Development and Implementation of the Quality Evaluation Metric Application

To Promote Continuous Process Improvement at Phillips, Hager and North

by

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Abstract

This thesis describes the development and implementation of the Quality Evaluation Metric application (QEM) in the Client Services (CS) Department at Phillips, Hager and North Investment Management, Ltd. The objective of this project is to assist the CS department in improving client satisfaction by reducing the number of errors committed during processing mutual fund transactions.

Initially, the only sources of data available regarding how and why errors occur were in paper format, inconsistent and qualitative in nature. The QEM application was developed and implemented to collect data on errors electronically through a web interface. Eleven months of historical data was entered into the QEM application and the results from the data analysis provided valuable insights into the performance of the business processes in the department. Additionally, with the results obtained from the data analysis, periodic quality reports were developed and implemented within the company to promote continuous quality improvement and to evaluate the success of any quality initiative undertaken by the department in the future.

The QEM application serves as a channel to periodically monitor the quality of service, to provide valuable insights into the performance of the business processes and to evaluate future quality improvements. All three results are essential in promoting and sustaining continuous improvements.
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1. Project Background

The research documented within this thesis was conducted at the Center for Operations Excellence (COE) in the Faculty of Commerce and Business Administration within the University of British Columbia. This thesis reports the accumulation of results of a project done in collaboration with COE partner Phillips, Hager & North Investment Management Limited (PH&N).

PH&N is one of the foremost investment management companies located in Canada and manages over $33 billions in assets [PHN]. This firm provides three types of services - institutional fund management, private client portfolio management, and mutual fund account management. The primary concern of this thesis is with the Client Services Department (CS) of the company.

The CS department is responsible for processing mutual fund transactions. This department can be perceived as a separate operational unit within PH&N for the purpose of this study. The CS department provides services to three types of clients - retail clients, internal clients and brokers. Retail clients are retail mutual funds investors. Internal clients consist of investment managers overseeing institutional clients and clients with private portfolios. Dealers represent their clients and submit requests to PH&N on their clients' behalf.

1.1 Project Objective

Due to the inherent nature of service within the investment management industry, the operating costs needed to run investment management companies are primarily fixed and variable costs are low. This means that human and technology resources are relatively independent of the value of assets that the company is managing. Thus one of the major driving forces for profits at PH&N is demand for providing investment management services. As shown in Figure 1, two factors that affect the client’s decision to use the services of an investment management company are investment returns and client satisfaction. Client satisfaction refers to the quality of services that the client receives independent of investment returns.

![Diagram](image)

Figure 1 Driving Force of Profits at PH&N
Client satisfaction is expansive and difficult to define. As illustrated in Figure 2, client satisfaction spans between two ends of a spectrum – qualitative and quantitative. Examples of this claim may include situations in which PH&N may have processed the trade accurately but the client was dissatisfied because he or she received discourteous service. Conversely PH&N may have processed a request incorrectly but the promptness in correcting the error impressed the client and led to a positive experience. It is important to note that the business processes encompass both the qualitative and quantitative aspects of client satisfaction. The quantitative aspect is seen in the physical workflow, which includes actual transaction processing, whereas the qualitative aspect is seen primarily in the delivery method of services.

PH&N recognized this relationship between client satisfaction and profits. As a result the company initiated three projects in order to improve client satisfaction on the qualitative side; two of which were conducted in collaboration with the COE. Paul Hiom [Hiom] developed a model simulating the manner in which PH&N handled all of their client contacts. The model was used to evaluate possible changes to client contact architecture so as to improve customer service as well as to increase potential revenue generation. Ana Maria Kim [Kim] developed a scheduling tool to provide the call center with an approach to allocate and schedule staff to achieve target service levels. The third project is the implementation of the ONYX system, a customer relationship management system that collects and stores every client-firm interaction. All three projects were conducted with the objective of improving the customer service level.

The objective of this project is to assist the CS department at PH&N towards improving client satisfaction through the implementation of a quality initiative. This thesis focuses on the quantitative aspect of client satisfaction and elucidates the procedures employed in this project to implement a quality program at PH&N with the objective of reducing the number of errors perpetrated during processing mutual fund transactions.

1.2 Business Needs and Benefits

Figure 3 on the following page describes the relationship between business processes and client satisfaction within an organization. A specific business procedure...
dictates each type of transaction and spans through multiple departments. For example when a client initiates a “purchase” request to procure the Canadian Equity Fund, the external client, the CS department, the Contact Center and the client’s advisor may be involved. The transaction follows a specific path in which distinct actions are taken to consummate the client’s request. The client is only exposed to the output of the process. The accuracy of the output is what is of importance to the client as a client conceivably would be dissatisfied if his request were processed erroneously.

If an error occurs in this operation, one or more of the specific tasks within the business process must have failed and created an output that is unfavorable to the client which in turn can be detrimental to the PH&N-client relationship. A more detailed explanation of errors appears in the next section (Section 1.3). Since the output is inherently dependent on the process itself, the client’s desire for accurate outputs implicitly demands flawless workflow.

PH&N takes every error seriously and deals with it promptly. Before this project began, a weekly error report was issued detailing all errors. It itemized the type of error and the action taken to correct it as well as the error percentage – the daily error rate as the percentage of total number of transactions. An in-depth analysis on the current methodology of evaluating quality is discussed in Section 1.4. If a certain type of error occurs repeatedly, a quality meeting will be held to discuss the reasons why these errors occurred and to determine the course of action that should be taken to prevent this from happening in the future.

1.3 The Nature of Transaction Errors

An error occurs when any unfavourable output is created while fulfilling a client’s request. Errors are discovered through two channels. The first channel involves the clients themselves. A client upon discovering an error has been committed on his or her transaction or information request will report it to the CS department. This channel of error detection accounts for the majority of errors within the department. The second method is through the “Transaction Rejection Report”. The UNITRAX system, a mutual
fund trading system, produces this report every day and outlines all the rejected transactions that were put through the previous day. This is a more proactive method of detecting errors because these errors are usually corrected before the confirmation reports are sent to the clients. However, this method of detecting errors is very limited because the UNITRAX system detects only two types of errors: transactions rejected because there is a problem with the system itself and transactions rejected because there is a problem settling the trade with the clients’ accounts due to insufficient funds.

An error is only considered such if it is reported to the CS department. It is quite possible that not all errors are discovered. This may be due in part to the client feeling that the error is very minor and that it is not worth his or her effort to report this mistake to the company. In this case PH&N would be oblivious to the error. It is impossible to capture this characteristic; therefore this research assumes that all errors are discovered and reported.

As mentioned above the client reports the majority of the errors. Clients can only detect errors through reviewing their correspondence with PH&N (such as confirmation reports, quarterly statements) and with the bank (such as bank statements). A period of time is required, denoted as Time Lag, before the error is reported to PH&N. In this thesis, Created Date denotes the day that the error was committed by PH&N, Report Date denotes the day that the error was reported to PH&N by the client and Resolved Date denotes the day that the actions were taken to correct the error.

An error can be further classified as either a controllable error or an uncontrollable error. A controllable error is one in which the tasks and actions pertaining to the business process are capable of preventing an error from occurring. For example, the dollar amount on the fax is unclear when processing a redemption transaction. The redemption process dictates that the staff should call the client to confirm the dollar amount. If the staff made a determination and assumed that the client meant $7000 instead of $1000, an error would have been created and this specific error would come under the classification of a controllable error. An uncontrollable error is defined as an incidence in which the staff had absolutely no control over the output of the process. An example of an uncontrollable error might be if the client wrote down the incorrect fund name during the purchase process.

1.4 Analysis of current error reporting methodology

Prior to this study, PH&N evaluated and reported errors manually. When a mistake is reported to PH&N, an error report must be completed and then stored in paper format and filed. No electronic version of error report is available. Error reports can be mislaid or lost over time. This paper-reporting format is insufficient as it lacks accuracy as well as efficiency.

A copy of the current report is included in Appendix A. The error report is not structured to be process oriented. The “Detail” field is the only field that vaguely
describes which task(s) in the business process failed. However this field is qualitative and is free form text.

The human aspect of the current methodology of reporting error poses data issues. Different people have dissimilar perceptions of error. The information included on the error report varies from person to person. Hence the data captured on the error report is inconsistent.

The lack of electronic data, inconsistency in the data and the qualitative nature of available data regarding process task failures make data analysis difficult. Although valuable information can be extracted from the quality assurance personnel’s’ experience in the CS department, this information may be subjective and limited. Most important of all, trends and characteristics of the business process failures may be overlooked. Without historical data and information of how and why errors are created, the COE team or any external consultants cannot objectively assess the quality issues that the CS department faces.

### 1.4.1 Analysis of current quality measurement

Currently, PH&N evaluates quality based on the daily controllable error rate. Error Rate is defined as:

$$\text{Error Rate} = \frac{\text{Number of incorrect transactions reported}}{\text{Number of Transactions}}$$

This measure alone is not effective and statistically inaccurate in assessing the quality of the operation. The error rate as defined is dependent on the date when the client reports the error to PH&N and neglects the day when the error is created. Figure 4 is a simple example that will demonstrate the inaccuracy of this measurement.

![Figure 4 Reporting Error By Resolved Date Vs Reported Date](image)

This example shows that the reported error rate is worsening over the 3 days period; however, in reality, the actual error rate is decreasing. Management may be
tended to implement changes to the business processes and to the staff in the department in the hopes of improving quality of service.

This discrepancy between the actual and the reported error rate can be spotted easily in this three days example. However, when the time horizon is extended, it is impossible to correctly assess quality. Figure 6 demonstrates the discrepancy over an eleven months period. The graph is based on the data collected when initializing the Quality Evaluation Metric (QEM) database used to electronically collect data on errors. The data compiled and the methodology of collecting the data are discussed in detail in Section 3.1

![Comparison of Actual and Reported Errors](image)

**Figure 5**

The circles in Figure 6 identify periods where there is a discrepancy in the trends of the quality level of the CS department. This discrepancy has occurred frequently and can be discouraging to the staff. For example, the circle with label A shows that the quality of service in the CS department is deteriorating according to the current methodology of reporting errors. Even though the staff endeavoured to ensure the accuracy of their work, the measurement indicated to them that their efforts led to the deterioration in service.

Another metric used to measure quality of service at the CS department is the cumulative percent of transactions processed correctly since July 1999; however, similar to the daily error rate, there are flaws in this measurement. The volume of daily transactions is either in hundreds or in thousands. The cumulative number of transactions since July 1999 was very large. The department would have to incorrectly process a significantly large number of transactions in order to lower this measurement by even 0.01% in a short period of time. A 99.82% value may be seen to be no different than 99.81% and therefore management may overlook the hidden implications of this measurement.

Both the daily error rate and the cumulative percent of transactions processed correctly are internally focused and are only suitable to assess staff performance. Neither
of these measurements provide any information on how many clients are dissatisfied, how many resources are allocated to correct the errors or how the errors affect client satisfaction. Moreover, there is no measure of error severity.
II. Literature Review

Total quality management (TQM) may be an appropriate concept to assist the CS department toward improving client satisfaction. Numerous papers and books discuss the concepts of TQM. The definition and theory of TQM vary depending upon the author. Dean and Evans define TQM as “total, company-wide effort that includes all employees, suppliers, and customers, and that seeks continuously to improve the quality of products and processes to meet the needs and expectations of customers” [Dean and Evans]. This definition of TQM summarizes the four fundamentals of TQM effectively – customer focus, strategic planning and leadership, continuous improvement, as well as empowerment and teamwork.

Dean and Evans emphasize that any quality initiative should have the objective of improving client satisfaction. All aspects of the business, from the products it offers to the method of delivering the service, should be carefully examined to determine the effects of changes on client satisfaction. “Remaining close to the customer” [Dean and Evans] is critical in retaining existing customers and in pursuing prospective customers.

TQM requires thorough planning and full commitment from top management. This leadership is critical in ensuring the success of TQM. The authors accentuate that “if commitment to quality is not a priority, any initiative is doomed to failure” [Dean and Evans].

Continuous improvement is essential to achieve the highest levels of quality and competitiveness. As well, the process of continuous improvement must contain periodic and systematic evaluation. A measurement system, based on reliable information and data, must be implemented to assess the progress and effectiveness of quality efforts. The authors indicate that these measurements should be directly linked to customer satisfaction and operational performance to achieve optimal results.

