The aim of this master’s project is to assess the information needs of a developing hedge fund and make recommendations in the design and implementation of information systems that can support the organization’s activities. While the names of the fund, its employees, and manager are fictional, the assessment and recommendations delivered in this paper are based on the needs of an existing startup, and intended to support the ongoing development of its infrastructure. This project will delineate the functional requirements of the proposed systems in consideration of the needs of the organization’s primary stakeholders, describe existing systems, and establish a process for the organization to develop new or adapt existing systems.

Headings:

Systems analysis

Systems design

Information storage & retrieval systems – Finance
A SYSTEMS ANALYSIS APPROACH TO IMPROVING AND EXPANDING EQUITIES TRADING SYSTEMS

by

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Introduction

One of the most pressing challenges faced by any new organization is the development of an information-technology infrastructure that can support its operational needs. This is especially true in the world of financial investment, where the costs associated with system breakdowns, such as might occur when a brokerage’s order executions are delayed by network lag, can be especially high. Accordingly, organizations such as the fictional hedge fund (henceforth named Equable Assets Management) can benefit from the utility of a requirements analysis when implementing information systems.

The objectives of this project are as follows:

1. Delineate Equable Assets Management’s primary stakeholders and the functionalities they will require from the organization’s information systems.
2. Assess the functionality required of current business processes as they apply to the client’s use of existing tools and determine the best means of adapting them to the expanded needs of Equable Assets Management.
3. Deliver a model visualizing Equable Assets Management’s manager’s vision of an ideal system to support enhanced business practices and the organization of information.
1.1 Problem Definition

Greg Powell is a successful day trader who has spent his career refining his investment strategies, and is preparing to expand the scope of his activities to establish a hedge fund. At present, he works alone, utilizing the TradeStation electronic trading platform to analyze markets, execute trades, and log his trading history. Additionally, he records his trades in a Microsoft Excel workbook, grouping them in tables indicating the type of strategy that guided its execution. He also consults a variety of disparate financial information sources in order to stay appraised of market trends. As Greg prepares to hire and train other traders to work in service of his hedge fund, he has identified a need for a more efficient organization of this information that will enable him to better assess the performance of his existing strategies, develop new ones, and communicate reports of performance to the fund’s clients. To this end, Greg is seeking to design an information system for his organization that can fulfill the functional requirements of the fund’s stakeholders, either by adapting existing commercial systems to suit his organization’s needs, or hiring developers to build one to his specifications.

1.2 Stakeholder Requirements Analysis

As the manager of Equable Assets Management, Greg Powell will require a system that can support the following functions:

- Direct asset appropriations amongst employed traders and client accounts
- Update existing investment strategies and implement new ones
- Generate performance reports for individual accounts or any combination thereof based on user-determined criteria
• Create and assign workspaces (user-defined information environments that guide trading activity) to employees

The traders employed by Equable Assets Management will require a system that can support the following functions:

• View and analyze historical and contemporary market data from live feeds
• Select and apply technical indicators that attempt to predict market activity
• Retrieve daily workspace assignments and accompanying guidelines
• Automatically record data pertaining to daily trades

Potential and existing clients who might invest their own funds with Equable Assets Management will require a system that can support the following functions:

• Web-enabled account creation
• Web-enabled access to accounts allowing for the deposit and withdrawal of funds
• Automatically generate historical and contemporary reports of account performance
• Input asset allocation preferences for personal account

1.3 Scope of Project

As the author of this paper is neither a programmer nor a web or database developer, its ultimate purpose is to analyze his client’s existing processes, determine the areas in which he feels they should be improved, and assess possible solutions for their improvement. The project will also serve to delineate the functionalities the client perceives as required for the information systems that will need to be developed to accommodate his hedge fund’s business activities, providing a foundation for the creation
of formal system requirements specifications documents to be delivered to developers.

Additionally, this project will deliver a model that visualizes how these improvements can be implemented in his hedge fund’s expanded information environment.
**Existing Systems**

Greg Powell’s current business practices are dependent on his use of online brokerage TradeStation Securities’ commercial software (referred to simply as TradeStation), an electronic platform that enables users to analyze financial markets and execute trades based on real-time data feeds as well as archives of historical data, employing both pre-built and user-defined statistical algorithms to filter potential trades in service of the user’s trading strategies. Because TradeStation has fulfilled Greg’s functional requirements throughout his career as an independent agent, Greg and his consultant have decided to adapt Equable Assets Management’s improved business processes to accommodate the continued use of the TradeStation electronic trading platform and brokerage. While Greg has successfully used TradeStation’s electronic platform to support his business processes in the past, as he seeks to expand the scope of his activities, he has identified several areas of functionality that are inadequately developed to serve his vision of an ideal business process, primarily with regards to its efficiency and the organization of information that guides his trading strategies. In order to aid Greg in adapting the TradeStation electronic trading platform in a way that can best serve to address his need for improvement, this section will describe and assess the features and usability of the TradeStation software, and identify specifically the areas of Greg’s process that can be improved by expanding his information systems.
2.1 TradeStation Analysis and Trading Platform

