus on change of balance sheet size

Constraints Metrics

Tier-1 ratio (in%): Regulatory required ratio

Economic Capital usage: Alignment between risk appetite and risk taking

Leverage ratio: Regulatory requirement, overview of balance sheet usage

Liquidity: Information on stability of non-interbank related funding mix

Business mix

Share of classic banking: Shows non-investment banking activity

Share of growth region: Addresses involvement in growth regions

(Definition of Group Metrics – Value Based Management November 2010
Deutsche Bank Group Analysis & Reporting)

An interesting fact to note is that several of the Value Based Metrics included are not considered metrics by most usual definitions. As was found while

researching the VBM categories, typically financial metrics usually include only ratios. Information from a company's financial statements would be used to calculate the ratios, but these numbers themselves were not considered to be metrics. Accordingly, despite the fact that the numbers are frequently used to measure performance, certain metrics included in the VBM did not show up in the research for financial metrics within each category. These include IBIT, Economic profit, Revenues Costs, Average Active Equity, Assets, and Total Equity Adjusted. Despite this, the data from financial statements can nevertheless function as performance measurements and give valuable information to managers when displayed against benchmarks.

The MQP team researched each category of performance metric; Profitability metrics, Growth metrics, Regulatory Constraints metrics, and Business Mix metrics. The research included internet searching, and use of WPI's Library, which yielded valuable resources.

The first category of the VBM researched was profitability metrics. Profitability ratios generally display earnings generated versus the resources invested in an activity. The research of common profitability metrics gave fairly consistent results. Two very typical profitability ratios are return on assets, and return on equity. The return on assets ratio is a measure of how effectively assets are being used to generate profits. The return on equity ratio is a measurement of profits earned for each dollar invested. Return on equity is a direct measurement of increased shareholder value.

Growth metrics were a less common category of financial ratios. Although every company tracks growth in some way, simply comparing the income statement or balance sheet data to that of previous years is the most common method seen. Growth metrics, however, can still offer valuable data when benchmarked appropriately. Common growth ratios are revenue growth, net income growth, and asset growth. The growth ratios tend to be measured on a yearly basis.

Constraint metrics, the third category in the VBM, is a particularly uncommon category for metrics, meaning this is not a category of metrics often considered to measure performance. Despite this, the constraint metrics that Deutsche Bank's VBM specifies are extremely common. The measurement of the Tier-1 capital ratio is required by regulations, and so was not surprising to find that it is a commonly measured type of metric.

The final category, Business Mix, is also a relatively unusual performance measurement category. Despite this, the information delivered can be extremely useful, as it displays which areas are performing well, and what types of businesses are performing well.

In addition to contributing to the team's understanding of the VBM metrics, the research conducted revealed that appropriate benchmarking can greatly influence the usefulness or effectiveness of any metric. As a metric displayed without benchmarking is just a number, it could easily lose meaning for the manager who is supposed to understand the meaning and make decisions based on the metric.

4.1.3 Industry Best Practices Review

In order to conduct the industry best practices review, annual reports, press releases, publications, and the investor relations portions of websites were examined for references to the metrics included in the VBM. This analysis shows the metrics that the banks rely on, and want their shareholders and the public to know about. The possible weakness inherent to such an investigation is the fact that although many companies may use all or most of the performance metrics being researched, they would not necessarily be willing to publish every metric used for internal evaluation. In order to try to mitigate the affect this weakness might have on the team's ability to analyze the results of the industry best practices review, the publications available to the public from Deutsche Bank were read. The team attempted to conduct the same research for Deutsche Bank as was performed for the other companies, in order to understand which metrics Deutsche Bank may measure, but refrain from publishing. This additional information helped to evaluate which areas the industry best practices results may be the least accurate.

Despite this limitation, this industry best practices review will allow a better understanding of what Deutsche Bank's competitors want their shareholders to know about the company. If they publish a set of metrics including some of the VBM metrics, it is likely that the intent is to convince the public of their ability to develop shareholder value. Because of this connection, the industry best practices review can benefit Deutsche Bank by improving their understanding of

competitor activity, as well as having an indication of which metrics may be directly connected to increased shareholder value.

The twelve competitors surveyed were

Bank of America
BNP Paribas
Citigroup
Commerzbank
Credit Suisse
Goldman Sachs
JP Morgan Chase & Co.
Morgan Stanley
Royal Bank of Scotland
Santander
Societe Generale
UBS

These companies were chosen for the best practices review because Deutsche Bank displays these twelve as competitors on their internal webpage. The companies all share many similarities with Deutsche Bank. These banks are global investment banks that offer a wide range of products and services to their clients. Bank of America, Citigroup, Goldman Sachs, JP Morgan Chase & Co., and Morgan Stanley are all US banks. Royal Bank of Scotland, Santander, Societe Generale, UBS, BNP Paribas, Commerzbank, and Credit Suisse are European banks. As portions of annual reports are often written to encourage shareholder confidence, the industry best practices review started with reading each company's annual report. Additionally, reading through their investor relations web pages gave additional insight into what each company considered

important to convey to their shareholders. In some cases, even with reading through these documents and webpage, similarities were scarce between the VBMs used by Deutsche Bank and the metrics that the companies published. In such cases, additional documents published by the company were read.

Each competitor's Annual Report was read, with extra attention given to any 'Management Discussion' or similar sections. If reading the Annual Report did not result in many metrics being identified, the press releases and company website 'Investor Relations' page were examined. Because the performance measurement trends can change very quickly (for example, the VBM project began in 2009), only documents released between 2009 and 2010 were used in the industry best practices review.

The metrics that each company used were compared against metrics that came from two sources: the Value Based Metrics page from the Group Finance intranet website, and the proposed metrics for inclusion in OPAL Finance from the "Working Group Overview" PowerPoint presentation. The metrics are displayed according to their source:

The **Performance**, **Balance Sheet**, and **RWA** metrics were proposed to be included in OPAL Finance (see "Working Group overview – BPA" page 3) but are not included in the original VBMs explained on the VBM intranet page. Two Business Mix metrics were also not included in the original VBMs - RoA and RoTCD. Although this portion (Profitability, Balance Sheet and RWA) was included in the industry best practices review, variances were minor and this

section was not included in discussion. The charts of data collected for this portion of the best practices review can be found in Appendix C – Performance, Balance Sheet & RWA Charts.

The VBMs are divided into four sections – **Profitability**, **Growth**, **Constraints**, and **Business Mix**. This follows the original divisions as set by the Group Finance Management Agenda's release of the Value Based Management guidelines.

However, the Growth metrics were removed from the "Working Group overview" suggestions for metrics. Although there were discrepancies between the chart seen below (taken from the "Working Group Overview PPT) and the original VBMs proposed as part of the Value Based Management project, all metrics mentioned by both of these sources were included.

Revenues / Costs and VBM metrics		
Performance	**Revenues**	
	Comp. and benefits	
	Non. Comp direct costs	
	Indirect costs	
	Costs	
	IBIT	
	IBIT Annualised	
B/S	Average active equity (AAE)	
	Total assets (USGAAP)	
	Average Total assets (USGAAP)	
	Total Equity Adjusted	
Risk	Average RWA	
	Tier 1 Capital	
VBM metrics (excl. Growth)	Profitability	RoE (in %)
		Economic profit (in EUR m)
		IBIT (in EUR m)
		CIR (in %)
	Constraints	Tier-1 ratio (in %)
		Economic capital usage (in %)
		Leverage ratio (in %)
		Liquidity ratio (in %)
	Mix	RoA (in %)
		Growth regions (in %)
		RoTCD(in %)

The metrics mentioned in the chart to the left, as well as the metrics specified in the original VBM chart (seen in section 4.1.2) were all included in the industry best practices review. The chart is missing the Growth section, but has two additional metrics in the Business Mix section: RoA and RoTCD.

Deutsche Bank

Although the VBM project originated in Deutsche Bank, one limitation to the industry best practices review was the possibility that banks use these metrics, but do not publish their results unless mandated. As a way to help determine which metrics might be used by a company, but purposefully not published in annual reports or financial statements, the same review of Deutsche Bank publications was conducted as was done for the other twelve companies.

Value Based Metrics – Deutsche Bank	Profitability	RoE	Return on average shareholder's equity
		Economic Profit	Net income
		IBIT	Income before income taxes
		CIR	Cost-income ratio
	Growth	Revenue Growth	Revenue growth
		IBIT Growth	IBIT compared to previous years, but no metric provided
		Asset Growth	Asset growth
		EP Growth	Pre-tax profits
	Constraints	Tier-1 ratio	Tier-1 ratio
		Leverage ratio	Leverage ratio
		Liquidity ratio	Liquidity ratio
		Economic Capital Usage	Economic Capital Usage
	Business Mix	Share of Classic Banking	
		ROA	RoA
		Revenue from growth regions	
		RoTCD	

Deutsche Bank's VBMs for the most part shared a lot of similarities with the metrics Deutsche Bank elected to publish. The only category of VBM where this was not true was the Business Mix category; Share of Classic Banking was not found in the reports or webpage, nor was Revenue from growth regions or RoTCD.

The findings for this review may indicate that the results for the Business Mix category of metrics may not be as relevant as the results for the other categories would be. This was determined based on the fact that if Deutsche Bank chooses not to publish certain metrics to the public that are being measured, competitors will likely exhibit the same behavior and refrain from publishing some of those metrics. Because of these findings, it cannot reasonably be concluded that other banks do or do not use the Business Mix metrics

Bank of America

Value Based Metrics – Bank of America	Profitability	RoE	Return on Average Equity, Return on Average Assets
		Economic Profit	Economic profit
		IBIT	IBIT
		CIR	Efficiency ratio – fully taxable equivalent basis expense over taxable revenue
	Growth	Revenue Growth	Revenue growth, net interest income growth
		IBIT Growth	
		Asset Growth	Asset growth
		EP Growth	
	Constraints	Tier-1 ratio	Tier-1 common, Tier-1 total
		Leverage ratio	Tier-1 Leverage
		Liquidity ratio	Liquidity ratio
		Economic Capital Usage	
	Business Mix	Share of Classic Banking	Revenue by business
		ROA	ROA
		Revenue from growth regions	
		RoTCD	

Bank of America's industry best practices review resulted in many similarities between the VBMs used by Deutsche Bank and the metrics published. The metrics that Bank of America had in common with Deutsche Bank's VBM were

mostly in the profitability and constraints categories. The growth category is missing two VBMs: IBIT growth, and economic profit growth. The Business mix category is missing Revenue from growth regions; although it was not expected to find a metric with the same exact name, or even that measures the same thing, no similar concept was discussed in the annual report or publications. Additionally, the RoTCD was not found. The Economic capital usage metric was one of the metrics in the Constraints category that was also not identified, nor was a similar metric found in the discussion. However, the review of the publications and website resulted in the identification of return on average equity, IBIT, Efficiency ratio, and the economic profit for the Profitability metrics. For the growth metrics, Revenue growth and Asset growth were identified. In the Constraints category, the Tier-1 ratio, Tier-1 Leverage ratio, and liquidity ratio were found in common with the Deutsche Bank VBMs. Finally, the search for metrics that are the same or similar to the metrics in the business mix category resulted in two metrics. Return on Assets, in the business mix category, was identified. Share of classic banking was not found as a specific metric, but revenue by business was identified by the Bank of America publications. The revenue by business was chosen to stand in for that metric because revenue by business can give an indication of how much of the bank's revenue is due to 'classic banking' activities. This would only require minimal additional analysis, so this metric was included to satisfy that portion of the Business Mix category.

BNP Paribas

Value Based Metrics – BNP Paribas	Profitability	RoE	Return on equity
		Economic Profit	Profit
		IBIT	Gross Operating Income, Net Income
		CIR	CIR
	Growth	Revenue Growth	Revenue growth
		IBIT Growth	
		Asset Growth	Asset growth
		EP Growth	Economic profit growth
	Constraints	Tier-1 ratio	Tier-1 ratio, total ratio, tier-1 capital, total tier-2 capital
		Leverage ratio	Leverage
		Liquidity ratio	Liquidity
		Economic Capital Usage	
	Business Mix	Share of Classic Banking	Revenue by business
		ROA	ROA
		Revenue from growth regions	
		RoTCD	

BNP Paribas's chart indicates similar set of metrics as the Deutsche Bank VBMs. The Profitability metrics category had the same or similar metrics for all four metrics. The one difference, IBIT is not used; rather Gross Operating Income and Net Income are used. The growth section also had many similarities with the Deutsche Bank VBMs; three of the four metrics were exact matches. However,

IBIT Growth was not measured by BNP Paribas. In the Constraints section, the published metrics matched well with Deutsche Bank's VBMs for the most part. The tier-1 capital ratio, leverage ratio and liquidity ratios were all published. However, economic capital usage was not referred to in the reports reviewed. Additionally, the revenue from growth regions and RoTCD in the Business Mix did not seem to have equivalents in the reports read.

Citigroup

Value Based Metrics – Citigroup	Profitability	RoE	Return on equity,
		Economic Profit	Profit
		IBIT	Income (net of taxes)
		CIR	
	Growth	Revenue Growth	Revenue growth
		IBIT Growth	
		Asset Growth	Asset growth
		EP Growth	
	Constraints	Tier-1 ratio	Tier-1 capital
		Leverage ratio	Leverage ratio
		Liquidity ratio	Liquidity ratio
		Economic Capital Usage	
	Business Mix	Share of Classic Banking	
		ROA	RoA
		Revenue from growth regions	Revenue by region
		RoTCD	

Citigroup's review revealed a few more differences than some of the other banks. The Profitability section, which for the previous two banks described had matched on all four metrics, only had three matches – RoE, profit, and Income. The term Income (net of taxes) was used, rather than IBIT. The growth section showed revenue growth and asset growth, but was missing IBIT growth and economic profit growth. However, the regulatory constraints section matched for the first three, Tier-1 ratio, leverage ratio and liquidity ratio, and only was lacking a metric for the last metric, economic capital usage. Finally, the Business mix section again had metrics portraying similar information for RoA and Revenue from growth regions; the bank did not measure revenue from growth regions, but it did measure revenues by region, which with minor analysis could indicate revenue by growth region.

Commerzbank

Value Based Metrics – Commerzbank	Profitability	RoE	Operating return on equity
		Economic Profit	Operating profit
		IBIT	Pre-tax result
		CIR	CIR
	Growth	Revenue Growth	Earnings growth
		IBIT Growth	
		Asset Growth	Asset growth
		EP Growth	
	Constraints	Tier-1 ratio	Tier-1 Capital ratio, Core capital
		Leverage ratio	Leverage ratio
		Liquidity ratio	Liquidity
		Economic Capital Usage	
	Business Mix	Share of Classic Banking	
		ROA	
		Revenue from growth regions	
		RoTCD	

Commerzbank's results show matches for the four profitability metrics, three constraint metrics matches on only two of the growth metrics, and none of the business mix metrics. In the profitability metrics, the metrics used were slightly different terms than what are used by Deutsche Bank. The Operating profit, operating RoE, and Pre-Tax result were substituted for economic profit, RoE and

IBIT. For the growth section, earnings growth was substituted for revenue growth, and asset growth was identified. The IBIT growth and economic profit growth, however, were not. The Constraints section was lacking only the economic capital usage, and there were no matches for the Business Mix category.

Credit Suisse

Value Based Metrics – Credit Suisse	Profitability	RoE	RoE
		Economic Profit	Net income margin, profit
		IBIT	Pre-tax income margin
		CIR	CIR
	Growth	Revenue Growth	Revenue growth
		IBIT Growth	
		Asset Growth	Net New Asset Growth
		EP Growth	Profit Growth
	Constraints	Tier-1 ratio	Tier-1 ratio, total capital ratio
		Leverage ratio	Leverage ratio
		Liquidity ratio	Liquidity
		Economic Capital Usage	
	Business Mix	Share of Classic Banking	
		ROA	ROA
		Revenue from growth regions	Net new assets by region
		RoTCD	

Credit Suisse's results show that many of the same profitability metrics are used as are indicated in the Deutsche Bank VBMs. However, for IBIT and economic profit, similar metrics were used rather than exact matches. These are net income margin and profit, and the pre-tax income margin. The growth section shows that the IBIT growth was not indicated in the publications, but the profit growth, revenue growth, and net new asset growth were all there. The constraints section matched for three of four, only missing the economic capital usage metric. The Business Mix section, however, was missing two of the metrics; Share of Classic Banking, and RoTCD. Additionally, the Revenue from growth regions was not measured by Credit Suisse, but Net new assets by region was, and was used as an equivalent.

