

FSA Integration Partner

United States Department of Education

Federal Student Aid



Data Strategy 2.0
Data Quality
152.1.10a Data Quality Management
Support Report I

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Executive Summary

The Data Quality Management Support Report I provides a status update for the data quality initiative that began with the Data Quality Mad Dog Report (Deliverable 123.1.3) and the Data Quality Assurance Strategy and Implementation Plan (Deliverable 123.1.5). The Data Strategy Data Quality Team has worked through the first half of this initiative to complete many of the tasks recommended in these two deliverables, as well as to expand upon the methods and tools presented within these volumes. This report provides an update on these tasks and accomplishments completed to-date.

Deliverable 123.1.5 recommends the formation of a Steering Committee to oversee the reconciliation of data quality issues identified in Deliverable 123.1.3. In February 2004, the Data Quality Steering Committee was created, defining roles and responsibilities. With cooperation from the Steering Committee, the Data Strategy Data Quality Team reviewed and revised the Data Quality Implementation Methodology. This four-phased process, through which data quality issues are to progress, provides the guideline for many of the tasks to be completed during the initiative. While the Steering Committee is just completing the Prioritization Phase, essential progress has been made towards the establishment of a repeatable process for FSA to follow. The four phases of this process, and the associated tools, are shown in Figure ES1.

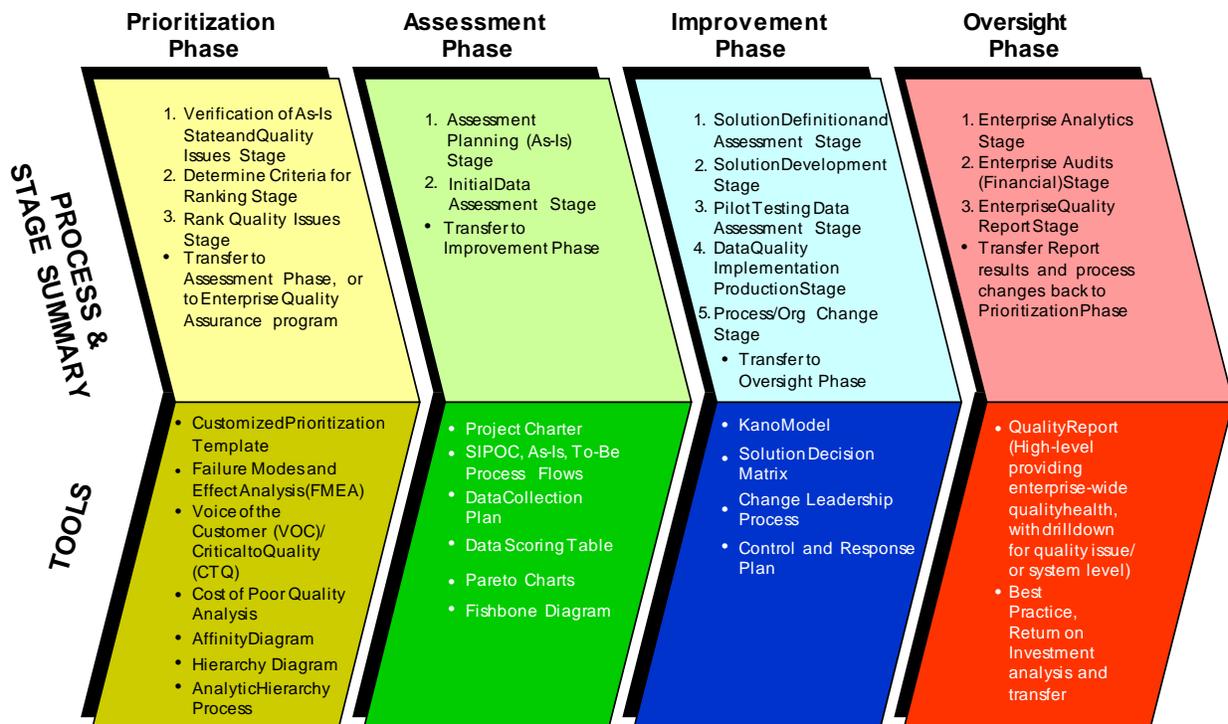


Figure ES1: Data Quality Implementation Process Summary



During the Prioritization Phase, a customized prioritization method was developed, drawing from several of the methods presented to the Steering Committee, including the Analytical Hierarchy Process and Failure Modes and Effects Analysis. The Customized Prioritization Template is a tool that FSA can utilize and update to evaluate the priority of current and newly identified data quality issues. The tool reflects the criteria most important to FSA business owners, and vital to FSA performance. Through the use of this tool, the Steering Committee has begun prioritizing data quality issues, including the Top Ten and Quick Hits identified in the Data Quality Mad Dog Report.

To maintain and update the issues identified by the Data Quality Mad Dog Report, the team developed a Microsoft Access database, the Data Quality Issue Management tool. The tool provides customizable reporting capabilities as well as integrated templates for issue prioritization and analysis. Forms are provided for issue entry, update, and resolution. Three reports are currently generated in the tool, the Data Quality Summary Issue Report, the Data Quality Detailed Issue Report, and the Data Quality Issue Prioritization Summary Report; these reports are included in Appendices F, G, and H respectively. Each report was reviewed by the Steering Committee and is customized towards its intended audience.

Deliverable 123.1.5 also recommends the generation of a training program to establish data quality standards throughout the FSA enterprise. Materials generated and presented to the Steering Committee have been gathered to serve as training materials, to be utilized in the future as the Data Quality initiative is communicated to the greater FSA community. In addition to the presentations already provided in Steering Committee meetings, this deliverable includes Assessment and Improvement Phase presentations.

Moving forward, the Data Strategy Data Quality Team will continue to work with the Steering Committee to prioritize the remaining set of data quality issues. The issues will undergo assessment to identify root-causes and solutions will be recommended by Working Groups. Concurrently, the Steering Committee will identify additional data quality issues and examine tools currently utilized in the enterprise to perform issue management. Upon completion of the second half of Data Strategy's Data Quality initiative, recommendations will be made as to the transition of the oversight of FSA's data quality work and the integration of FSA's data quality group into the bigger picture of the Target Vision's Common Data Architecture.



Amendment History

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1 Introduction

1.1 Purpose

The purpose of this document is to report on the implementation and progress of the Data Quality Assurance Strategy, a framework for identifying, correcting, and maintaining data within the FSA Enterprise. This process was spring-boarded by the Data Quality Implementation Methodology presented during Data Strategy 1.0 in the Quality Assurance Strategy and Implementation Plan (Deliverable 123.1.5). The plan proposed a strategy for the improvement of data quality and the maintenance and refinement of data across the enterprise. Additionally, this report examines the current status of issues identified and detailed through the Data Quality Mad Dog Report (Deliverable 123.1.3), highlighting the issues facing data owners.

Beyond the information presented in Deliverables 123.1.3 and 123.1.5, this report provides a refined Data Quality Implementation Methodology based on feedback from the FSA Data Quality Steering Committee, and a further examination of data quality methods. It also presents an expanded toolset to address and resolve data quality issues. Issues gathered during the Mad Dog process are consolidated, expanded, and the status and priority of those issues are updated.

1.2 Scope

The Data Strategy Data Quality Team's goal is to enact the Data Quality Implementation Methodology and facilitate the resolution of the data quality issues presented in Data Strategy 1.0 deliverables. The Team used these deliverables, additional research, and analysis to collaborate with FSA and launch the Data Quality Assurance Strategy and Implementation Plan. The scope of this document focuses on the elements of the Plan that have been completed to-date.

The current representation of the Data Quality Steering Committee, as well as their roles and responsibilities, is presented. Business templates are provided as tools for generating criteria to evaluate issues, data, and solutions. This document also includes the results of the prioritization of a representative set of issues completed by the Steering Committee. This set of issues is discussed further in Section 4 Current Status. Top priority issues will be assigned to Working Groups and will be analyzed through a series of working sessions. Moving forward, the Steering Committee will continue to meet as an overseeing body; identifying, prioritizing, assigning, and closing issues. The issue specific Working Groups will continue to meet to assess issues and develop solutions. Progression of all issues is tracked and reported through a Microsoft Access tool, which is also discussed in this report.

Throughout the remainder of the Data Strategy Data Quality effort, identified issues will be worked towards resolution. Although no new issues have been defined, it is expected that several will surface during the second half of this effort. Materials generated and included in



the Appendices (specifically the presentations included in Appendix E) are intended to be useful as training and awareness reference material for the FSA community, including the Steering Committee, Working Groups, and additional system owners and users.

As the Data Quality Implementation Methodology is worked through and refined, it is anticipated that a clearer necessity for a specific issue management tool will be defined. Beyond examination of COTS tools, it will also be important to examine tools already utilized internally within FSA that may be leveraged. Additional process materials, issue analysis, and tools analysis will be presented in the Data Quality Management Support Report II (Deliverable 152.1.10b).

1.3 Results Achieved

To date, the Data Strategy Data Quality Team has achieved several important goals while working towards a full-fledged Data Quality Implementation Methodology. The process was jumpstarted by the establishment of the Data Quality Steering Committee. The Steering Committee members were identified by FSA and a kick-off meeting was held to solicit feedback to the proposed Data Quality Implementation Methodology presented in Deliverable 123.1.5. In a subsequent meeting, the Team reviewed the roles and responsibilities of the Steering Committee and Working Groups.

Through input from the Steering Committee, and additional research and analysis, the Data Quality Team refined the Data Quality Implementation Methodology. An additional consideration was made for issues that are not data-defect driven, but rather necessitate organizational, regulatory, or process changes. Further consideration was also given to steps for solution development prior to testing, and the development of required communication and implementation plans. The Steering Committee will also play a greater role in the oversight of the Data Quality Implementation Methodology.

As another element of this effort, the Data Quality Team consolidated issues presented at varying levels of detail in the Data Quality Mad Dog Report. These issues were entered into a Microsoft Access database tool, the Data Quality Issue Management (DQIM) tool, developed for issue entry, tracking, and resolution. A summary of these issues is included in Appendix F and detailed in Appendix G.

The Team also developed an expanded set of business templates to be included in the DQIM tool, and to work as aids in issue assessment and presentation. The business templates utilized in the Prioritization Phase were presented to the Steering Committee. Presentation materials have also been generated for the Assessment and Improvement Phases, and are included in Appendix E.

To help FSA evaluate methods in ranking, a toolset for prioritization of issues was provided to the Steering Committee. Using the provided business templates as a guide, a customized method for ranking issues was devised (Reference Section 4.2.2 Prioritization Phase Business Templates). The Data Quality Team then began prioritization of the consolidated issues list.



The Top Ten issues and Quick Hits identified during the Mad Dog process were chosen first to continue the Data Quality Implementation Methodology. Refer to Appendix H Data Quality Issue Prioritization Summary Report for the current results. Once prioritized, these issues will be ready for the Assessment Phase.

1.4 Assumptions

The following is a list of assumptions for the Data Quality Management Support Report I (Deliverable 152.1.10a):

- Future success and implementation of the Data Quality Assurance Strategy and Implementation Plan is dependent on the appropriate commitment and buy-in from resources identified to participate in the Steering Committee and Working Groups. It is imperative that the proper resources and knowledge be provided in a timely manner to resolve issues and improve data quality.
- The provided methodology and business templates are to serve as references and recommendations. They are tools that will help raise awareness and education of FSA's quality initiatives so that improvements can be made. It is up to FSA to decide which processes and tools best fit the issues and the organization.
- The current issues list developed during the Data Quality Mad Dog Report, deals with those affecting internal FSA activity, and only addresses issues involving cross-system interfaces. Errors and changes involving single systems, and those caused by trading partners and borrowers, are not within the current scope of this effort.
- The current Mad Dog issues list only addresses issues identified by FSA business and system owners during the Data Strategy 1.0 effort. Additional processes and tools are necessary to more formally identify yet-to-be-defined issues.
- Although only the Top Ten, Quick Hits, and some additional issues from the Data Quality Mad Dog Report have been prioritized, the remaining issues still require prioritization. The issues will then continue through the Data Quality Implementation Methodology.
- Organization of issues by Business Capability Area (BCA) will help FSA evaluate and resolve issues in a way that moves toward the Target State Vision.
- Enacting the Data Quality Implementation Methodology will allow for a future internal or commercial tool recommendation; no tool recommendation is to be made yet. It is possible that FSA may find that an internal tool already exists that can serve the purposes necessary for data quality issue management.
- Training materials are being developed throughout the process. After an iteration of working through issues, training materials can be refined and presented to the larger FSA community.