Participation and teamwork from all staff members within an organization is essential to succeed in TQM. Since the performance of business process requires the collective efforts of all staff members, individual efforts may prohibit quality improvements. Incentives should be incorporated to facilitate teamwork among staff members toward achieving quality improvements. Staff members have “first hand” knowledge of the performance and potential problems of the business processes; thus, empowering the staff can enhance the success of quality improvements by providing the “training in quality skills related to performing their work and to understanding and solving quality-related problems”[Dean and Evans].

Federal Express (Fedex) is an ideal example to illustrate the success and benefits of implementing TQM [AMA]. The company won the Malcolm Baldrige National Quality Award in 1990, a prestigious award perceived as the highest distinction for quality in an American corporation. All of the principles discussed above were clearly applied by Federal Express to achieve TQM. The most interesting result from this
example is the Service Quality Indicator. The SQI measures the impact of particular service outputs on client satisfaction.

SQI is comprised of a set of outputs that influence customer satisfaction; for example missed pick-ups, wrong day late deliveries and right day late deliveries. Each factor is weighted relative to the negative impact in client satisfaction. For example missed pickups have a score of ten points per occurrence, wrong day late deliveries five points and right day late deliveries one point (the ideal SQI score is zero). In this manner, the level of effect from operations on customer satisfaction is taken into account. If Fedex were simply to measure on-time delivery, all three scenarios would affect the measurement equally.

"...from the first days of FedEx's operation until well into the late 1980s, the primary gauge by which the company measured service performance and customer satisfaction was percentage of on-time delivery—the number of packages delivered on time as a percentage of total package volume. By the late 1980s, Federal Express officials began to recognize that percentage of on-time delivery was, in reality, an internal or introspective measure of customer satisfaction using the company's own standards, not an external measure of customer satisfaction using the customer's standards." [AMA]

Since customer satisfaction is not being measured directly, verifying that the measured quantities in fact do correlate to customer satisfaction is necessary. In the case of Fedex, this validation process came in the form of comparing the trends of SQI scores and customer satisfaction survey results over time. Figure 6 shows a general relationship between the SQI scores and level of customer satisfaction. From the empirical data, the level of customer satisfaction increases as SQI scores decreases. This in turn demonstrates that the SQI scores serve as an indicator of client satisfaction. The SQI scores were therefore used as a benchmark for Fedex's current business processes and the evaluation of business process changes.

![Figure 6 Benchmarking SQI with Customer Satisfaction at Fedex](image-url)
III Methodology

A Quality Evaluation Metric (QEM) application was developed to provide a means to evaluate current business processes. The QEM application provides a systematic and accurate approach to collect error data and therefore provides insights into how an error occurred within a process. With this increased understanding of how and why errors occur, recommendations can be made to prevent these errors from happening which will lead to a reduction in the number of errors and ultimately improve the client’s satisfaction.

3.1 “As Is” Process Modeling

The objective of the “As Is” Process Modeling is to understand and document the business processes within and around the CS department. Each process is defined in terms of the nature of the client’s request; for example, a set of distinct actions is taken to process a “Purchase” transaction. Process maps were developed for each business process in collaboration with the staff at the CS department. For each process interviews were conducted with senior staff of the department who had an in depth knowledge of that specific process.

The level of detail in the process maps is kept at a high level. Instead of mapping out every action taken to process a request, similar actions are grouped into one step. For example, “pre-screening” the transaction involves a number of steps including checking whether the clients have left previous messages in the UNITRAX system regarding this particular trade, checking whether the clients wrote down the correct account number, and checking foreign contents limitations [PHN-2]. These actions are all grouped under the step entitled “Pre-screening”. The steps within pre-screening for processing a purchase transaction will be different from processing a switch transaction. The level of detail in the process map was determined together with the CS management. Management and the COE project agreed that it would be impractical and of limited benefit to the CS department or the COE project team to map out all actions in detail.

Seventeen business processes were identified and mapped. They are grouped into 5 main categories:

1. Basic Financial Transaction
2. Non-Financial Transaction
3. Advanced Financial Transaction
4. Information Transfer Transaction
5. Error Correction
3.1.1 Basic Financial Transactions

Basic financial transactions are transactions with significant volumes for which there are standard processes. There are five different types of basic financial transactions. A purchase transaction is the purchase of any PH&N pooled fund product. A redemption transaction is the sale of any PH&N pooled fund product. A transfer transaction moves holdings from one account to another and the two accounts do not necessarily have to be held by the same client. A switch transaction switches holdings from one fund to another. Dealer services transactions are transactions that are carried out by dealers on behalf of clients.

3.1.2 Non-Financial Transactions

Either an external client or a Portfolio Manager on behalf of the client can initiate non-financial transactions. These transactions include any information changes, administrative changes or automatic transaction set-up, modification and termination.

3.1.3 Advanced Financial Transactions

This category of transaction is relatively low in volume and the complexities of these transactions are significantly greater than Basic Financial Transactions. There are six different types of advanced financial transactions. Account Holding Re-balancing is used to convert the current holdings in a client’s account into client specified fund weightings. Foreign Content Re-balancing ensures that no client’s account is over the foreign content limit on his or her RRSP account. RRSP rollover transfers a client’s RRSP holdings from another financial institution over to PH&N. Annual RRSP to RRIF Conversion rolls over the client’s account from RRSP to RRIF when the client reaches the age of 69. RESP Set-up creates an RESP account for current PH&N’s clients only. The Estate process rolls over the deceased client’s estate to his or her designated beneficiary.

3.1.4 Information Transfer Transactions

There are two types of transactions in this category. Quarterly Statements Production produces statements summarizing details of all transaction activity during the previous quarter and a snap shot of the current holdings in each of the client’s accounts. Client Information Requests provide and gather all information requested by the client regarding his or her account with PH&N.

3.1.5 Error Correction

Error Correction corrects errors once they are reported to the CS department.
The “As Is” Modeling stage is an iterative process due to the constant introduction of new products offered by PH&N (RESP, PHN.com); therefore it is important that the staff at the CS department possess the knowledge to develop these process maps after the consulting project terminates. All the process maps were developed jointly with the staff members. As well, training was provided for the Operation Analyst (this role will be described more in detail in the Conclusion) to use Process v3, a software application preferred by PH&N to standardize all process maps developed within the firm. By involving the staff in the development of the process maps, the staff at PH&N possesses the knowledge and ability to sustain this iterative process after the project terminates.

The “As Is” Process Modeling serves as a baseline for the implementation of the Quality Evaluation Metric (QEM) application. In addition, the “As Is” Process Models provide the means to identify a specific task within each process when a business process fails.

3.2 Development of the Quality Evaluation Metrics

The purpose of the QEM application is to collect data on errors electronically. Development of the QEM application was a critical phase of the project because without any electronic data it would be difficult to accurately assess the service quality level of the CS department. This application is designed to solve all the problems, which are the lack of electronic data, inconsistency, and the qualitative nature in the data, concerning the current methodology of reporting error. The application has the following features:

1. Tied to Process Modeling
2. Computerized Interface
3. Automatically Generate Statistics
4. Flexible to Changing Process

3.2.1 Tied to Process Modeling

Together with the process maps developed in “As Is” Modeling, the QEM application focuses on errors committed due to specific task failure(s) within a business process. This provides information on how the specific tasks and business processes are performing and may provide an idea on potential improvement areas or areas where additional training may be required.
3.2.2 Computerized Interface

The application is in the form of an intranet application. The web interface allows the user to store information about an error into a database. Because multiple users within PH&N will be required to use the QEM application, the platform of the application must be chosen to allow for easy access, to avoid installation problems and to ensure consistent performance for all users. An intranet application centralizes all the efforts to implement the application and it can be accessed through a web browser.

The information presented on the web interface will vary depending on the type of user. Two levels of access were defined according to user groups - general users and quality administrator. General users include investment managers, investment managers’ administrators, Contact Center staff, advisors and CS staff. General users will be required to enter the background information of the error, such as Report Date, Report By, Discovered By, Batch Date, Batch ID, Account Number, a description of the error in the Detail field, and a description of the Actions Required to correct the error.

Quality administrators will have full access to the QEM application. In addition to the background information, the quality administrators will have to enter information into critical data fields. This includes the Resolved Date, Resolved By, the specific business process that failed (Transaction Type), the reason for correcting the error (Adjustment Reason), and the task(s) within the business process that failed (Process Task Failure). The quality administrator role will only be assumed by 1 or 2 quality assurance staff in the CS department in order to ensure data consistency and integrity.

In addition, the quality administrator has to input the time spent to fix the error and the number of people involved in fixing the error. The users will input the estimates of these two measures. These two measures provide an idea as to how complicated an error is and raise the awareness of the time and resources needed to correct an error.

3.2.3 Automatically Generate Error Statistics

Four new statistics are generated automatically once the error report is fully resolved by the Quality Assurance staff. These are time lag, gain/loss, the number of process task failures and the number of previous errors committed on the client.

Time lag is the time difference between the error and its discovery. As discussed in Section 1.4, an error is usually reported to PH&N days after the error was created. This statistic is critical in depicting the service quality level of the department. The use of this statistic is explained in detail when discussing the development of periodic quality reports in section 3.6. In addition, time lag directly affects PH&N and the client. A direct monetary cost, denoted as Gain/Loss, is incurred to reverse each incorrect transaction and to repost the correct transactions. As fund prices fluctuate day to day, and assuming that the fund price rises in the long run, the cost to reverse and repost transactions will likely be higher if this period of time is longer. In addition, the longer
this period is, the more likely that there are more transactions needed to be adjusted during this time period.

Gain/Loss is the direct dollar cost of correcting an error due to price differences in the funds involved in incorrectly processed transactions. If, for example, an error was committed on a buy order on September 5th, and the error was found and corrected on October 6th, any adverse changes in the price of the fund during this period is a cost that PH&N must absorb.

An error is created when one or more tasks within a business process fail. The number of tasks that have failed is a measure that provides insights into the efficiency and effectiveness of a particular business process. It provides a “flag” to potential improvement areas and areas for additional training.

The number of previous errors committed is developed based on the hypothesis that client satisfaction may have a non-linear relationship with this metric. An additional benefit may be to use them as pointers to “unfortunate” clients; clients who PH&N had committed multiple errors on in the past. Special attention may be paid to “unfortunate” clients to repair client-firm relationship.

3.2.4 Flexible to Changing Processes

Because of the frequent introduction of new products offered by PH&N and the changing processes, the data fields must be easily updated. It is impractical and unfeasible if the staff has to re-program the QEM application every time a new business process is introduced or a specific process is changed. Flexibility was built into the QEM application. The list of selections for each data field, (such as Process Task Failure, Transaction Type, Discovered By, and Adjustment Reason) are updateable. These data fields were not “hard-coded” into the QEM, meaning the lists of selections within each data field is not coded directly on the web page; instead, they are generated from a database. An interface within the application was created to allow the quality administrator to add and modify the list of selection for each field directly in the database.

The QEM application took two months to complete. Regular progress meetings were held between the COE project team and the CS department throughout the development. These meetings were used to manage expectations with the goal being to solicit feedback on the functionality of the QEM application from the end users.

The QEM application consists of twenty separate web pages. A thirty-six-page document was produced detailing the purpose, functionality and programming logic of each web page as well as the relationship between web pages. A user manual was also developed to provide training assistance. Appendix B is the user manual of the QEM application.
3.3 Initializing the QEM Database

The paper version of the error report is the only source of data that was available to the COE project team at the beginning of the project. The lack of electronic data made data analysis difficult at this point. The QEM application was used to convert the error report from paper to electronic format. The purpose of this conversion was to make data analysis possible and also serves as a testing phase of the QEM application.

Eleven months of error reports, from July 1999 to May 1999, were entered into the database through the QEM application. This time period was chosen so that a comparison could be made between last year and this year. Our original intention was to use twelve months of error reports but because the error reports of June 1999 had been moved to the firm’s storage, we decided to use the error reports (eleven months) available to the project team.

The error reports in July 1999 were chosen for a training session. This training session was necessary because the paper version of error reports focused on the source of the error (who committed the error) whereas the new electronic version concentrated on which specific process task(s) failed. This training session was used to clarify the new “process oriented” error reports. Two teams, each consisting of one member from the COE project team and one quality assurance staff member from the CS department, entered in the error reports. This collaboration was a valuable experience for both groups. The COE project team gained valuable knowledge as to the nature of errors and why they occurred. The COE team then used this knowledge to guide the quality assurance staff to the specific tasks within the business process that failed. This transfer of knowledge is critical as it allows the CS department to continue to implement changes and make continuous improvements based on the data from the process oriented error reports once the project terminates.