Goldman Sachs

Value Based Metrics – Goldman Sachs	Profitability	RoE	RoE
		Economic Profit	Profit
		IBIT	Pre-tax earnings
		CIR	
	Growth	Revenue Growth	Revenue growth
		IBIT Growth	
		Asset Growth	Asset growth
		EP Growth	Profit growth
	Constraints	Tier-1 ratio	Tier-1 ratio, total capital ratio
		Leverage ratio	Leverage ratio, adjusted leverage ratio, tier-1 leverage ratio
		Liquidity ratio	Liquidity, debt to equity ratio
		Economic Capital Usage	
	Business Mix	Share of Classic Banking	
		ROA	ROA
		Revenue from growth regions	Assets by region
		RoTCD	

Goldman Sachs' results are unusual for the Profitability category. The RoE, Profit, and pre-tax earnings all matched, but there was no Cost/Income ratio found or other efficiency measure that would be comparable. In the Growth section, the review showed that revenue growth, asset growth, and profit growth were all measured, but IBIT growth was not. The Constraints section matched for the

tier-1 ratio, leverage and liquidity ratios, but economic capital usage or other similar metrics were not found. In the Business Mix section, the Share of classic banking and RoTCD were not evident in the publications. However, ROA and Assets by region were found for the Business Mix category.

JP Morgan Chase & Co.

Value Based Metrics – J P Morgan Chase & Co.	Profitability	RoE	RoE
		Economic Profit	earnings
		IBIT	IBIT
		CIR	Efficiency ration
	Growth	Revenue Growth	Revenue growth
		IBIT Growth	
		Asset Growth	
		EP Growth	Earnings growth
	Constraints	Tier-1 ratio	Tier-1 capital ratio, total capital ratio, tier-1 common capital ratio
		Leverage ratio	Tier-1 leverage ratio
		Liquidity ratio	Liquidity
		Economic Capital Usage	
	Business Mix	Share of Classic Banking	
		ROA	ROA
		Revenue from growth regions	Revenue by region
		RoTCD	

The JP Morgan Chase & Co. review shows again that the Profitability section is the most consistently measured area. The RoE, earnings, IBIT, and efficiency were all matched with the metrics in this section. In the growth section, there were only two similar metrics; revenue growth and earnings growth, The IBIT growth and Asset growth were not published in the reports. In the constraints section, the standard three ratios (required by some laws) were evident; the tier-1 ratio, leverage ratio, and liquidity ratio were all found in the report. Economic capital usage was not found. In the Business Mix section, there were only two matches; ROA and revenue by region.

Morgan Stanley

Value Based Metrics – Morgan Stanley	Profitability	RoE	Ro(average)E
		Economic Profit	
		IBIT	Income before tax
		CIR	
	Growth	Revenue Growth	Revenue growth
		IBIT Growth	
		Asset Growth	Asset growth
		EP Growth	Economic profit growth
	Constraints	Tier-1 ratio	Total capital ratio, tier-1 capital, tier-1 common ratio
		Leverage ratio	Tier-1 leverage ratio
		Liquidity ratio	Liquidity reserves
		Economic Capital Usage	
	Business Mix	Share of Classic Banking	
		ROA	ROA
		Revenue from growth regions	Assets by region
		RoTCD	

The Morgan Stanley review showed fewer of the profitability metrics than was typical for most of the companies reviewed. The RoE and IBIT had similar metrics of Return on (average) equity, and Income before tax. In the Growth section, there were three matches; Revenue growth, asset growth, and economic profit growth. The constraints section showed the three usual constraints, tier-1 ratio, leverage

ratio, liquidity ratio and not economic capital usage. Finally, in the business mix section, Morgan Stanley reported the ROA, and Assets by region.

Royal Bank of Scotland

Value Based Metrics – Royal Bank of Scotland	Profitability	RoE	Return on Equity
		Economic Profit	Net interest margin
		IBIT	
		CIR	CIR
	Growth	Revenue Growth	Revenue growth
		IBIT Growth	
		Asset Growth	
		EP Growth	Profit growth
	Constraints	Tier-1 ratio	Core Tier-1 capital ratio
		Leverage ratio	Leverage Ratio
		Liquidity ratio	Liquidity reserves
		Economic Capital Usage	
	Business Mix	Share of Classic Banking	Revenue by business
		ROA	ROA
		Revenue from growth regions	Revenue by region, Assets by region
		RoTCD	

Royal Bank of Scotland reported the RoE, net interest margin, and the cost income ratio for the Profitability section, missing the IBIT metric. The growth section shows Revenue growth and profit growth, missing IBIT growth and Asset growth. The

Constraints section showed the three required ratios: Tier-1 ratio, leverage ratio, and liquidity reserves rather than liquidity ratio. Economic capital usage was not reported. In the Business Mix section, there were three matches; Revenue by business (which was substituted for share of classic banking), ROA, and revenues and assets by region (substituted for revenue from growth regions).

Santander

Value Based Metrics – Santander	Profitability	RoE	RoE
		Economic Profit	Economic profit
		IBIT	
		CIR	Efficiency ratio
	Growth	Revenue Growth	Revenue growth
		IBIT Growth	
		Asset Growth	Asset growth
		EP Growth	Profit growth
	Constraints	Tier-1 ratio	Core Capital, Tier-1 Capital ratio, ratio BIS
		Leverage ratio	Leverage ratio
		Liquidity ratio	Liquidity
		Economic Capital Usage	
	Business Mix	Share of Classic Banking	
		ROA	ROA
		Revenue from growth regions	Revenue by region
		RoTCD	

Santander reported RoE, economic profit, and an efficiency ratio (which was substituted for Deutsche Bank's VBM cost/income ratio) in the profitability section. In the growth section, revenue growth, asset growth, and profit growth were reported. In the constraints section, Tier-1 ratio, leverage ratio, and liquidity were all reported. In the Business mix section, only the ROA and revenue by region (substituted for revenue from growth regions) were reported

Societe Generale

Value Based Metrics – Societe Generale	Profitability	RoE	RoE
		Economic Profit	
		IBIT	IBIT
		CIR	C/I ratio
	Growth	Revenue Growth	Revenue growth
		IBIT Growth	Net banking income growth
		Asset Growth	
		EP Growth	Profit growth
	Constraints	Tier-1 ratio	Tier-1 ratio
		Leverage ratio	Leverage ratio
		Liquidity ratio	Liquidity
		Economic Capital Usage	
	Business Mix	Share of Classic Banking	
		ROA	
		Revenue from growth regions	Sector revenue
		RoTCD	

Societe Generale reported RoE, IBIT, and their Cost/Income ratio for the profitability section. In the growth section, revenue growth and profit growth were reported, and net banking income growth was substituted for the IBIT growth metric from the Deutsche Bank VBMs. In the Constraints section, the tier-1 ratio, leverage ratio, and liquidity ratio were all reported. However, in Business mix, only one metric was reported. Sector revenue was substituted as a metric for revenue from growth regions because it may indicate the revenue from growth regions with minor analysis.

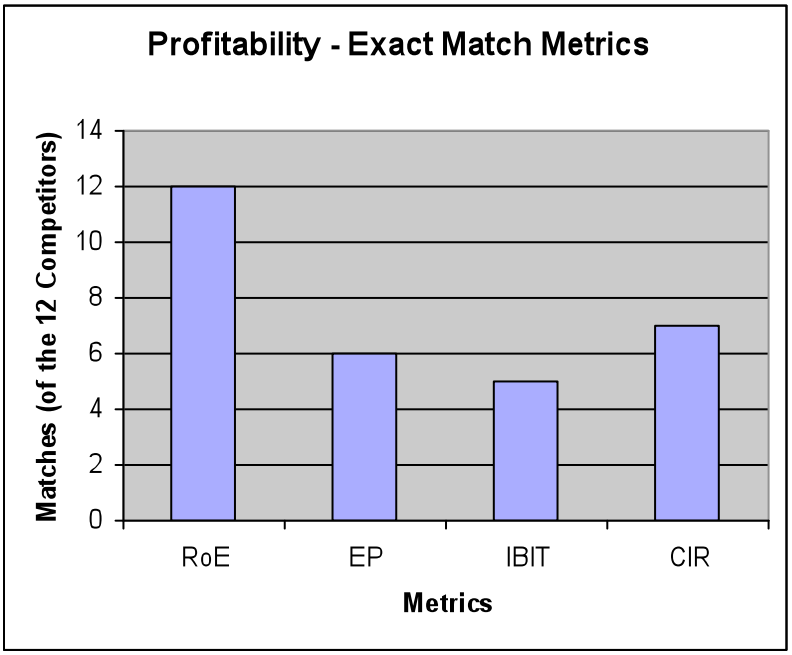
UBS

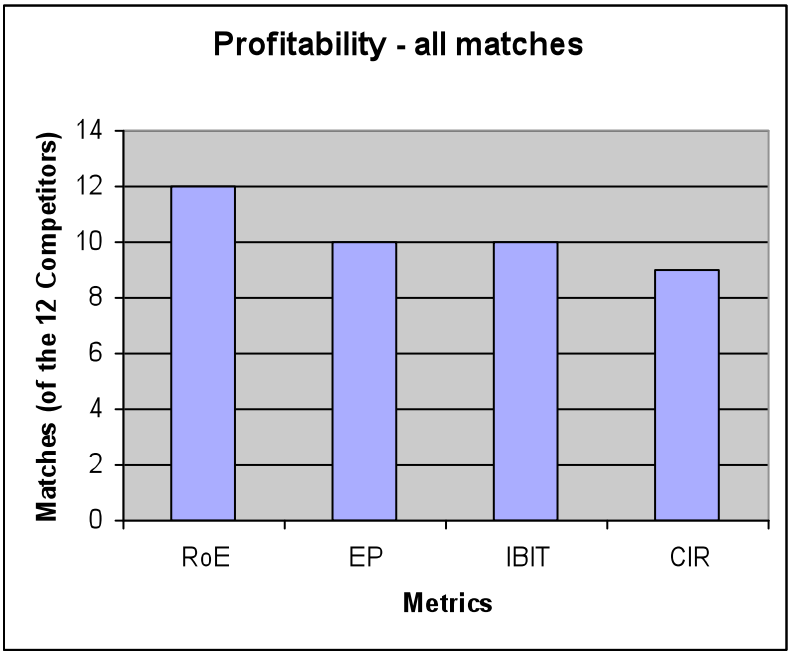
Value Based Metrics – UBS	Profitability	RoE	RoE
		Economic Profit	profit
		IBIT	Operating profit before tax
		CIR	C/I ratio
	Growth	Revenue Growth	Pre-tax profit growth
		IBIT Growth	
		Asset Growth	net new money
		EP Growth	Net profit growth,
	Constraints	Tier-1 ratio	BIS Tier-1 ratio, BIS total ratio
		Leverage ratio	FINMA Leverage ratio
		Liquidity ratio	Liquidity
		Economic Capital Usage	
	Business Mix	Share of Classic Banking	
		ROA	ROA
		Revenue from growth regions	Revenue from growth regions
		RoTCD	

UBS' review resulted in all of the profitability ratios, three of the growth ratios, three of the constraints ratios, and two of the business mix ratios. The profitability metrics reported include RoE, profit, operating profit before tax (substituted for IBIT), and the C/I ratio. In the growth section, the bank reported the pre-tax profit growth (substituted for revenue growth), and net profit growth and net new money, which

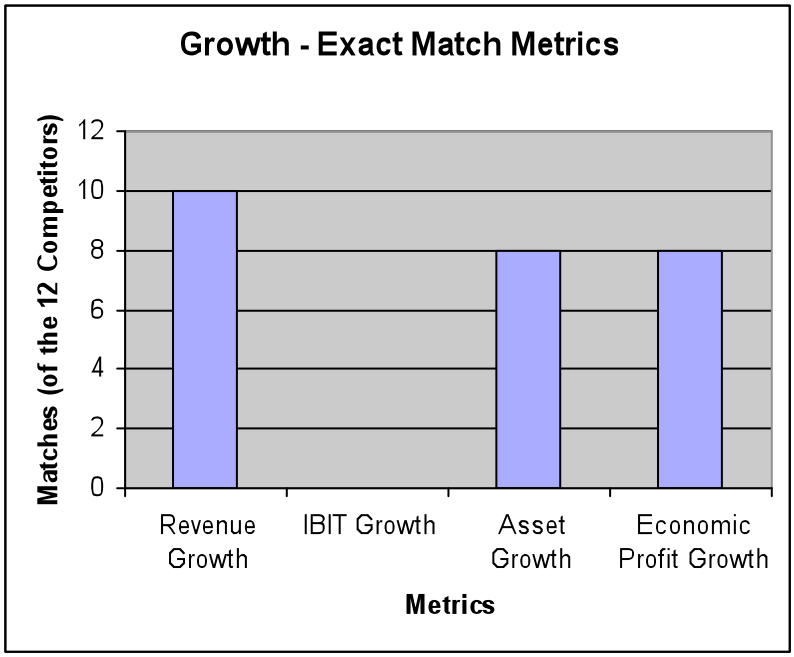
were substituted for economic profit growth and asset growth. The constraints reported include the tier-1 ratio, leverage ratio, and the liquidity ratio. Finally, the business mix section has two reported metrics; ROA, and revenue from growth regions.

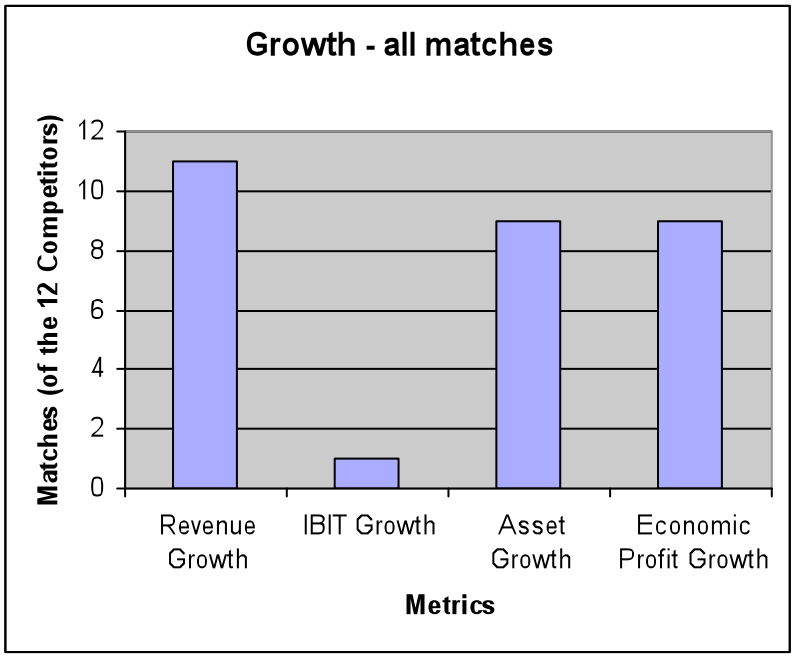
Summary Charts:



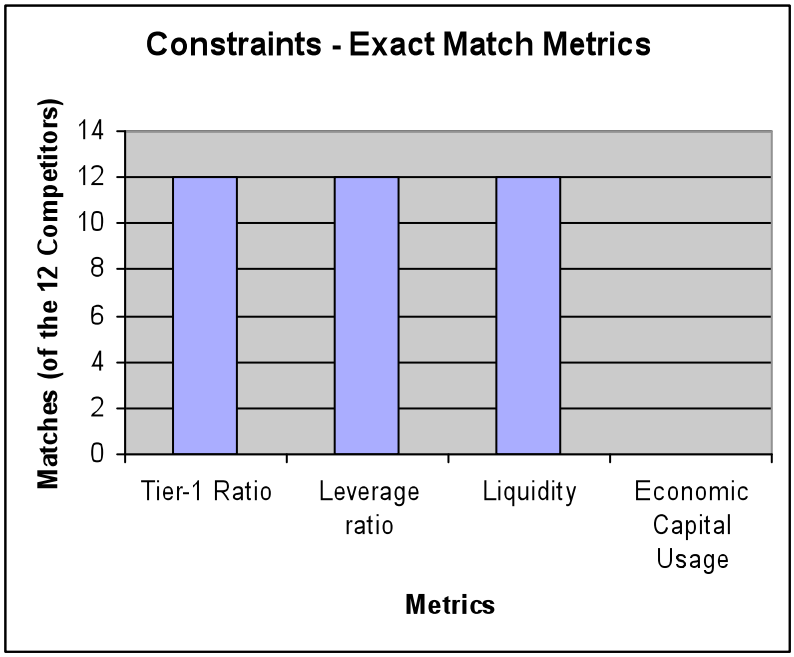


As the two Profitability charts above demonstrate, the Profitability metrics were measured by nearly all companies surveyed, and the metrics did not vary greatly. However, inclusion of metrics published that used slightly different terminology did indicate that profitability is measured by all competitors.