2 Background

2.1 Data Strategy 1.0 Overview

The purpose of Data Strategy 1.0 was to get “The Right Data to the Right People at the Right Time.” This was done through developing an overall approach towards data to ensure that accurate and consistent data is available to and exchanged between FSA and their customers, partners, and compliance and oversight organization. Data Strategy 1.0’s function was to define FSA’s enterprise data vision and strategy for how it will combine the tools, techniques, and processes to handle its enterprise data needs. In particular, Data Strategy 1.0 focused on the integration of the following components: 1) FSA Data Strategy Framework, 2) Technical Strategies, 3) XML Framework, 4) Common Identifiers, and 5) Institution Enrollment and Access Management.

The Data Strategy 1.0 initiative was in response to FSA’s desire to deliver overall improvements in the areas of data quality and data consistency. Further, FSA leveraged this initiative to support their business objectives:

1. Reduce redundant data storage;
2. Improve customer service;
3. Increase accuracy of analytics;
4. Increase efficiency in data handling;
5. Reduce costs;
6. Remove FSA from the GAO high-risk list;
7. Maintain a clean audit.

The two efforts of Data Strategy 1.0 Data Framework most relevant to data quality, and the basis for this report, are the Data Quality Mad Dog Report and the Quality Assurance Strategy and Implementation Plan.

2.1.1 Data Quality Mad Dog Report

The Data Quality Mad Dog Report (Deliverable 123.1.3) addressed the prioritization of data quality issues identified by FSA system and business owners within the enterprise. This deliverable established an active list of data quality issues between FSA systems and presented recommendations for solutions to correct the deficiencies. During the prioritization analysis in the Data Quality Mad Dog Report, a Top Ten list was created to highlight the most critical data quality issues and to serve as a starting point to resolve issues. Each data quality issue was analyzed to determine if a solution could be implemented in a short period of time and at a reasonable cost, referred to as a “Quick Hit.” A detailed report was completed for the Top Ten and Quick Hits, capturing information such as detailed description of issue, recommended solution, dependencies, estimated time and cost, and business areas impacted. In addition, The Data Quality Mad Dog Report provided a further detailed analysis of the Top Ten and Quick Hits data quality issues and categorized these issues into common data quality processes. The



categories identified were: 1) Common Identification Methods, 2) Data Reconciliation and Analytics, and 3) Education and Communication.

During the Mad Dog effort, an analysis was conducted and recommendations for resolution were provided for the Top Ten data quality issues and Quick Hits. These recommendations have been documented in the Data Quality Detailed Issue Report found in Appendix G. The data quality issues and their suggested resolutions represent the beginning of the improvement process for FSA data quality. This process ranges from one time data and process corrections, to repeatable reconciliation services and ultimately to independent audit capabilities which enable reliable, cross-system analytics generation. The Data Quality Mad Dog Report serves as the catalyst for establishing an on-going, enterprise wide data quality methodology. The Data Quality Assurance Strategy and Implementation Plan documents this strategy in detail and provides the framework necessary to create a viable FSA data quality assurance process.

2.1.2 Quality Assurance Strategy and Implementation Plan

The Quality Assurance Strategy and Implementation Plan (Deliverable 123.1.5) proposed a strategy to address the potential deficiencies outlined in the Data Quality Mad Dog Report. This deliverable outlined a methodology for the improvement of data quality and the maintenance and refinement of data across the enterprise. In addition, this strategy provides business owners the ability to identify, track, and correct quality issues. The Data Quality Assurance Strategy and Implementation Plan assists FSA in achieving its business objectives of reducing data quality issues within the enterprise, and lays a foundation of repeatable processes that FSA can leverage, and collaborate with outside parties and agencies, to progress toward the high level organizational goals of removal of the Federal Student Aid program from the General Accounting Office's (GAO) high-risk list.

The Data Quality Implementation Methodology draws from industry best practices, such as Total Quality Management (TQM), Six Sigma, ISO 9000, and the Capability Maturity Model (CMM), Business Owner input, external quality subject matter experts, and with the assistance of the FSA Enterprise Quality Assurance Program group. The methodology presents the tools which may be leveraged to discover new data quality problems and to ensure the integrity of the data through cross-program analytics and audits.

The Data Quality Implementation Methodology is organized into a four phased process, which is depicted in Appendix B. The methodology consists of the following four phases: 1) Data Quality Prioritization Phase, 2) Data Quality Assessment Phase, 3) Data Quality Improvement Phase, and 4) Data Quality Oversight Phase. In the Data Quality Prioritization Phase, the Steering Committee will identify and rank data quality issues. During the Data Quality Assessment Phase, cross system business and technical representatives are enlisted into a working group to analyze data quality issues. Data will be inspected, defects measured, and sample data determined for testing. The Data Quality Improvement Phase will develop and implement solutions for data quality issues. During the Data Quality Oversight Phase, the quality of the enterprise's data continues to be measured and agreed upon until quality



standards are met. This process is examined in further detail in Section 4.2.1 Data Quality Implementation Methodology.

The Data Quality Assurance Strategy and Implementation Plan provides a means of addressing a number of the FSA business objectives. This strategy delivers the organizational and procedural recommendations in order to meet data quality assurance needs. A three phased approach was recommended to assist with the implementation of the Data Quality Implementation Methodology. These three phases included Steering Committee Formation, Tools Analysis, and Development of a Quality Assurance Training Program. Steering Committee Formation is necessary to assist with managing the Data Quality Implementation Methodology and includes activities such as reviewing the As-Is state of FSA business and technologies, creating high-level data quality standards and requirements for the Data Quality Report, and compiling a list of data quality issues for the Report. A Tools Analysis should be conducted to identify a COTS tool to be used as an enterprise data quality tool. The Quality Assurance Training Program is responsible for informing FSA personnel of the goals, objectives, and vision of the Quality Assurance Strategy. This work group will implement a solution life cycle of gathering high level requirements and designing a detailed methodology training application. By implementing the Data Quality Assurance Strategy and Implementation Plan, FSA establishes an enterprise-wide data quality initiative through a consolidation of business processes, data storage, and new technology.

2.2 Data Strategy 2.0 Overview

The Data Strategy 1.0 initiative included an overall Enterprise-wide Data Framework that integrated Technical Strategies, an XML framework, Common identifiers and Enrollment and Access Management Components into a Target State Vision. After completion of this initiative, gaps in functionality were identified in some key areas that needed additional research and exploration to provide greater detail on how they will integrate with the Target Vision. These areas included:

- FFEL / Student Data Enrollment Data Reporting Options;
- Website and Portals Consolidation Options;
- Shared Services Implementation Options;
- Impact of CSB Procurement Outcome;
- Financial Transaction Processing Options;
- Enterprise Analytics Support Architecture Options.

Additional research will result in a greater detailed analysis of complex or program specific areas within the Target State. Two specific recommendations of the Data Strategy Framework, XML Management, and Data Quality Management are ready for roll-out into the organization. The goal of Data Strategy 2.0 is to provide a more detailed analysis of the overall Enterprise-wide Data Framework that integrates the areas listed previously, as well as a functioning XML Management Tool and support of an active Data Quality Management process for FSA.



3 High-Level Approach

3.1 *Plan through September 30, 2004*

This section describes activities planned for completion during Data Strategy 2.0, from January 7, 2004 through September 30, 2004. At the onset of Data Strategy 2.0, a schedule was provided to the Steering Committee that outlined key meetings and outcomes that would guide the progression of the Data Quality Implementation Methodology. While the scheduled dates acted only as a guideline, the outcomes of the meetings serve as an indication of the Data Quality Team's approach. Although outside initiatives have caused some delays, it is believed that all of those outcomes can still be achieved.

The first goal of the Data Quality Assurance Strategy and Implementation Plan is to establish the Data Quality Steering Committee. As discussed in Deliverable 123.1.5, the Steering Committee's role is to ensure the continuity of the Data Quality initiative throughout the enterprise, acting as the program management team. The Steering Committee enforces the standards and procedures of the Data Quality Implementation Methodology while monitoring enterprise-wide quality issues. Formation of this group early within the Data Strategy 2.0 timeframe is vital to the success of the Data Quality initiative.

Once the Steering Committee is formed, the members have several immediate tasks to complete. The first is the finalization of roles and responsibilities for not only members of the Steering Committee, but also for members of Working Groups who will be assigned to assess the issues. Additionally, the Steering Committee must evaluate the current issues list, gathered during the Data Quality Mad Dog Report, and perform updates on issue status and details. With those updates complete, the Steering Committee may begin the Prioritization Phase of the Data Quality Implementation Methodology.

During the Prioritization Phase, the Steering Committee's first goal is to create criteria in order to rank the data quality issues. With criteria gathered and ranked as to their own importance, the issues are ready for ranking. A representative set of issues is to be selected in order to expedite the process and perform a "test run" of the Data Quality Implementation Methodology; the Top Ten and Quick Hits from the Data Quality Mad Dog Report is recommended. Once the representative set of issues makes it far enough through the process, the process can be revised and improved for the remaining set of issues, as well as new issues identified in the future. With the subset of issues selected, the Steering Committee is to perform the prioritization of that subset. Finally, those issues are to be assigned to Working Groups with Project Managers from those Working Groups identified.

Working Groups begin the Assessment Phase of the Data Quality Implementation Methodology. During the Assessment phase, the Working Group Project Manager will join the Steering Committee meetings on a regular basis to provide status updates. The assessment is completed when the groups have identified the root-causes of the issues and are ready to explore solution options, at such time which the issue enters the Improvement Phase.



Before September 30, 2004, the goal is that the Working Groups provide solution recommendations for each of the representative issues and that FSA will begin working through improvements. Additionally, the Data Quality Implementation Methodology will be revised by the Steering Committee. Issue ranking criteria will be selected that may be used not only for existing issues, but for future issues. The Steering Committee will also prioritize the remaining issues and recommend Working Groups for each of the issues. It is expected that along with the remaining issues, new issues will be identified as well that require progression through this process. To assist the Steering Committee in the oversight of the process, an analysis of both internal and COTS data quality management tools may be provided, if requested, within Data Quality Management Support Report II.

3.2 Milestones

Table 1 below summarizes the key milestones to be achieved within the Plan through September 30, 2004, and includes the current status of those activities. For additional information on completed or in progress activities, refer to Section 4 Current Status.

| Milestone | Status |
|---|---|
| Formation of the Steering Committee | Completed |
| Review of process, roles and responsibilities with the Steering Committee | Completed; Presentation was reviewed and revised. Reference Appendix E Presentation Materials - Roles and Responsibilities presentation and Appendix D Meeting Minutes. |
| Generation of comprehensive issue report(s) | Completed |
| <i>Prioritization</i> | |
| Generation of Prioritization criteria | Completed |
| Identification of representative set of issues | Completed - Data Quality Mad Dog Report Top Ten, Quick Hits. |
| Prioritization scoring and ranking of representative set completed | In Progress |
| Prioritization of remainder of issues | In Progress |
| <i>Assessment</i> | |
| Formation of Working Groups and assignment of Project Managers | Not Started |
| Review of process, roles and responsibilities with Working Groups | Not Started |
| Issue assessment completed of representative set | In Progress |
| Assess remainder of issues | Not Started |
| Steering Committee review of assessed issues | Not Started |
| <i>Improvement</i> | |
| Generation of candidate solutions | Not Started |
| Recommendation of solutions | Not Started |
| Development of solutions | Not Started |
| Pilot test of solutions | Not Started |
| Implementation of solutions | Not Started |



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| Milestone | Status |
|--|-------------|
| <i>Oversight</i> | |
| Identify new issues | Not Started |
| Update Data Quality Implementation Methodology | Not Started |
| Transition Data Quality initiative within organization | Not Started |
| Assess Data Quality tools | Not Started |

Table 1: Milestones and Status



4 Current Status

4.1 Measure Against Approach

Based on the approach provided in Section 3 High-Level Approach, the Data Quality Team set out to complete the tasks necessary to achieve the vision laid out by the Quality Assurance Strategy and Implementation Plan. As Section 3.2 Milestones presents, a number of tasks have been completed or are in progress. This section details the tasks, work products, tools, and reports completed or underway as a joint effort between the Data Strategy Data Quality Team and FSA.