Data entry was carried out in five sessions of three hours per session. The data entry team was composed of four people, two members from the COE team and two staff members from the CS department. The time duration was kept at three hours to minimize inaccuracy during the data entry process. Although each error report required approximately two minutes to input into the system, the nature of data entry is repetitive. The accuracy of the data entry may be sacrificed if this repetitiveness is sustained for too long a period of time. The duration of the session is long enough so that a significant number of error reports can be entered into the database in each session but short enough so that the negative effect of repetitiveness is minimized.

The goal of data entry was to collect information that we can use to perform preliminary data analysis on the performance of the business processes. Free form data, such as Details and Action Required, was unnecessary for historical data. The fields that were entered are Report Date, Resolved Date, Batch Date, Transaction Type, Adjustment Reason and Process Task Failure. It would be time consuming and not beneficial if all the information on the current error report were entered into the QEM.
The eleven months of data created 1386 entries in the database. A 10% sample was taken to determine the accuracy of the data entry. Two days from each month were chosen at random to make up the validation sample. This method of selecting the sample was chosen based on the assumption that there are 20 business days in a month and the number of error reports in one day would be the same as other days. Table 1 shows that this assumption, on average, holds true.

<table>
<thead>
<tr>
<th></th>
<th>Jul '99</th>
<th>Aug '99</th>
<th>Sep '99</th>
<th>Oct '99</th>
<th>Nov '99</th>
<th>Dec '99</th>
<th>Jan '00</th>
<th>Feb '00</th>
<th>Mar '00</th>
<th>Apr '00</th>
<th>May '00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database</td>
<td>123</td>
<td>82</td>
<td>78</td>
<td>101</td>
<td>83</td>
<td>120</td>
<td>222</td>
<td>135</td>
<td>166</td>
<td>143</td>
<td>120</td>
</tr>
<tr>
<td>Sample</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>11</td>
<td>11</td>
<td>10</td>
<td>24</td>
<td>14</td>
<td>15</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>Percent</td>
<td>8%</td>
<td>11%</td>
<td>10%</td>
<td>11%</td>
<td>13%</td>
<td>8%</td>
<td>11%</td>
<td>10%</td>
<td>9%</td>
<td>10%</td>
<td>11%</td>
</tr>
</tbody>
</table>

Table 1 Sample Selection to validate Data Entry

All information on the electronic version of the error report is checked with its corresponding paper error report. Table 2 is a summary of the data validation efforts.

<table>
<thead>
<tr>
<th></th>
<th>Jul '99</th>
<th>Aug '99</th>
<th>Sep '99</th>
<th>Oct '99</th>
<th>Nov '99</th>
<th>Dec '99</th>
<th>Jan '00</th>
<th>Feb '00</th>
<th>Mar '00</th>
<th>Apr '00</th>
<th>May '00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>11</td>
<td>11</td>
<td>10</td>
<td>24</td>
<td>14</td>
<td>15</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>Incorrect entries 0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Percent error 0.0%</td>
<td>0.0%</td>
<td>12.5%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0%</td>
<td>8.3%</td>
<td>0.0%</td>
<td>6.7%</td>
<td>0.0%</td>
<td>7.7%</td>
<td>4.3%</td>
</tr>
</tbody>
</table>

Table 2 Errors Within Sample

The sample used to validate the data collection efforts yielded an error estimate of 4.3%. Almost all of the errors found, except one, in the data entry were associated with incorrectly entering two dates - Report Date and Resolved Date. The dates were incorrectly entered into the system usually by one or two days. This may have been caused by the format used to input these dates into the system. Three drop down boxes, one for year, month and day are used to ensure a consistent date format. Repetitive data entry may cause the staff to choose the wrong day from the drop down list (by one or two days).

It is interesting to note that no errors have been found with the Batch Date. Batch Date was required to identify the specific date that the error occurred. Since Batch Date, unlike Report Date and Resolved Date, was not recorded on the paper version of the error report, the staff had to look for the Batch Date in the supporting documents attached to the error report, or in the UNITRAX system. This additional work may have made the staff more aware of what they were choosing for the Batch Date whereas no effort is required to find the Report Date and Resolved Date.

This type of error should not pose a serious problem. Once the QEM application is implemented and used every day, one staff member at most could enter in one or two error reports and the repetitive nature of entering the error report should be eliminated. The validity of the results of the data analysis discussed in Section 3.4 should not be
affected because, as discussed in Section 1.4.1, the department should focus on the Created Date of the error instead of the Report Date.

3.4 Data Analysis

Data analysis was carried out using the eleven months of data collected. The analysis concentrated on three main areas: volume, effectiveness and cost. Volume analysis provided the COE project team with an objective view of CS department operations, such as workload and the existence of seasonal pattern. Effectiveness analysis provided information about the performance of the business processes within the CS department in the past. Cost analysis provided information on the cost or benefit of quality. The results of the analysis were presented to Pamela Brault, Manager of CS, and Karim Datoo, Team Supervisor of CS, for validation and feedback.

3.4.1 Volume Analysis

Figure 7 shows a time series graph of the basic financial transaction volume. Basic financial transactions consist of four types of transactions – Purchase, Redemption, Switch and Transfer. Although dealer service transactions are categorized as basic financial transactions, they were not included in this analysis because the majority of the dealers use FUNDSERV, an automated web system that allows the dealers to directly place and settle a trade. Limited interaction from PH&N is required to process dealer services transactions. In addition, advanced transactions such as RESP, were not included in this analysis because the number of request for advanced transactions is significantly smaller than basic financial transactions.

![Time Series of Total Basic Financial Transaction Volume (July 99 - May 00)](chart.png)

Figure 7

Observes that volume of transactions stayed relatively constant from July to November, started to climb up in December, and then peaked in February. This increasing trend corresponded to RRSP season. The volume then decreased as of March, returning to the normal volume level by May.
According to Ms. Brault and Mr. Datoo this trend is similar to their experience in the past but they pointed out to us that RRSP season does not start until January and transaction volume in December is usually at the same level as other months. Pam and Karim explained to us that a new product was introduced in December 1999 and this sudden increase in volume in December last year may be a result of the introduction of this new product. The increase in volume in December is not expected to reoccur in the year 2000.

Figure 8 is a breakdown of basic financial transactions into purchase, redemption, switch and transfer transaction.

![Time Series of Basic Financial Transaction](image)

We see that only the purchase and switch transactions are susceptible to volume increases in the RRSP season. This is logical because most people will contribute (Purchase) to their RRSP funds and switch between funds (from their cash accounts to RRSP accounts) before the deadline for RRSP contribution in February.

In summary, this analysis shows that workload doubled during RRSP season and that only the purchase and switch transactions are susceptible to RRSP seasonality.

### 3.4.2 Effectiveness Analysis

There were 1386 error reports recorded during the period July 1999 to May 2000. Figure 9 on the following page shows the percentage of errors committed in each transaction category. Basic financial transactions include Purchase, Redemption, Switch and Transfer. Non-financial transactions include client information changes and automatic transaction set-up. Advanced transactions include account holding rebalancing, RRSP rollover and RESP.
The chart shows that the majority of the errors (84%) were due to the failure of the basic financial transaction process. Therefore this analysis is focused on basic financial transactions. Figure 10 below shows a time series plot of each type of basic financial transaction error.

Figure 10 shows that the purchase and switch errors increase during the RRSP season. In addition, by comparing the time series of each type of basic financial transaction volume (Figure 8) and this plot, we can see that the number of errors is relative to the volume of transactions. Both the volume and the number of errors committed on redemption and transfer transaction stayed relatively constant. In addition, as volume of purchase and switch transaction increases, the number of errors committed in purchase and switch transaction increases. This relationship is important because we must incorporate this characteristic when reporting quality level to the staff in the department.
Figure 11 shows the percentage of errors committed in each type of basic financial transaction.

![Breakdown of Basic Financial Transaction Errors](image)

Figure 11

44% of the errors in the Basic Financial Transactions are caused by the failure of the purchase process. Since there is a relationship between volume and the number of errors, we must compare the results from the effectiveness analysis with the volume results before any conclusion is made. Table 3 shows a comparison between the percentage of error committed in each basic financial transaction and its corresponding volume. **Error Rate Per 1000 Trans.** is calculated by dividing the number of errors by its corresponding number of transactions.

<table>
<thead>
<tr>
<th>Percentage of Basic Financial Transactions</th>
<th>Error</th>
<th># of Errors Per 1000 Trans.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase</td>
<td>27%</td>
<td>44%</td>
</tr>
<tr>
<td>Redemption</td>
<td>19%</td>
<td>24%</td>
</tr>
<tr>
<td>Switch</td>
<td>47%</td>
<td>23%</td>
</tr>
<tr>
<td>Transfer</td>
<td>7%</td>
<td>9%</td>
</tr>
</tbody>
</table>

Table 3 Effectiveness of Basic Financial Transactions

Table 3 shows that only redemption and transfer transaction error percentages are similar to their volume percentages. Although purchase transaction had a lower volume percentage than switch transaction, its error percentage was significantly higher than the error percentage of the switch transaction. The purchase process had a higher tendency to fail, approximately 10 errors for every 1000 transactions, whereas the Switch process had performed very well in the past with 3 errors for every 1000 transactions.

To investigate why the purchase process had a higher failure rate, we further drilled down into the data in the specific process tasks that failed in both switch and purchase transaction. Figure 12 and Figure 13 on the following page show the frequency of the specific process task failures within purchase and switch transaction, respectively.
Two key observations result from comparing Figure 12 and 13. First “Pre-screen – Transaction Level” consistently ranked in the top three of both types of process. Both Ms. Brault and Mr. Datoo expected this trend as this particular task had been the most problematic in the past. The second observation is that the process task “Client Provided Incorrect Information” ranked number one within the Purchase process whereas it ranked number twelve within the switch process. The external clients appeared to have difficulty in providing the correct information to PH&N during a purchase process. This result can be explained by the inherent difference of the two processes. The purchase process requires the client to specify the account number, the fund that he or she wants to purchase and the amount of the purchase. If the client provided a legitimate account number, a legitimate fund name and the amount on the request matched the amount on the cheque the staff has little control over the outcome of the transaction. On the other
hand, the switch process has built-in checks that will notify the CS staff that the client had provided the incorrect information. For example, the client must hold the Canadian Equity Fund before he or she can switch from the Canadian Equity Fund to US Equity Fund. In addition, the client must hold more than 100 units of Canadian Equity Funds before he or she can switch 100 units of Canadian Equity Funds to US Equity Funds. The client must know exactly what funds he or she holds, the amount of holdings in each fund and the account numbers that hold each fund. The staff should pick up incorrect information provided and the client should be contacted to confirm the information on the request.

Figure 14 shows a frequency chart of the Adjustment Reasons within the failure of the process task “Client Provided Incorrect Information”.

The account number caused the most problems for external clients. A client can hold multiple accounts with PH&N. For example, the client can hold a Cash (or non-RRSP) account, an RRSP account, a Spousal RRSP account and an RESP account at any given time. Keeping track of what account holds which funds is difficult and confusing. As well, the format of the account number can create confusion for the client. The difference between the account number for a cash account (eg. a/c# 1234567) and a RRSP account (eg. a/c# 234567) is recognized by the one which appears first.

In summary, the analysis reveals the following:

- The number of errors is dependent on the volume of transactions.
- 84% of the errors are committed in Basic Financial Transactions.
- The purchase process had a higher error rate.
- Clients had problems providing the correct account number in a purchase process.
3.4.3 Cost Analysis

Gain/Loss is a measurement of the direct cost of financial transaction process failures. When an error occurs on a financial transaction and transactions are backdated, (reversed or re-posted) the change in fund price from the date on which the error occurred to the date on which the error was found results in a gain or loss to PH&N. In order to ensure that the book value of the account is correct, when a transaction is backdated, any transaction that occurred in the account after the date of the error and before the date of the backdating must also be reversed and re-posted. This causes the gain/loss to be magnified.

It is important to note that an error can induce an indirect cost such as time and resources spent to fix the error. However, this information was not captured when initializing the database because it is impossible to estimate the time it took to correct an error one year later. Therefore only direct cost was analyzed in the cost analysis.