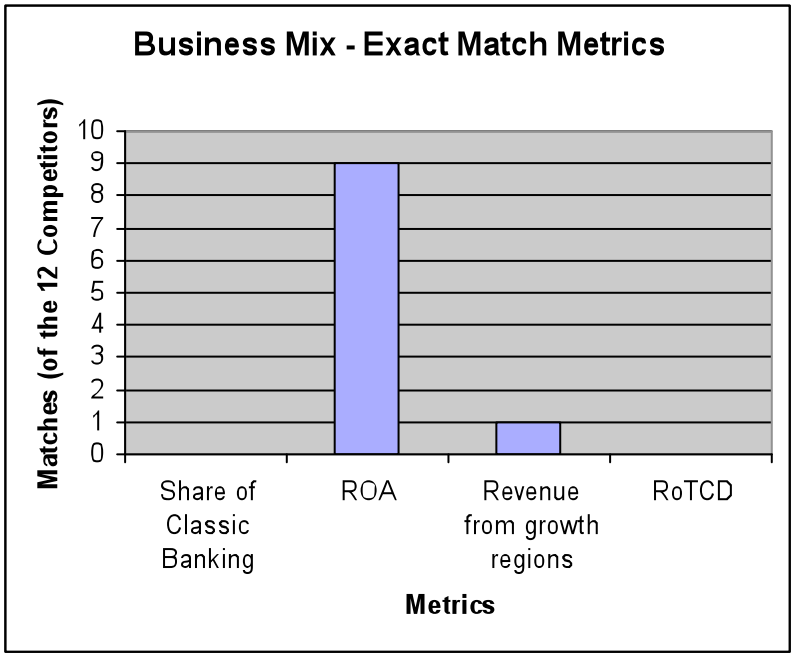


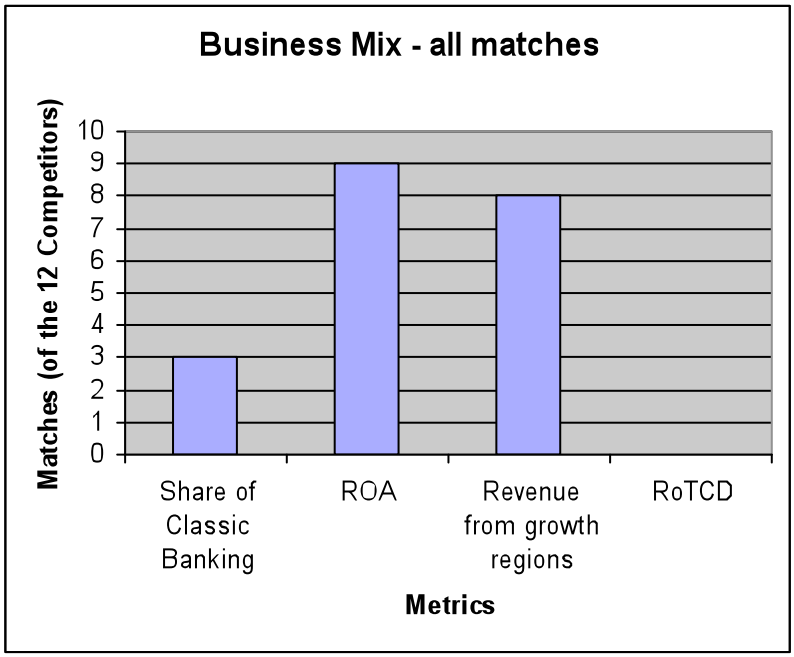


The Growth metric charts shown above demonstrate that many banks are measuring some form of growth, but the exact metrics used are not as consistent as they were in the Profitability category.



The Constraints category was unique in that each of the metrics showed minimal variability, and all companies measured and published these metrics. Accordingly, there were no similar metrics found, only exact matches. The only exception was the Economic Capital Usage metric, which was not measured by any of the companies surveyed. Interestingly enough, Deutsche Bank is the only company who published the 'economic capital usage' metric. However, as this is a form of measuring asset allocation, it is likely that most banks measure asset allocation. The publication of this information may likely be the variance point.





This category resulted in the least matches for using the exact same metrics. However, as was noted in the beginning of this section, Deutsche Bank does not publish three of these metrics, but does measure them. This may indicate that banks

measure these metrics but decide not to publish them, so the results from this portion of the industry best practices review are inconclusive.

Overall, the industry best practices review indicated that the Value Based Metrics used by Deutsche Bank tend to be used by most of their competitors. Specifically, several categories of metrics had near unanimous use.

- The Profitability ratios are very commonly used indicators of profitability. They showed little variation, and were found to be used exactly in the same form as the VBMs used by Deutsche Bank more frequently than the metrics in any other category.

- The Growth category of metrics indicated that many banks are measuring growth in some form or another, but that the way they choose to measure their growth is often very different. This is shown by the fact that there were many banks that used similar but not identical growth metrics.

- The Constraint category of metrics, similarly to the profitability category, showed that practically all banks are using these measurement techniques. This is most likely due to the fact that the Tier-1 Capital Ratio and the Tier-1 Leverage Ratios are required by regulations for many of these banks, and the Liquidity ratio will soon be required. The one metric that did not seem to be as frequently measure was Economic Capital Usage.

- The Business Mix category showed the least consistencies across the companies surveyed. The results of the review indicate that in some

companies, similar metrics like Revenue from Business Sectors and Revenues by Region were measured, which with a bit more analysis, could reveal to their manager the Share of Classic Banking and Revenue from Growth Regions, but finding exact matches to the VBMs used by Deutsche Bank in this category was rare. The results of this portion of the project were determined to be inconclusive because of the fact that Deutsche Bank chooses not to publish many of these, although they are internally measured.

4.1.4 Regulatory Change Review

The regulatory change review portion of the project focused on two regulations that are likely to impact Deutsche Bank in the coming years; the Dodd-Frank Wall Street Reform and Consumer Protection Act, and the Basel III framework. The team researched the Dodd-Frank Wall Street Reform and Consumer Protection Act, which was introduced June, 2010. The very recent nature of the law and the fact that it creates so many new regulatory agencies makes this a very interesting subject to all working in finance. As the Act is over 2,300 pages, and peppered with references to previous legislation, the law would take a long time to analyze and understand if referencing only the text of the legislation. Accordingly, this review has been mostly drawn from the summary by David Huntington et al, published by the Harvard Law School Forum on Corporate Governance and Financial Regulation, with additional valuable information found in the summary of the law provided by the senate public files website.

The 2,300+ page financial regulation, which was passed July 15th, is expansive and the measures touch on a multitude of areas within finance. The Act creates significant changes in the structure of financial regulation. Many of the measures stipulate changes to previous laws in the scope of previous legislation, and others nullify some of the provisions in previous legislation entirely. Most significant to the financial regulatory system is the creation of new independent regulatory agencies, which have the authority to regulate the financial system. Additional measures allow more authority for existing regulatory agencies, the Securities and Exchange Commission (SEC) and the Federal Reserve.

The new agencies established by the Act are the following:

- The Financial Stability Oversight Council
- The Office of Financial Research
- The Consumer Financial Protection Bureau
- The Office of Financial Literacy
- The Federal Insurance Office.

The Financial Stability Oversight Council, a new council created by the Act, also creates within their authority, the Office of Financial Research, which would be housed and funded by the Treasury. The Financial Stability Oversight Council would have sixteen members. Among the sixteen members, the council must include representatives from the Treasury, the Federal Reserve Board, the SEC, CFTC, OCC, FDIC, FHFA, NCUA and the Consumer Financial Protection Bureau. Additionally, one member, called the independent member, must have insurance expertise. The

creation of the Financial Stability Oversight Council is intended to identify and respond to risks in the financial system. The Council is authorized (by a 2/3 vote) to require a non-bank financial company be regulated by the Federal Reserve. The council is also authorized to make recommendations to the Federal Reserve pertaining to requirements for companies as they grow, break up large companies (by a 2/3 vote), and make risks transparent by publicizing information.

The Consumer Financial Protection Bureau will be funded and housed by the Federal Reserve, but will be independent of the Fed. The CFPB will have authority to write rules that will govern all financial institutions, as well as the authority to enforce regulations for large financial institutions. Currently, consumer protection responsibilities fall within several offices and agencies. The creation of the CFPB is intended to make consumer protection the responsibility of one agency. Another office created as a result of the Act is the Federal Insurance Office. This office will collect information and monitor the insurance industry for any risk indicators. This office will also streamline state insurance regulations. A measure included in the Dodd-Frank Act also establishes an Office of Minority and Women Inclusion in all federal banking and securities regulatory agencies. This office will be tasked with increasing employment among women and minorities in the banking industry. Within the SEC, an Office of Credit Ratings will be created, which will have the authority to fine other agencies.

The Dodd-Frank Wall Street Reform and Consumer Protection Act also created many new rules for financial entities. Many of these rules include efforts to increase

transparency and accountability, by mandating that banks and financial companies publish certain information regularly, or that they make that information available to regulatory agencies. An example is the hedging disclosure requirement. This measure requires that the company disclose if employees or directors are permitted to purchase hedge fund financial instruments or not. OTC derivatives, asset-backed securities, mortgages and other financial instruments are all more strictly regulated as a result of the changes in this Act. Other sections mandate minimum risk securities retained, to decrease the risk that financial companies are able to take on. This Act also requires that executive compensation be published, and that stockholders have a say in corporate affairs (say-on-pay and say-on-golden-parachute).

New regulations also try to fix the moral hazard issue that arose as a result of the Too-Big-To-Fail Bailouts: Any large bank holding company that has received TARP funds cannot avoid Federal Reserve supervision by dropping the bank. To prevent this, a measure of the Act states that any company that was a bank holding company and received financial assistance under TARP will be treated as a non-bank financial company supervised by the Federal Reserve if the company ceases to be a bank holding company. The threshold for federal regulation of financial companies was also increased as a result of this Act: if a financial company has assets over twenty-five million, they now must submit to federal oversight and regulation and must register with the SEC.

The Act also focuses on reworking the influence of credit ratings in the financial system. The writers of the legislation wanted to decrease reliance on credit ratings. The resulting laws include nullifying Rule 436(g) of the Securities Act of 1933. This, as well as the new Office of Credit Ratings will give the SEC more authority over credit rating agencies. The SEC can now deregister an agency for providing bad ratings, something that previously was more difficult to do. To ensure that rating agencies are publishing the most accurate information, there are additional regulations requiring that ratings analysts pass qualifying exams.

The Dodd-Frank Financial Legislation also strengthens the effect of previous legislation. The measures include an increased liability for stockholders against agencies. Many additional penalties for lenders have been written into this Act, in an effort to protect consumers from the repercussions of bad deals. One measure specifies that bad actors, (defined as any person with a security filing felony conviction, or is barred from association with regulated entities because of fraud, or who has violated any fraud or manipulation law) cannot participate in offering securities or other financial instruments. The SEC enforcement has also been strengthened, by increasing monetary penalties, expanded federal jurisdiction, and expanded liability under section 20 of the Exchange Act.

In addition to researching the Dodd-Frank Wall Street Reform and Consumer Protection Act, the upcoming Basel Accords were researched. Basel III is a set of reform measures intended to improve the strength and integrity of banking industry regulations. The measures are being developed by the Basel Committee on

Banking Supervision. The Committee published proposals for what Basel III could be expected to address in December 2009. The documents published since have indicated more specific changes to financial regulatory reform. The specific problems the reforms address include improving the banking industry's ability to recover from shocks (such as the 2008 crisis), and improving the risk management within banks and governance of risk management from regulatory agencies. To accomplish this, there are a multitude of proposed changes.

The Basel Committee is proposing new definitions of capital (to exclude elements that may have previously been accepted under Basel II). Basel II has been criticized for having allowed inadequate capital by permitting questionable deductions in the calculation of capital. The resulting situation could allow banks to show strong capital ratios and still have limited tangible common equity. It is estimated that just by redefining capital to eliminate some of these issues, capital ratios will be significantly strengthened. In order to resolve this, the new definition of capital includes the following stipulations:

- No goodwill deductions
- No minority interest as equity deduction (in event of a take-over, net income of 3rd party minorities can't be retained as common equity)
- Deferred tax assets can only be deducted if they depend on the future realization of profits
- No deductions of bank investments in own shares
- No deductions of bank investments in other banks

The Basel Committee is also attempting to increase the risk coverage of the capital framework. This consists of strengthening the capital requirements for counterparty credit risk exposures from derivatives, repos, and securities financing activities. The Basel III Accords will also mandate that banks build up capital buffers, by requiring a larger minimum ratio. Additionally, the accords are updating the minimum liquidity standard. Finally, the Committee is introducing a leverage ratio.

These new definitions, guidelines and recommendations for capital ratios, risk coverage, liquidity and leverage are not binding legislation themselves, as the Basel Committee is not a regulatory body. Instead, these recommendations and definitions are created together by the central bank governors in order to promote uniform legislative coverage. Individual countries are encouraged to adopt these measures in ways that best fit their own regulatory and financial system. However, because these guidelines are meant to be adopted as an international standard, it is prudent for banks to adopt these standards on their own.

The review of the new regulations indicated that the primary impact on financial metrics will be in the regulatory constraints ratios; the Tier-1 Capital Ratio, Leverage ratio, and Liquidity ratio.

4.2 Mobile OPAL design

The following sections contain the results from the second part of the MQP project, to research requirements for enabling OPAL Finance to run on a mobile device. The sections describe which developing platforms would be the best fit, how to

determine which applications are ideal for a mobile device, and how to design for optimal usability.

4.2.1 Platform Comparison

In the world of software development, a good developing platform means multiple functionalities, great coding environment and easy usability. With a good developing platform, a developer or a developing team can shorten the timeline of production, simplify the organization of resources and improve the quality of final product. Therefore, it is very important to choose a suitable developing platform. In particular, cross compiling developing platforms are especially of interest for developing Mobile OPAL. After some online research, four platforms were chosen as candidates for detailed comparison: PhoneGap, Appcelerator Titanium, Qt and Adobe Flash CS5. However, Adobe Flash CS5 was excluded from comparison because it was discovered that the Apple SDK license agreement 3.3.1 explicitly prohibits the use of Adobe Flash for iOS application development.

To compare the three remaining cross compiling platforms, the following criteria were considered:

- Coding language for development
- Supported platforms to which source code is cross compiled
- Relative strengths and weaknesses

The coding language and supported platforms were found directly on the official sites of each cross compiling platform. Their relative strengths and weakness were analyzed based on current industry discussion and practices.

In Qt, C++ is used as a standard language to create projects and to deploy the Qt framework. With the provided C++ class library, a C++ programmer can access an extensive set of powerful APIs, which can be used to build advanced applications with less time and effort. In addition to the C++, a developer can also use other languages including Ada, Pascal, Perl, PHP, Python, Ruby and Java, by using the language binding technique. For example, PyQt binding provides developers with the ability to program in Python, while still having access to all of the functionalities offered by Qt. Some other popular examples include Qt Jambi for binding Qt to Java and QtRuby for binding Qt to Ruby.

Unlike Qt, both PhoneGap and Appcelerator Titanium employ web-developing techniques such as JavaScript, HTML, and CSS as the main developing code. This allows a web developer to easily apply their web developing skills to developing mobile applications using these two platforms.

With C++ as the main coding language, and offering multiple language binding choices, Qt is accessible to more potential developers. Most web developers who are using JavaScript and HTML a lot, however, would favor PhoneGap and Appcelerator Titanium over Qt as the main developing platform.

Of course, it would be ideal to have more supported platforms, as long as the quality of produced applications is not compromised. At this time, Nokia Qt officially supports mobile application development for Symbian, MeeGo, Maemo 5 and Windows CE/Mobile. (Nokia Cooperation, 2010) However, since Nokia made Qt open source to the community, there have been various external parties working on Qt porting projects. These third-party porting projects may still be incomplete and not fully functioning at this time, but with more time and effort, developers could potentially deploy Qt for Amazon Kindle DX, Embedded Linux, Android and iOS. This portrays Appcelerator Titanium and PhoneGap in a negative light. Appcelerator Titanium supports only iPhone or iPad, Android and a beta version of BlackBerry, (Appcelerator Inc., 2010) and PhoneGap supports iPhone or iPad, Android, Palm, Symbian, Maemo, Windows Mobile and BlackBerry. (Stark, 2010) If going only by the number of platforms supported, Qt and PhoneGap come out significantly ahead of Appcelerator Titanium.

As the scope of this project was limited to iOS, Android and BlackBerry 6, with iOS given highest priority, the analysis of relative strengths and weakness of these developing platforms was concentrated around support for development of an iOS application. The three platforms all have their strong and weak points, when a wide range of abilities is considered. However, instead of developing a comprehensive comparison, the analysis focused on the three criteria in the following list.

1. ***Support for iOS development:*** Currently Qt does not officially support iPhone or iPad porting yet. Even though there is a third party developing team working on

a Qt-iPhone project, no examination of that project code has be done and the code cannot be guaranteed to be compatible. PhoneGap has better support for iOS application development, and supports cross compiling to iPhone application. Appcelerator Titanium supports both the iPhone and iPad. At this time, among compared platforms, Appcelerator Titanium provides the best compatibility for iPads.