4.1.1 Completed Tasks

As Section 2 Background states, one of the three key tasks identified by the Quality Assurance Strategy and Implementation Plan was the formation of the Data Quality Steering Committee. With FSA assistance, this group was identified and brought together for several important meetings during the period of this report, including the review of roles and responsibilities, and review of the Data Quality Implementation Methodology and Prioritization Phase business templates. Several changes were suggested for the Steering Committee and Working Groups roles and responsibilities. Within the Steering Committee, the IT Management Liaison role was added, ensuring that additional FSA initiatives outside of Data Quality are considered during the process. Several changes were made to the Working Groups. The Contractor Application Architect replaced the Database Administrator/Technical Architect role because it was determined that this role more accurately describes the personnel with the right knowledge to address data quality issues. An umbrella role for solution development and testing representatives was also added to consider the resources necessary for technical development and testing once a solution is identified. The updated Roles and Responsibilities presentation can be found in Appendix E.

Throughout the period encompassed by this deliverable, the Data Quality Team has been revising the original Data Quality Implementation Methodology presented in Deliverable 123.1.5 (Reference Appendix B). Upon review with the Steering Committee and additional research into industry best practices and tools, several changes were made. First, the Pilot Testing Data Assessment Stage was moved from the Assessment Phase to the Implementation Phase to make the process more sequential. The Improvement Phase was altered to make additional considerations for solution development. A key point from the Steering Committee Kick-off was that data quality reconciliation may involve more than technical fixes; it may also entail organizational or process changes. For this reason, another stage was added to the Improvement Phase. The Steering Committee's role in oversight was expanded. Lessons learned, return on investment (ROI), and the implementation process will be evaluated and reviewed. Additionally, a point was made during the Kick-off that not every data quality issue will follow the process exactly, and not every issue will complete it. Feasibility checkpoints are embedded throughout the process to evaluate whether an issue should continue through data



quality management. The Data Quality Implementation Methodology is now closer to a realizable, repeatable framework.

One of the most intensive tasks completed for this deliverable was the compilation of new and existing business templates. These templates serve as reference materials and tools that the Steering Committee and Working Groups may use during the issue resolution process. Through additional research, the Data Quality Team was able to put together an extensive set of templates. The Prioritization Phase templates have been presented to the Steering Committee in a series of meetings. In addition to the business templates presented in the Quality Assurance Strategy and Implementation Plan, the Data Quality Team added a new form of Failure Modes and Effects Analysis (FMEA) scoring using expected cost, as an alternative to Risk Priority Number (RPN). Cost of Poor Quality (COPQ) was examined as a method for calculating expected cost. The Team presented an additional method for prioritization, called the Analytic Hierarchy Process (AHP). The Affinity diagram was introduced to capture business objectives. The Hierarchy diagram was added to align business objectives. AHP utilizes the information gathered through the Affinity and Hierarchy diagrams to prioritize the gathered objectives. Based on a combination of concepts from FMEA and AHP, a customized method for prioritization was created. For additional information on the business templates, refer to Section 4.2.2 Prioritization Phase Business Templates.

As stated in Sections 1.2 Scope and 1.4 Assumptions, a formal tool recommendation for issue management is not included in this report. It is recommended that the Steering Committee first examine tools already being utilized within FSA that may be leveraged for the needs of data quality. In the interim, the Data Quality Team has developed a Microsoft Access tool as a repository for the data quality issues. The Data Quality Issue Management (DQIM) tool provides customizable options for reporting on the status of the issues. Forms were developed for entering issue information. Moving forward, several of the business template tools will be added to make the reports generated by the tool even more useful and powerful. The summary, detailed, and prioritization reports; included in Appendices F, G, and H respectively; were developed and viewed by the Steering Committee for approval. Both the Steering Committee and the assigned issue Working Groups will be able to use these reports to view the relevant information on their issues. In the future, the reports can be further customized based on the audience. An audit trail for the entire issue resolution process may be maintained within the tool. For details on the tool and the reports, refer to Section 4.2.5 Data Quality Issue Management Tool and Reports.

The issues from the Data Quality Mad Dog Report have been compiled and consolidated into the DQIM tool. These issues can be divided into six categories: Bad Data, System Inconsistencies, Data Access, Data Quality System Enhancements, General System Enhancements, and Process Enhancements. Bad Data describes issues where something is currently recognizably wrong with system data, or there is a concern over data integrity. System inconsistencies represent issues where data is not necessarily wrong in different systems, however similar data is maintained different ways. Data Access issues are those where additional access to data would provide means for FSA personnel and their customers to



do business more easily. Data Quality System Enhancements are those issues where there is not necessarily anything currently wrong with the data, but a system enhancement would help ensure data integrity and ease of access going forward. Additionally, these issues describe problems that create additional unnecessary effort. General System Enhancements are those that are not currently data quality issues. However, enhancements to the system will make it easier for FSA personnel to do their job. Process Enhancements are similar to General System Enhancements; however they require change to processes instead of systems. These issue categories can be used when developing standards for system owners to address issues.

The Steering Committee generated a set of impact criteria for prioritizing data quality issues, as shown in Table 2. These impact criteria were ranked as to their relative importance. Based on the rankings, issues are evaluated against each impact to develop a prioritization rating. Refer to the Customized Prioritization Template in Section 4.2.2 Prioritization Phase Business Templates for more information on this process. Using this tool, a subset of the issues was prioritized. Those issues are slated for assessment by Working Groups and will continue through that process moving forward.

| Criteria Ranking | Impact Criteria | Criteria Percentage |
|------------------|--|---------------------|
| 1 | Could it negatively impact financial statements/annual audit? | 27.43% |
| 2 | Does it result in erroneous payments? | 25.63% |
| 3 | Does it impact student/borrower eligibility? | 17.75% |
| 4 | Does it result in inaccurate billing? | 7.93% |
| 5 | Does it impact oversight or program integrity? | 6.07% |
| 6 | Does it impact system integration? | 4.76% |
| 7 | Does it impact cycle time for payments or other critical services? | 4.54% |
| 8 | Does it impact FSA's ability to formulate the budget? | 2.10% |
| 9 | Does it necessitate significant manual work arounds? | 2.02% |
| 10 | Could the issue cause technical defaults? | 1.77% |

Table 2: Impact Criteria, Rankings, and Percentages

4.1.2 Tasks In Progress

To-date, several tasks have been initiated, or are continuously taking place throughout the course of the Data Quality initiative. Prioritization has been completed for the Top Ten and Quick Hits, as well some additional issues. Through additional Steering Committee meetings, the remainder of the issues will be prioritized. Upon completion of prioritization, issue assessment will take place until issue causes are identified, at which point the Improvement Phase will begin to propose solutions. Presentations for Assessment and Improvement business templates are included in Appendix E, and will be refined as necessary moving forward. While this is occurring, the Steering Committee is identifying new issues to inject into the process.

Throughout the first half of the Data Quality initiative, the Steering Committee has provided valuable feedback into the processes and tools proposed by the Data Quality Team. From this



feedback, the Data Quality Team is performing continuous reviews and revision of the Data Quality Implementation Methodology. Additionally, the training reference materials provided about the process, such as those included in the Appendix E, are being developed. At the completion of this initiative, a comprehensive set of data quality presentations will be available to the FSA community.

The Data Quality Team is also continuing development of the DQIM tool, including improvements to issue entry, analysis, and reporting capabilities. Many of the business templates provided in Appendix E Presentation Materials are being integrated into the tool for future utilization. While this tool provides the means for the Steering Committee and Working Groups to work through the issue management process now, FSA has also highlighted the need for tools analysis within the organization. This analysis has begun, as Deliverable 123.1.5 provided some limited commercial tool explanation, and may be supplemented by additional COTS tool examination. Those results, and the results of all of the tasks currently underway, will be included in the Data Quality Management Support Report II (Deliverable 152.1.10b).

4.2 Work Products

The Data Strategy Data Quality Team has spent the past several months developing a range of work products meant to provide assistance and guidance to FSA in their initiative to raise awareness and improve data quality. The remainder of this section explains the compilation of processes, tools, reports, and results developed by the Data Quality Team.

4.2.1 Data Quality Implementation Methodology

The Data Quality Assurance Plan and Implementation Strategy was created to align FSA's data quality objectives with various FSA business objectives that are part of the Data Strategy Target State, taking into consideration the business model and technical requirements of FSA. The cornerstone of the strategy is the Data Quality Implementation Methodology. It serves as a repeatable guideline through which data quality issues are to follow. Figure 1 presents the four phases and subsequent stages of the Data Quality Implementation Methodology. For a larger version, refer to Appendix B.