The TradeStation Platform offers several tools designed to support the viewing and analysis of live market data. The RadarScreen tool generates up to eight customizable pages (which can be saved, closed, and loaded again for future use) of interactive tables and visualizations that allow users to view and sort combinations of live and historical market data according to search criteria manually entered into an empty field in the relevant column, pre-selected technical indicators, symbol lists from market indices and lists created by the user, and time intervals. The RadarScreen tool also allows users to customize and activate alerts that can notify the user of relevant trends or automate the execution of orders in response to market changes. Tabular data is generated using two types of analysis techniques:

1. Indicators, which use statistical algorithms to forecast market behavior based on historical data, are displayed as the most recent value for the calculation.

2. ShowMe’s and PaintBars are notifications that highlight particular fields within the table and display price values when market conditions match user-defined event-based parameters.

Users may sort rows in the table in ascending or descending values by double-clicking the desired column, or automatically by using the format command to set preferences for sort criteria and frequency.

To generate graphs, TradeStation’s Chart Analysis tool visualizes live and historical market data in a customizable time series with a variety of information visualization techniques such as bar, line, and candle-stick graphs. By clicking the “link window” buttons in the Chart Analysis and RadarScreen windows, the user can employ the Chart
Analysis tool to visualize the results of an analysis technique tabled in RadarScreen by selecting the field containing the desired value. (“Getting Started with RadarScreen” 1-9)

TradeStation allows users to execute orders either manually using a widget called the TradeStation Order Bar or automatically through the TradeStation Securities brokerage in accordance with the parameters of the user’s active trading strategies. Given the volatile and highly time-sensitive context of financial markets, Greg considers the ability of the software to automate trade orders in accordance with pre-developed strategies as essential. With EasyLanguage, TradeStation’s proprietary programming language, users can develop and back-test their own trading strategies using historical data before “going live” and implementing them in active markets. This is another feature of the software that Greg considers mandatory, as the ability to develop and test experimental trading strategies is fundamental to the growth of his business. When used in conjunction with the RadarScreen tool, EasyLanguage can be used to program customized indicators or define parameters for algorithmic computations of live and historical market data.

TradeStation also supports the installation of third-party add-ons developed by EasyLanguage programmers, allowing users to install custom indicators or trading strategies built by others. Additionally, EasyLanguage is capable of referencing external DLLs, a feature which allows for the possibility of programming modifications in other languages. (EasyLanguage Essentials 1-3)

The TradeStation TradeManager Analysis tool generates a performance report that logs the details of every trade executed by the user. The information displayed in the report can be filtered by symbol, time frame, and account (if the user is trading with
resources from multiple accounts). ("TradeManager - Advanced Order Management Tool")

2.2 Business Processes
Because the details of Greg’s strategies and their setups involve high-level technical analysis of financial markets that are outside the descriptive scope of this project, this section will make no reference to the specific indicators that are used to generate the data that informs his daily activity. Instead, it will contextualize the information by describing its sources, the nature of its organization, and how it is used to guide his activity. For the purposes of this paper, it is useful for the reader to understand that setups, when referred to in this context, are analogous to tactics, specific modes of market analysis and maneuvering that help serve the goals of the trader’s larger strategies. “Gap play,” for example, refers to the overall strategy that the types of setups (or tactics) are intended to support. Greg’s business process can be roughly delineated in four phases, described below, with Greg’s thoughts as to how each phase can be improved.

2.2.1 Pre-Market Preparation
Before the market opens at 8 a.m. and trading begins, Greg must perform a historical analysis of market conditions. To do so, he uses RadarScreen, selecting indicators where appropriate to generate tables of data derived from TradeStation’s data feed of historical market conditions, each table pertaining to indices, sectors, key price market levels, volume market levels, and sentiment readings respectively. Greg then imports the tables to Excel and examines each field’s value, manually performing algorithmic calculations and annotating them with abbreviations that designate statuses
(B for Buy, S for Sell, N for Neutral or “no action,” serve as examples, though these change depending on the data being analyzed) guiding his potential trades. Because the number of fields he must examine and perform calculations upon can number in the hundreds, this is a laborious and time-consuming process, and one that Greg is seeking to automate with improvements to his system.