Creating a subset of data consisting of errors that resulted in an absolute value of gain/loss of greater than $500 yielded some interesting results. The results (the exact loss) for this part of the analysis will not be reported in this thesis to respect confidentiality. From this analysis it became clear that the majority of the direct loss was caused by a small subset of failed transactions with costs exceeding $500. In fact over 96% of the total losses that occurred over this 11 months period occurred on transactions with the absolute value of the gain/loss exceeding $500.

![Magnitude of Gain/Loss (Over $500) By Account Type (July 1999 to May 2000)](image)

Figure 15

Further analysis (Figure 15) shows that errors that caused larger gain/losses came, a vast majority of the time, from private and institutional managed accounts (POF - Portfolio of Funds accounts, POL - Pooled funds accounts and SEG - segregated funds or individual stocks accounts). This result echoes intuition since the magnitude of the transactions in these types of accounts is much larger than in regular mutual fund accounts. Thus, even though the percentage of total errors committed on regular mutual
fund accounts are large (Figure 16), the direct cost of these errors is very small relative to the total loss.

![Percentage of Total Errors Segregated By Account Type (July 1999 to May 2000)](image)

In summary, the cost analysis showed that 39% of errors caused 94% of the total direct cost to fix all errors, and of these, 39% of errors were caused on accounts managed internally by PH&N.

### 3.5 Measuring Future Process Improvements

The data analysis described in the previous section demonstrated the power and benefits of the QEM application. With systematic data collection and analysis on the collected data, "pin-pointing" potential areas of improvement or areas where additional training is required will be possible. However, evaluation of the changes made to the business processes is necessary to ensure that the company is heading in the right direction, towards improving client satisfaction. The following is an example of how the QEM application can be used to evaluate the effectiveness of PHN.com (a new web-based trading system for mutual funds processing) in decreasing the number of errors.

PHN.com was introduced to the CS department as a means to process mutual fund transactions through a web interface. The objective of this application is to improve efficiency while decreasing the number of errors committed during processing mutual fund transactions. Along with the introduction of PHN.com, changes to the current business processes were made. The most significant change is that the step, 2nd keying, was eliminated. Current processes for processing basic financial transactions require two people – 1st keyers and 2nd keyers, to enter in each transaction. The information entered by the two keyers must agree in order to process the transaction in the UNITRAX system.
This double keying serves as a quality check to ensure accuracy. PHN.com only required data to be entered in once and a confirmation, describing the details for each transaction, would be displayed to the user. In addition, most of the pre-screening steps were carried out automatically by the system. The application will alert the user if the information entered into the application violates any of its built in rules for pre-screening.

This application was rolled out to the CS department in phases. The first phase was implemented in February 2000 and the application allowed the CS department to perform switch transactions through PHN.com. In order to evaluate the effectiveness and the impact of the application in reducing number of errors, the COE project team was asked to perform an analysis based on the data captured by the QEM application when initializing the database.

Switch Transactions are processed through two delivery channels - Unitrax and PHN.com. Our goal was to understand the types of errors that occur within the two delivery methods, and provide a baseline for understanding trends in these errors.

Figure 17 shows the volume of the switch transactions from Jan 2000 to May 2000. The downward trend of the total number of Switch Transactions coincides with the ending of the RRSP seasons. Increased usage of PHN.com is clearly visible. By April, the total number of switch transactions processed through PHN.com is approximately the same as those processed through UNITRAX.
Figure 18 shows the time series of the number of errors committed in switch transactions processed through UNITRAX and PHN.com and Table 4 is a comparison of the effectiveness of the two systems.

![Monthly Switch Errors (Jan - May 00)](image)

**Table 4 Effectiveness of UNITRAX and PHN.com**

<table>
<thead>
<tr>
<th>Percentage of Switch (April – May 2000)</th>
<th>Error Rate Per 1000 Trans.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Volume</strong></td>
<td><strong>Error</strong></td>
</tr>
<tr>
<td>UNITRAX</td>
<td>51%</td>
</tr>
<tr>
<td>PHN.com</td>
<td>49%</td>
</tr>
</tbody>
</table>

The number of errors committed on switch transactions processed through PHN.com is consistently lower than the UNITRAX system when the volume of transactions processed in each system is approximately the same during March, April and May. The graph (Figure 18) and the table (Table 4) lead us to the conclusion that the number of errors found in PHN.com transactions is slightly lower (3.8 errors in 1000 transactions) than the error rate for UNITRAX system (3.34 errors in 1000 transactions).

Many explanations are possible for this improvement, for instance the selection of transactions considered suitable for PHN.COM may mean that more straightforward transactions are being handled through this delivery method. Three transaction types in particular are not possible through the PHN.com delivery method - locked-in accounts, assignments and portfolio rebalancing. These three types of switch transaction are more complex and this may create the difference in the frequency of errors caused externally in Unitrax vs PHN.com transactions. Figure 19 on the following page shows the breakdown of switch errors in each system.
The 22% of errors that are currently attributed to “system” for the PHN.com delivery method are a result of system rejections for a variety of reasons. The expectation is that these errors will be reduced to nil as the implementation of PHN.com continues.

Finally, the Client Services errors within the PHN.com delivery method include duplicate transactions processed, insufficient funds to complete the transaction, and data entry mistakes such as missed selection boxes. It seems reasonable to expect the quantity of these sorts of errors to decrease as users become more familiar with the system and improvements are made to the prescreening of transactions.

3.6 Development of Periodic Quality Report

Periodic evaluation of quality is necessary to sustain continuous improvement in any organization. As well, a consistent and accurate measurement should be used to describe the quality level and to recognize the staff for their efforts in improving quality. However, the periodic quality report should be designed to suit the needs of different people within the organization. For example, in PH&N, internal clients will not care about the frequency of process task failure. They are concerned only with the accuracy of the outputs. On the other hand knowing which particular task(s) frequently failed is very useful for the staff at the CS department for the purpose of making improvements.

Three separate quality reports were developed and automated using the Visual Basic Application for EXCEL. The information on all three reports is generated from the data collected through the QEM application and from the UNITRAX system. Each report includes measurement and information that is of interest to the target group:

1. Weekly Dashboard for staff in CS department
2. Quarterly CS Report Card for internal clients
3. Monthly Management Report for CS management
3.6.1 Weekly Dashboard

The purpose of a weekly dashboard is to provide the staff in the CS department with an overview of the quality level in the department. It also serves as a means to recognize the effort that the staff members have put into improving quality in the department during the period. As discussed in Section 1.4, the measurements that the CS department used were presumably problematic. A new methodology was developed to better describe the quality level of the department. Appendix C is the actual weekly dashboard for the period week 2 of September.

A cumulative approach was chosen because it can track the progress of quality within a month. In addition, this method allows comparison of quality level with previous months. The methodology for comparison is explained below (See Volume Adjusted Comparison). The quality report up to a given week is generated on the Thursday of the following week. For example, the weekly dashboard up to week 2 of September 2000 (September 1 – September 10) will be generated on September 14, 2000. The weekly dashboard is separated into 6 sections.

1. Cumulative projected number of errors
2. Target
3. Volume adjusted comparison
4. Progress
5. Frequency of Process Task Failure
6. Commentaries

Cumulative projected number of errors

Error percentages alone do not provide enough meaningful information to effectively manage a client service department. Information such as how many clients were dissatisfied is more valuable than a traditional percentage measure. The absolute number of errors is used to reflect the error rate in the department. As well, the new error reporting methodology focuses on the Created Date of an error instead of the Report Date. However, due to the nature of how errors are reported to the firm, it is difficult to correctly capture this statistic. An error might not be reported to the firm until months or even years later. A new error reporting methodology was developed to predict the monthly number of errors.
Figure 20 is a generic example used to demonstrate the new error reporting methodology. The beginning of any Reporting Period is always the first day of the month, which can fall on any day of the week. In this example the Reporting Period is the first week of the month and it starts on a Monday and ends on a Sunday. The Reporting Period is defined in terms of weeks and it accumulates from the beginning of the month. For example, the sample Weekly Dashboard shown in Appendix C is for the first 2 weeks of September and the Reporting Period starts from September 1 to September 10.

Because of the uncertainties in the time it takes to report an error, an arbitrary date, denoted as Cut Off Date, is defined to set a deadline for calculating the number of errors committed during the reporting period. There are two reasons for choosing Wednesday as the Cut Off Date. First, it allows retail clients an opportunity to review their transaction summaries over the weekend and report any errors found to PH&N on the following Monday and Tuesday. Second, CS management holds a department meeting every other Thursday. Management desires to have the results of the Weekly Dashboard generated so that they can discuss any quality issues during the meeting.

Although the most appropriate and accurate way to report errors is to have the Cut Off Date as far as possible from the reporting period, this will contradict the timeliness objective of the Weekly Dashboard. The objective of the Weekly Dashboard is to provide feedback to the staff of the CS department on quality issues in order to facilitate service improvements. The Weekly Dashboard of three weeks ago is less likely to generate any interest and motivation for the staff to improve quality.
The errors reported during the Collecting Period, from the first day of the month to the Wednesday following the end of the Reporting Period, are traced back to the date when the errors are created. If the reported error happened before or after this period, this error will not be counted. Using historical data, the COE project team reproduced the monthly number of errors under this new methodology and the results are shown in Figure 21.

![Time Series of Errors Report before Cutoff Vs Actual Errors](image1)

**Figure 21**

Observed that the errors created and reported before cutoff is consistently lower than the actual number of errors committed. Applying an adjustment factor derived from historical data could reduce this gap. A Time Lag analysis was carried out to derive a set of adjustment factors that can be used to project the number of errors within a Reporting Period based on the errors found during that period. Figure 22 shows the estimated cumulative distribution function of Time Lag.

![cdf's of Time Lag](image2)

**Figure 22**
The new methodology uses the results from this analysis and adjusts the number of errors created and reported before the Cut Off Date by a factor associated with the Report Lag. Report Lag is the difference in days between the Created Date of the error and the Cut Off Date. The factor associated for each Report Lag is the inverse of the percentage of errors found for each Time Lag. For example, as shown on Figure 23, the percentage of error reports discovered within one day (Time Lag = 1) is 44.8%; therefore the factor for Report Lag of one day is 5.4095. Table 5 shows the calculation for the first two weeks of September 2000.

<table>
<thead>
<tr>
<th>Date</th>
<th>Day of Week</th>
<th># of errors reported before Cut Off</th>
<th>Report Lag</th>
<th>Adjustment Factor</th>
<th>Projected # of Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept 1</td>
<td>Friday</td>
<td>3</td>
<td>12</td>
<td>1.253</td>
<td>3.761</td>
</tr>
<tr>
<td>Sept 3</td>
<td>Monday</td>
<td>3</td>
<td>9</td>
<td>1.322</td>
<td>0</td>
</tr>
<tr>
<td>Sept 4</td>
<td>Tuesday</td>
<td>3</td>
<td>8</td>
<td>1.342</td>
<td>4.028</td>
</tr>
<tr>
<td>Sept 5</td>
<td>Wednesday</td>
<td>1</td>
<td>7</td>
<td>1.371</td>
<td>1.371</td>
</tr>
<tr>
<td>Sept 6</td>
<td>Thursday</td>
<td>1</td>
<td>6</td>
<td>1.454</td>
<td>1.454</td>
</tr>
<tr>
<td>Sept 7</td>
<td>Friday</td>
<td>1</td>
<td>5</td>
<td>1.541</td>
<td>1.541</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>9</td>
<td></td>
<td></td>
<td>12.155 (12)</td>
</tr>
</tbody>
</table>

Table 5 Sample Calculation of the Forecasting Model

Nine errors were created during the Reporting Period (September 1 – 7) and found before the Cut Off Date (September 13). The projected number of errors on each day is derived by multiplying the number of errors reported before Cut Off Date by the Adjustment Factor. Therefore, the number of errors reported on the Weekly Dashboard for the first two weeks of September 2000 is twelve.

This method of projecting the errors assumes that the cumulative distribution function of Time Lag is the same throughout the year. The historical data was divided into two sets – the estimation set (July 1999 to March 2000) and the validation set (April to May 2000). The factor associated with each Report Lag is derived from the estimation set and the validation set was used to evaluate the forecast. Figure 23 shows the results of the forecasting model.
The Mean Absolute Percentage Error (MAPE) is 6% for the estimation set, whereas it is 5% for the validation set. January 2000 is the only month where there was a noticeable discrepancy between the projected and the actual number of errors. This may have been caused by RRSP season. Clients may be more aware of their transaction records with PH&N because they have to make sure that everything is processed correctly before the RRSP contribution deadline. In which case they may be reporting errors sooner than usual and thereby causing the predicted number of errors to be higher than the actual number of errors. This discrepancy should not pose serious concerns as long as a consistent approach is used to evaluate quality within the department.