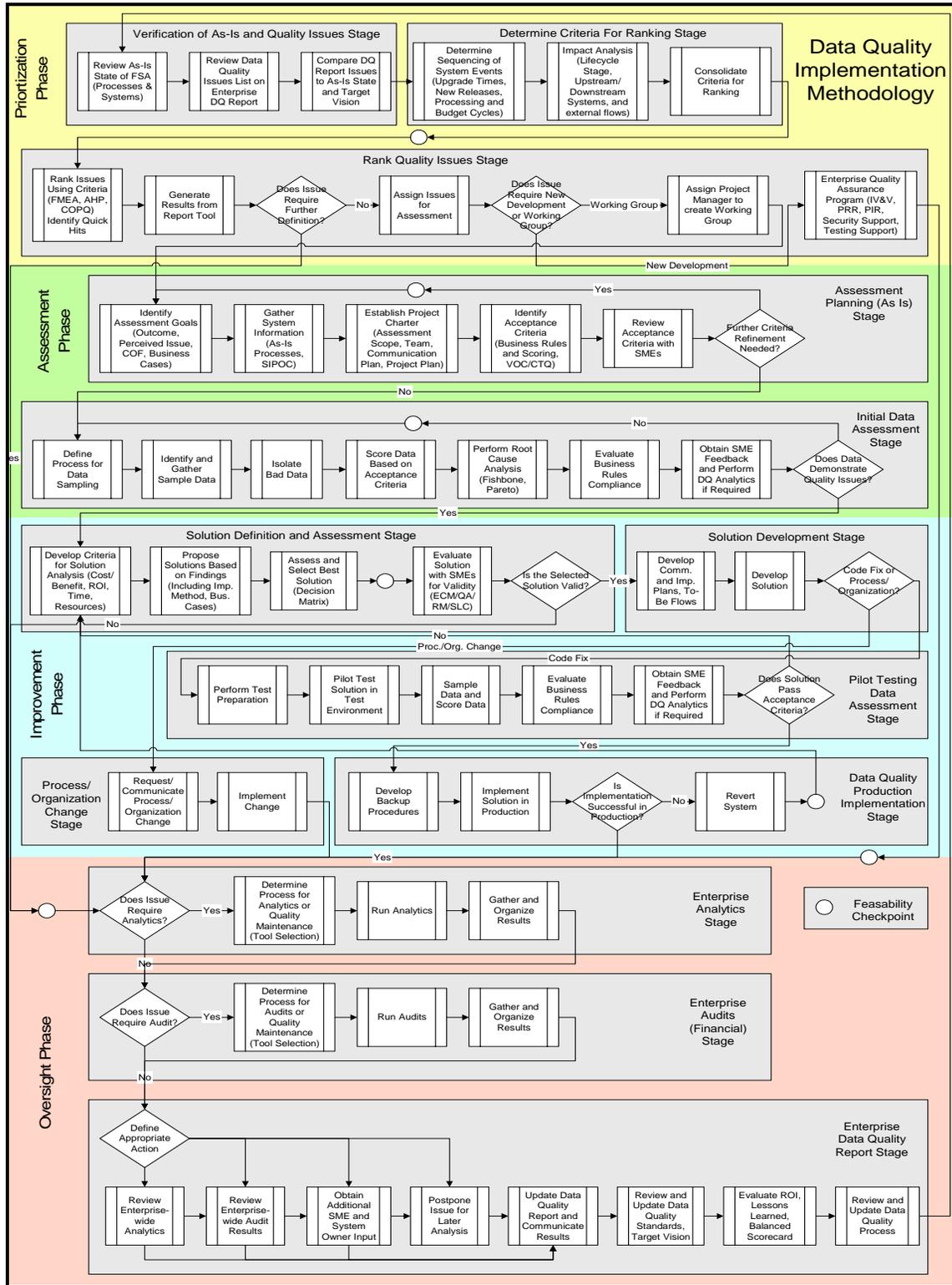


Figure 1: Data Quality Implementation Methodology



- **Data Quality Prioritization Phase:** Issues enter the process in the Data Quality Prioritization Phase, performed by the Steering Committee. The goals of this phase are to gather necessary information about the issue including considerations for the Current and Target States of systems, to gather prioritization criteria for ranking issues, and to perform the issue prioritization. The outcome of this stage is a prioritized set of issues ready for examination by assigned Working Groups and/or the Enterprise Quality Assurance Program.
- **Data Quality Assessment Phase:** Issues not resolved by planned development are assigned to Working Groups. The Working Groups plan for the assessment, and define goals, scope, and assessment criteria in a project charter. System processes are defined, data is sampled and analyzed, and root-causes are identified. The outcome of the Assessment Phase is a specific root-cause that contributes the majority of occurrences of the issue.
- **Data Quality Improvement Phase:** The Working Group will continue their analysis in the Improvement Phase by generating candidate solutions and identifying the best solution by trying to meet the greatest number of critical customer requirements. The solution, and the corresponding implementation and communication plans will be generated. Based on whether the solution is a technical fix or a process or organizational change, the solution will be tested, implemented, and communicated accordingly.
- **Data Quality Oversight Phase:** The Oversight Phase takes place throughout the entire issue management process. If issues require additional clarification, analytics, or audit, it is completed through the oversight of the Steering Committee. If solutions require additional evaluation or issues require a sanity check to decide if they remain issues, they are sent to the Steering Committee. The Steering Committee will also provide updates to the issue management report, the Current and Target system states, and the issue management process itself.

As described in the following section, a group of tools (business templates) and processes are used during each phase to support the objectives of the Steering Committee and Working Groups. Figure 2 maps the Data Quality Implementation Methodology phases and subsequent stages to the tools that support them. These tools and processes are a collection of industry best practices, including Six Sigma, Quality Function Deployment, CMM, and others. Refer to Sections 4.2.2 Prioritization Phase Business Templates, 4.2.3 Assessment Phase Business Templates, and 4.2.4 Improvement Phase Business Templates for expanded descriptions of these templates, linked to their corresponding phases.

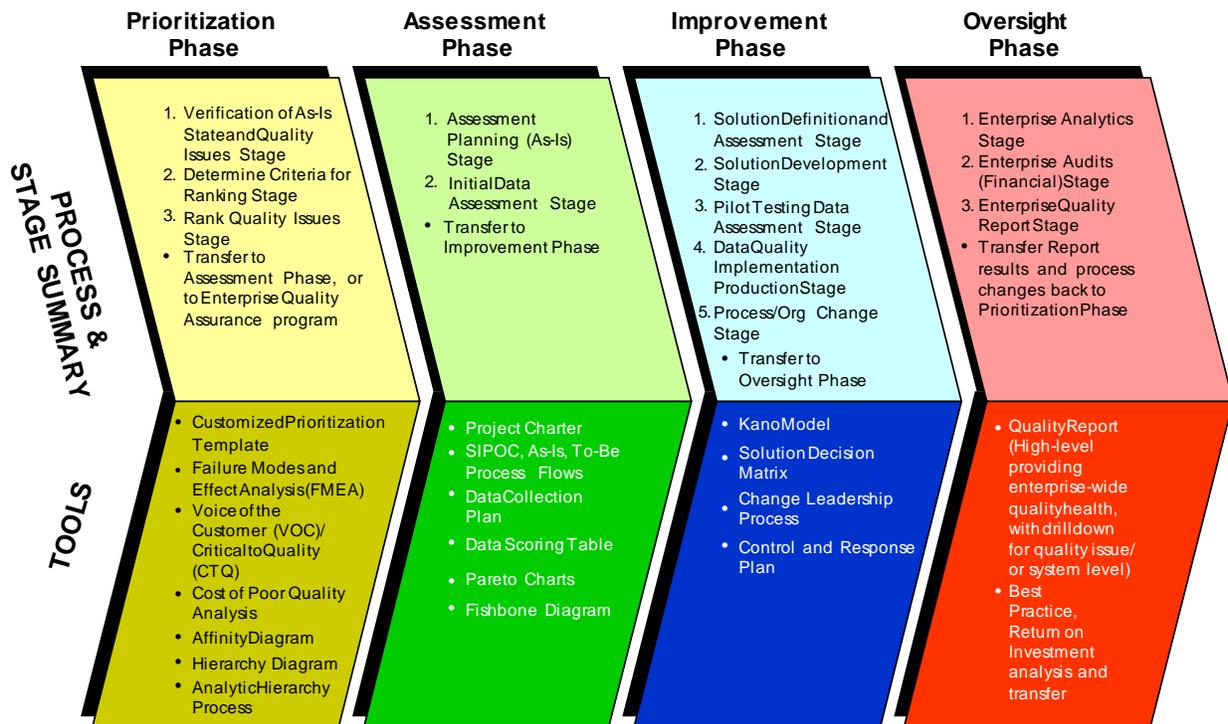


Figure 2: Process and Tools Mapping Overview

4.2.2 Prioritization Phase Business Templates

The Prioritization Phase business templates are provided to assist the Data Quality Steering Committee with identifying the criteria for prioritization and assignment of data quality issues. A few of the business templates outlined below were previously discussed in Deliverable 123.1.5 Quality Assurance Strategy and Implementation Plan. Additional business templates have been provided as an alternative to prioritize the issues. A brief description along with an example of the tool is provided for each business template outlined below. For a further detailed analysis of the business templates and examples, reference the Prioritization Phase Process and Business Templates presentation dated April 13, 2004, included in Appendix E. The first business template, in Section 4.2.2.1 Customized Prioritization Template, was created by the Steering Committee for use by FSA. The other business templates are arranged in the recommended, sequential order based on critical outcomes needed from the previous template. Information gathered during the usage of these business templates will also be beneficial in documenting system processes for the Assessment Phase of the Data Quality Implementation Methodology. These business templates will enable the Steering Committee to use a repeatable process for each data quality issue.



4.2.2.1 Customized Prioritization Template

The Customized Prioritization Template (CPT) was developed as a hybrid prioritization method, drawing from parts of both the Failure Modes and Effects Analysis (FMEA) and Analytic Hierarchy Process (AHP) processes. Like FMEA, the CPT process considers the occurrence of a data quality issue. A low occurrence score means that the issue occurs infrequently. A high score translates to a high degree of regularity. Detectability in FMEA is replaced by a value more relevant to FSA, visibility and customer service. Visibility and customer service is an evaluation of how apparent a data quality issue will be to the surrounding community. A low score means that the issue may not go past a system in which it is contained. A high score means that the issue may cause negative publicity for FSA. Finally, the severity score from FMEA is replaced with an impact rating. The impact rating is a much more comprehensive evaluation of severity of a data quality issue.

Based on the concerns of the FSA business owners taking part in the Steering Committee, a list of criteria was generated. This criteria was translated into questions, displayed in Table 3 below, to be asked about each issue as the issue is evaluated. Each criterion is ranked against the other criteria to generate a picture of relative importance using the AHP's normalization technique (Reference Section 4.2.2.8 Analytic Hierarchy Process). Criteria are placed in a table, where each row heading and column heading represents a criterion. A row representing a criterion is ranked against the columns of other criteria using a 1/5/9 number system. If the row is of equal importance as the column, it receives a 1. If it is somewhat more important, it receives a 5. If the row is extremely more important than the column, it receives a 9. If the row is somewhat or extremely less important, the inverse is true, and the row receives a 1/5 or 1/9 rating, respectively.

Based on these scores, each criterion is normalized and a percentage is calculated. First, each column is summed. Then, each row value in the column is divided by the sum value to calculate a normalized value. These normalized results make up the second half of the table. Once the normalized results are calculated, the result values in each row are added to calculate the normalized row sum. The normalized row sum column is then added up to calculate the total normalized row sum. Each normalized row value is finally divided by the total value to calculate a percentage value. This percentage represents the relative importance of one criterion to the entire group. The percentage assigned to a criterion then serves as its weight in the impact rating analysis. Refer to Table 3 to see the criterion and their associated weights.

| Criteria Ranking | Criteria Description | Criteria Weight |
|------------------|---|-----------------|
| 1 | Could it negatively impact financial statements/annual audit? | .2743 |
| 2 | Does it result in erroneous payments? | .2563 |
| 3 | Does it impact student/borrower eligibility? | .1775 |
| 4 | Does it result in inaccurate billing? | .0793 |
| 5 | Does it impact oversight or program integrity? | .0607 |
| 6 | Does it impact system integration? | .0476 |
| 7 | Does it impact cycle time for payments or other critical | .0454 |



| Criteria Ranking | Criteria Description | Criteria Weight |
|------------------|---|-----------------|
| | services? | |
| 8 | Does it impact FSA's ability to formulate the budget? | .0210 |
| 9 | Does it necessitate significant manual work arounds? | .0202 |
| 10 | Could the issue cause technical defaults? | .0177 |

Table 3: Impact Criteria, Rankings, and Weights

These questions and weights may be used for the prioritization of FSA’s data quality issues. Every issue is evaluated against the criteria questions. Questions are answered about the issue, some with a yes or no, and some with a range of values. Each question has a 0 to 10 range.

| Criteria Question | Criteria Answer Type | Criteria Answer Scale |
|--|----------------------|-----------------------|
| Could it negatively impact financial statements/annual audit? | Yes/No | 10/0 |
| Does it result in erroneous payments? | Yes/No | 10/0 |
| Does it impact student/borrower eligibility? | Yes/No | 10/0 |
| Does it result in inaccurate billing? | Yes/No | 10/0 |
| Does it impact oversight or program integrity? | None/Low/Medium/High | 0/3/7/10 |
| Does it impact system integration? | None/Low/Medium/High | 0/3/7/10 |
| Does it impact cycle time for payments or other critical services? | None/Low/Medium/High | 0/3/7/10 |
| Does it impact FSA's ability to formulate the budget? | None/Low/Medium/High | 0/3/7/10 |
| Does it necessitate significant manual work arounds? | None/Low/Medium/High | 0/3/7/10 |
| Could the issue cause technical defaults? | Yes/No | 10/0 |

Table 4: Impact Criteria, Answer Types, and Answer Scales

| Additional Weighting Factors | Answer Type | Answer Scale |
|------------------------------|--|--------------|
| Occurrence | Rare/Often/Always | 1/3/5 |
| Visibility/Customer Service | Low/Medium/High | 1/3/5 |
| Cost to Implement | \$0 - \$100,000/\$100,000 - \$500,000/\$500,000 - \$2,000,000/>\$2,000,000 | N/A |
| Time to Implement | 0 - 6 months/6 months - 1 year/1 year - 2 years/ >2 years | N/A |

Table 5: Additional Factors, Answer Types, and Answer Scales

Based on the 0 to 10 score, the question score is then multiplied by the weight calculated during the criteria evaluation to determine the total score for that criterion. The scores for each criterion question are added together to calculate the impact rating. This resultant impact rating is also on a 10 point scale. Finally, the impact rating is multiplied by the occurrence and visibility/customer service scores, which are on a 5 point scale, to calculate the final priority ranking. The priority ranking is measured on a scale of 0 (low) to 250 (critical). The priority



ranking ranks the issue against other data quality issues, providing FSA with a picture of high priority issues. An example is shown below in Figure 3.