2. ***The quantity and quality of available APIs:*** Although Qt provides the richest set of APIs for application development, many of them are targeted at desktop software development. This undermines Qt's potential to be used to develop iOS applications. Comparing PhoneGap and Appcelerator Titanium, the latter provides 25 modules, 73 objects, 720 methods and 1832 properties in its key APIs in the latest mobile version 1.4.This is significantly more than PhoneGap. Furthermore, through recent years' development, Appcelerator Titanium has evolved into a dedicated cross compiling platform for iOS and Android, exposing developers to many native APIs provided by iOS and Android SDKs. Providing native API access to developers enables them to build applications with a more native outlook, and better performance. In contrast to Appcelerator, PhoneGap's strength has been to provide more supported mobile platforms, which has limited its dedication to any specific one of them. Another difference between the two platforms is the degree of bridging from their APIs to native APIs, where bridging is the one to one mapping process that maps platform provided APIs to native APIs To better utilize native resources on the devices, Appcelerator Titanium offers more bridging and compiles the JavaScript code into a native

application. Using this approach, the final application is tied closer to the device hardware layer. PhoneGap, however, uses less bridging for building the application. Instead, it creates a native wrapper around the produced application that makes it look like a native application, but inside it still relies on web supports such as HTML.

3. ***Developing Environment:*** Qt is the only platform that comes with an IDE for editing and manipulating files directly within the platform. PhoneGap and Appcelerator Titanium do not include an IDE. As a result, developers need to find their own code editors for programming, and the resource organization can only be done manually by arranging files in the source directory. Nevertheless there are many popular free editors for editing JavaScript and HTML files, such as Dashcode in Mac or Notepad++ in Windows. Although not ideal, developers can quickly get used to one favorite editor, and sometimes even prefer it to a built-in IDE.

Considering all of the above criteria, it seems that Qt may not be a good candidate for developing mobile applications for Android, BlackBerry and iOS. This may change if in the future it fully supports porting to iOS and Android. Considering PhoneGap's performance, even though it supports all three platforms, the lack of specific dedication to any one of them weakens its ability to create pure native-like applications. At this time, Titanium may be best suited for the purpose of Mobile OPAL development for Deutsche Bank. Titanium is also currently more favored among web developers who are interested in developing applications for Android,

BlackBerry or iOS systems. The comparison information can be summarized in the following charts:

Cross Compiling Platforms	Supported Platforms						
	iPhone	iPad	Android	Blackberry	Symbian	Maemo	Windows Mobile
Qt	X*		X*	X	X	X	X*
Titanium	X	X	X	X**			
PhoneGap	X	X	X	X	X	X	X

* Not fully supported, third party development.
** Beta version

Cross Compiling Platforms	Developing Languages
Qt	C++, Java, Ruby and other languages*
Titanium	JavaScript, HTML, CSS
PhoneGap	JavaScript, HTML, CSS

* Developers can use various languages by using the language binding technique.

Cross Compiling Platforms	Relative Strengths and Weaknesses	
	Pros	Cons
Qt	• Powerful and comprehensive APIs • Full featured IDE	• Lack of support for iOS devices
Titanium	• More dedicated APIs • Produces more native like apps	• Platform-specific APIs • Supports only two platforms
PhoneGap	• Supports more devices • More generic APIs	• Lack of dedication • Generally worse app quality

4.2.2 Framework to Evaluate Applications

Throughout the software development life cycle, Software Quality Assurance (SQA) is vitally important. Along with Software Quality Control (SQC), together they provide a set of comprehensive testing and improvement procedures to ensure the quality of the software. During the development of Mobile OPAL applications, a framework for assessing existing and new requirements could help reinforce the entire SQA and SQC cycles. The assessment framework developed for Mobile OPAL was established with two focuses. One sets guidelines for more general applications, and the other is a specific analysis for productivity applications.

By studying the Human Interface Guidelines provided by Apple Inc. and researching common industry practices, the following guidelines were developed for general applications.

Recommended features:

1. *Intuitive controls:* Intuitive control means that the appearance of a control item on the screen appropriately indicates its actual function. For example, a button would allow tapping, and a partial view display would allow scrolling to view the rest of the screen.
2. *Real time feedback:* In all situations, an application should provide users with prompt feedback, particularly in a mobile environment. A user might quickly lose patience and switch to something else unless they are getting feedback from the application.
3. *Consistent with Apple default functions:* Implementing functions that are consistent with Apple's original design can shorten a users' learning curve, as they would already know what to do with the given control items. For example, with the "+" button, new users would know immediately that they can add new item to the existing setting.
4. *Minimize the number of available control choices:* Instead of trying to build a powerful application with various control supports, a minimal number of choices in fact would work better on a mobile device. This is because fewer control choices can reduce the time it takes to decide which control model to use when they share similar functionalities and it also saves precious screen space on a mobile device.
5. *Implement appropriate user gesture interactions:* There many gesture interaction models provided by the multi-touch screen. It is critical to implement these functions appropriately. The following chart describes these in greater detail.

Gestures	Action
Tap	To press or select a control or item (analogous to single mouse click)
Drag	To scroll or pan
Flick	To scroll or pan quickly
Swipe	In a table-view row, to reveal the delete button
Double tap	To zoom in and center; To zoom out if already zoomed in
Pinch open	To zoom in
Pinch close	To zoom out
Touch & hold	In an editable text, to display a magnified view for cursor positioning

6. *Provide push notification:* Providing push notification when data changes or new data is available can make fetching information more efficient. A good example of push notification is the iPhone Facebook application, which displays a number on the home screen icon to indicate the number of new requests.
7. *Fingertip-size target:* Try to make all action targets at least the size of fingertips. If there are too many items to fit on the screen within reason, allowing a zooming capability is recommended.
8. *Be prepared to quit and resume at any time:* As mobile devices are mostly used in a moving situation, a user could close the application in a sudden due to unexpected events or arriving at destinations. Therefore, the application should be prepared to close up and save all necessary data at any time.

9. *Handles phone calls:* For cell phones, an application must be able to handle the interruption by phone calls smoothly, when the application needs to pause and resume immediately as the call comes in and ends.

Discouraged features:

1. *Requires excessive user typing:* In general, requiring too much user text input means the application fails to use the multi touch interface appropriately. Simple actions such as swiping and tapping on a multi touch screen are much better for a mobile device than text typing.
2. *Complex application layout:* A complex layout could frustrate a user in many ways. These include increasing new users' learning curve and wasting users' time on finding an item through complicated navigation.
3. *Excessive waiting time:* As a matter of performance, an application needs to have a reasonably short running time. Being responsive is especially important for mobile applications.
4. *Deprives users of the control of the application:* Users feel in control of the application. It is highly recommended to provide users with more control rather than less. Examples of providing a user more control include asking for confirmation when performing potentially dangerous actions, or providing enough time to cancel an action during the process.
5. *Customizes the interface too much:* Although a customized interface may offer more flexibility for each individual user, undue customization could waste users' time and distract users from focus on the main task.

6. *Technical jargon:* Generally, technical jargon may have a negative impact on a users' experience. Jargon should be avoided unless it is frequently used and unavoidable, in which case a summarized info page should be provided.
7. *Irregular startup:* Any experiences that could hinder the application from starting up, such as repeating alert messages, should be avoided.

In addition to the assessing guidelines for general applications, there are some guidelines more applicable only to productivity applications, as described below:

Recommended features:

1. *Provides preference setting:* Among three types of applications, a productivity application is the most likely to provide preference setting or customization. For example, the weather application allows a user to customize the cities whose weather forecasts are of interest. Applying to Mobile OPAL, one possibility is that the preference setting could allow users choose what OPAL functionality to display automatically upon open up.
2. *Focuses on primary task:* It can be sometimes tempting to provide various decorative or auxiliary items in the application, but it is important to keep the primary task clear and focused.

Discouraged features:

1. *Uses a multi-segment back button:* As a productivity application often uses a hierarchical layout, a multi-segment back button may appear beneficial for

navigating back one or multiple levels. However, a multi segment can be too large and leave no space for displaying other items.

2. *Encourages users change settings too often:* It could cumbersome to encourage users either implicitly or explicitly to often customize their preference settings. In general, the preference setting is intended to provide greater individual user experiences and is often designed to be unchanging.

General Applications	
Cons	Pros
Excessive user typing	Instinctive control
Complex application layout	Real time feedback (start immediately)
Excessive waiting time	Consistent with Apple default functions
Deprives users of the control of an application	Minimize number of control choices
Customize the interface too much (info focused vs. environ)	Implement appropriate user gesture interactions
Technical jargon	Provides push notification
Any type of start up experience that hinder users	Provides fingertip-size target
	Prepared to quit and ready to resume
	Handles phone calls
Productivity applications	
Cons	Pros
Uses a multi-segment back button	Preference setting (support customize)
Encourages users often change settings	Focuses on primary task

4.2.3 Navigation and Control Design

Different applications tend to have different designs. Therefore it is important to identify what category of application Mobile OPAL falls in before a detailed analysis can be done. Apple has categorized all the iOS applications into three major groups: productivity application, utility application and immersive application.

A productivity application often facilitates users to accomplish important tasks. These tasks are usually based on the organization and manipulation of detailed information. Both Mail and Photo applications are well-defined examples of productivity applications. Figure 1 and figure 2 show a screenshot from both applications.

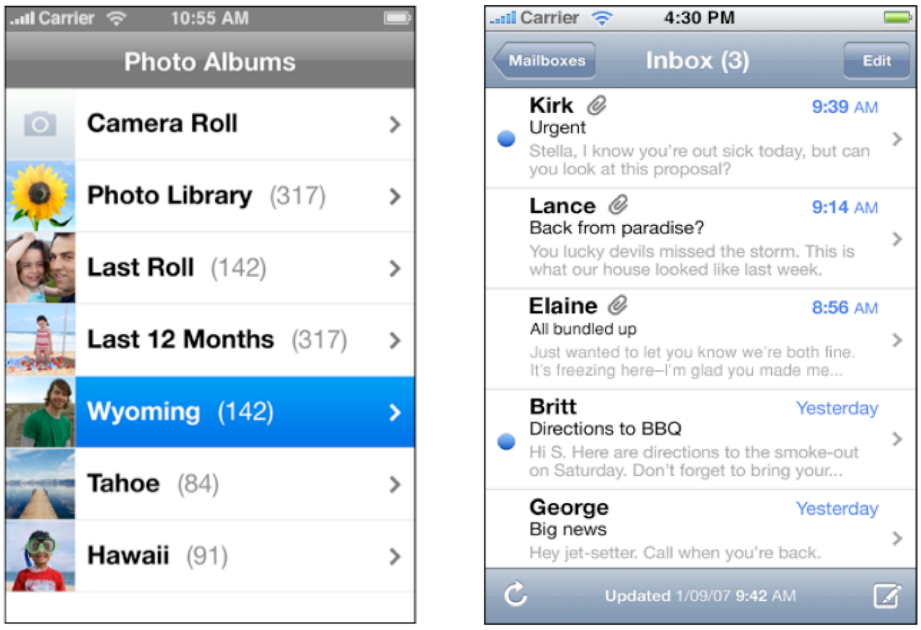


Figure 1

Figure 2

A utility application normally performs simple tasks and provides a quick summary to the user. In contrast to a productivity application, a utility application generally employs a flattened list of items. The built-in Weather is a good example of utility application as shown in figure 3:

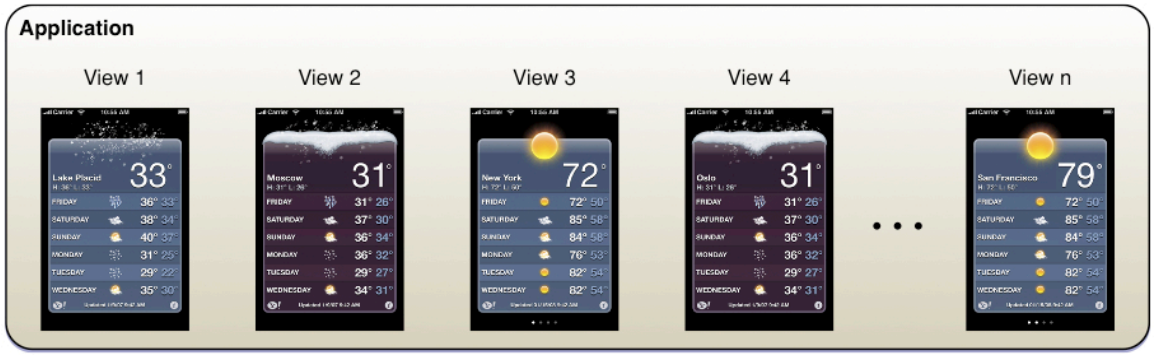


Figure 3

An immersive application generally provides a full screen and a visually rich environment so that a user can focus on the content. Most iOS games are immersive applications, as they normally hide all other information while users are enjoying the game.

In order to categorize Mobile OPAL, it is important to consider the various functions Mobile OPAL will support and which structure it would employ. Because it will help users to accomplish many tasks, and will require well-organized data structures, Mobile OPAL is best categorized as a productivity application.

Navigation Models for iPhones

A good navigation design facilitates the process by which a user locates a desired functionality, performs an action and finishes a task. By providing a smooth and instinctive navigating experience, an application can reduce a user's operational time and improve productivity. However, there is no universally perfect navigation style for all applications. Depending on the purpose and inherent data structure of an application, the best navigation model choice may differ. There are three widely implemented navigation styles among current applications; these are the hierarchical layout, the parallel layout, and the simple layout.

Compared to the other layout models, a hierarchical layout is especially capable of managing application organizations. For example, the iPhone Mail application uses hierarchical style to organize all the folders and subfolders so that a user can easily find the desired email. Within an application of hierarchical structure, a user usually navigates back and forth different levels by tapping the back button and choosing a sublevel. However, if a user only wants to select an item within the same level, forcing him to go back and enter the level again is annoying. To avoid this situation, a common complementary design is to allow inter-level movements. The Mail application is a good example. With the up and down button (as shown on the upper right corner in Figure 4), a user can easily go to next or previous email without exiting the current scope.

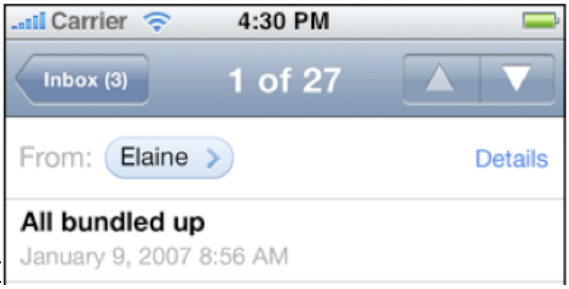


Figure 4

In contrast to a hierarchical layout, a parallel layout functions better at switching between different pages. By swiping, a user can smoothly browse all the parallel pages interchangeably, without exiting the current application level. Alternatively, a user can change the displayed page by selecting from a tab bar, where each tab represents a parallel view.

A simple layout structure should be used only when the application has only a small number of views and expects users to stay in the same view for most of the operating time. With the very limited page-linking structure, a user should not need to navigate within the application once getting into the main page.

A simple layout does not suit Mobile OPAL well, because a user may want to have different functionalities packaged in Mobile OPAL and it is difficult to contain all different functionalities within the same page view. A parallel layout can achieve managing different pages, but suffers from the lack of organization. In addition, a parallel layout typically has up to 5 parallel tabs or segments, which may not satisfy the required number of supported functionalities. A hierarchical layout is a good candidate for the navigational design of Mobile OPAL. This is the same result as Apple's recommendation, since Mobile OPAL falls into the category of a productivity application. As Apple pointed out in the iPhone Human Interface Guidelines (HIG),

“Productivity applications often organize user data hierarchically. In this way, people can find information by making progressively more specific choices until they arrive at the desired level of detail.

Apple’s HIG also provides some design recommendations for a productivity application, based on common industry practices and their own experiences in developing productivity applications. First of all, it is recommended to use a hierarchical organization for a productivity application. A hierarchical design, compared to the other two models, has two major strengths:

- Capable of organizing different levels of lists: A simple layout does not innately display more than few items in an organized way. Similarly, a parallel layout can offer the user to choose at most five tabs. When the number of available items to choose exceeds five, the fifth tab is displayed as ‘More’, or another indication of additional choices, which can be annoying to a user and should be avoided if possible. In addition to the limited item number, a parallel layout generally displays the perspectives from the same set of data, or subtasks related to the same function of the application. Unlike a simple layout and a parallel layout, a hierarchical organization can easily handle complex levels and sub items.
- Scalability and extended functionality: A hierarchical design offers much more scalability than the other two layouts. When more functions need to be supported later, a simple layout would be too complex to implement. A parallel layout also suffers from the number limit and lack of level support. However,

with a hierarchical structure, the new function can be inserted into the right level at the right place easily.

To implement a hierarchical layout, developers can utilize the table element that is provided in UIKit, which is a very powerful framework included in iOS SDK. To demonstrate the applicability of the hierarchal layout, a simple sketch was created using Balsamiq Mockups, shown in figure 5. The corresponding layout in the Mail application for iPhone is displayed in figure 6.

