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SUBTASK 4.5 REPORT

EVALUATION OF PIMS DOCUMENTATION

One of Three Six-Month Reports
Confidential

IN-DEPTH TECHNICAL REVIEW OF PENSION BENEFIT GUARANTY CORPORATION'S
MULTIEMPLOYER AND SINGLE-EMPLOYER PENSION MODELS

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Introduction

In July 2015, the Social Security Administration (SSA) engaged the FTI Consulting team (FTI) to conduct an 18-month, in-depth technical review of the Pension Benefit Guaranty Corporation's (PBGC) single-employer (SE) and multiemployer (ME) Pension Insurance Modeling System (PIMS). Task 4 of the Statement of Work (SOW) consists of 10 subtasks required for this in depth review - nine specific areas of review and a final report.¹ Three of the subtask reports are due at the end of each of the six-, 12- and 18-month periods. This report for Subtask 4.5, along with those for Subtasks 4.1 and 4.9, are due at the six-month period. As a part of our comprehensive review of PIMS, this report documents our evaluation of the existing PIMS documentation for adequacy and usefulness (see Subtask 4.5: Evaluate PIMS Documentation).²

The documentation of PIMS operation and use is important because one of the best ways to build confidence in the models is to allow non-PBGC personnel to use them. This report will primarily focus on the documentation related to the operation of the model and its output. Our review of the documentation of the inner workings of PIMS will be supplemented in the 12-month, 18-month and final reports as the technical review progresses.

This report presents FTI's review of the current PIMS system documentation and addresses the following key questions raised in Subtask 4.5:³

- a. How adequate is the existing documentation?
- b. What are best practices for comparable models?
- c. Does the documentation serve all potential users, including present and future operators of the models, and consumers of the models' output in the executive and legislative branches of government who need to know particular details about the model and the history of design decisions?

Altogether, the SOW prescribed that FTI would produce three reports for each of the three six-month periods during the contract. Our team recognized that, due to the tasks necessary for the project start-up, the time to complete the reports during the first six months would be compressed. The start-up tasks included the initial kick-off meeting with the PBGC and SSA, creating the final workplan, installing the servers at the FTI Consulting Data Center, reviewing initial documentation and gaining an understanding of the system. Due to the tighter window to complete reports, we chose the three subtasks that were not solely dependent on the system being fully operational. Subtasks 4.1 (Evaluate Modeling of Macroeconomic Variables) and 4.9 (Evaluate the Presentation of Model Output) were identified by our team as ones for which a significant amount of work could be completed without access to PIMS software. We expected Subtask 4.5 would be challenging to complete in the first six

¹ Social Security Administration, Evaluation of the Pension Benefit Guaranty Corporation's Pension Models, Description/Specification/Work Statement, p. 14.

² Ibid., p.19

³ Ibid., p.19

months, but also considered that a review of the documentation would be necessary in order to help our team understand the system. At this time, the documentation review is focused on the documentation surrounding the operation of the model and its technical design. Although our team has produced comprehensive reports for this first six-month period, we also recognize that during the next 12 months there will be significant added insight gained that will enhance our understanding of PIMS and could potentially change some of our views. Additional information and findings will be included in the future as either an addendum to this report or in the Subtask 4.10 final report, or both.

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Findings

In our review of the PIMS system documentation, we found that much of the documentation provided was out of date, incomplete or inaccurate, and that other documentation that would be expected for a system as complex and important as PIMS was missing or non-existent. In addition, there are opportunities to make the documentation more useful to the potential users of PIMS. As covered in more detail in this report, we make the following recommendations to the PBGC, ranked by order of importance:

1. Create an updated process flow chart for each model
2. Develop a formal yearly review plan for all PIMS documentation to ensure that it remains accurate as the PIMS application is updated
3. Update the User Guide to accurately reflect the current version of the PIMS application
4. Restructure the User Guide to provide step-by-step instructions detailing how to run a PIMS projection
5. Draft a new section in the PIMS User Guide that describes the SAS scripts required to run a PIMS projection and create output for the Projections Report
6. Combine the Input Data Structure and Data Dictionary to create one comprehensive document describing the entire PIMS input data structure
7. Update the Input Data Structure and Data Dictionary, as necessary, to reflect the current state of the PIMS input data structure and so it contains detailed descriptions of each table and parameter
8. Draft a new section in the new combined Data Structure/Data Dictionary document that describes how to access the Database Manager, and how to update tables and parameters