The forecasting model used historical data to estimate the Adjustment Factors. However, any changes to the processes regarding the timeliness of when clients report errors to the CS department may require re-parameterization of the Adjustment Factors. The COE project team recommended that the CS department review the cdf of Time Lag periodically, preferably twice a year.

**Target**

The target is the maximum number of errors set by the management of the department. The target provides a goal for the staff in the department to work towards improving quality. This target is chosen based on historical trends and an assessment of the potential for quality improvement by management. Although the goal of any quality initiative should be zero errors, a zero error target may prohibit quality improvements. Setting attainable goals and adjusting the goal towards zero error incrementally has been shown to be more beneficial and effective in motivating the staff [Dean and Evans]. On the other hand, this target should be set such that it will pose some challenges in attaining the target.

**Volume adjusted comparison**

Although the target can be used to motivate the staff for quality improvement, it is important for the management not to focus the success of quality improvement based on this target alone. It is possible that the staff put in an extensive effort to improve quality and even though the target was not met. An improvement in quality over the last month may as well be as successful as attaining the target.

The data analysis in Section 3.4.2 indicated that there is a relationship between the number of transactions and the number of errors committed. The number of errors committed in January and the number of errors committed in May cannot be compared. The workload in January doubles the workload in May because of RRSP season. It would be unfair and inaccurate to compare the two months based on the absolute number of errors.

A “Standard Month” methodology was used to adjust the number of errors in different months to account for the variance in workload. The number of transactions in a “standard month” was determined by taking the average number of transactions for all
non-RRSP months (all months except January, February and March) in the database. The number of errors is then adjusted according to the “standard month” transaction volume.

This methodology allows fair comparison among different periods. Trends in quality, either improving or deteriorating can be spotted easily. The weekly dashboard compares current period result with the previous three months and with the same month last year. Due to the variation in the number of business days within a reporting period, it is important to acknowledge this discrepancy by comparing the results based on the same number of business days. For example, if the number of business days in this reporting period is five, the number of volume-adjusted errors of the first five working days from last month are used to calculate the percentage change from last month. An increase in percentage represents an improvement in quality whereas a decrease in percentage represents a decline in quality of service.

Progress

This chart tracks the progress of the quality efforts with respect to the target.

Frequency of Process Task Failure

This measurement is particularly useful for the staff because it provides an area where the staff can work on improving quality in the future. If the process task - “Pre-screening” consistently failed in the past, this chart should alert the staff that more attention should be paid while pre-screening a client’s request in the future.

Commentaries

This section is a review of the quality level of the department by both the quality administrator and management. Solutions to past quality problems should be included in this section to allow for future improvements. As well, management should recognize any significant improvements in the past in order to motivate continuous improvement among the staff.

3.6.2 Monthly management report

The purpose of this report is to provide a quantitative description of CS department activities to the management of CS. Management agreed that the monthly report should be structured similar to the data analysis discussed in Section 3.4. Three key performance indicators were defined to quantitatively describe the CS department:

1. Volume
2. Effectiveness
3. Direct monetary cost of correcting errors.
Appendix D shows the monthly report for September 2000. Volume analysis includes two sections – a breakdown of volume according to the four types of basic financial transaction (purchase, redemption, switch and transfer) and a breakdown of volume into retail clients (denoted as MUT) and the 5 types of internal clients (denoted as POF, POL-Private, POL-Institutional, SEG-Private and SEG-Institutional). The effectiveness measure entails an analysis of the errors segregated into the four types of basic financial transaction as well as a frequency chart of process task failures. The last section, direct monetary cost of correcting errors, summarizes the cost to rectify erroneous transactions for the month.

The three types of analysis presented on the monthly management report are limited and only provide a framework to evaluate the quality of service within the CS department. One responsibility of the Operation Analyst is to use the results obtained from this report to perform an in depth analysis in uncovering the causes of the quality issues indicated by the report. An example of an in depth analysis was shown in Section 3.4.2 when discussing the effectiveness analysis on historical data; however, this scheme of data mining requires extensive knowledge on database structures and query designs. A custom search interface was developed (See Figure 24) to assist the Operation Analyst. This search interface does not require any knowledge of database structures and query designs. The user selects the desired information to be displayed and a set of search criteria. Then the search interface will automatically build the query to generate the results. The search interface is not within the scope of this thesis and it will not be discussed in detail.

![Custom Search Interface](image)

Figure 24 Custom Search Interface

3.6.3 Quarterly CS Report Card
As mentioned in Section 1.2, a business process spans through multiple departments and it requires collaborative effort among these departments to produce an accurate output. Although throughout this project, the investment managers and their administrators were treated as internal clients, it is important to recognize that these internal clients are in fact a part of the business process within PH&N. Both the internal clients and the CS department must work together to achieve the objective of continuous improvements in quality. However this joint effort among the CS department and the internal clients did not exist in the past. This was partly due to the lack of a systematic approach in collecting and reporting errors. The purpose of the Quarterly CS Report Card is to provide a means to initiate a joint effort between the internal clients and the CS department with the aim of improving quality at PH&N as a group.

Internal clients can be classified into five categories based on the type of accounts – Portfolio of Funds accounts (POF), Private Pooled Fund accounts (POL – Private), Institutional Pooled Fund accounts (POL – Institutional), Private Segregated Fund accounts (SEG – Private) and Institutional Segregated Fund accounts (SEG – Institutional). Each type of internal clients will receive a Quarterly CS Report Card with information relating to their accounts. Management from the CS department gets together with each type of internal client at the end of each quarter to discuss any quality issues involving both parties. A sample of the report is included in Appendix E. The report can be separated into 5 main areas:

1. Total transaction volume
2. Transaction volume placed by internal clients
3. Comparison among internal clients
4. Number of Errors committed on internally managed accounts
5. Commentaries

Total transaction volume:

This measurement describes the workload of the CS department in the reporting quarter.

Total transaction volume placed by internal clients

This measurement provides an indication of the internal clients’ contribution to the CS department workload.

Comparison among internal clients

Two charts, Breakdown of Transaction Volume and Breakdown of Transaction Volume in Dollars, are used to compare the contribution from each type of internal client to the CS department’s workload. It is important to recognize that even though one particular type of internal client (such as SEG – Institutional) does not contribute as much as other clients (such as POL) in terms of absolute transaction volume, this particular
internal client is still very important to the firm and the CS department, because of its high transaction volume in dollars.

**Number of errors committed on internally managed accounts**

This measurement provides the frequency of process failures committed on internally managed accounts. An absolute number of errors is employed to suggest the idea of a zero error target. The chart, Breakdown of Process Failures, summarizes the occurrence of all process failures and is included to illustrate that both the internal clients and the CS department must work together to achieve a zero error target.
IV Implementation

Implementation in this project can be separated into two parts:

1. Implementation of the QEM application
2. Implementation of the Periodic Quality Reports

4.1 Implementation of the QEM application

The QEM was thoroughly debugged and tested when initializing the database with one year of historical error reports. This testing phase was extremely important to the success of the implementation of the QEM. Client participation during the testing phase has proven to be successful and beneficial to both the COE project team and the client. Involving the users in this phase provided the COE project team with feedback on the functionality of the application that can be used in fine tuning the application to suit the needs of the end users. As well, expectations could be managed effectively by letting the client know exactly what they are getting and with them being familiar with the functionality and performance of the application.

Knowledge sharing through periodic progress meetings with the client was also important to ensure the success of the implementation phase. Any new changes to the CS department that may affect the implementation of the application was clearly communicated well in advance to the COE team. As well, any potential problems or changes with the project foreseen by the COE team were clearly conveyed to the clients during these meetings. This knowledge sharing technique eliminated surprises to both the client and the COE project team and establishes mutual trust and cooperation.

Implementation of the QEM application was rolled out to different user groups in phases:

- Phase 1 (August 2000) – Contact Center
- Phase 2 (September 2000) – CS department
- Phase 3 (October 2000) – Investment Manager and Administrator

Rolling out the application to different user groups in phases allowed the COE project team to pay special attention to each user group.

Network conflict was the only problem encountered during the implementation of the QEM. The “Windows Novell” system did not recognized some users while logging onto the QEM application through the intranet and it was resolved by expiring the user’s password. This problem was documented and the IT department was made aware of the problem and solution to prevent it from occurring in the future. Despite this glitch, the application was well received by all user groups and there were no negative reactions. Some of the comments that the COE project team received are:
• “It is very user friendly and easy to use.”
• “It is more efficient since I can track the progress of an error report electronically.”
• “I like the fact that the QEM application automatically retrieves data stored in UNITRAX and present it on the error report.”

4.2 Implementation of the periodic quality reports

Implementation of the periodic quality reports was carried out in September 2000 and it experienced no problems. This was partly because the three types of quality reports were developed together with the management in the CS department. The purpose of each report and the meaning of each measurement on the reports were clearly explained to the management.

The COE project team was skeptical at the beginning of the implementation of the Weekly Dashboard due to its complexity – projecting number of errors, adjusting the number of errors with respect to a “Standard Month” for comparison and the concept of a target. Fortunately, the use of a simple example to illustrate the concepts behind the report during the presentation to the CS staff and the support from the CS management greatly helped the COE project team to implement this report.

Management’s dedication and support played a significant role to ensure the success of the implementation of the quality reports. Management support is shown by the initiative of integrating the results from the Weekly Dashboard into staff performance evaluation.
V Conclusion

5.1 Project Success

The success of this project was contingent on the joint effort between the COE project team and the CS department. Like any other quality initiative, quality requires continuous improvement to business processes and practices. Further, for this endeavor to be deemed successful, it requires constant effort and commitment from both management and staff. As well, a well-designed information system is essential to support management’s approach toward quality improvements. The implementation of the QEM application serves as a channel to periodically monitor the quality of service, provide valuable insights into the performance of the business processes and evaluate future quality improvements. All three results played a significant role in promoting and sustaining continuous improvements.

The results of this project are considered of great value by the management of the CS department. This claim is supported by the subsequent actions taken by the management during the course of the project. A new position, Operation Analyst, was created in July 2000 to ensure that the concept of business process modeling will continue when the project terminates. In addition, the Operation Analyst is responsible for periodically monitoring the quality of service using the data collected by the QEM application as well as identifying potential improvement areas and/or areas needed additional training. Another new position, Training Specialist, was created in October 2000 to use the results obtained from the Operation Analyst, mainly areas requiring additional training, and to indoctrinate the staff. As mentioned in Section 4.2, management integrated the results from the Weekly Dashboard into the annual staff performance review as an incentive to promote teamwork. Through these efforts it is evident that management values the results from this project and are dedicated to continuous improvements.

5.2 Outstanding Issues

There are two issues that require further analysis:
1. Severity of Errors
2. Concept of Total Quality Management

5.2.1 Severity of Errors

The impact of errors on client satisfaction was not examined in this research. For example, is there a difference in terms of client’s satisfaction if the staff misspelled the client’s name or the staff bought the wrong funds? A similar methodology like the SQI implemented by Federal Express [AMA] should be developed to link process outputs with client satisfaction. With the data collected through the QEM application, statistical analyses on how different types of errors influence investment behavior is one way of
developing the link. In addition, periodic customer surveys may lead to valuable insights into how the processes affect client satisfaction.

5.2.2 Concept of Total Quality Management (TQM)

Total quality management requires the participation of the whole firm. Throughout this project, the CS department was regarded as a separate operational unit where other departments within the company were viewed as internal clients. Nevertheless, as mentioned in Section 2, all departments within the firm must work together to achieve TQM. The Quarterly CS Report Card is only the first step toward the collective cooperation among departments in achieving continuous quality improvement.