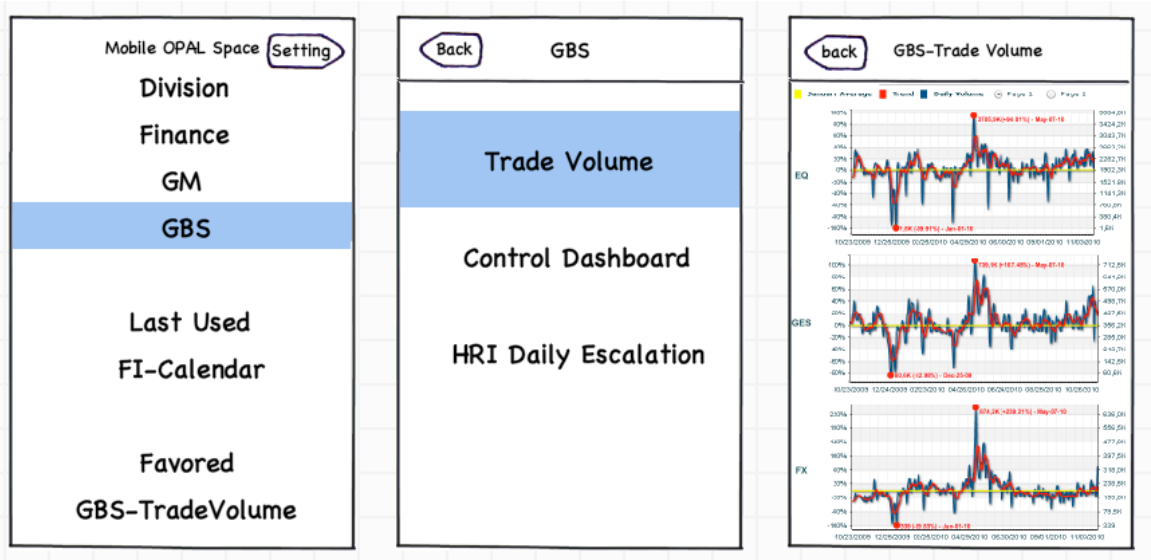


Figure 5

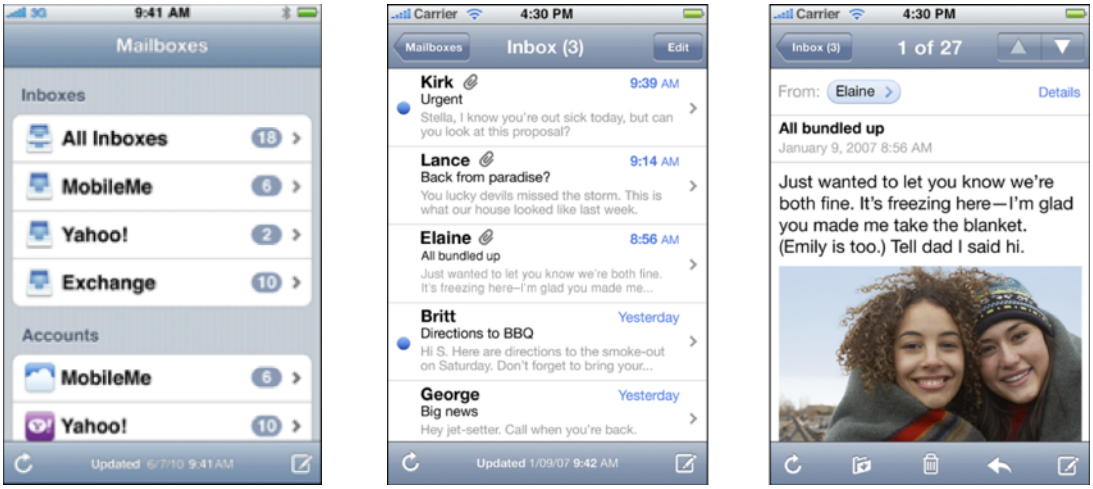


Figure 5

Navigation Models for iPads

With a much larger display screen, an iPad would be able to deliver more content to a user at one time. Accordingly, this requires certain modifications to the prototype design of Mobile OPAL for cell phones, so that the tablet version can fully utilize the larger screen. The new User Interface (UI) elements and behaviors in iPads include:

Split view: In contrast to iPhones, iPads can support to multiple views, thanks to the larger screen. In particular, an iPad application can present data in a master-detail way. In the master section on the screen, an application can provide a list of

summarized titles, while in the detail section; the details corresponding to the chosen title in the master section are displayed.

Popover: A popover can temporarily provide additional information. One advantage of using popover is that it can provide some additional information as needed for temporary purpose. However, using it too often could compromise users' experience within the main window and main contents.

Results list button: A result list button can be used to reveal the search results in a table view.

Modal view: An application can allow a user to choose modal view styles such as full screen, partial screen or a customized modal interface that is more specifically tailored to the application.

Edit menu: With a larger screen, an application can offer menu items such as copy, paste and cut on a menu bar, instead of the choose-appear style on iPhones, where the edit menu only appears as a pop up when some context is selected by users.

Keyboard customization: An iPad can support a customized keyboard instead of the system default keyboard. With the customized keys, a user can accomplish certain tasks more easily.

Custom text view: A customized text view can provide more advanced word processing abilities such as spell checking and auto completion for text input.

Among all these new capabilities an iPad provides, the most significant new UI element in iPads is the split view, as it provides more flexibility to organize the contents shown on the screen. One key principle of moving Mobile OPAL from an iPhone to an iPad is to let users see more content and do more work in one screen, in which a split view could play an important role.

The most commonly practiced technique to achieve that principle is to flatten the information hierarchy. In a hierarchical model, an application presents one table list on the window at one time, representing one hierarchy level. Now using split view, an application can display two or more levels at the same time. A good example for this technique is the Mail application.

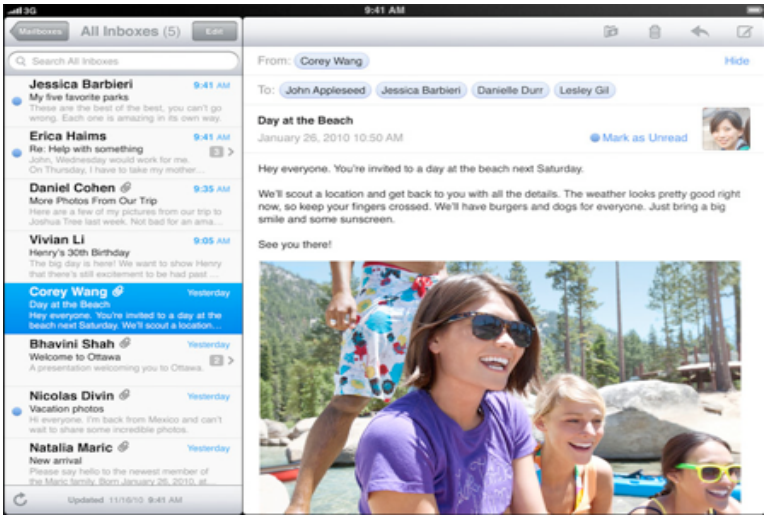


Figure 6

Figure 7 above shows a sample view of the Mail application for iPad. The screen is split into two parts. The left part is a table view that provides a summary of emails in one inbox, while the right part displays the detailed information of the email

chosen from the left side. By using split view, now Mail application has combined two levels in a hierarchy into a single view, and has flattened the hierarchy.

Applying the same technique, figure 8 shown below is a simple example design for PIP Dashboard in iPad.

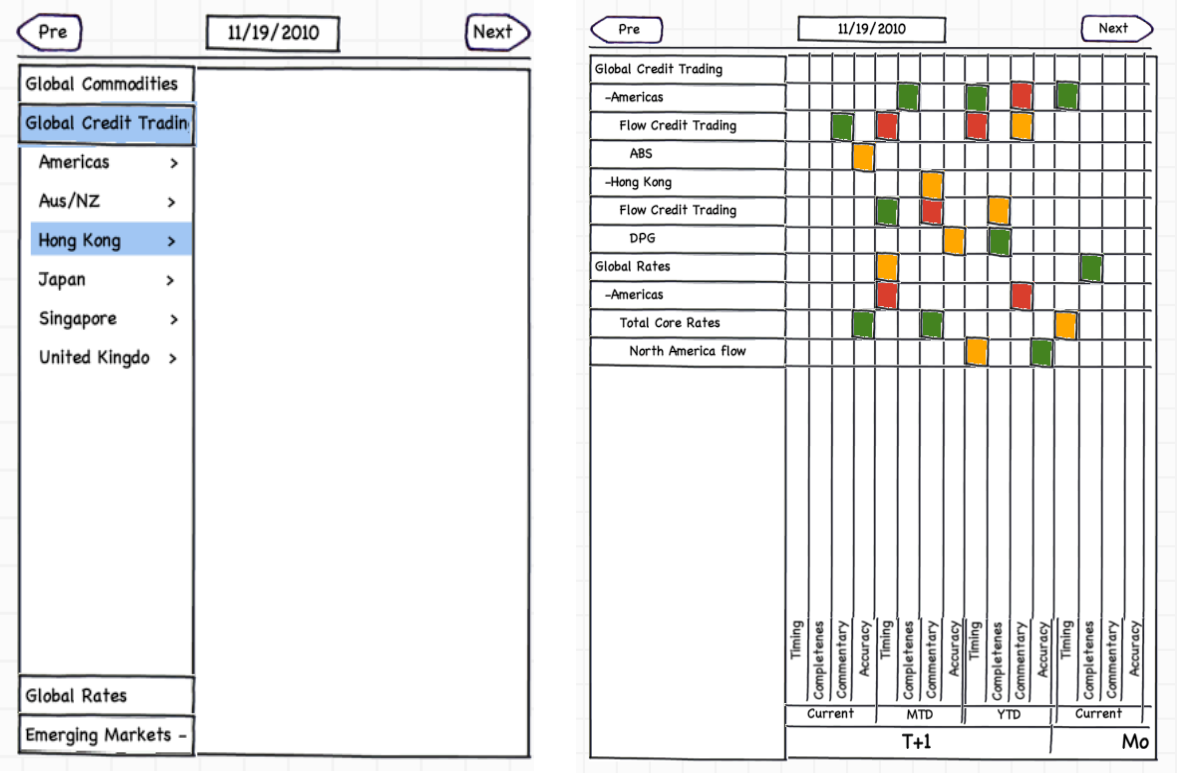


Figure 7

As shown in the above sample design, a user can choose all the folders that he or she is interested in in the left panel, and then tap on the right panel to bring up the detailed Red Amber Green information. The process of choosing folders is all done in the left panel. The navigation style is identical to the one in an iPhone. While limited by the width in the portrait mode, the right panel implements a scroll view so that users can scroll the right panel by swiping. However, one shortcoming of this design is the entire screen is not utilized efficiently during choosing folders, as the entire right panel is left unused. An

alternative design is to allow the user to use the entire screen to choose desired folders, as shown in figure 9.

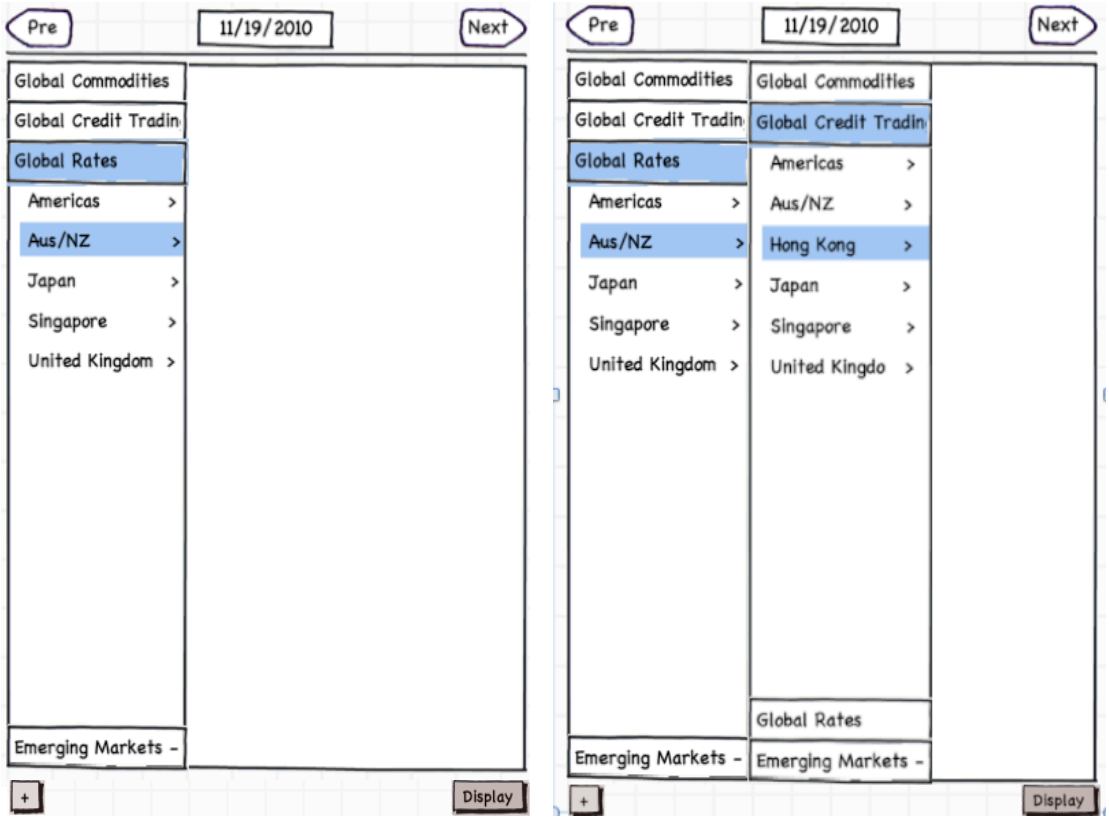


Figure 8

In the alternative design, instead of using only the left panel to go back and forth to choose folders, now a user would tap on the plus button at the left bottom corner and bring up a new folder panel. After all needed folders are chosen, the user could tap on the display button at the right bottom corner to have the same Red Amber Green information displayed. By using the same design principle, two more candidate mockup designs for Finance Event Calendar and Control Dashboard are shown in figure 10 and figure 11, respectively

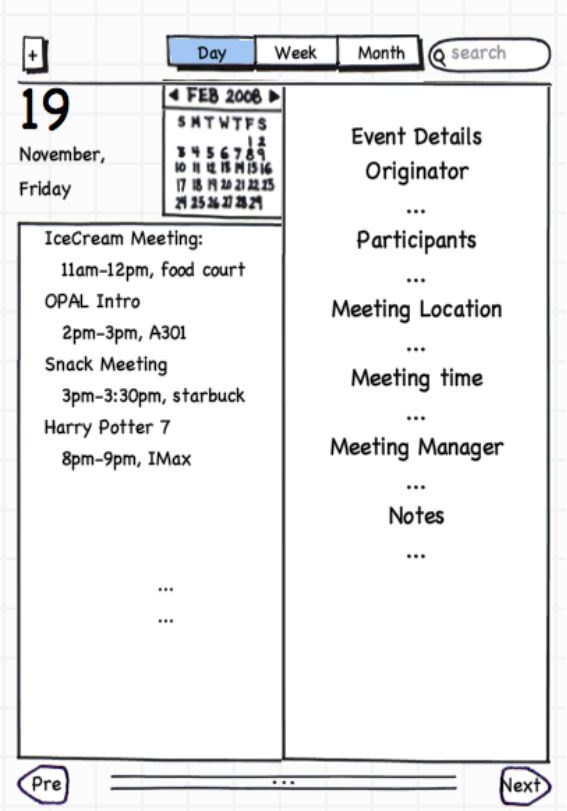


Figure 9

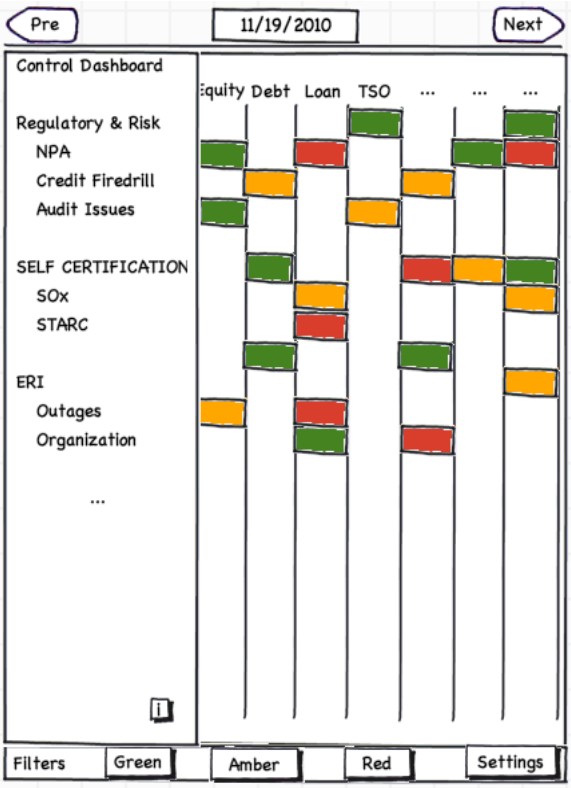


Figure 10

Control Design for cell phones and tablets

With over 300 million applications in the market, there are a variety of different control models that can be implemented. The following are the most commonly used control models:

- Rounded Rectangle Button
- Detail Disclosure Button
- Info Button

- Page Indicator
- Picker
- Table list
- Segmented Controls
- Slider
- Search Bar
- Text Field
- Activity Indicator
- Progress View
- Label

In order to understand better which control types are appropriate for Mobile OPAL, it is essential to understand what each control model does and what type of control it provides.