Data Quality Issue Prioritization Tool

Wednesday, May 05, 2004

Issue Number:

Issue Description:

| No. | Impact Criteria | Answer | Score | Weight | Total Score |
|-----|--|--------|-------|--------|-------------|
| 1 | Does it result in inaccurate billing? | Yes | 10 | 0.08 | 0.79 |
| 2 | Does it result in erroneous payments? | Yes | 10 | 0.26 | 2.56 |
| 3 | Does it impact FSA's ability to formulate the budget? | Low | 3 | 0.02 | 0.06 |
| 4 | Does it impact oversight or program integrity? | High | 10 | 0.06 | 0.61 |
| 5 | Does it impact system integration? | High | 10 | 0.05 | 0.48 |
| 6 | Does it necessitate significant manual work arounds? | Medium | 7 | 0.02 | 0.14 |
| 7 | Does it impact student/borrower eligibility? | Yes | 10 | 0.18 | 1.77 |
| 8 | Could it negatively impact financial statements/annual audit? | Yes | 10 | 0.27 | 2.74 |
| 9 | Could the issue cause technical defaults? | Yes | 10 | 0.02 | 0.18 |
| 10 | Does it impact cycle time for payments or other critical services? | Medium | 7 | 0.05 | 0.32 |

| | | | | |
|---|--|--------------------------------|------------------------|--|
| Occurrence Rating | <input type="text" value="Always"/> | <input type="text" value="5"/> | Impact Rating | <input style="width: 90%;" type="text" value="9.65600"/> |
| Visibility/Customer Service Rating | <input type="text" value="High"/> | <input type="text" value="5"/> | | |
| Cost to Implement | <input type="text" value=">\$2,000,000"/> | | Priority Rating | <input style="width: 90%;" type="text" value="241.400"/> |
| Time to Implement | <input type="text" value=">2 years"/> | | | |

Figure 3: Example Prioritization Evaluation

4.2.2.2 Voice of Customer (VOC)

The Voice of Customer (VOC) tool may be used during the Determine Criteria for Ranking Stage in the Data Quality Implementation Methodology. The VOC tool develops customer requirements based on business processes. These requirements may be used for scoring the data quality issues. Using the VOC process requires five steps to take place: 1) identifying customers impacted by data quality issue, 2) collecting data and sources, 3) analyzing data to generate requirements, 4) transferring requirements into Critical to Quality (CTQ) characteristics, and 5) setting specifications for CTQs. This information is the source of data for the CTQ Analysis. In addition, the Voice of Customer results may also be used for the Affinity and Hierarchy Diagram analysis. Refer to Figure 4 for example of the VOC process.

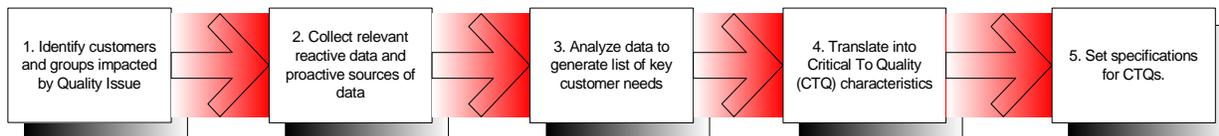


Figure 4: VOC Process

4.2.2.3 Critical to Quality (CTQ)

The Critical to Quality (CTQ) tool is used during the Determine Criteria for Ranking Stage in the Data Quality Implementation Methodology. This tool is a subcomponent of the VOC process, translating customer needs derived from the VOC into critical to quality attributes that are necessary for acceptable quality levels. As part of the VOC process, a CTQ tree is created to define the business needs, the drivers for those needs, and the CTQs that determine the drivers. Critical to Qualities that are derived may be used as low-level criteria in the Hierarchy Diagram in Section 4.2.2.4 Affinity Diagram. These metrics will be used to assist with the Assessment Phase. Figure 5 is an example of a CTQ Tree.

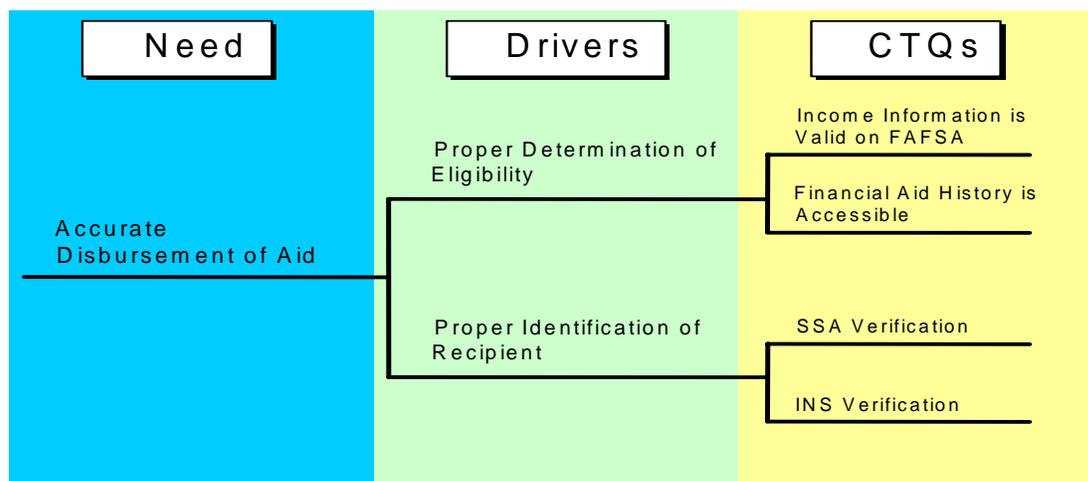


Figure 5: Example CTQ Tree

4.2.2.4 Affinity Diagram

The Affinity Diagram tool is used in the Determine Criteria for Ranking Stage of the Data Quality Implementation Methodology. The Affinity Diagram is a tool designed to identify and group criteria (i.e. business objectives within the organization) for importance in ranking data quality issues. The criteria may be developed using feedback from the Voice of Customer (VOC) analysis discussed previously in this section. The Steering Committee reviews the criteria and groups it based on shared affinities. This tool is valuable in setting up the groundwork for determining the criteria that will be used in the final stages of the Prioritization



Phase. The criteria and grouping headers will be used as data in the Hierarchy Diagram and Analytic Hierarchy Process (AHP) analysis further in the Prioritization Phase. Refer to Figure 6 for an example of an Affinity Diagram.

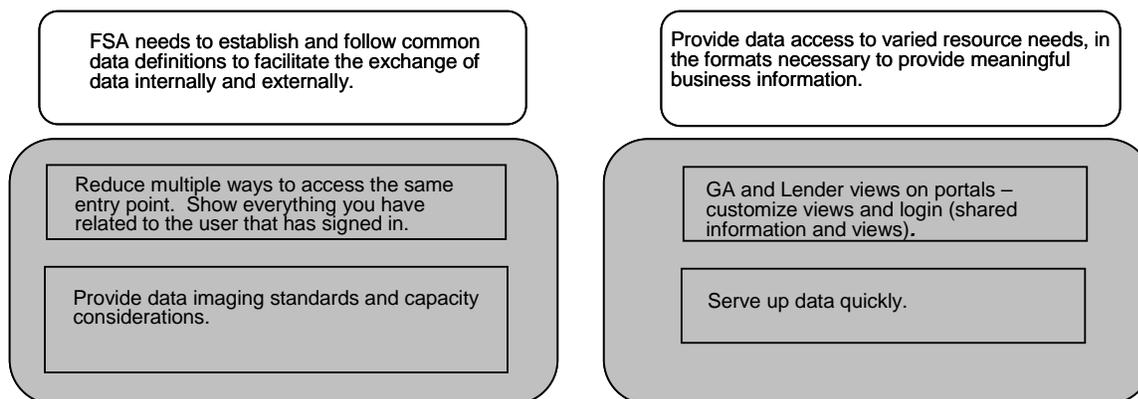


Figure 6: Example Affinity Diagram

4.2.2.5 Hierarchy Diagram

The Hierarchy Diagram tool is used in the Determine Criteria for Ranking Stage of the Data Quality Implementation Methodology. This tool is another method of grouping criteria using the information developed in the Affinity Diagram. The Hierarchy Diagram tool is designed to align criteria according to different levels to further define the criteria of highest importance. In addition, this tool refines criteria groupings and ensures there are no overlaps between levels and critical criteria are not missing. The Steering Committee evaluates and determines relative levels of criteria. Next, the Steering Committee organizes and aligns the criteria by the identified levels. Assessment of criteria is performed to ensure the proper criteria were identified. The criterion is then aligned according to importance and will assist with the AHP analysis in the Rank Quality Issues Stage of the Prioritization Phase. Figure 7 shows an example of a Hierarchy Diagram.

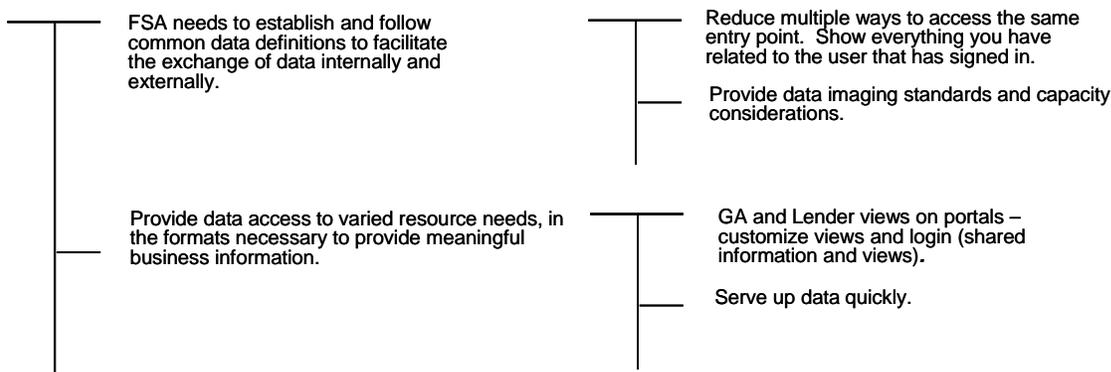


Figure 7: Example Hierarchy Diagram



4.2.2.6 Cost of Poor Quality (COPQ)

The Cost of Poor Quality (COPQ) tool is also used during the Rank Quality Issues Stage of the Data Quality Implementation Methodology. The COPQ tool is an alternative method of estimating cost of data quality issues. This tool determines the extent to which organizational resources are used for deficiencies that occur in its processes and the potential savings by implementing process improvements. The identification of activities that only exist because of poor quality of a data issue is required to begin the COPQ analysis. After the activities have been identified, further assessment is needed to determine where in the organization the cost of each activity takes place. The next step in the COPQ tool is to determine the method of calculating COPQ. There are two methods to calculate COPQ: 1) Total Cost of Resources and 2) Frequency of Activity. The Steering Committee will choose the appropriate method for the data quality issue and compute the COPQ. These estimated costs will be evaluated and used in ranking issues. These values may also be used for the cost scale in the FMEA Expected Cost analysis. For an example of each method, reference Tables 6 and 7 below.