A new project conducted in collaboration with the COE in the trading department at PH&N is currently underdevelopment. The objective of this project is to evaluate the quality of the business processes within the trading department. Aside from the company’s dedication to quality improvement, the success of the previous project conducted with COE in assisting the CS department to implement a quality program greatly reinforces PH&N’s support to the current trading project.
VI References

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**Hiom, Paul** 2000 Simulation Modeling as a Decision Analysis Support Tool A Case Study at the PH&N Telephone Contact Centre *University of British Columbia*

**Kim, Ana Maria** 2000 Contact Centre Staff Scheduling At Phillips, Hager and North Investment Management Ltd. *University of British Columbia*
### Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account Number</td>
<td>the account number of the incorrect transactions</td>
</tr>
<tr>
<td>Action Required</td>
<td>free-form text describing the set of action taken to correct the error</td>
</tr>
<tr>
<td>Adjustment Reason</td>
<td>describes why an error occur</td>
</tr>
<tr>
<td>Batch Date</td>
<td>the day that the error was processed</td>
</tr>
<tr>
<td>Batch ID</td>
<td>the unique number associated with the batch of transactions containing the error</td>
</tr>
<tr>
<td>Created Date</td>
<td>the day that the error was committed by PH&amp;N</td>
</tr>
<tr>
<td>Detail</td>
<td>free-form text describing what and why the error occur</td>
</tr>
<tr>
<td>Discovered By</td>
<td>the person/entity who discover the error</td>
</tr>
<tr>
<td>Locked-in accounts</td>
<td>funds within this account cannot be withdrawn or surrendered prior to maturity</td>
</tr>
<tr>
<td>POF</td>
<td>Portfolio of Fund accounts</td>
</tr>
<tr>
<td>POL - Private</td>
<td>private pooled products (such as the Canadian Equity Fund)</td>
</tr>
<tr>
<td>POL - Institutional</td>
<td>institutional pooled products (such as the Canadian Equity Fund)</td>
</tr>
<tr>
<td>Portfolio Rebalancing</td>
<td>request from the client to adjust the holdings according to a specified weights</td>
</tr>
<tr>
<td>Process Task Failure</td>
<td>the failure of a specific task(s) within a process that led to an error</td>
</tr>
<tr>
<td>Report By</td>
<td>the staff member who fills out the error form</td>
</tr>
<tr>
<td>Report Date</td>
<td>the day that the error was reported to PH&amp;N</td>
</tr>
<tr>
<td>Resolved By</td>
<td>the staff member, usually the Quality Administrator, who rectify the error</td>
</tr>
<tr>
<td>Resolved Date</td>
<td>the day that the actions were taken to correct the error.</td>
</tr>
<tr>
<td>SEG - Private</td>
<td>private segregated accounts (individual stocks)</td>
</tr>
<tr>
<td>SEG - Institutional</td>
<td>institutional segregated account (individual stocks)</td>
</tr>
<tr>
<td>Sources of Errors</td>
<td>the department/staff member who committed the error</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td>Time Lag</td>
<td>the difference, in days, between when an error is created to when it is reported to PH&amp;N.</td>
</tr>
<tr>
<td>Transaction Type</td>
<td>the specific transaction that failed</td>
</tr>
</tbody>
</table>
Appendix A

Sample Error Report (Paper version)
Appendix B

QUALITY EVALUATION METRIC (QEM)

USER'S MANUAL

(AUGUST 2000)
1.0 INTRODUCTION

The Quality Evaluation Metric (QEM) is a web-based application that electronically captures and tracks reported errors in mutual fund processing at Phillips, Hager, and North. These include financial errors, such as back-dated trades that result from misplaced orders, and non-financial errors - those that do not directly affect the monetary value of a client’s account. Through the electronic tracking capabilities of the QEM, reports can be produced more quickly. Trends in types of errors will be tracked and error reports will be generated on a weekly, monthly, and quarterly basis.

2.0 GETTING STARTED

ACCESSING THE APPLICATION

Access to Internet Explorer 5 on the user's terminal is the only system requirement to operate the QEM. If a version lower than 5 is installed on your system, please call the Support Centre at ext. 6129.

Select the Applications option from the Onyx toolbar and then select QEM. Once selected, the following dialog box appears:
MAIN MENU

Upon entering a valid user name and password and clicking the Submit button, the Main Menu screen will appear. The Main Menu consists of the following options:

- **Error Summary Report**
  The user can generate a summary report of all error reports that were resolved during a specified period.

- **Error Entry**
  By clicking on the “Data Entry” button a blank data entry screen opens for the user, enabling a new error report to be entered.

- **Withhold Confirmation / Tax Receipts**
  For a specified period, the user can generate a report of all the confirmations and tax receipts that must be withheld.

- **Error Report**
  The user can search for a specific error report by Account Number, Client Name, Error Number, or Error Report Status (Open or Closed). See diagram in Section 4.0.
3.0 CREATING A NEW INCIDENT REPORT

From the Main Menu screen under the Error Entry section, click on the Data Entry button. A blank data entry form will then appear on the screen. This is the screen in which all the error report data is entered. The key fields are:

- **Discovered By**: the department or person who discovered the error

  
  ![Discovered By](Registered Holder/Beneficial Owner)


- **Batch Date and Batch ID**: the values for these fields are taken from the supporting documentation detailing when the original error first occurred. This documentation should include not only the date that the original error occurred, but also the Batch ID this error was associated with. The Batch Date is a very important field as it is one of the key variables in determining Gain or Loss on a “Financial” error.

- **Accounts Affected**: which account(s) was/were affected by the error. The first account number should always be entered in the top left cell. If more than one account number was affected, each subsequent account number should be entered in the top cells first, from left to right, and then in the bottom cells – also from left to right.

  ![Accounts Affected](First Second Third)

  
  ![Accounts Affected](Fourth Fifth Sixth)
• **Transaction Category:**
  - did the error have a monetary, "**Financial**" implication - such as keying in the incorrect account number which requires reversing the trade
  - did the error have a "**Non-Financial**" implication - such as entering the wrong address for a customer
  - did the error have both a Financial and Non-Financial implication

  **Transaction Category:**
  - Financial
  - Non-Financial
  - Both

• **Error Number:** this number is automatically generated and assigned to all new error reports; however, the number is only temporary and does not become permanent until the Submit button is clicked. The error number consists of two parts:
  i) the date the error report is entered into the system
  ii) the error report number based on how many error reports have been entered into the system on a particular day

  **Example:**

  Error Number: 20000801-1

  Entered on Aug 1, 2000
  First report entered on Aug 1, 2000

• **Detail and Further Action Required:** these screens contain free form text boxes for the user to input any details regarding the error, in addition to any action that needs to be taken to resolve the error. The maximum length the user can input is 500 characters, including spaces and punctuation.
• **Document Number:** this is the unique document number associated with a document image in the FileNet system.

Just as with account number, Document Number(s) is/are entered starting at the top left cell, continuing to the end of the top row, then proceeding to the bottom left cell, continuing to the end of the bottom row.

![Document Number Table](image)

Finally, once all the data has been entered in all the appropriate fields, the user must click on the Submit button. This enables the information to be saved in the database and the error number changes from temporary to permanent. Once the Submit button is clicked, an Error Report screen appears. If the user decides *not* to click on Submit but rather, chooses to go back to the Main Menu, none of the information entered will be saved and the Main Menu will appear.

![Submit Button](image)

**ERROR REPORT SCREEN – CREATING AN INCIDENT**

Assuming the Submit button was pressed, some additional information will appear. Where the user entered only the account numbers on the data entry screen, the Error Report screen associates these numbers with investors’ names. The purpose is to provide additional verification of data input for the user. It is also important to note that at this point the error report can still be edited or updated, if necessary.

When the Error Report screen comes up, the user has two choices: Edit Report or Create Incident. By choosing the Edit Report button the user can only change the information on the error report that was just entered. If the user chooses Create Incident, a new “incident” will be created in the Onyx system; no editing or updating can be made to the incident in the Onyx system by the user. Any further changes to be made to the error report once an incident has been created should be processed by the Quality Assurance staff member.
Once Create Incident has been clicked and the Onyx system has been successfully updated, this button will no longer exist in subsequent viewings of the report. Note: The Create Incident button should not be clicked unless the user is confident the information entered in the report is correct.

MESSAGES FROM THE ONYX SYSTEM

If Create Incident is chosen, a new screen will appear. The message on this next screen will be one of the following:

i)  Onyx has been successfully updated – this means that the incident was successfully created in the Onyx system

ii) Onyx Update was unsuccessful – either the account number was entered incorrectly or the investor does not exist in the system. The user needs to return to the report and verify the information entered

Once the incident has been created, an automatic e-mail notification will be sent to the Quality Assurance staff member to take further action.
4.0 SEARCHING FOR AND UPDATING AN EXISTING REPORT

On the Main Menu, the section titled "Error Report" enables the user to search for an existing error report and to view or modify it. The user can search by one of four different methods: Account Number, Client Name, Error Number, or Status of the Error Report (Open or Closed). The results of the query will be shown at the bottom of the page. The user can view the specific error report by clicking on the "Report" link. As well, updating specific error reports is possible by clicking on the "Update" link. The "Update" Link will redirect the user to the data entry screen - which shows the previously entered data. Note: if the Create Incident button was clicked prior to the user searching for the error report in the manner listed here, any changes made will be superficial and will not update the incident in the Onyx system.

The Error Report section from the Main Menu as well as an example of the Search Results retrieved (by Error Number) are displayed below.

Error Report

Search by Account Number

Search by Client Name

Search by Error Number

Search by Status: Open Update

Search Results:

<table>
<thead>
<tr>
<th>Client Name</th>
<th>Account Number</th>
<th>Error Number</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>8403</td>
<td>20000718-1</td>
<td>Open</td>
<td>Update</td>
</tr>
<tr>
<td>1420</td>
<td>20000718-10</td>
<td>Open</td>
<td>Update</td>
</tr>
<tr>
<td>5744</td>
<td>20000718-10</td>
<td>Open</td>
<td>Update</td>
</tr>
<tr>
<td>17100</td>
<td>20000718-10</td>
<td>Open</td>
<td>Update</td>
</tr>
</tbody>
</table>
5.0 FURTHER INFORMATION

While this manual attempts to explain the most frequent actions that will be performed through use of the Quality Evaluation Metric, it is impossible to document all potential questions or problems. Therefore, should you encounter a problem or have any further questions, please contact:

Derek Leung ext. 6165

If Derek is not available, ask for Nicole Franjic at the same extension.

6.0 Additional Features for Quality Administrator

In addition to the functionality described in previous section for general users, the Quality Administrator (QA) has the right to the following features:

1. Right to resolve an error report
2. Data fields update
3. Financial cost summary
4. Recalculate gain/loss

6.1 Right to resolve an error report

After the QA has fully corrected the error in the UNITRAX system, he or she has to complete the corresponding error report in the QEM system. More specifically, the QA is required to enter or update the following data fields – Resolved Date, Resolved By, Caused By, Cost Incurred To, Transaction Type, Adjustment Reason, Time Spent to Fix, Number of Staff Involved, Action Required and Process Task Failure.

Resolved Date and Resolved By

Resolved Date is the date where all actions, reversing and reposting transaction, are taken to correct the data. Resolved By is the staff member who corrected the error.

Caused By

This field lists all the current staff members within the CS department. This field will only be populated if the error was committed due to a process failure within the CS department and that the particular staff member(s) who committed the error is known. This field uses check boxes to allow for multiple entries. As well, this field can be updated by the QA (see Section 6.2)
Cost Incurred To

The person that is accountable for the direct dollar cost for correcting an error. This field is set to "PH&N" as default if this field was not populated.

Transaction Type

The specific process failed and led to the error. This field dictates the set of process task failures that will be presented for the QA to choose from when updating the data field "Process Task Failure". This field can be updated by the QA (see Section 6.2).

Adjustment Reason

This field describes the reason for correcting the error. This field uses check boxes to allow for multiple entries. As well, this field can be updated by the QA (see Section 6.2).

Time Spent to Fix Error and Number of Staff Involved

These two measures are an estimate of the time needed to fix the error and the human resources required to fix the error. These two measures provide an indicator to the opportunity cost (time and staffs) required to fix an error. Time Spent to fix error is in minutes.

Action Required

Action required is the description of the set of actions required to correct the error.