Several of the control models both display information to the user and potentially can allow the user to perform actions. This would include the rounded rectangle button, the detail disclosure button, the information button, and the page indicator. A rounded rectangle button is a widely used control model that enables a user to perform an action. The title of the button helps the user understand the task associated with the button. A detail disclosure button indicates to a user that there is additional information that can be displayed, and it allows the user to navigate to the additional information. Represented by a small “>” symbol, the button is usually used in a table view, where it indicates that there are more sublevels to follow. After an item followed by that symbol is chosen, the current window changes to a new table list that contains all sublevel items. In general practices, a back button is provided to enable the user go back to the upper level. An information button enables users to see and manipulate the configuration details of an application. Generally, it is often used in a utility application and is virtually placed behind the

screen. When a user clicks on the info button, the currently displayed window is turned around and the detailed information page is brought up. A page indicator is another control model that both displays information. When an application has multiple pages that it can display, it can use a page indicator to indicate which is the page currently being viewed. A page indicator could display a dot for each page, and indicate which page is currently being viewed by highlighting the particular dot. One example of the use of page indicator is the Weather application as shown in figure 8, in which the page indicator at bottom shows there are two configured cities.

Figure 11

Another variety of control model allows users to view several choices and to navigate between the choices. A picker is a spinning wheel that allows a user to choose a value among a set of choices. However, a picker functions best when displaying a limited number of choices. When an application needs to provide a large number of choices, a better way would be to list all the choices in a table list. A table list is a table view that is customized to allow users for choosing one or more options. Similarly, a segmented control tab is another option to allow a user to navigate between choices. A segmented control is a tab bar that can be used to

navigate between several parallel pages. A slider is another commonly used control model that performs a similar function. Using a slider, an application allows a user to adjust a value within a continuous range. A slider is typically used when a user may want to have fine-grained control over the value.

The search bar and text field are two control models that allow for less limited user inputs. A search bar accepts text input from user and performs a search. It can facilitate a user to locate certain desired items. A text field is the place where a user can input text with a keyboard. In general, an application would not necessarily consider this option as the input method unless the input is difficult to predict. This is because requiring a user to type input into a text field requires more time than some other options and can be prone to user error.

Other control models primarily display information to users. An activity indicator indicates that the current operation is being processed. It delivers important feedback to a user, showing the application is still working on the current task instead of frozen. An activity indicator is especially helpful when the completion of a task frequently takes more than a few seconds. A progress view is a good tool to provide a user with better understanding of the current operation status. A progress view provides a user with the same feedback as an activity indicator, and it also shows the current progressing status and speed so that a user is able to decide if to quit the operation or to keep waiting. A label can be used to provide users with information. It usually has a limited amount of text and informs a user of the current content or what to do in the current step.

When deciding which control models are best for a productivity application like Mobile OPAL, the key criteria examined were as follows:

1. Provides enough feedback: Two most commonly used feedback providers are the activity indicator and progress view. Depending on the type and requirement of the application, they are used in different situations. For example, in a web browser, an activity indicator may suffice to show that the web page is loading, while if a user is downloading or streaming something from the web, a progress view may be a better choice. In general, an activity indicator works for a short wait time such as one second or two, and a progress view functions better when the action takes substantially more time. These two control models are recommended to use whenever appropriate.
2. Requires minimum user input: In the environment of a mobile application, users are reluctant to provide excessive inputs. In the case of unavoidable input requirements, users favor the simplest input method. There are several control models that facilitate user inputs, including but not limited to pickers, table lists, sliders and text fields. Among these options, text fields require a great amount of typing and are error prone. Accordingly, the text fields should only be used when absolutely necessary. Instead of asking for direct input from users, it is better to provide multiple choices for users to pick, which can be done by pickers and table lists.
3. Does not hinder displaying main contents: Although all control models could facilitate user actions, overwhelming ancillary information and control buttons may detract from the main contents. As an example, an activity indicator is

better than a progress view in the case of short waiting time, since it occupies much less space, therefore saves more space for displaying major contents. All types of buttons, as well as the segment bar, should only be used for crucial functions.

4.3 OPAL Finance User Experience Evaluation

Users can add folders to root folders, and edit folder security to control the permission of who can view, edit or upload. The PIPs, Pre-Issuance Process Documents are very important in Finance.

The PIP Dashboard shows RAG status of a PIP – Red, Amber, or Green ratings, as determined by the report rater. The PIP is rated on timing, (automatically collected from the upload date and time), accuracy, completeness and commentary. The rating is displayed as a RAG in the PIP dashboard. The Alertboard in OPAL Finance has drilldown capability to display the HRI (High Risk Incident) Dashboard, the VaR (Value at Risk) Dashboard, NIBBT (Net Income Before Bonus and Taxes) Dashboard, the PIP Dashboard, the Trade Volumes Dashboard, and the Dart Dashboard. The Alertboard also links to the Report Library and to the Balance Sheet Report in the Report Library.

The Alertboard is made up of modules of data called alertlets. The alertlet can be either a group of data displayed, or a summary of information from an alternate source. This last category would include any alertlet that has a drilldown capability. The HRI Dashboard, the VaR Dashboard, the NIBBT Dashboard, the PIP Dashboard,

the Trade Volumes Dashboard, and the Dart Dashboards are all accessible through alertlets with a drilldown capability.

The Event Calendar allows users to view events, search events according to set criteria, and to create, edit, cancel, and delete events. The application is linked to email, so users invited to an event will be notified by email.

As one important element in the Software Development Life Cycle, identifying the functional bugs and inappropriate implementations can help improve the quality of the software and meet the requirements more accurately.

From the perspective of a novice user, certain unsuitability that may escape adapted users could be identified more easily. After a comprehensive set of black-box navigation and control tests, the following suggestions were made for corresponding OPAL applications:

Workspace Setup Dashboard

- The dragging functionality is either buggy or lags a lot due to computer hardware issue, if the dragging actions are performed successively.
- When exchanging the location of two icons or re-select one icon, the OPAL space actually does an entire reload even though these actions do not have any functional effects.

Report Library

- (Reports Tree tab) After choosing a certain folder, it is more often (by personal experiences) to display all the visible files in all subfolders in the right panel. Currently, it only displays the files under the chosen folder itself while hiding all items in subfolders.
- (Reports Tree tab) Sometimes a user would prefer to have backward and forward options so that he/she can access the previous viewing file easily.

GBS – Control Dashboard

- After I double click on a RAG cell, I expected the drill down would open in a new window so that I can view multiple drill downs at the same time, instead of open in the current window.
- The back button usually sits on the top left corner in common software practices, instead of now sitting on the top right corner.
- Implementation for the info buttons for the terms on the left side is missing.
- When a user changed the Management Information (MI) Date, there is no information provided to see if the current content is being changed. A better practice would be providing an indicator or shadowed the window.

GBS – Trade Volumes

- It seems that under the "Trade Volume" tab, the "Volume Trends per Product" tab serves as zoom-in for the "Product Group Trends" tab. A more intuitive way might be to indicate a user the ability to click on one chart (such as EQ or GES), which will bring up the corresponding "Volume Trends per Product".

- For “Volume Trends per Product” under the “Operational Volumes” tab, some red dots (bottom dots in this case) number is actually hidden under the bottom line and there is no show up information when mouse is moved on it.

Finance Event Calendar

- For the adding event, nothing will be saved until I hit the “Add Event” button. So during creating one event, I can’t switch to the calendar view unless I save it first, then come back to modify it. This can be solved by implementing a pop-up add event window, or keeping all data temporarily if tab is changed before hitting the create button.

For the applications in general, some recommendations have been compiled.

- It may be better to support minimum, maximum and close buttons on the top right corner for all desktop OPAL applications, as Report Library does.
- Sometimes after choosing from a drop down menu, the page is refreshed automatically, but sometimes it requires clicking on an extra “apply” button. It could be more consistent if they all share the same behavior.
- The window implementation seems a little strange. It consists of a top bar and a separate lower window. When the mouse is moved over the topside of the lower window, it shows the resize indicator for the lower window, which however turns out to resize the entire window.

Chapter 5. Recommendations

Based on the results and analysis formed by the MQP Team, the following section includes the recommendations for Deutsche Bank. The recommendations have two sections; one describing the conclusions reached as a result of the industry best practices review and regulatory change review, and the other describes the mobile application design that would best fit a mobile version of OPAL, based on extensive research.

5. 1 Recommendations of Financial Metrics for OPAL Finance

The review of industry best practices, combined with the review of upcoming regulatory changes has resulted in these recommendations being compiled.

- Profitability Metrics should be included
- Growth Metrics should be included – However, which ones should be determined by additional research and analysis.
- The Tier-1 Capital ratio, Leverage and Liquidity ratios should all be included. Inclusion of the Economic Capital Usage metric would likely be helpful.
- Depending on usefulness to a FD/FM's role, the Business Mix metrics should be considered for inclusion. Best practices review showed inconsistency and was inconclusive. If the metrics in this section would be helpful, the determination of the best metrics requires additional research and analysis.
- All metrics should be benchmarked to ensure usefulness and relevancy.

Value Based Metrics Industry Best Practices Review:

The industry best practices review indicated that the profitability ratios used by Deutsche Bank's VBM program are very commonly used indicators of profitability. As these are very standard indicators, and showed little variation, the reasonable recommendation would be to use these VBMs as they are. Including these VBMS in OPAL Finance would hopefully contribute to increased profitability and increased shareholder value.

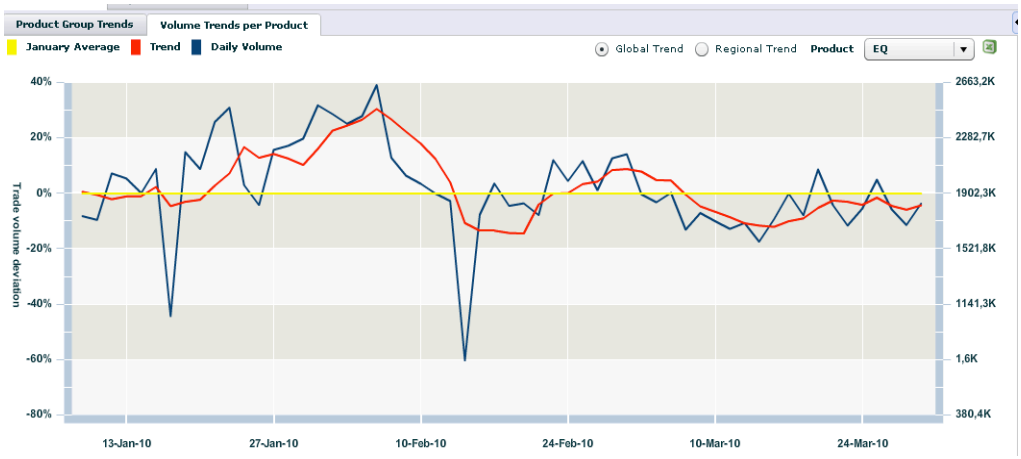
The growth category of metrics showed that many banks are measuring growth in some way, but that the way they choose to measure is often very different. However, these constraints are very important to measure consistently. As growth portrays a very different view of the company's performance that may not be clearly visible from the other metrics, including these growth metrics in OPAL Finance is highly recommended. Because of the variance in growth measurements, however, it is recommended that an analysis into which growth metrics would be most useful for FD/FMs.

The constraints category of metrics did not show such uniformity as the profitability category did, but the tier-1 ratio, leverage ratio, and liquidity ratio all seemed to be common constraints that banks track. However, Economic capital usage was not as commonly published. This may be because this is information banks are not required to publish, and so although they track the metric internally, they for some reason choose not to publish it. It is also possible that this metric does not contribute as much towards measuring an improvement in shareholder value.

The business mix category can be safely labeled the least consistently measured category. Additionally, because Deutsche Bank measures all of these metrics and only publishes one, the conclusions that can be drawn from the best practices review are necessarily uncertain. However, the information they would convey to FD/FMs might be valuable information, and difficult to obtain in other ways. Therefore, it is recommended that additional research be conducted to determine which of the business mix VBMs should be included in OPAL Finance.

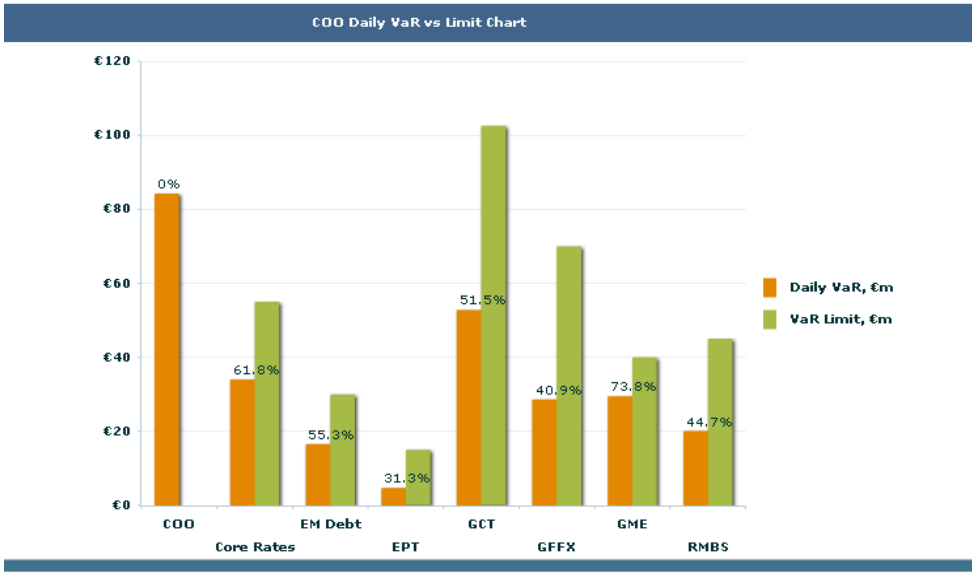
Benchmarking:

How these metrics are displayed to FD/FMs is also extremely vital. While researching performance measurement, the one thing all the sources emphasized was that benchmarking is key. If a metric is not benchmarked against something, and the FD/FM has nothing to compare it against, the metric is likely to be useless. The benchmarks can be one of several types; historical values of the same metric, forecasted values, or the current metrics for other similar businesses or competitors. As an example of the last benchmarking technique, the metrics could be compared within DB's varied businesses, which may give managers an idea of which divisions are doing really well. Comparing the metrics with competitors' data might be more difficult, but if the information is available, this could help keep Deutsche Bank well informed and aware of its competition.



The above picture is a screen-shot from the OPAL GBS-Trade Volumes Dashboard. The yellow line indicates the average, and the blue and red lines indicate the daily volume and the trend, respectively. This program is a good example of how in order to be easily understood and applied, metrics should have benchmarks or reference points of some type. This graph has the average trade volume as a reference, as well as the time progression so that Financial Director/Managers could compare the numbers with past performance.

Business	Daily VaR, €m	VaR Limit, €m	%
COO	84.2 €m	0 €m	0%
Core Rates	34.0 €m	55 €m	61.8%
EM Debt	16.6 €m	30 €m	55.3%
EPT	4.7 €m	15 €m	31.3%
GCT	52.8 €m	102.5 €m	51.5%
GFFX	28.6 €m	70 €m	40.9%



The above picture is a screenshot from OPAL's GM VAR Dashboard (Global Markets Value at Risk Dashboard). This is a very easily read graphic, despite the fact that it conveys a lot of varied information; it shows the Daily VaR (Value at Risk), and the VaR limit for each of eight different businesses. Above the graph is the exact value in a spreadsheet form for more exact knowledge of the numbers for each business.

This type of graphic could be very useful for many of the metrics, if comparison against several businesses and a benchmark is desired.

Based on the initial Value Based Management research conducted on common performance measurement techniques, the following benchmarking techniques are recommended for each of the four VBM categories.

For the Profitability and Growth metrics, historical values, averages, and projected future values may all be valuable data to have available and to benchmark the current value of the metric against.

To ensure the relevance of the data displayed by the Constraint metrics, it would be valuable to benchmark those metrics against the regulatory constraints, and always have an understanding of the bank's position compared to the regulatory requirements.

Finally, if it is determined that including the Business Mix metrics in OPAL Finance would be helpful, benchmarking those metrics against internally set goals and limits would most likely benefit a manager's use of that category of metrics.