2.2.2 Active Market Information

Once armed with the information derived from historical data that his strategies suggest should predict market trends, Greg can begin navigating the live data which guides him in actually executing trades. While the analysis used in his pre-market preparation should identify trends in buying and selling pressures (which are in turn indicative of correlating increases and decreases in the values of share prices and market indices), Greg cannot know for sure whether the actions suggested by indicators applied to yesterday’s data will prove profitable under live market conditions. Accordingly, the indicators he employs and indices he references during his active trading test the veracity of his historical analysis, thus guiding him in adjusting his behavior to account for shifts in buying and selling pressures. Each day, he manually formats a RadarScreen page to generate tables and visualizations from TradeStation’s live data feed of the indicators and indices that inform his application of the day’s trading strategies. Again, this is a time-consuming process that Greg wishes to automate.

As market conditions progress throughout the day, Greg regularly refers to his active market information, assessing which strategies will be most effective on that day and applying particular setups wherever market conditions match the parameters deemed necessary for their successful execution. These setups are driven by the monitoring and
collection of live data from various sources, including the pre-built Active Market Information RadarScreen page, websites of particular exchanges and markets (such as http://www.cmegroup.com and http://www.onechicago.com), and sources of financial news such as the TradeStation Ticker Bar (a widget that presents the user with a live feed of recent news headlines). Because Greg is constantly clicking back and forth between a varying combination of Internet browser windows and the TradeStation platform, he wonders if there might be a better means of organizing and monitoring the information pertinent to his activities.

2.2.3 Executing Trades

Each individual setup is informed by its own system of data monitoring and analysis, much of which requires the manual computation of numbers according to pre-determined formulas. The results of these analyses are designed to remove the capacity for human error from the trading process, since they designate the conditions under which specific actions (such as buy and sell) should be taken in response to the market’s fluctuations. Greg is interested in automating as much of this process as possible, especially with regards to the manual calculations he must perform for each setup.

Currently, Greg uses RadarScreen to generate the market data that informs his analysis, saving a page for each setup that is already formatted to the necessary parameters of his desired filters and indicators. The particular sectors, indices, or stocks monitored on each setup page vary according to the data Greg collects during the Active Market Information phase of his process. When the values of fields in the tables generated on each page meet the conditions defined by that page’s setup, Greg considers that setup “hit,” and places an order using the TradeStation order bar, manually entering
the symbol that refers to the security being traded and designating the types of actions to be taken, at what prices and quantities, and for what durations using a combination of drop-down lists and input fields. The trade is then executed by the TradeStation brokerage. Greg would like to be able to more quickly identify when strategies are hit, and if possible, automate the successive execution of orders.

### 2.2.4 Recording Performance History

When Greg submits a trade to the TradeStation brokerage, its details are logged and made available for his perusal through the TradeStation platform with the TradeManager Analysis tool. Because the refinement of his strategies depends on his ability to monitor their respective performances, Greg uses this tool to generate a comprehensive list of the trades he has executed within a certain time frame. He then scours the list, identifying and sorting trades according to the strategies that informed their execution. Once a relevant trade is identified, he records its details in an Excel spreadsheet, creating individual tables on a single page that categorize trades executed under certain strategies by type. This is another task that Greg hopes can be automated by his expanded information systems.

### 2.3 Summary of Desired Improvements

The areas of his business process that Greg feels could be improved can be generalized into two areas of functionality. The first pertains primarily to the efficiency with which Greg completes the tasks comprising his business processes. During the pre-market preparation phase of gathering the information which guides the day’s selection of strategies and subsequently the setups employed in their service, Greg must manually perform a number of calculations, and then manually structure the resulting data in the
desired manner. Setups are similarly served by manual computations, such as when Greg determines how many shares to trade and at what prices to enter (buy) and exit (sell). This is a process he desires to automate such that this information will be already available to him at the time the market opens. Additionally, he must be actively monitoring the TradeStation RadarScreen throughout the day in order to identify profitable trading opportunities, and then manually execute whatever trades are deemed profitable under the parameters of his setups. Time is of the essence in Greg’s business, and so even the briefest moment of inattentiveness can prove costly. Greg would like his enhanced system to automatically identify and execute profitable trades.