Process Task Failure

After all the fields described above have been entered, the QA must press the "submit button" at the bottom of the screen in order to save the updates to the error report. A new window will appear on the screen. This new window allows the QA to choose the process task failures of the error. As mentioned in above, this list of process task failure changes according to the type of transaction chosen in the data entry screen. The "submit" button must be pressed to save any changes. Process Task Failure can be updated by the QA (see section 6.2).
ERROR REPORT

Error Number: 2000090
BatchDate: 20000809
BatchID: 61
Client Name: JOINT ELI
Accounts Affected: 1923757
Status: Closed
Discovered By: Investors
Reported Date: Sep 08.
Resolved Date: Sep 08.
Caused By: Robert P
Melanie I
Cost Incurred To: 
Trans Category: Financial
Transaction Type: Switch
Adjustment Reason: Incorrect
Process Task Failure: Prescreen
1st and 2nd
Details: This report was processed on April 00 using correct dollar amounts.

http://line/apps/inter_reporting/ErrorSource.asp?TransType=Switch

Transaction Type: Switch
Process Task Failure:
- Miscommunication Contact Center
- Incorrect Key into PHN.com
- IKON - Sorting
- Batching/Sorting
- Prescreen - Investor Level
- Prescreen - Account Level
- Prescreen - Transaction Level
- System - UNITRAX
- System - PHN.com
- 1st and 2nd key Independence
- Inv Manager Request Incorrect
- Client Provided Incorrect Information
- Other

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When the Error Report screen comes up, the QA has two choices: Edit Report or Update Incident. By choosing the Edit Report button the QA can only change the information on the error report that was just entered. If the QA chooses Update Incident, the corresponding “incident” in the Onyx system will be updated with the new information and the incident will be set to “close”; no editing or updating can be made to the incident in the Onyx system through the QEM application. The QA must change or update the corresponding incident in the Onyx system.

Once “Update Incident” has been clicked and the Onyx system has been successfully updated, this button will no longer exist in subsequent viewings of the report. Note: The Create Incident button should not be clicked unless the user is confident the information entered in the report is correct.

MESSAGES FROM THE ONYX SYSTEM

If Create Incident is chosen, a new screen will appear. The message on this next screen will be one of the following:
iii) *Onyx has been successfully updated* – this means that the incident was successfully created in the Onyx system.

iv) *Onyx Update was unsuccessful* – either the account number was entered incorrectly or the investor does not exist in the system. The user needs to return to the report and verify the information entered.

### 6.2 Data Fields Update

To ensure the flexibility and the robustness of the QEM application, almost all of the data fields are run from the database and they can be modified by the QA.

The QA must press “Fields Update” on the Main Menu to start the modifying process.

The QA will then be directed to the “Data Field Update” screen where the QA can choose to update the data field he or she desires.

#### DATA FIELDS UPDATE

- Update Password
- Update Discovered By
- Update Staff
- Update Transaction Type
- Update Adjustment Reason
- Update Process Task Failure
- Update Email Address
6.2.1 Update Password

This function allows QA to add a new user to the QEM application or to modify the information regarding an existing user.

<table>
<thead>
<tr>
<th>User Index</th>
<th>User</th>
<th>Login</th>
<th>Password</th>
<th>Full Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Investment Manager</td>
<td>invman</td>
<td>invman</td>
<td>N</td>
</tr>
<tr>
<td>2</td>
<td>Client Services</td>
<td>cs</td>
<td>cs</td>
<td>N</td>
</tr>
<tr>
<td>3</td>
<td>Administrator</td>
<td>ta</td>
<td>qem</td>
<td>Y</td>
</tr>
</tbody>
</table>

User Index – unique ID of a user
User – the name of the user
Login – the login name of the user
Password – the password of the user
Full Access – “N” for general user and “Y” for quality administrator

Pressing the “Close” button will close the current “pop up” window and redirect the QA back to the “Data Field Update” screen.
To add a new user

Press the “Add” button and the following screen will appear.

All data fields, User, Login, Password and Full Access, must be entered in order to add a new user. As well, the input box “Full Access” must be either “Y” or “N” and it is case sensitive. Pressing the “Cancel” button will redirect the user back to the “Password Update” screen where he or she can choose “Add”, “Modify” or “Close”

To modify an existing user

Press the “Update” button and the following screen will appear:
Similar to "To add a new user", all data fields, User, Login, Password and Full Access, must be entered in order to add a new user, the input box “Full Access” must be either “Y” or “N” (case sensitive). As well, the QA must enter a valid User Index to properly modify an existing user. Pressing the “Cancel” button will redirect the user back to the “Password Update” screen where he or she can choose “Add”, “Update” or “Close”.

6.2.2 Update Discovered By

This will allow the QA to update the Discovered By data field.

<table>
<thead>
<tr>
<th>Discover Index</th>
<th>Discovered By</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Registered Holder/Beneficial Owner</td>
</tr>
<tr>
<td>2</td>
<td>Test Run</td>
</tr>
<tr>
<td>3</td>
<td>Investment Manager/Administrator</td>
</tr>
<tr>
<td>4</td>
<td>Record Keeper</td>
</tr>
<tr>
<td>5</td>
<td>Royal Trust</td>
</tr>
<tr>
<td>6</td>
<td>Client Services/Contact Center</td>
</tr>
<tr>
<td>7</td>
<td>Accounting</td>
</tr>
</tbody>
</table>

Discover Index – unique ID associated with each Discovered By field
Discover By – the person or entity who discovered the error.

Pressing the “Close” button will close the current “pop up” window and redirect the QA back to the “Data Field Update” screen.

To add a new Discovered By field

Press the “Add” Button and the following screen will appear
Type in the name of the new Discovered By field and press the “submit” button. Pressing the “Cancel” button will redirect the user back to the “Discovered By Update” screen where he or she can choose “Add”, “Update” or “Close”.

To modify an Discovered By field

Press the “Update” Button and the following screen will appear

Both Discover Index and Discovered By fields must be entered and the Discover Index entered must be a valid Discover Index in order to save the changes. Pressing the “Cancel” button will redirect the user back to the “Discovered By Update” screen where he or she can choose “Add”, “Update” or “Close”.

6.2.3 Update Staff

The QA must update the staff list of the CS department when there is a new staff member or an existing staff member left the department.
Staff Index – unique ID for a staff member
Name – name of a staff member
Departed – “No” for CS staff and “Yes” for not CS staff

The staff list is used for the Caused By field in the data entry screen. To recap, the Caused By field is to identify the specific staff member(s) that is responsible for committing a specific error.

Because the staff list is quite extensive, the screen shot did not capture the whole “Update Staff” screen for updating the staff. Similar to “Update Password” and “Update Discovered By”, three buttons are available for the QA to choose from – “Add”, “Update” and “Close”

Pressing the “Close” button at the bottom of the screen will close the current “pop up” window and redirect the QA back to the “Data Field Update” screen.

To add a new staff member

This function is used when the CS department hires a new staff member.

Pressing the “Add” button will redirect the QA to the following screen

![Add Staff Screen](http://linx/apps/error_repoiting/updatestaff.asp)

The input box must be populated in order to add a new staff member. Pressing the “Cancel” button will redirect the user back to the “Staff Update” screen where he or she can choose “Add”, “Update” or “Close”.
To modify a staff member

This function is used if a staff member changes his or her name or if the staff member left the CS department.

Pressing the “Update” button will redirect the QA to the following screen:

![Update Staff Interface]

Both Staff Index and Staff Name fields must be entered and the Staff Index entered must be a valid Staff Index in order to save the changes. Pressing the “Cancel” button will redirect the user back to the “Staff Update” screen where he or she can choose “Add”, “Update” or “Close”.

6.2.4 Update Transaction Type

This allow the QA to add a new transaction process or modify the name of an existing transaction.
Transaction Index – unique ID for each Transaction Type
Transaction Type – name of the transaction type

Pressing the “Close” button at the bottom of the screen will close the current “pop up” window and redirect the QA back to the “Data Field Update” screen.

To add a new transaction

This function is used when a new process is introduced in the CS department.

Pressing the “Add” button will lead the QA to the following screen:

The input box must be populated in order to add a transaction type. Pressing the “Cancel” button will redirect the user back to the “Transaction Type Update” screen where he or she can choose “Add”, “Update” or “Close”.

After a new transaction type has been successfully added, the QA must define a list of process task failure that is specific to this new type of transaction. It is extremely important that the QA follows the procedure outlined below.

1. Press the “Close” button on the “Transaction Type Update” screen.
2. Press “Update Process Task Failure”

DATA FIELDS UPDATE

3. Choose the new Transaction Type from the drop down menu and press “submit”

4. Check to see if you chose the name of the new transaction type. If correct, press the “Add” button. Otherwise, press the “Choose Transaction” button and choose the correct transaction type.
5. Type in “Other” in the “Add Process Task Failure” input box and then press “submit”

```
http://mex/apps/enor_reporting/update30uice.asp - Microsoft Internet Expl
```

6. Check to see if you have added a new process task failure for the “New Transaction”

```
Process Task Failure Update
New Transaction
Process Index Task Name Map To Index Controllable Active
1 Other 1
```

7. Press the “Update” button on the “Process Task Failure Update” screen
8. Enter in 1 for Process Index, “Other” for Task Name, 1 for “Map To Index”, “Y” for Controllable, Y” for Active and then press “submit”

9. The following screen should appear where “New Transaction” is the name of your new transaction type you added in the beginning.

10. Press “Add” if you wish to add more process task failure. You must add the “Other” Process Task Failure first before you add any other new tasks because of how the QEM was coded.

It is **extremely important** that the QA follows these 10 steps carefully every time a new transaction type is added to the QEM application. A detailed explanation of add and modifying a process task failure is given in Section 6.4.6.
To modify an existing transaction

Pressing the “Update” button will lead the QA to the following screen:

Both Transaction Index and Transaction Type fields must be entered and the Transaction Index entered must be a valid Transaction Index in order to save the changes. Pressing the “Cancel” button will redirect the user back to the “Transaction Type Update” screen where he or she can choose “Add”, “Update” or “Close”.

### 6.2.5 Update Adjustment Reason

This function allows the QA to update the list of adjustment reason available.

<table>
<thead>
<tr>
<th>Adjustment Index</th>
<th>Adjustment Reason</th>
<th>Active</th>
<th>Last Modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Incorrect Amount</td>
<td>Yes</td>
<td>7/31/00</td>
</tr>
<tr>
<td>2</td>
<td>Incorrect Account Number</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Incorrect Fund</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Conversion</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Trade Date</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Order Missed/Lost</td>
<td>Yes</td>
<td>5/26/00</td>
</tr>
<tr>
<td>7</td>
<td>Other</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

Adjustment Index – unique ID for each adjustment reason
Adjustment Reason – name of the adjustment reason
Active – “Yes” for active and “No” for inactive
Last Modified – the date of which it was last modified
To add an adjustment reason

Pressing the "Add" button will redirect the QA to the following screen:

The input box must be populated in order to add a new adjustment reason. Pressing the "Cancel" button will redirect the user back to the "Adjustment Reason Update" screen where he or she can choose "Add", "Update" or "Close".

To modify an adjustment reason

Pressing the "Update" button will redirect the QA to the following screen:

All fields, Adjustment Index, Adjustment Reason and Active, must be entered. The Adjustment Index entered must be a valid Adjustment Index in order to save the changes. As well, the Active field must be either "Y" or "N" and it is case sensitive. Pressing the "Cancel" button will redirect the user back to the "Transaction Type Update" screen where he or she can choose "Add", "Update" or "Close".
6.2.6 Update Process Task Failure

This function allows the QA to add or modify the process task failure within a transaction type. Because each transaction type has its own process tasks, the QA must choose the desired transaction type shown in the following screen before proceeding with the update.

Once a specific transaction type is chosen, a list of process task failure will be shown.

**Process Index** — unique ID associated with each task within a specific process

**Task Name** — the name of the process task failure

**Map To Index** — if a specific process task is no longer in use and it is replaced by a new process task, the Map To Index is used to redirect all the old process task to the new process task. For example, if the task associated with process index 1 is no longer used and it is replaced by the task with process index 2, the Map To Index of process index 1 will be 2.

**Controllable** — “Y” if an error committed due to the failure of this specific task can be avoided by the CS department if the process was carried out properly, “N” if an error can not be avoided.

**Active** — “Y” for active and “N” for inactive
Last Modified – the date the specific process task failure was modified.

Pressing the “Choose Transaction” button will redirect the QA back to the screen where he or she chooses the Transaction type from a drop down box. Pressing the “Close” button at the bottom of the screen will close the current “pop up” window and redirect the QA back to the “Data Field Update” screen.

To add a new process task failure

Pressing the “Add” button will redirect the QA to the following screen:

The input box must be populated to add a new process task failure. Pressing the “Cancel” button will redirect the user back to the “Process Task Failure Update” screen where he or she can choose “Add”, “Update”, “Choose Transaction” or “Close”.