| Activity Resulting from Poor Quality | Cost Location | Cost Location | Cost Location | Total Cost of Resources | Percentage of Resources to Counter Poor Quality | Total Cost for Activity |
|--|------------------|--------------------|---------------|-------------------------|---|-------------------------|
| Manual Data Entry | Wages & Benefits | | | \$40,000 | 5% | \$2,000 |
| Audit Trail Reconciliation | Wages & Benefits | System Maintenance | | \$62,500 | 8% | \$5,000 |
| Total Cost of Poor Quality = S [(Total Cost of Resources) * (Percentage of Resources to Counter Poor Quality)] | | | | | | \$7,000 |

Table 6: Example of Cost of Poor Quality Using Cost of Resources and Percent Utilization

| Activity Resulting from Poor Quality | Cost Location | Cost Location | Cost Location | Frequency of Activity (#/yr) | Average Cost | Total Cost for Activity |
|---|------------------|--------------------|---------------|------------------------------|--------------|-------------------------|
| Manual Data Entry | Wages & Benefits | | | 50 | \$40 | \$2,000 |
| Audit Trail Reconciliation | Wages & Benefits | System Maintenance | | 12 | \$450 | \$5,400 |
| Total Cost of Poor Quality = S [(Frequency of Activity) * (Average Cost)] | | | | | | \$7,400 |

Table 7: Example of Cost of Poor Quality Using Frequency and Cost of Correction Activity

4.2.2.7 Failure Modes and Effects Analysis (FMEA)

The Failure Modes and Effects Analysis (FMEA) is a tool used during the Rank Quality Issues Stage of the Data Quality Implementation Methodology. FMEA is used to identify, prioritize, and eliminate potential failures from systems or process flows. The Steering Committee reviews the failure modes identified and determine the severity of each issue. Next, potential causes for the failures are researched and listed with their reported frequency and the current controls which will prevent the failure from occurring. At the end of the FMEA analysis, a Risk Priority Number (RPN) is calculated to assist with prioritizing issues. The Steering Committee



may use this information coupled with previously identified prioritizing criteria to evaluate ranking the data quality issues. A sample FMEA analysis is provided in Table 8.

| Process Step | Potential Failure Mode | Potential Failure Effects | Severity | Potential Causes | Occurrence | Current Controls | Detectability | RPN |
|---|--|--|----------|--|------------|--|---------------|--|
| Applicant records are processed and validated by FSA. | Records with incorrect identifiers are allowed to enter FSA. | Invalid Student borrowers can be created. A student could potentially have multiple SSAs in FSA. This may also cause aid to be disbursed inaccurately. | 7 | Lack of a SSA match in COD, DLCS, DMCS, and NSLDS (systems other than CPS and PIN site do not verify SSA). | 4 | No automatic verification of SSA. Manually have to look up borrower and fix information. | 3 | RPN = Severity * Occurrence * Detectability = 84 |

Table 8: Example FMEA Analysis

Expected cost is another method of FMEA that may be used in ranking the data quality issues. This FMEA method is used to determine the expected cost of a specific issue relative to risk. The severity, occurrence, and detectability values from the first FMEA risk analysis method will be used in the calculation of expected cost. The Steering Committee determines the probability and cost scales used in the expected cost analysis. After this information is gathered, expected cost can be determined and used to compare against the RPN previously calculated. The higher the expected cost of poor quality, the higher the data quality is prioritized. The FMEA Risk Priority Number and FMEA Expected Cost analysis can provide different outcomes for evaluating risk. Re-evaluation of data quality issue ranking might be necessary based off of further analysis. Figure 8 depicts an example of FMEA Expected Cost.



| Example Occurrence Ratings | | Example Cost Function | | | |
|----------------------------|-------------|-----------------------|------|-----|---------------|
| Occurrence | Probability | Severity | Cost | RPN | Expected Cost |
| 1 | 6.667 E-7 | 1 | 50 | | |
| 2 | 6.667 E-6 | 2 | 100 | | |
| 3 | 6.667 E-5 | 3 | 150 | | |
| 4 | .0005 | 4 | 200 | 16 | \$.1 |
| 5 | .0025 | 5 | 250 | | |
| 6 | .0125 | 6 | 300 | | |
| 7 | .05 | 7 | 350 | 28 | \$.175 |
| 8 | .125 | 8 | 400 | | |
| 9 | .333 | 9 | 450 | | |
| 10 | .75 | 10 | 500 | | |

Figure 8: Example of FMEA with Expected Cost

4.2.2.8 Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) tool, presented as an alternative to FMEA, is used in the Rank Quality Issues Stage in the Data Quality Implementation Methodology. The AHP tool measures the importance and prioritizes criteria in order to rank data quality issues. Previously gathered information from the Affinity and Hierarchy Diagrams helps compile the information necessary for the AHP analysis. To use this tool, the matrix is populated with defined criteria. Rows and columns of criteria are compared and ranked according to importance. After the criteria has been compared, normalization of the columns is necessary in order to calculate the percentages determining the importance of each criteria. This tool enables the Steering Committee to prioritize data quality issues based on what is vital to them and the organization. An example of the AHP tool can be seen below in Table 9. The AHP tool is used as part of the Customized Prioritization Template presented in Section 4.2.2 Prioritization Phase Business Templates.



| Objectives | Normalized Columns | | | | | Normalized Columns | | | | | Row Sum | % |
|--|--------------------|-----|------|-------|----|--------------------|------|------|------|------|---------|--------|
| | A | B | C | D | E | A | B | C | D | E | | |
| A: Provide data access to varied resource needs, in the formats necessary to provide meaningful business information. | 1 | .2 | .33 | 3 | 5 | .105 | .1 | .068 | .29 | .238 | .801 | 16% |
| B: FSA needs to establish and follow common data definitions to facilitate the exchange of data internally and externally. | 5 | 1 | 3 | 3 | 7 | .524 | .5 | .621 | .29 | .33 | 2.265 | 45% |
| C: Provide data mining and analytics tools that allow simple access to data and facilitate trending, forecasting and the necessary information for business decisions. | 3 | .33 | 1 | 3 | 5 | .315 | .167 | .207 | .29 | .238 | 1.217 | 24% |
| D: Improve the timeliness and efficiency of data feeds to accommodate varied audience data needs. | .33 | .33 | .33 | 1 | 3 | .035 | .167 | .068 | .097 | .143 | .51 | 10% |
| E: Provide access to common calculations in a standardized and central location. | .2 | .14 | .2 | .33 | 1 | .02 | .07 | .041 | .032 | .048 | .211 | 4.2% |
| Totals | 9.53 | 2 | 4.83 | 10.33 | 21 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 5.00 | 100.0% |

Table 9: Example Analytic Hierarchy Process

4.2.3 Assessment Phase Business Templates

The Assessment Phase Business Templates are provided to enable issue Working Groups to perform detailed issue analysis to determine the root-cause of the problem(s). Several of these templates were also discussed in Deliverable 123.1.5. Brief descriptions are provided below for each template. For detailed examination of the templates and examples, including FSA-related examples, please refer to the Assessment Phase Business Templates PowerPoint presentation included in Appendix E. The outcome of each template is important to the creation of the next. The templates are provided in the suggested order in which they may be used. By utilizing the templates, FSA can create comprehensive system documentation not only useful for current analysis and solution generation, but also valuable for future assessment. For the assessment process, the Data Quality Team introduced the Project Charter, which enables the project team to stay focused and the project goals to be communicated across the organization. To gather data during the assessment, the Data Collection Plan was proposed.

The resultant presentation and the templates described in this section were developed for future use with the Steering Committee and Working Groups, and will be updated, as required, for deliverable 152.1.10b Data Quality Management Support Report II (due September 30, 2004).

4.2.3.1 SIPOC

The SIPOC Diagram is a tool used during the Assessment Planning Stage of the Data Quality Implementation Methodology. SIPOC, an acronym, is used to obtain a clear understanding of



the Suppliers, Inputs (Key Process Input Variables (KPIV)), Process, Outputs (Key Process Output Variables (KPOV)), and Customers for the project under investigation. To model the process, the As-Is systems analysis Deliverable 123.1.2 As-Is System Data Flows will prove valuable. Suppliers are the source of input for the process; they include internal FSA systems and external trading partners. The Inputs are data and information being sent by the supplier to the process. Outputs are the data files and information exiting the processes which are sent to the customers. As with suppliers, customers can range from external trading partners to internal FSA systems. The SIPOC is valuable for identifying the true scope of the issue evaluation, and also helps identify where to collect data. Figure 9 shows a general SIPOC outline.

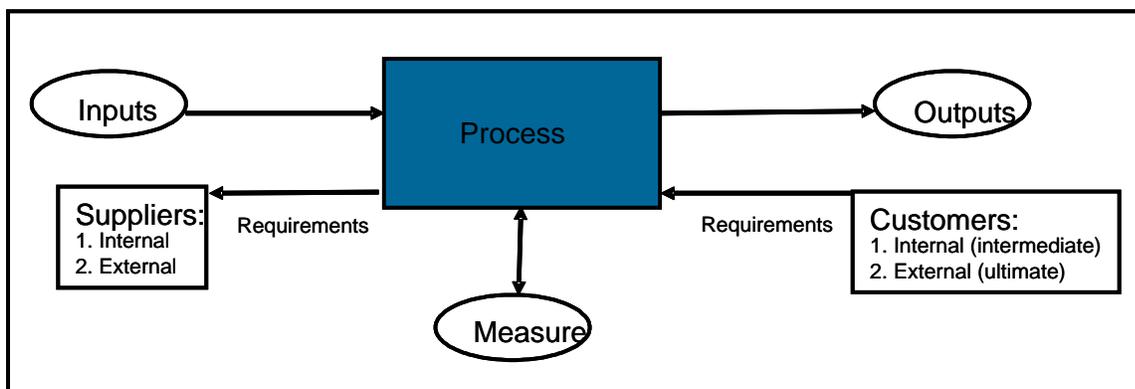


Figure 9: Example SIPOC Diagram

4.2.3.2 Project Charter

The Project Charter is a tool used during the Assessment Planning Stage of the Data Quality Implementation Methodology. With the SIPOC generated, the scope of the project should be clearly defined and captured in a Project Charter. The Charter is intended to build a clear team understanding of project scope and objectives, and serves as a communication tool for the team when discussing these elements. Project significance is defined to obtain buy-in from required participants in the issue resolution process. The charter may be stored in the Data Quality Issue Management tool and associated with the issue. This enables tracking of milestone completion and provides a method for reporting to project team members. A sample project charter is shown below in Table 10.

| Charter Elements | Information/Agreements |
|-----------------------------|--|
| Problem Statement | 13000 anomalous first and last names with numbers in them e.g. N1ELSON (I or L=1 and O=0) exist in system databases. This error can prevent record matches |
| Project Objective | Identify and correct all sources of anomalous data within NSLDS |
| Project Significance | The ability to match records between systems will be improved |
| Key Milestones | Root-Causes Identified Solution selected Solution implemented Data cleanup completed |



| Charter Elements | Information/Agreements |
|---|---|
| Project Scope | Identification and resolution of sources of anomalous data within NSLDS Cleanup of existing anomalous data within NSLDS |
| Team: Roles and Responsibilities | From Roles & Responsibilities presentation: Project Manager - FSA System SME - Contractor Application Architect - Solution Development and Testing Reps - |

Table 10: Example Project Charter

4.2.3.3 Data Collection Plan

The Data Collection Plan establishes the method in which data will be gathered in order to perform issue analysis within the Initial Data Assessment Stage of the Data Quality Implementation Methodology. In addition, it defines the people, measurements, and schedule involved in the collection of data. The issue Working Group Project Manager or System Owner will coordinate with the FSA System SME and Contractor representatives; these representatives will be technical representatives from the system who can identify sample sets of data to be assessed for the purpose of highlighting the known data inconsistencies (Note: these sample sets of data may also identify new issues). The data collection plan is specific to issues that have identifiable areas of bad data. Like the project charter, this tool serves as a communication aid so that system owners can be made aware of the anticipated sampling process. The plan may also be stored in the Microsoft Access tool, associated with an issue, for communication and reporting purposes. An example of a Data Collection Plan is shown in Table 11.