The second area of improvement can be broadly classified as the organization of information. Because the data Greg uses comes from a variety of sources and is displayed in a variety of formats, Greg spends a great deal of time manually collecting, reorganizing, and classifying this data to suit his purposes, such as he does when monitoring the active market and recording his performance history. In Greg’s ideal vision of an enhanced business processes, equities whose behaviors match the parameters of his setups are automatically filtered and displayed from the larger collections of data representing their respective markets. Similarly, trades are automatically recorded and organized according to the strategy that guided their execution.
Improving and Adapting Existing Systems

This section of the paper will make recommendations to the client as to how he might improve existing systems to meet his perceived need for improvement. Additionally, this section will describe the client’s vision for his hedge fund’s organizational structure and operational procedures in order to identify areas of expanded functionality that cannot be fulfilled by existing systems, and thus call for the development of new ones.

3.1 Customizing the TradeStation Analysis and Trading Platform

The ability of users to customize all aspects of market analysis and trading using EasyLanguage is the TradeStation platform’s greatest strength. With EasyLanguage, users can customize indicators, alerts (ShowMe’s and PaintBars), and searches that filter market data, all in accordance with the parameters defined by the programmer in service of his strategies and setups. Because the third-party sources Greg consults for market information derive their data from the same feeds provided by the TradeStation platform, EasyLanguage commands could be programmed to deliver data filtered according to each source’s search parameters, eliminating his need to refer to multiple sources for market information. Users may also use EasyLanguage to automate orders when equities’ market behaviors match the conditions defined by their setups. These capabilities indicate that the improvements Greg is seeking to implement with regards to the development and testing of new strategies and setups and the automation of data collection, data analysis, and order execution are indeed feasible by programming EasyLanguage functions. For
the most part, program commands are constructed using logical if-then statements written in English, and so the language is thus easier to learn than more complicated languages for traders with less technical backgrounds. *(EasyLanguage Essentials 3-5)* While this characteristic of EasyLanguage is a clear advantage, it also means that its capacity to provide more robust functionality is somewhat limited, and so is inadequately suited to solve his organization of information problem.

### 3.1.1 Expanding TradeStation Platform Functionality

In order to enable their users to better adapt the TradeStation platform to fulfill the needs of their organizations, TradeStation has made an EasyLanguage Extension Software Development Kit (or SDK) available as an add-on to the existing software. The EasyLanguage SDK allows programmers to use EasyLanguage in conjunction with higher-level programming languages such as C++ by referencing external dynamic-link libraries (DLLs) to execute functions unsupported by EasyLanguage commands. This makes feasible the integration of the TradeStation platform with third-party systems and applications, such as databases and customized user interfaces. *(“EasyLanguage Extension Software Development Kit,” 1-3)* Accordingly, Greg and his consultant have decided that in order to address his organization of information problem, a user interface that collects, organizes, and displays pertinent data from TradeStation in the desired format and allows users to execute orders without manually switching to the TradeStation platform should be developed. Additionally, to improve his ability to record and analyze his firm’s performance history and generate reports for existing and potential clients, a relational database should be designed to operate in conjunction with the TradeStation platform, Greg’s customized user interface, and the hedge fund’s client-accessible
website. Later sections of this paper will describe in more detail the required functionalities of these tools within the context of Greg’s vision for his hedge fund’s organization and operations.

3.2 Hierarchical Organization of Expanded Operations
At the time of this paper’s completion, the specific requirements of the developing organization’s administrative and information-technology entities that will support and maintain the firm’s infrastructure are difficult to predict. This is for two reasons. First, the size of the organization (i.e., the number of employees necessary to fulfill business functions) will vary depending on the amount of startup capital Greg is able to acquire. Secondly, until the tools Greg wishes to develop to support his enhanced business processes have been successfully created and tested, it is impossible to ascertain the degree or extent to which these applications will need to be maintained by qualified information-technology professionals. While the author is certain that Equable Assets Management will need to incorporate such support entities into its structure, the present dearth of necessary information means that this section of the paper will refer only to the primary stakeholders already described in section 1.2.

3.2.1 Contextualizing Stakeholder Interactions in New and Adapted Systems
As the operational manager of Equable Assets Management, the execution of the firm’s daily business processes begins with Greg. After assessing market conditions, Greg delegates the day’s activities to the traders under his employ, assigning to them a class of equity (options, stocks, futures, and foreign exchange markets) to be traded and identifying the strategies deemed appropriate for profitable trading by his assessment. He also allocates operational funds to each trader. This is done in consideration of each
trader’s ability and performance history. For example, if Greg observes that one of his employees has been historically performing particularly well in trading options, he might decide to allocate more of the firm’s working capital to that employee’s daily operations. Contrarily, under opposite conditions, he might choose to allocate less. These tasks would be supported by Greg’s customized user interface and relational database, with access to the functionalities that support them restricted to him alone.