Scope and Methodology of Our Evaluation

This report addresses the accuracy and completeness of the PIMS models' documentation, our observations regarding limitations of existing documentation, and our recommendations for additional needed documentation that is either referenced by existing documents or would provide additional value. Our review of the provided model documentation focused on whether it accurately reflects the design and operation of the PIMS model and whether it is presented in a manner which is easy to understand and follow. This report does not address the adequacy of PIMS's modeling techniques, model assumptions and model implementation. The remaining reports in our in-depth review will address those issues.

As part of this evaluation, we identified and reviewed the following documents provided by PBGC:

1. Pension Insurance Modeling System: User Guide for PIMS SOA "Core" (vFY09.1)
2. Pension Insurance Modeling System (PIMS) Input Data Structure vFY09.1
3. PIMS Data Dictionary
4. SE-PIMS Programmer's Guide: A Brief Description of PIMS's Source Code
5. Pension Insurance Modeling System: PIMS System Description for PIMS SOA "Core" (vFY09.1)
6. Multiemployer PIMS System-Validation Document: Key Differences Between SE-PIMS and ME-PIMS
7. SE-PIMS Environment Plan FY 11 v1
8. PIMS Technical Architecture vFY09
9. PIMS User Notes: Edit, Compile, and Execute PIMS Code
10. PIMS Overview 2011
11. A Brief History of PIMS
12. Pension Insurance Modeling System: Data Development Manual

In addition to the documentation provided, we requested numerous additional documents that were either referenced by the documents received or that we would have expected to exist. The PBGC informed us that these documents, as listed below, either did not exist or could not be located and as such were not included in our review:

1. **Documentation for the Database Manager** – Several documents make reference to the "Database Manager" but no documentation was provided explaining its operation or function.
2. **Process flow charts for SE- or ME-PIMS** – Custom designed software typically includes a process flow chart as part of the design documentation which provides an overview of how information will travel and be transformed by the various components. They also provide an easy reference point for the developers and the stakeholders who review the software after completion. When kept up-to-date they provide a useful reference document when attempting to track down potential errors or when making edits to existing code.

3. **ME versions of documentation provided for SE-PIMS** – Some of the provided SE-PIMS documentation does not have a corresponding ME-PIMS version. Based on our discussions with the PBGC and our use of the model in test there are significant differences between the two models and as a result dedicated versions of key technical documents were expected.
 - a. ME-PIMS User Guide
 - b. ME-PIMS Programmers Guide
 - c. ME-PIMS System Description
 - d. ME-PIMS PPG AppB - Tech Architecture
 - e. ME-PIMS PPG AppA - PIMS Data Model
 - f. ME-PIMS Environment Plan

Our approach to reviewing the PIMS’s documentation had two components: 1) a review of the documentation associated with the operation of PIMS; and 2) a review of the technical documentation for the design of the models’ implementation. This report includes our findings on both. However, the technically-focused section will be supplemented on an as needed basis as part of our Subtask 4.6 review of the models’ implementation.

Evaluation of the Operations Documentation

The PIMS documentation associated with the operation of the models is focused predominantly on single-employer plans (SE-PIMS). Differences noted between SE-PIMS and the multiemployer plans (ME-PIMS) are described in the “Multiemployer PIMS System-Validation Document: Key Differences Between SE-PIMS and ME-PIMS” document. We reviewed all operational documents provided and evaluated what other documentation should be developed to ensure a user can fully operate and navigate the PIMS modeling system.

Pension Insurance Modeling System: User Guide for PIMS SOA “Core” (vFY09.1)

The purpose of the Pension Insurance Modeling System “User Guide for PIMS SOA ‘Core’ (vFY09.1)” document (PIMS User Guide) is to provide PIMS users with detailed instructions regarding all of the functionality within the PIMS application. We evaluated this document for both accuracy compared to the application and efficacy in providing the information necessary for potential users to navigate and understand the application.