<table>
<thead>
<tr>
<th>Process Index</th>
<th>Task Name</th>
<th>Map To Index</th>
<th>Controllable</th>
<th>Active</th>
<th>Last Modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Miscommunication Contact Center</td>
<td>1</td>
<td>N</td>
<td>Yes</td>
<td>5/26/00</td>
</tr>
<tr>
<td>2</td>
<td>IKON - Sorting</td>
<td>2</td>
<td>N</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Batching/Sorting</td>
<td>3</td>
<td>Y</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Prescreen - Investor Level</td>
<td>4</td>
<td>Y</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Prescreen - Account Level</td>
<td>5</td>
<td>Y</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Prescreen - Transaction Level</td>
<td>6</td>
<td>Y</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Predeposit</td>
<td>7</td>
<td>Y</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>System - UNITRAX</td>
<td>8</td>
<td>N</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>1st and 2nd key independence</td>
<td>9</td>
<td>Y</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Inv Manager Request Incorrect</td>
<td>10</td>
<td>N</td>
<td>Yes</td>
<td>5/26/00</td>
</tr>
<tr>
<td>11</td>
<td>Client Provided Incorrect Information</td>
<td>11</td>
<td>N</td>
<td>Yes</td>
<td>6/30/00</td>
</tr>
<tr>
<td>12</td>
<td>Other</td>
<td>12</td>
<td>Y</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
To modify a process task failure

Pressing the “Update” button will redirect the QA to the following screen:

All fields, Source Index, Source Name, Map To Index, Controllable and Active must be entered. The Source Index entered must be a valid Process Index in order to save the changes. As well, the Active field and the Controllable field must be either “Y” or “N” and it is case sensitive. Pressing the “Cancel” button will redirect the user back to the “Transaction Type Update” screen where he or she can choose “Add”, “Update” or “Close”.

6.2.7 Update Email Address

An email notification is sent to the QA once an incident is created in the Onyx system. However, because it is possible that the QA can be unavailable, this function allows the QA to redirect the email notification to the backup staff member when the QA is not
available.

Index – the unique ID for each email addresses.
Email Address – self-explanatory

Pressing the “Close” button at the bottom of the screen will close the current “pop up” window and redirect the QA back to the “Data Field Update” screen.

To add an email address

Pressing the “Add” button will redirect the QA to the following screen:

The input box must be populated to add a new email address. Pressing the “Cancel” button will redirect the user back to the “Email Address Update” screen where he or she can choose “Add”, “Update”, “Delete” or “Close”.

To modify an email address

Pressing the “Update” button will redirect the QA to the following screen:

The fields Email Index and Email Address must be entered and the Email Index entered must be a valid Index in order to save the changes. Pressing the “Cancel” button will redirect the user back to the “Email Address Update” screen where he or she can choose “Add”, “Update”, “Delete” or “Close”.

73
To delete an email address

Pressing the "Delete" button will redirect the QA to the following screen:

![Email Address Update](http://finx/apps/erroi_reporting/updateemail.asp - Microsoft Internet Explorer)

Email Address Update

<table>
<thead>
<tr>
<th>Index</th>
<th>Email Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><a href="mailto:EWu@phn.com">EWu@phn.com</a></td>
</tr>
</tbody>
</table>

Delete Email Address:

Email Index: [submit] [Cancel]

The email index must be entered and it must be a valid index to delete an email address from the system. Pressing the "Cancel" button will redirect the user back to the "Email Address Update" screen where he or she can choose "Add", "Update", "Delete or "Close".

### 6.3 Financial Cost Summary

This function allows the QA to generate a report summarizing the "Gain/Loss" of all errors during a specified period

![Financial Cost Summary](image)

### 6.4 Re-Calculate Gain/Loss

Because mutual funds do not get priced until the end of a working day, the Gain/Loss associated with the reversing and reposting of transactions that the QA made during the day cannot be calculated. Therefore, Gain/Loss of today's error reports will need to be calculated again tomorrow. This function allows the QA to re-calculate the Gain/Loss of the error reports during a specified period in a batch.

![Re-Calculate Gain/Loss](image)
Appendix C

Sample Weekly Dashboard
Week 2 of September, 2000
Sept 1 - Sept 10

ERRORS
(cumulative to-date)

TO-DATE*

12

* PROJECTED

TARGETED

55

COMPARATIVE VOLUME-ADJUSTED
ERRORS
(cumulative to-date)

<table>
<thead>
<tr>
<th></th>
<th>1M</th>
<th>2M</th>
<th>3M</th>
<th>1 YR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>29%</td>
<td>41%</td>
<td>41%</td>
<td>33%</td>
</tr>
</tbody>
</table>

Improved | Worsen

Number of Process Failures
September, 2000

# of Errors

0 1 2 3 4 5 10 20 30 40 50 60

Week #

Target
To-Date
Process Failures for September, 2000
Segregated by Process Task Failure

1st and 2nd key Independence
Prescreen - Transaction Level
Inv Manager Request Incorrect
Other
Prescreen - Account Level
System - UNITRAX
Miscommunication Contact Center
Miscommunication Call Center
IKON - Sorting
Client Provided Incorrect Information
Batching/Sorting

Number of Failures

*one error may result in more than one process task failure

Commentaries
Appendix D

Sample Monthly Management Report
By Transaction Type

<table>
<thead>
<tr>
<th></th>
<th>Sep-99</th>
<th>Jun-00</th>
<th>Jul-00</th>
<th>Aug-00</th>
<th>Sep-00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase</td>
<td>3639</td>
<td>4024</td>
<td>4554</td>
<td>4537</td>
<td>4611</td>
</tr>
<tr>
<td>Redemption</td>
<td>2595</td>
<td>3881</td>
<td>3323</td>
<td>3176</td>
<td>3322</td>
</tr>
<tr>
<td>Switch</td>
<td>4668</td>
<td>5718</td>
<td>8332</td>
<td>8133</td>
<td>9061</td>
</tr>
<tr>
<td>Transfer</td>
<td>703</td>
<td>1126</td>
<td>1068</td>
<td>1106</td>
<td>1034</td>
</tr>
<tr>
<td>Total</td>
<td>11905</td>
<td>15352</td>
<td>17277</td>
<td>16952</td>
<td>15028</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Sep-99</th>
<th>Jun-00</th>
<th>Jul-00</th>
<th>Aug-00</th>
<th>Sep-00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase</td>
<td>31%</td>
<td>30%</td>
<td>26%</td>
<td>27%</td>
<td>31%</td>
</tr>
<tr>
<td>Redemption</td>
<td>22%</td>
<td>25%</td>
<td>19%</td>
<td>19%</td>
<td>22%</td>
</tr>
<tr>
<td>Switch</td>
<td>40%</td>
<td>37%</td>
<td>48%</td>
<td>48%</td>
<td>40%</td>
</tr>
<tr>
<td>Transfer</td>
<td>6%</td>
<td>7%</td>
<td>6%</td>
<td>7%</td>
<td>7%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

By Account Type

<table>
<thead>
<tr>
<th></th>
<th>Sep-99</th>
<th>Jun-00</th>
<th>Jul-00</th>
<th>Aug-00</th>
<th>Sep-00</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUT</td>
<td>5473</td>
<td>6065</td>
<td>6968</td>
<td>7712</td>
<td>6342</td>
</tr>
<tr>
<td>POF</td>
<td>2346</td>
<td>3891</td>
<td>5351</td>
<td>4291</td>
<td>3762</td>
</tr>
<tr>
<td>POL - INST</td>
<td>3202</td>
<td>4144</td>
<td>3847</td>
<td>4016</td>
<td>3696</td>
</tr>
<tr>
<td>POL - PRIV</td>
<td>26</td>
<td>151</td>
<td>104</td>
<td>123</td>
<td>143</td>
</tr>
<tr>
<td>SEG - INST</td>
<td>644</td>
<td>742</td>
<td>704</td>
<td>513</td>
<td>617</td>
</tr>
<tr>
<td>SEG - PRIV</td>
<td>87</td>
<td>250</td>
<td>212</td>
<td>218</td>
<td>210</td>
</tr>
<tr>
<td>Total</td>
<td>11778</td>
<td>15253</td>
<td>17186</td>
<td>16873</td>
<td>14970</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Sep-99</th>
<th>Jun-00</th>
<th>Jul-00</th>
<th>Aug-00</th>
<th>Sep-00</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUT</td>
<td>46%</td>
<td>40%</td>
<td>41%</td>
<td>46%</td>
<td>42%</td>
</tr>
<tr>
<td>POF</td>
<td>20%</td>
<td>26%</td>
<td>31%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>POL - INST</td>
<td>27%</td>
<td>27%</td>
<td>22%</td>
<td>24%</td>
<td>20%</td>
</tr>
<tr>
<td>POL - PRIV</td>
<td>0%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>SEG - INST</td>
<td>5%</td>
<td>5%</td>
<td>4%</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>SEG - PRIV</td>
<td>1%</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Breakdown of Basic Financial Transaction Volume

Breakdown of Basic Transaction Volume Segregated By Account Type
Phillips, Hager & North
Investment Management Ltd.
CS Management Report

Effectiveness

<table>
<thead>
<tr>
<th></th>
<th>Sep-99</th>
<th>Jun-00</th>
<th>Jul-00</th>
<th>Aug-00</th>
<th>Sep-00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase</td>
<td>30</td>
<td>31</td>
<td>36</td>
<td>59</td>
<td>72</td>
</tr>
<tr>
<td>Redemption</td>
<td>19</td>
<td>31</td>
<td>22</td>
<td>21</td>
<td>19</td>
</tr>
<tr>
<td>Switch</td>
<td>7</td>
<td>27</td>
<td>28</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Transfer</td>
<td>3</td>
<td>4</td>
<td>9</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
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Number of Errors Per 1000 Transactions

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<th>Jun-00</th>
<th>Jul-00</th>
<th>Aug-00</th>
<th>Sep-00</th>
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<td>8.24</td>
<td>9.70</td>
<td>7.91</td>
<td>13.00</td>
<td>15.61</td>
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<tr>
<td>Redemption</td>
<td>7.32</td>
<td>7.99</td>
<td>6.62</td>
<td>6.61</td>
<td>5.72</td>
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<tr>
<td>Switch</td>
<td>1.50</td>
<td>8.22</td>
<td>3.24</td>
<td>3.44</td>
<td>4.29</td>
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<tr>
<td>Transfer</td>
<td>4.27</td>
<td>7.09</td>
<td>7.49</td>
<td>8.14</td>
<td>4.94</td>
</tr>
</tbody>
</table>

Breakdown of Basic Financial Transaction Errors

- **Purchase**: 40%
- **Switch**: 21%
- **Transfer**: 16%

Process Failures for September, 2000
Segregated by Process Task Failure

- 1st and 2nd key independence
- Prescreen - Transaction Level
- Inv Manager Request Incorrect
- Batching/Sorting
- Client Provided incorrect information
- Other
- Prescreen - Account Level
- System - UNITRAX
- System - Phx com
- Miscommunication Contact Center
- Prescreen - Investor Level
- Miscommunication Call Center
- IKON - Sorting

Number of Failures
Phillips, Hager & North Investment Management Ltd.
CS Management Report

Cost

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<th>Feb-00</th>
<th>Mar-00</th>
<th>Apr-00</th>
<th>May-00</th>
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<th>Oct-00</th>
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Year To Date

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</tr>
<tr>
<td>Total</td>
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</tr>
</tbody>
</table>

Gain/Loss Segregated By Account Type

- September 2000
- Year To Date
Appendix E

Sample Quarterly CS Report Card
Phillips, Hager & North
Investment Management Ltd.

Client Services Report Card

Quarter 3, 2000

Total number of transactions placed

\[
\begin{align*}
49,029
\end{align*}
\]

\[
\begin{align*}
\text{Last Quarter} & \quad 47,744 \\
\text{Last Year} & \quad 36,086
\end{align*}
\]

Total number of transactions placed
POF

\[
\begin{align*}
13,381
\end{align*}
\]

\[
\begin{align*}
\text{Last Quarter} & \quad 12,277 \\
\text{Last Year} & \quad 7,588
\end{align*}
\]

Breakdown of Transaction Volume

Breakdown of Transaction Volume in Dollars
Transacted
Phillips, Hager & North Investment Management Ltd.

Client Services Report Card

Number of Process Task Failures Committed
POF

92

Last Quarter 99
7% Last Year 54 70%

Breakdown of Process Failures

Within C.S. External to C.S.

48 48
47 46
46 45
45 44
44
43
42

Commentaries