Upon receiving their assignments, traders proceed with the day’s activities, monitoring data, applying setups, and executing trades in accordance with the strategies selected by their manager. These activities would be supported by the customized user-interface, each assignment taking the form of a pre-designed workspace that collects, organizes, and displays pertinent active market information from the TradeStation platform, and allows traders to adjust and apply setups to execute orders using the funds allocated to them by the manager. The user interface would then feed the details of these transactions to Equable Assets Management’s database, automatically recording the firm’s performance history to support Greg’s internal evaluations as well as the generation of client reports.

In order to fulfill the stakeholder requirements of new and potential clients, it will be necessary to develop a website. For potential clients, the website will serve to advertise Equable Assets Management’s services, and enable them to create user accounts if they wish to begin investing funds with the firm. Existing clients, upon logging into their accounts, will be able to deposit additional funds, request withdrawals of funds, indicate the preferred allocation of their funds among the classes of equities traded by Equable Assets Management, and download performance history reports.
specific to their accounts. These features will be supported by integrating the website with Equable Assets Management’s relational database.

In order to support the successful integration of these systems, a conceptual model has been created to visualize these interactions in the context of Equable Assets Management’s business processes and its stakeholder’s activities, and is included in Appendix A of this paper.
Future Tasks and Continued Collaboration

At the time of this paper’s completion, a great deal remains to be done in order to successfully develop and implement the client’s desired improvements in the expanded context of his startup hedge fund. The ultimate usefulness of this project will be determined by the products of an ongoing collaboration between the author and client, the details of which will be described in this section.

4.1 System Requirements Specification for Programming EasyLanguage Functions and Wireframe for User Interface Design

As neither the author of this paper nor his client possess the technical skills or knowledge to program functions in EasyLanguage, a third-party developer will need to be contracted to build the client’s desired customizations to the TradeStation platform. The TradeStation Strategy Network, which serves as a marketplace for third-party developers to sell their modifications, will be the primary resource for author and client in vetting and selecting a developer to program the desired improvements. Since the improved organization of information and trading efficiency the client seeks to achieve through the use of customized workspaces depends on their successful integration with the TradeStation platform, the primary criteria for selecting a developer will be his ability to program in both EasyLanguage and a higher-level language that can be referenced by an external DLL to create the customized user interface. Accordingly, a system requirements specification document delineating all necessary functions and use cases
will need to be composed, and a wireframe designed that indicates the components of the customized user interface envisioned by the client.

4.2 Relational Database System Requirements Specification and Entity-Relationship Model

As neither the author of this paper nor his client possess the technical skills or knowledge to develop a relational database, a third-party developer will need to be contracted to build the database that meets the organization’s functional requirements. Again, the TradeStation Strategy Network will serve as the primary resource for author and client in selecting a developer. The author will be responsible for composing a system requirements specification document as well as producing an entity-relationship model in order to conceptualize the database’s functionality.

4.3 Website System Requirements Specification

While the client has already contracted with a third-party to develop his hedge fund’s website, a system requirements specification document will need to be delivered that details the functionalities to be fulfilled by the website as well as the aspects of the database with which it should be integrated. The client has opted to leave the website’s visual design up to the developer, though he expects to enjoy a significant degree of oversight when reviewing the final product.
Methodology and Conclusions

The information presented in this paper was the product of a systems analysis approach to devising solutions to perceived deficits in existing systems and developing new ones to accommodate the expanded operational procedures of a fledgling organization. In the context of the systems development process outlined in Hugh Beyer and Karen Holtzblatt’s Contextual Design: Defining Customer-Centered Systems, this paper fulfills the “System requirements analysis” phase of development. (222).

Information regarding the client’s existing business processes was collected primarily from an unpublished report of his trading strategies that he uses as an advertising tool in client acquisition and technical manuals for the TradeStation Analysis and Trading Platform. When clarifications were necessary, the client offered a live demonstration of the ambiguous process, though at no time was he observed during active business hours.

In order for the author to acquire a better understanding of financial markets and equities trading in general, a number of other books were consulted, and are included in this paper’s bibliography.

In conclusion, this paper represents the foundation of an ongoing collaboration between the author and his client. Through the course of its research and writing, the author acquired an extensive understanding of the systems and processes that inform the activities of an equities trader, which will enable him to proceed with the design phase of the systems development process in support of the establishment of his client’s hedge fund.
Works Cited


Bibliography


Appendix A – Conceptual Model of Stakeholders and Systems

Conceptual Model of Stakeholders and Systems Interactions