5.2 Mobile OPAL Development Recommendations

Based on the analysis in Chapter 4, the following recommendations can be made.

- Titanium is the best-fit Cross Compiling Platform for Mobile OPAL
- Hierarchical layout is the best-fit navigation layout for cell phones
- Flattened Hierarchical layout is best for tablets
- Simpler control model is best
- Assessment framework guides design:
    - Create a simple application
    - Aim for intuitive control
    - Keep user in control

With the consideration for supported platforms, programming language and relative strengths and weaknesses, Appcelerator Titanium Mobile is recommended as a better developing platform. At this time, it supports all three targeted platforms and only these three. With this limited supported platform, all resources, such as provided APIs, deliver dedicated support for each individual porting platform. In addition, by compiling the source code into native application, Titanium usually produces applications with better appearance and performance. However, if Qt is going to fully support iPhone porting feature in the future and if it is the platform used to develop OPAL desktop system, then it would be an ideal environment for

porting OPAL desktop to all mobile platforms. At that time, the visual debugger, a full feature IDE and the comprehensive APIs provided by Qt would all contribute to an advantage over both Phone Gap and Appcelerator Titanium Mobile.

It is generally recommended to use hierarchical navigation layout for Mobile OPAL on cell phones. The key measured components for comparison were the organizational capability and functional extendibility. Considering those two aspects, a hierarchical structure outshines the other commonly used layouts such as a parallel layout and a simple layout.

In contrast to the situation of cell phones, tablets have generally larger screens and therefore more space for providing additional details and supporting more functionalities. Using a popular technique for porting an iPhone application to an iPad application called flattening the hierarchy, Mobile OPAL for tablets would function best using a split view.

As for the control design, the difference between cell phones and tablets are not as obvious as for the navigation design. In general, simpler control models are favored over complex control models. The difference between simple and complex control models can be distinguished by many ways, such measuring the number of steps an action may require a user to take. Another good example is to measure the real time it may take for a user to perform one or a series of actions.

The assessment framework can be summarized in three key principles. The first is to make the application simple, both aesthetically and functionally. The second is to

make the application control intuitive, as other numerous applications would do. The last principle is to provide as much feedback as possible and keep users in control of the application.

Chapter 6. Conclusions

Although the two objectives this project was separated into appear different in many ways, they have an important feature in common. Both portions of the project will make important contributions to the development of OPAL Finance. The Financial Metrics and Best Practices portion, by recommending financial metrics to be included in OPAL Finance, will provide Finance Directors/Managers with access to the Value Based Metrics. By doing so, behavior changes that result in more efficient and well-informed management will hopefully begin to occur. Currently, because the Value Based Management project was only begun in 2009, the Finance Directors/Managers do not have access to the VBM metrics, nor do they have the ability to frequently consult equivalent sets of metrics. If the VBM metrics are included in OPAL Finance, managers will be able to leverage the new information, and focus their decisions more precisely on achieving increased shareholder return. Additionally, the Mobile OPAL Development recommendations will hopefully assist in the development of a well-designed and highly functioning version of Mobile OPAL. By allowing access to vital information through a mobile device, the effectiveness a manager could be improved by allowing optimal use of a manager's limited time.

Retaining an edge in such a competitive environment requires a company to be always changing, improving and growing; it is our hope that this MQP will contribute, even if in a minor way, towards such a result for Deutsche Bank.

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Appendix A – FD Agenda

Target FD Agenda	Metrics
BUSINESS PERFORMANCE & ADVISORY	▪ Number of Adhoc analytics projects delivering > 1 mm EUR of shareholder value or Proof constraints provided by FD influenced trading strategies eg. Credit RWA by counterparty exposure, Economic resources charges by trade, etc. ▪ Number of trades moved out of Level 3 (market value impact) ▪ Number of times education provided to FO by FDs eg. RWA impacts of Basel III, Economic resource charge impacts, VBMs ▪ Number of adhoc deep dive pieces of work/initiatives requested by Front Office and completed by Finance ▪ # of transactions ▪ RWA utilization
NEW BUSINESS EVALUATION	▪ Post implementation review for NPA to identify value adders / destroyers (eur value vs target) ▪ Time taken for Finance sign-off on NPAs from date first communicated by Business to Finance sign-off date
IMPACT OF FUTURE EVENTS	

Target FD Agenda	Metrics
V & C	▪ # of manual touch points vs. volume (as volume increases in a manual infrastructure, risk increases) ▪ Flash vs Actual Trend ▪ Trend of number and materiality of total P&L Adjustments OR Daily adjustments to the pnl (both temporary and permanent adjustments) ▪ # of locations involved in a process (Bangalore, Manila, Jacksonville, NY) ▪ Trend of Trader Sign-Offs ▪ Use of utilities (e.g. GCT providing utility service to GME, GFFX….) ▪ # late entries ▪ # of manual entries ▪ Number of Day 1 PnL trades and amounts held out of PnL due to trade booking or observability issues ▪ Instances of system failure which result in two day pnL's or significant PnL adjustments ▪ Breaks (as a percentage of total volume) ▪ FA to MA breaks ▪ Trader signoff is missing ▪ New Products traded prior to NPA Sign Off ▪ # of Stale curves and # of transactions affected ▪ # of MRP accounts ▪ # of unsubstantiated accounts ▪ # and value of accounts where ownership is in dispute ▪ Trend of FOBO and FOFO Aged breaks

Target FD Agenda	Metrics
V & C	▪ SOX testing/performance ▪ # of fails over 30 days ▪ # cancellations / corrects ▪ Suspense accounts (# and value) ▪ Other Assets (# and value) ▪ Other Liabilities (# and value) ▪ # late trades - missing system cutoffs ▪ Trend of outstanding open issues ▪ # and amount of operational losses ▪ CRES to G/L breaks ▪ Trading book breaches ▪ Banking book breaches ▪ VAR Limit breaches ▪ Staff Attrition – GBS & FDM ▪ Transfer pricing - are the appropriate documents in place?
BUSINESS PLANNING	

Target FD Agenda	Metrics
COSTS	▪ Review cost base of each business recommend savings of 5-10%, complexity reduction proposals
POLICY	▪ Penalties or losses for the Business / Bank due to failure to comply with any regulatory or accounting rules - which could have been avoided if FD were involved. Or losses prevented by FD by making the Business aware of the accounting breach. ▪ Number, ownership and aging of critical, significant and important Audit Points
PEOPLE	▪ Review cost base of each business recommend savings of 5-10%, complexity reduction proposals

Appendix B – FD Interview

The MQP team members interviewed Lydia Lopiparo, and Gary Richard. The interview was to discover areas of an FD's responsibilities where OPAL Finance might be able to assist. The interview with the FDs left the team with the following impressions:

1. Problem: Daily PIP delivery time too late, Month end delivery time (closed by business day 12, but receive information much too late)

Solution: KPI on PIP – time series analysis – allow evaluation of performance

Enable RAG view per type of evaluation (timeliness, accuracy, commentary, completeness) and allow users to view change in RAG status per evaluation type over time – track performance over time and isolate possible trends – seasonal, cyclical or monthly trends that may affect the quality of PIPs

2. Problem: Balance Sheet Substantiation – not normally a FD's responsibility but takes a lot of their time

Solution: Provide metrics on the Balance Sheet showing # of accounts with problems, # of accounts without problems, and other descriptions?

Enable OPAL to highlight the accounts that should be focused on, allow FDs to spend less time on Balance Sheet Substantiation.

3. Problem: DBRIS updates FDs on PnL incidents – but only updates once a quarter and is not connected to OPAL's HRI dashboard

Solution: Incorporate DBRIS – incident reporting when there is a PnL event with HRIs already shown in OPAL – can connection between HRIs and DBRIS incidents be shown? Do red HRIs turn into DBRIS incidents?

The interview with Finance Director/Managers Lydia Lopiparo and Gary Richard allowed a better understanding of what information Finance Director/Managers need in order to accomplish their goals and it also contributed a better understanding of the varied ways OPAL has the potential to help them in the future.

FD Agenda	**How can OPAL help**
Business Performance and Advisory	----------
• Revenue and fully loaded costs	display a dashboard with this info
• Value Based Metrics (VBM)	Display in a dashboard
• Benchmarking	Included in the comparison to yearly #s, daily changes. – all metrics should be benchmarked
V&C	----------
• Full understanding of the control environment	Metrics displaying information including: breaks & late entries & signoff missing & outstanding confirmation - could offer valuable information to FDs to prevent losses.
• Perform box1/2 V&C in an efficient/effective manner leveraging timely evidencing of operation of key controls in line with policy	Daily PIP: FDM receive a timely and complete daily PIP to perform V&C on daily financial output rather than rely on alternative measures Month end PIP: FDM receive a timely and complete Month End PIP to perform V&C rather than rely on alternative measures Valuation Control PIP: FDM receive a timely and complete valuation control section of the PIP to perform V& C rather than rely on alternative measures Materiality levels associated with the operation of controls needs to be agreed on a regular basis in line with policy. V&C performed by Finance in a consistent manner and completely and accurately evidenced. (from CIB Finance OPAL Workshop in London)
• Perform box ¾ V&C through timely review of outlier and trends and expected results data.	Predictive results from Business Drivers & Deep Dive on unexpected results (from CIB Finance OPAL Workshop)

Appendix C - Performance, Balance Sheet & RWA Charts

Deutsche Bank	Bank of America	BNP Paribas	Citigroup	Commerzbank
Performance	**Performance**	**Performance**	**Performance**	**Performance**
Revenues	Revenues	Revenues	Revenues	Profit
Costs	Costs			Operating expenses
IBIT	IBIT	Gross Operating Income, Net Income		
Balance Sheet	**Balance Sheet**	**Balance Sheet**	**Balance Sheet**	**Balance Sheet**
Average Active Equity	Return on average common shareholder's equity, return on average assets	Return on Equity	Return on common stockholder's equity, return on total stockholder's equity, total average equity to average assets	Operating return on equity, return on equity
Total Assets	Total assets, total earning assets		Net income to average assets	
Average Total Assets				
Total Equity Adjusted				Total Equity
RWA	**RWA**	**RWA**	**RWA**	**RWA**
Average RWA	Estimated incremental RWA	Risk-weighted assets		RWA
Tier-1 Capital	Tier-1 Capital	Tier-1 Capital, Total Tier-2 Capital, Allocated Tier-3 Capital	Tier-1 common, Tier-1 capital, Total Capital (1 &2)	Core capital ratio, own funds ratio

Deutsche Bank	Credit Suisse	Goldman Sachs	JP Morgan Chase & Co	Morgan Stanley
Performance	**Performance**	**Performance**	**Performance**	**Performance**
Revenues	Revenues	Revenue	Net Revenue	Net Revenue
Costs			Non interest expense	
IBIT	Pre-tax income margin	Pre-tax earnings	Pre-tax profit, IBIT	Income before tax
Balance Sheet	**Balance Sheet**	**Balance Sheet**	**Balance Sheet**	**Balance Sheet**
Average Active Equity			Total stockholder's equity	Total Stockholder's equity
Total Assets	Total Assets	Total Assets	Total Assets	Total Assets
Average Total Assets	Return on Average Assets	Adjusted assets	Return on Assets	
Total Equity Adjusted	Return on Average Equity	Common shareholder's equity		
RWA	**RWA**	**RWA**	**RWA**	**RWA**
Average RWA	RWA	RWA		RWA
Tier-1 Capital	Tier-1 Capital	Tier-1 Capital, total capital ratio	Tier-1 capital ratio, Total capital ratio, Tier-1 common capital ratio	Total capital ratio, Tier-1 capital ratio, tier-1 common ratio

Deutsche Bank	Royal Bank of Scotland	Santander	Societe Generale	UBS
Performance	**Performance**	**Performance**	**Performance**	**Performance**
Revenues	Total Income	Revenue, income	Revenue	Revenue
Costs	Expenses	expenses		
IBIT	Operating Profit before impairment losses	Profit before taxes	Earnings before tax	
Balance Sheet	**Balance Sheet**	**Balance Sheet**	**Balance Sheet**	**Balance Sheet**
Average Active Equity	Average Equity	Shareholder's Equity	Shareholder's Equity	Return on RWA, Equity attributable to UBS shareholders,
Total Assets	Total Assets	Total Assets	Total Assets	Total Assets
Average Total Assets				
Total Equity Adjusted				
RWA	**RWA**	**RWA**	**RWA**	**RWA**
Average RWA	Average RWA	RWA	RWA	RWA
Tier-1 Capital	Tier-1 Capital, Core Tier-1 Capital ratio	Tier-1 Capital	Tier-1 ratio	Tier-1 Ratio, BIS Capital Ratio

Appendix D- VBM comparison Charts

Deutsche Bank VBMs	Bank of America	BNP Paribas	Citigroup	Commerzbank
Profitability	**Profitability**	**Profitability**	**Profitability**	**Profitability**
RoE – return on equity	Return on average equity Return on average assets	Allocated equity	Return on equity, total average equity to average assets	Operating return on equity
IBIT	IBIT	Net Income		Pre-tax result
CIR	Efficiency ratio – Fully Taxable Equivalent basis (expense over taxable revenue)	CIR		CIR
Economic profit	Economic profit	Profit	profit	
Growth	**Growth**	**Growth**	**Growth**	**Growth**
Revenue Growth	Revenue growth, net interest income growth	Revenue growth	Revenue growth	
IBIT Growth				
Asset Growth	Asset growth	Asset growth		
EP growth		Economic profit growth		
Constraints	**Constraints**	**Constraints**	**Constraints**	**Constraints**
Tier-1 ratio	Tier-1 common, Tier 1 Total,	Tier-1 ratio, Total ratio, Tier-1 Capital,	Tier-1 common, Tier-1 capital, Total Capital (1 &2)	Tier-1 Capital ratio, Core capital
Leverage ratio	Tier-1 leverage			Leverage ratio
Liquidity				
Economic capital usage				
Business mix	**Business mix**	**Business mix**	**Business mix**	**Business mix**
Share of classic banking	Revenue by business	Revenue by business	Revenue from new products	
ROA	ROA	ROA		
Revenue from growth regions			Revenue by region	
RoTCD				

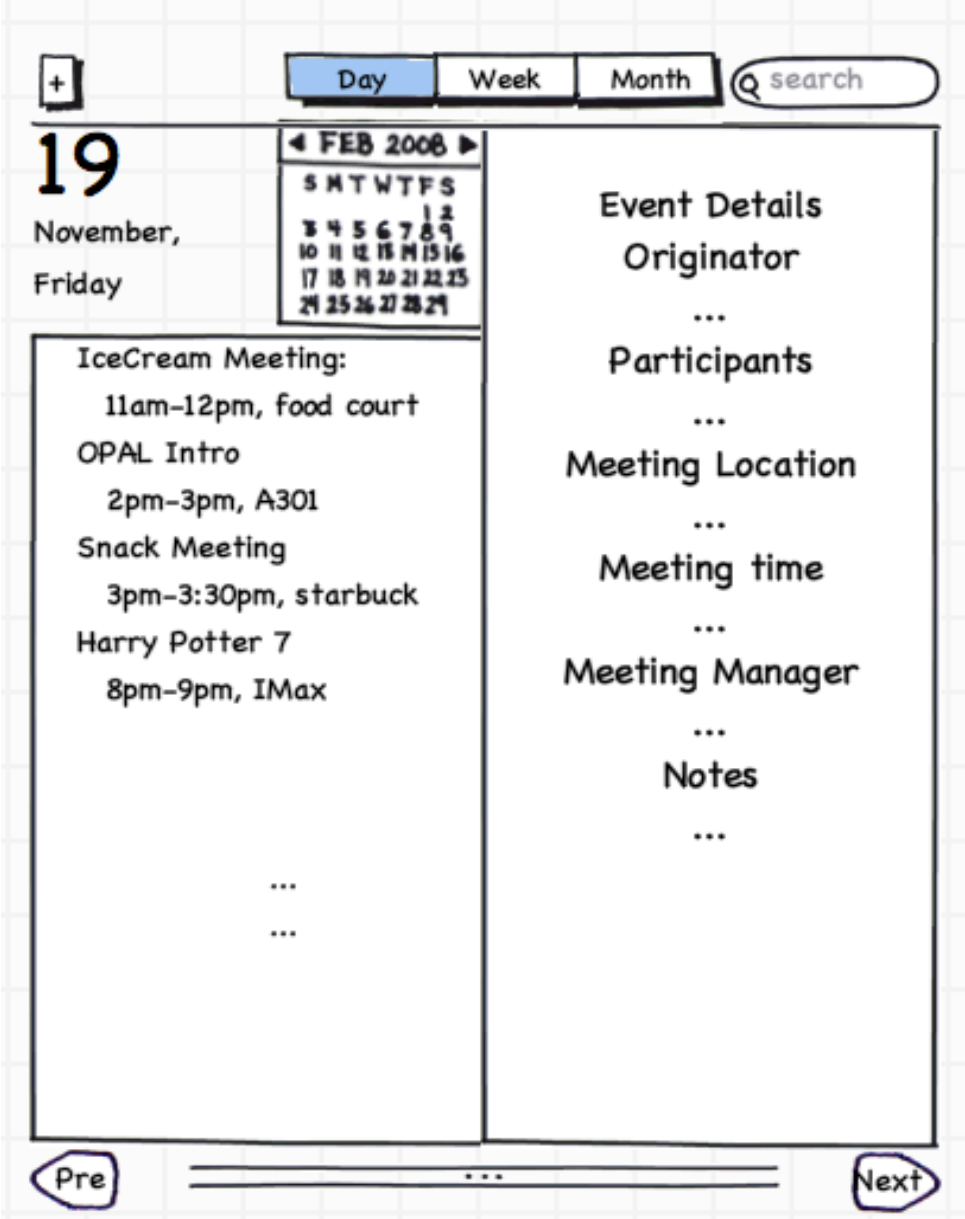
Deutsche Bank VBMs	Credit Suisse	Goldman Sachs	JP Morgan Chase & Co	Morgan Stanley
Profitability	**Profitability**	**Profitability**	**Profitability**	**Profitability**
RoE	RoE		RoE, RoA	Ro(average)E
IBIT	Pre-tax income margin	Pre-tax earnings	IBIT	Income before tax
CIR	CIR		Compensation expense as a % of total net revenue	
Economic profit	Net income margin, profit	profit	earnings	
Growth	**Growth**	**Growth**	**Growth**	**Growth**
Revenue Growth	Revenues	Revenue growth	Revenue growth	Revenue growth
IBIT Growth				
Asset Growth	Net New Asset Growth			
EP growth	Profit growth	Profit growth	Earnings growth	Economic profit growth
Constraints	**Constraints**	**Constraints**	**Constraints**	**Constraints**
Tier-1 ratio	Tier-1 ratio, total capital ratio	Tier-1 ratio, total capital ratio	Tier-1 capital ratio, Total capital ratio,	Total capital ratio, Tier-1 capital ratio,
Leverage ratio	Leverage ratio	Leverage ratio, adjusted leverage ratio, debt to equity ratio, tier-1 leverage ratio	Tier-1 leverage ratio	Tier-1 leverage ratio
Liquidity				Liquidity Reserves
Economic capital usage				
Business mix	**Business mix**	**Business mix**	**Business mix**	**Business mix**
Share of classic banking				
ROA	ROA	ROA	ROA	
Revenue from growth regions	Net new assets by region, assets by region, growth in assets	Assets by region	Revenue by Region	Assets by region
RoTCD				