| Performance Measure | Operational Definition | Data Source and Location | Sample Size | Who Will Collect the Data | When Will Data be Collected | How Will Data Be Collected | Other Data that Should be Collected at the Same Time |
|---------------------|------------------------|--------------------------------|-------------|---------------------------|------------------------------------|----------------------------|--|
| Accuracy | School Identifier | Schools COD FMSS GAPS | 500 Records | System Rep | At the end of next financial cycle | Random data sampling | School address School contact |

Table 11: Example Data Collection Plan

4.2.3.4 Data Quality Scoring Table

Based on criteria established, the data sampled using the Data Collection Plan will be evaluated and scored within the Initial Data Assessment Stage. The Working Group will use the scoring to validate that the sample data is within the desired quality levels. This enables the Working Group to identify bad sets of data and additional data sampling is necessary if no data sets are identified as unacceptable. Sample data must accurately represent the issue before a root-cause analysis can be conducted. A scoring table similar to the one depicted in Table 12 below may be utilized to facilitate this process. The table identifies sample sets of data in the left most column. The data is rated against each criterion and then weighted based on the acceptance criteria; weights must add up to 1. Criteria and weights will vary with each issue, and should be agreed upon by the Working Group. The weighted criteria scores are added for an overall data quality



score. Thresholds are set to determine the acceptable data quality level; the threshold should be set based on the specific issue, and the criteria and weights selected.

| Data Sample Set | Criteria with Weights | | | | Score | Is Data Quality Acceptable? |
|-----------------|---|--|---|---|-------|-----------------------------|
| | Criterion 1: Percent of dummy or invalid dates | Criterion 2: Percent of mismatches between COD and DLSS | Criterion 3: Percent of data with incorrect format | Criterion 4: Percent of null date fields | | |
| | Weight 1: 0.3 | Weight 2 0.2 | Weight 3: 0.1 | Weight 4: 0.4 | | |
| 1 | 0.3 | 0 | 0.1 | 0.5 | 0.9 | Y |
| 2 | 0.2 | 0.1 | 0.1 | 0.9 | 1.3 | N |
| 3 | 0.5 | 0.2 | 0 | 1.4 | 2.1 | N |

Table 12: Data Quality Scoring Table

4.2.3.5 Cause and Effect (Fishbone) Chart

The Fishbone Chart is a tool used within the Initial Data Assessment Stage of the Data Quality Implementation Methodology. Once bad data sets are identified, the cause of the defects may be immediately apparent. If, however, the root-cause has not yet been identified, the Fishbone Chart is an additional tool that can be leveraged to complete root-cause analysis. The Fishbone Chart may also be used when data sets are not available, or are not relevant to the presented issue. A clear and accurate picture of the As-Is system state and process flows is necessary in order to create a useful Fishbone Chart. Both the As-Is flows and the SIPOC diagram should be employed.

When conducting a root-cause analysis, the possibility of both technical and functional flaws in the business process must be considered. As shown in Figure 10 below, the issue is listed in a box which serves as the “head” of this skeletal diagram. A line is drawn out to represent the “spine” to which major causes of the issue are attached. Sub-causes, which can exist on various levels, branch off of the major causes. For each major cause, it is recommended to ask “Why?” up to five times, to drill down to the comprehensive set of sub-causes, or root-causes, of the issue. From the resulting Fishbone, candidates of the root-cause should be highlighted.

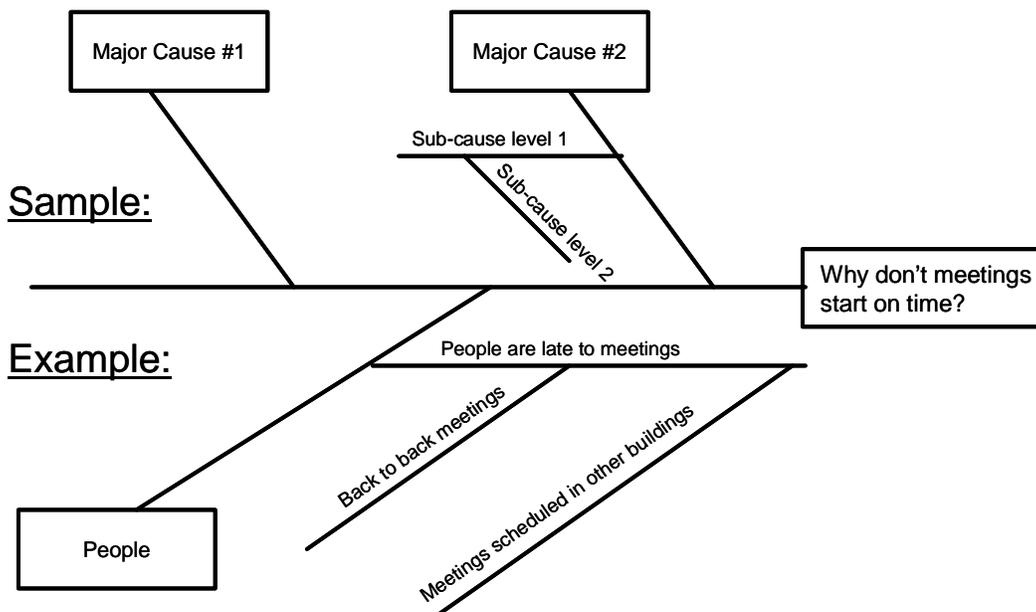


Figure 10: Example Cause and Effect (Fishbone) Chart

4.2.3.6 Pareto Chart

Although the Fishbone is useful in identifying root-causes for an issue, it is recommended that the analysis be taken even further, incorporating the use of a Pareto Chart. The Pareto Chart is a tool used in during the Initial Data Assessment Stage of the Data Quality Implementation Methodology. The Pareto Principle states that commonly it is only 20% of the candidates (or identified causes) that contribute to up to 80% of the errors. For this reason, Pareto Charts are used to focus a team's solution effort on those causes that contribute to the most occurrences of an issue. Where it is available, sample data may be profiled to graphically compare the importance of potential root-causes by charting their relative frequency and gauging their impact over a period of time. Through Working Group investigation, root-causes can be identified via a Fishbone Chart. These causes are then measured for frequency and diagrammed as demonstrated in the sample Pareto Chart in Figure 11 below.

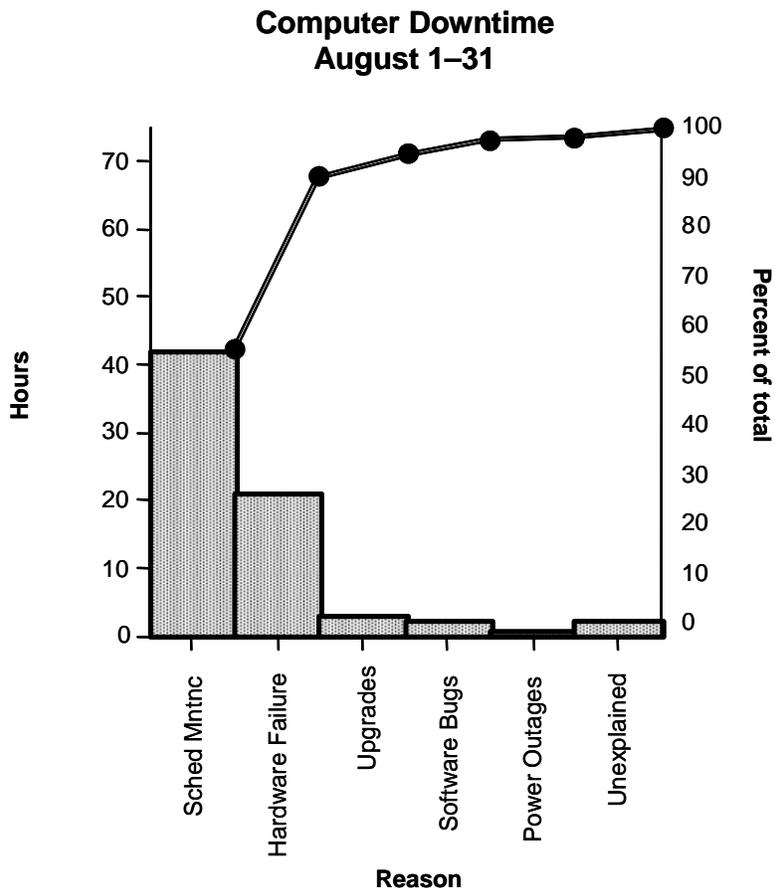


Figure 11: Example Pareto Chart

4.2.4 Improvement Phase Business Templates

The Improvement Phase Business Templates are provided to enable Working Groups to develop the best solution to a given issue and to provide controls around the implementation of a solution. Again, some of these templates were also discussed in Deliverable 123.1.5. Finally, for the improvement process the Data Quality Team introduced the Kano Model, an additional method of identifying and rating customer requirements. Brief descriptions are provided below for each improvement template. For detailed examination of the templates and examples, including FSA-related examples, refer to the Improvement Phase Business Templates PowerPoint presentation, included in Appendix E.

This presentation and the templates described in this section were developed for future use with the Steering Committee and Working Groups, and will be updated, as required, for deliverable 152.1.10b Data Quality Management Support Report II (due September 30, 2004).



4.2.4.1 Kano Model

The Kano Model is a tool, or philosophy, used during the Solution Definition and Assessment Stage of the Data Quality Implementation Methodology. In the Improvement Phase, the goal is to create the best possible solution that will remain valuable and consistent for the longest period of time. To satisfy the requirements of the customers identified in VOC analysis and the SIPOC for a given process and related issue, there are three types of requirements to consider. Normal or revealed requirements are those typically gathered through customer surveys. These requirements satisfy or dissatisfy in proportion to their presence or absence, respectively, in a process output. Expected requirements are basic requirements that are usually omitted from customer surveys. It is often when the customer is dissatisfied that they become apparent. Finally, exciting requirements are beyond customer expectation. Although their absence does not dissatisfy, their presence can mean drastically increased customer satisfaction. In many cases, exciting requirements become revealed/normal requirements with time. Figure 12 is an example of a Kano Model.

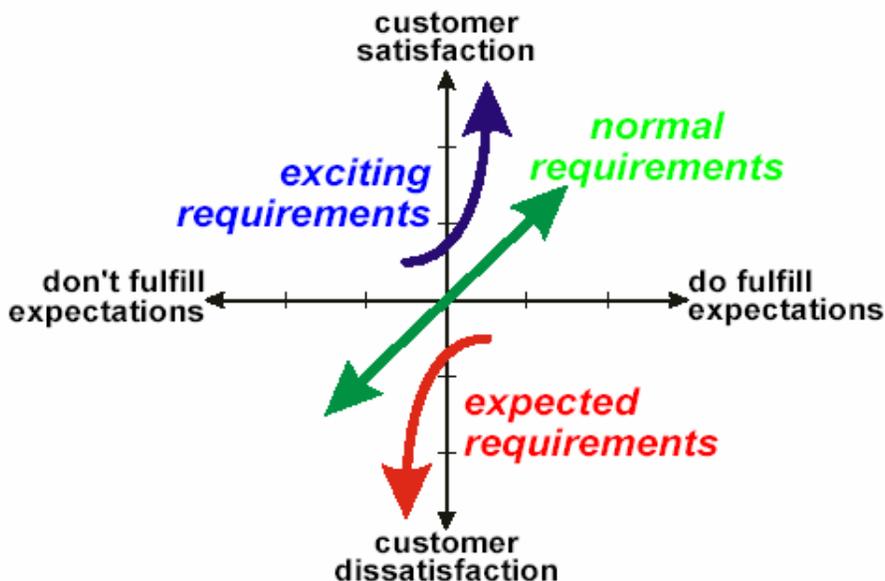


Figure 12: Kano Model

4.2.4.2 Solution Decision Matrix

Based on the requirements and objectives that arise from the Kano Model analysis, as well as additional analyses that take place during prioritization and assessment, solutions can be recommended. The Solution Decision Matrix is a tool used during the Solution Definition and Assessment Stage of the Data Quality Implementation Methodology. The best solution may seem immediately apparent. However, in order to quantify the impact of each solution option, members of the Working Group may vote on each solution's ranking relative to other options based on how well they meet an established set of criteria. The sum of these votes will then be multiplied by the weight of the metric to determine a score for the solution option in the given



criteria. Next, the scores from the criteria will be summed to determine the solution option's overall score. Table 13 is an example of a Solution Decision Matrix.

| Solution Option | Criteria with Weights | | | | Overall Score |
|-----------------|-----------------------|-------------------------------|---|--|---------------|
| | Criterion 1: ROI | Criterion 2: System Impact | Criterion 3: Ease of Implementation | Criterion 4: Customer Satisfaction | |
| | Weight 1: 0.2 | Weight 2: 0.2 | Weight 3: 0.1 | Weight 4: 0.3 | |
| A | 2.8 | 1.5 | 1.6 | 3.1 | 6.2 |
| B | 0.7 | 2.4 | 2.6 | 0.2 | 5.2 |
| C | 1.5 | 1.1 | 0.8 | 1.7 | 3.6 |

Table 13: Solution Decision Matrix

4.2.4.3 Change Leadership Process

In many cases, the change necessary to resolve an issue will not be a technical data fix (e.g. database change, data correction, data scrubbing and cleansing, etc.). Often, the required change is to a process or organizational structure, or even legislation behind the processes. For these cases, and for some technical data fixes, the Change Leadership process is another valuable tool. This tool may be used during the Solution Development Stage of the Data Quality Implementation Methodology. Change Leadership offers strategies for managing changes in tasks, people, culture, technology, and structure. After a solution has been identified and piloted, this template provides a framework to help keep the new process aligned with the organization's strategy, culture, structure, and management practices. This tool will provide the proposed solution's business case, financial impacts, and system impacts to the FSA Steering Committee in a consolidated format for final review. Refer to Figure 13 for an example of the Change Leadership Process.

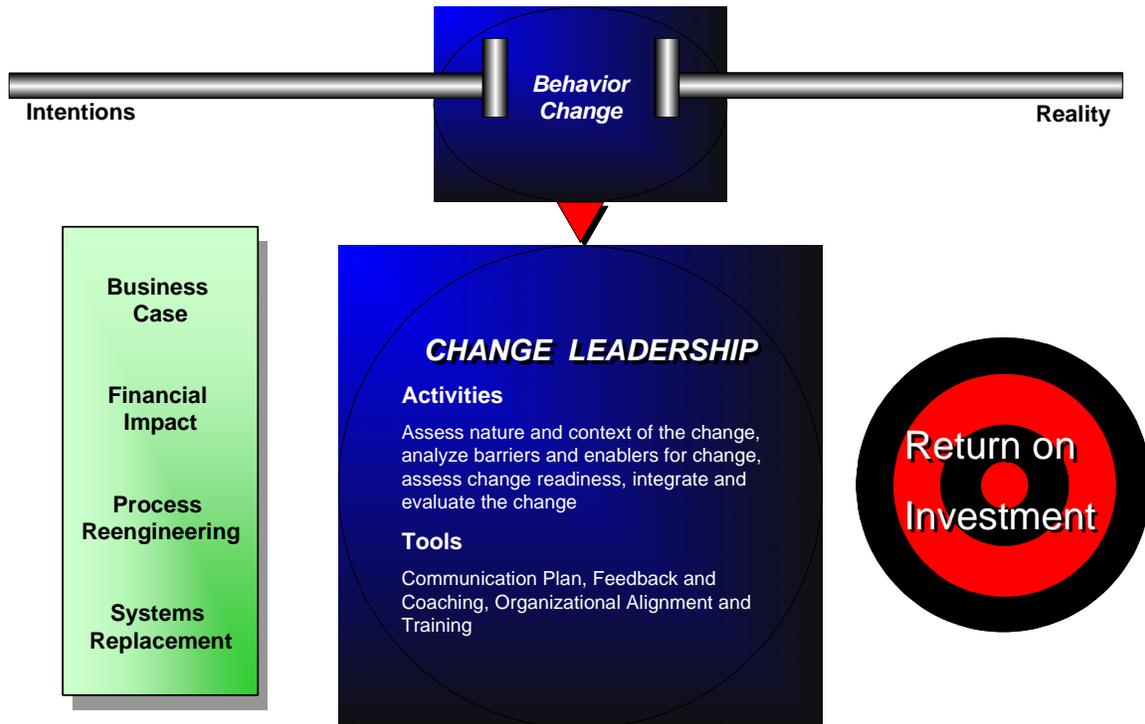


Figure 13: Change Leadership Process

4.2.4.4 Control and Response Plan

Once a technical solution is properly aligned and tested for production release, a Control and Response Plan is necessary to maintain standards for implementation. This tool may be utilized not only by Working Groups during production implementation in the case of unsuccessful release, but it can also be used by the Steering Committee for oversight purposes. The Control and Response Plan may be used during the Solution Development Stage of the Data Quality Implementation Methodology. The plan defines the process steps necessary for implementation, the person responsible for each step, and inputs/outputs for each step. Unlike a typical implementation plan, this document lists the control mechanisms in place to ensure sustained process performance and identifies the actions necessary when the process improvements are not maintained. This is another template that may easily be stored and communicated using the Data Quality Issue Management tool. Table 14 is an example of a Control and Response Plan.



| Control and Response Plan | | | | | | | |
|---------------------------|------------|-----------------|----------------|----------------------|-----------|--|--|
| Quality Issue: | | FAFSA mis-loads | | Core Team: | | DQ Working Group #3 | |
| Key Contact: | | Mike Brown | | Phone: | | XXX.XXX.XXXX | |
| | | | | Date (Orig.): | | 10/31/2003 | |
| | | | | Data (Rev.): | | N/A | |
| Process Step | Resp. | Output | Input | Amount of Data | Frequency | Control Method | Response Plan |
| Load FSA data | John Smith | Success | Applicant Data | 50,000 Rows | Daily | Field length validation and first and last name population | Contact FSA technical analyst, verify system loads, etc. |

Table 14: Control and Response Plan

4.2.5 Data Quality Issue Management Tool and Reports

The Data Strategy Data Quality Team developed a Data Quality Issue Management (DQIM) tool in Microsoft Access to assist with the tracking of data quality issues throughout this effort. This tool was designed as an interim solution to provide efficient, fast, and accurate reports, analysis, and data to the Steering Committee and FSA community. Data quality issue information in one central location is vital to delivering proper solutions. The data quality issues identified during Data Strategy 1.0 have been compiled from the Data Quality Mad Dog Report documented sources into one central repository. Information being tracked and maintained in this tool consists of data quality issue descriptions, resolutions, contact information, estimated resolution time, and cost, prioritization rankings, and associated business capability areas. To gain a better understanding of information being captured in the Data Quality Issue Management tool, reference the Data Quality Issue Management Tool Data Dictionary in Appendix I.

The Data Quality Team has also developed summary, detailed, and prioritization reports outlining data quality issues are displayed in Appendices F, G, and H respectively. The Team proposed additional fields that are captured in the reports and issue resolution forms within the tool. In addition, the Data Quality Team is currently developing entry forms for users with different responsibilities, such as contact information, submittal of new data quality issues, updating data quality issue information, and assignment of issues. Some of the business templates, presented in Sections 4.2.2 Prioritization Phase Business Templates, 4.2.3 Assessment Phase Business Templates, and 4.2.4 Improvement Phase Business Templates, have been incorporated into the tool to provide quick results for the different phases of the data quality issues. Figure 14 below shows an example of the different user forms developed in the DQIM tool for inputting data quality issue information. Additionally, Figure 15 illustrates the Customized Prioritization Tool for ranking data quality issues.



Data Strategy 2.0
Data Quality
Data Quality Management Support Report I

Form tabs: Contact Info | Issue Entry | Resolution Entry | Assignee Info | User Login

Issue Id: Mad Dog Issue No.: Priority: Status:

Submitter: Entry Date: Quick Hit: Yes No

Short Description of Data Quality Issue:

General Description of Data Quality Issue:

Impacts not addressing this issue:

Business Entities Affected: Aid Schools Person Financial Partner Lender

Trading Partner(s) Impacted: Schools Financial Partner Guaranty Agencies

Business Channels Impacted: Application Delivery Servicing Institution Participation

System(s) Impacted: All Systems COD CPS PEPs FMS eCB DLSS DLCS DMCS NSLDS

Dependencies: Related Issues:

Estimated Cost: Estimated Time:

Additional Comments:

Figure 14: DQIM Tool Issue Entry Input Form





Data Quality Issue Prioritization Tool

Thursday, May 06, 2004

Issue Number:

Issue Description: There is no ability to pull data from systems across the lifecycle to present a single, integrated student view complete with current status of a student's aid and workflow indicators relative to that student.

| No. | Impact Criteria | Answer | Score | Weight | Total Score |
|-----|--|--------|-------|--------|-------------|
| 1 | Does it result in inaccurate billing? | No | 0 | 0.08 | 0 |
| 2 | Does it result in erroneous payments? | No | 0 | 0.26 | 0 |
| 3 | Does it impact FSA's ability to formulate the budget? | None | 0 | 0.02 | 0 |
| 4 | Does it impact oversight or program integrity? | Low | 3 | 0.06 | 0.18 |
| 5 | Does it impact system integration? | High | 10 | 0.05 | 0.48 |
| 6 | Does it necessitate significant manual work arounds? | High | 10 | 0.02 | 0.20 |
| 7 | Does it impact student/borrower eligibility? | No | 0 | 0.18 | 0 |
| 8 | Could it negatively impact financial statements/annual audit? | No | 0 | 0.27 | 0 |
| 9 | Could the issue cause technical defaults? | No | 0 | 0.02 | 0 |
| 10 | Does it impact cycle time for payments or other critical services? | None | 0 | 0.05 | 0 |

| | | | | |
|---|--|--------------------------------|------------------------|--------------------------------------|
| Occurrence Rating | <input type="text" value="Always"/> | <input type="text" value="5"/> | Impact Rating | <input type="text" value="0.86028"/> |
| Visibility/Customer Service Rating | <input type="text" value="Low"/> | <input type="text" value="1"/> | | |
| Cost to Implement | <input type="text" value="\$500,000 - \$2,000,000"/> | | Priority Rating | <input type="text" value="4.3014"/> |
| Time to Implement | <input type="text" value="1-2 years"/> | | | |

Figure 15: DQIM Tool Issue Prioritization Tool Form



5 Next Steps

In preparation for the second half of the Data Quality Assurance Strategy and Implementation Plan effort, the following goals have been defined for the Steering Committee and the Data Quality Team:

- Continue roll-out of the Data Quality Implementation Methodology and resolution of data quality issues,
- Define guidelines for the types of data quality issues to be handled by the Steering Committee, and
- Determine transition plan for the Data Quality effort, including FSA's organizational placement.

In the coming months, the following tasks will be performed in support of these goals:

- Identify new data quality issues within the enterprise;
- Conduct an internal issue management tool analysis;
- Continue to communicate and educate the Data Quality Implementation Methodology to FSA;
- Identify issues to pilot phases of the Data Quality Implementation Methodology;
- Transition of Data Quality process and tools to FSA;
- Develop additional business templates in the DQIM tool.

The accomplishments of the Data Strategy 2.0 Data Quality effort will be documented in deliverable 152.1.10b Data Quality Management Support Report II, scheduled for delivery on September 30, 2004.



Appendix A: Acronyms



Appendix B: Data Quality Implementation Methodology



Appendix C: Data Quality Steering Committee Participants



Appendix D: Steering Committee Meeting Minutes



Appendix E: Presentation Materials



Appendix F: Data Quality Summary Issue Report



Appendix G: Data Quality Detailed Issue Report



Appendix H: Data Quality Issue Prioritization Summary Report



Appendix I: Data Quality Issue Management Tool Data Dictionary