Deutsche Bank VBMs	Royal Bank of Scotland	Santander	Societe Generale	UBS
Profitability	**Profitability**	**Profitability**	**Profitability**	**Profitability**
RoE	Return on Equity	RoE, RoA, RoRWA	RoE	RoAE
IBIT			IBIT	Operating profit before tax
CIR	CIR		C/I ratio	C/I ratio
Economic profit	Net interest margin	Economic profit		
Growth	**Growth**	**Growth**	**Growth**	**Growth**
Revenue Growth	Revenue growth	Revenue growth	Revenue growth	Pre-tax profit growth
IBIT Growth			Net banking income growth	
Asset Growth				
EP growth	Profit growth	Profit growth	Profit growth	Net profit growth, net new money
Constraints	**Constraints**	**Constraints**	**Constraints**	**Constraints**
Tier-1 ratio	Core Tier-1 capital ratio	Core Capital, Tier-1 capital ratio, ratio BIS	Tier-1 ratio	BIS Tier-1 ratio, BIS total ratio
Leverage ratio	Leverage Ratio	Leverage ratio	Leverage ratio	FINMA Leverage ratio
Liquidity	Liquidity Reserves			liquidity
Economic capital usage				
Business mix	**Business mix**	**Business mix**	**Business mix**	**Business mix**
Share of classic banking	Revenue by business		Sector revenue	
ROA	ROA	ROA		ROA
Revenue from growth regions	Revenue by region, Assets by region	Revenue by region		Revenue from growth regions
RoTCD				

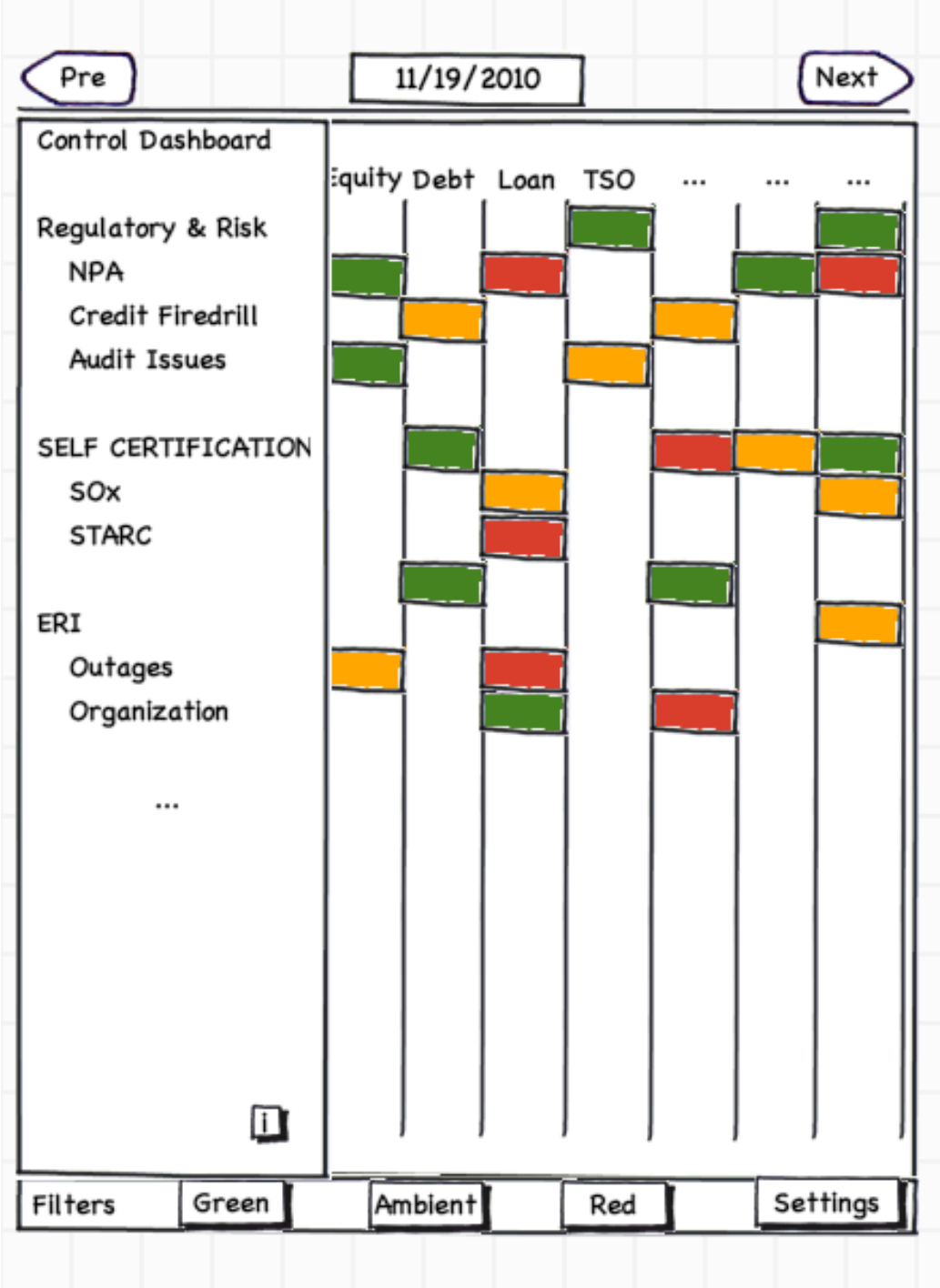
Appendix E – Cross Compiling Platforms Comparison

Comparison Between IOS Dev Platforms				
	Developing language	Supported platform	Pros	Cons
QT	C++, and most others (using Language Binding)	IPhone, Android, Symbian, Maemo, webOS, Amazon Kindle DX, Windows CE/Mobile, Embedded Linux	Flexible, wide support	No support for iPad
Titanium	HTML, CSS, JS	IPhone/iPad, Android, Blackberry (beta)	Output native app, supports module dev	No automated tests
Phone Gap	HTML, CSS, JS	IPhone, Android, Palm, Symbian, Maemo, Windows Mobile, and Blackberry	Automate tests	Output wrapper, rely on web app
Other solutions				
Flash CS5	Stopped development (Killed by Apple)			
XMLVM	Similar to Titanium, but supports more, such as .NET framework			
Notes: It may be of interest to notice that Apple has recently changed its user agreement for prohibit the native apps using cross compiling				

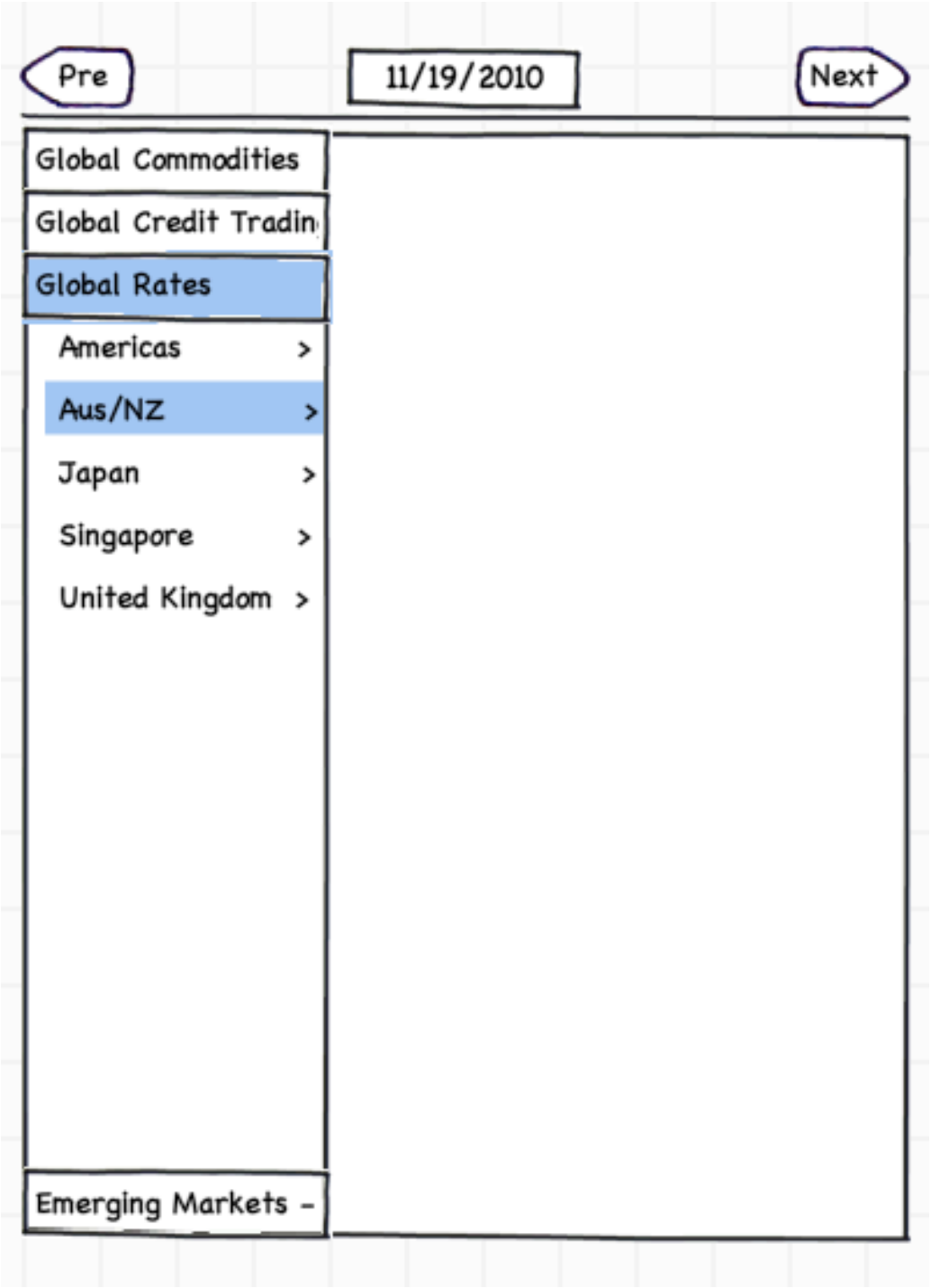
Appendix F: Prototype Design for Event Calendar

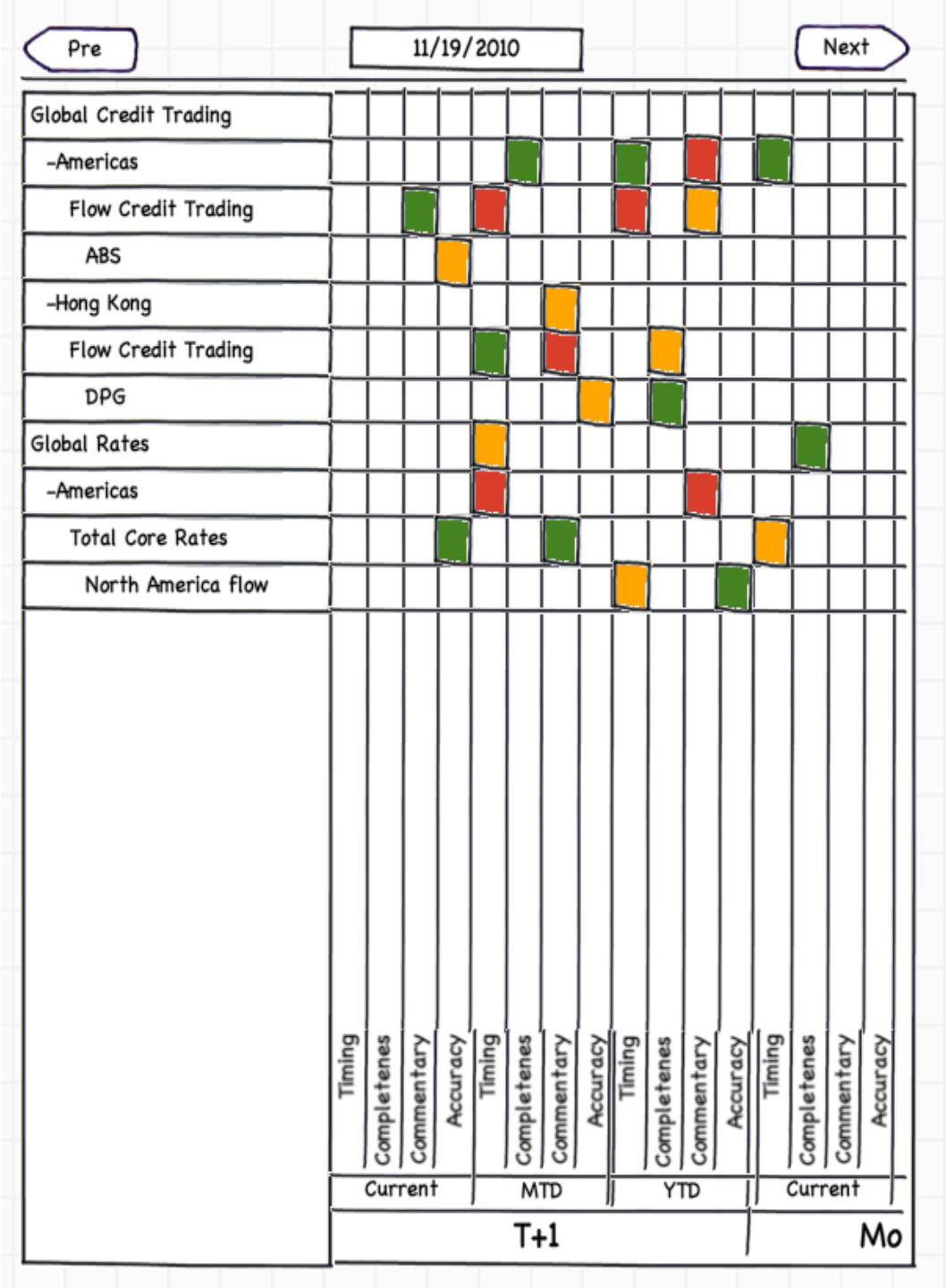


Appendix G – Prototype Design for Control Dashboard



Appendix H – Prototype Design for PIP Dashboard




Pre
11/19/2010
Next
Global Credit Trading
-Americas
Flow Credit Trading
ABS
-Hong Kong
Flow Credit Trading
DPG
Global Rates
-Americas
Total Core Rates
North America flow
Timing
Completenes
Commentary
Accuracy
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Completenes
Commentary
Accuracy
Timing
Completenes
Commentary
Accuracy
Current
MTD
YTD
Current
T+1
Mo