User Guide Accuracy

The PIMS User Guide should accurately depict and describe all functions and uses of the PIMS application in its current form. This includes all functionality required to run a PIMS projection, review the output, and perform basic administrative tasks.

We evaluated the User Guide’s accuracy in two steps:

1. Evaluate each section of the User Guide for accuracy compared to the current PIMS application

2. Review the entire PIMS application to determine if any functions were missing from the User Guide

During our review, we noted that the User Guide provided had not been updated since September 2010 despite comments from PBGC staff that the PIMS application undergoes a variety of updates each year. We found the User Guide to be outdated and inaccurate, noting the following issues:

1. Some sections in the User Guide refer to functions that no longer exist in the PIMS application, such as:
 - o Administrator functions referred to in Section 5
 - o Several of the “Tools” described in Section 4
 - o Appendices A, B and C, describing how to make updates to the data using FoxPro
2. Some sections indicate the migration of some features to a new PIMS Database Manager functions (e.g., Sections 3.3-3.5, which allow the user to view input data used in the PIMS model), yet we did not receive a copy of the Database Manager or any associated documentation for this new application.
3. Some sections contain minor inaccuracies in the descriptions of functions/forms in current PIMS applications (e.g., incorrect field names/descriptions and outdated screenshots of specific application forms).
4. Some functions contained in the application are not described in the User Guide (e.g., User Guide lacks a description of the “Single Scenario” tab on the Run Projection form).
5. The User Guide is missing information on some portions of the PIMS models’ functionality which could lead to confusion for new users (e.g., an error message occurs prior to each PIMS run that, according to PBGC staff, can be ignored).

User Guide Efficacy

The PIMS User Guide should contain enough information to ensure that any potential user, including those not familiar with the application, can understand, navigate, and utilize the application.

In our review, we considered four different potential PIMS user-types

1. Advanced PIMS user with actuarial/economics knowledge
2. Advanced PIMS user without actuarial/economics knowledge
3. Beginner PIMS user with actuarial/economics knowledge
4. Beginner PIMS user without actuarial/economics knowledge

We then reviewed the User Guide and attempted to use the PIMS application from the point of view of each user type. During our review, we found the document to be written with the assumption that the user had some actuarial or economics knowledge. The User Guide refers to numerous terms and aspects of the model without defining them for a user unfamiliar with the pension system. Considering the complexity of both the PIMS model and the overall pension system, we believe that a base level of user knowledge can be assumed, however, defining uncommon terminology (e.g., “vested-terminated

status”) is considered a best practice. Therefore, the PBGC should consider adding a glossary to the documentation.

We also found that the User Guide is designed for users already experienced with the PIMS application. The User Guide breaks the description of major application functionality into four major sections:

1. Quick start guide – provides an outline of the steps necessary to complete specific tasks for users familiar with the application
2. Screen guide – provides a detailed description of each screen/page found within the PIMS application
3. Tools guide – provides a detailed description of additional tools found in the application that are not directly essential for running a PIMS projection
4. Administrative tools guide – provides a detailed description of several administrative tools available in the PIMS application

During our review, we noted that none of the User Guide’s major sections contain detailed, step-by-step instructions on how to run a PIMS projection (the primary function of the PIMS application). The quick start guide contains step-by-step instructions for specific tasks, but does not indicate how a user would run a projection from start to finish (e.g., reviewing the final PIMS output). However, for a user familiar with PIMS, the quick start guide would provide a simple, useful tool for remembering how to utilize certain functions in the application.

The screen guide provides detailed descriptions of each screen found within the tool. These descriptions are generally provided in the order in which a user would encounter them while running a PIMS projection. However, the relationships between screens are not described. Thus, the only method for a new PIMS user to determine how to run a PIMS projection would be to use a combination of the quick start and screen guides simultaneously while attempting to run a model. Due to the separated nature of the two guides, new users may not find all of the necessary steps to run a model, creating a heavy learning curve that may discourage broader usage. Furthermore, attempting to learn the PIMS models without access to an experienced user would be quite difficult and require extensive trial and error.

The User Guide would also be confusing to a new user, as none of the functions described in the administrative tools guide, and only certain functions in the tools guide, still exist in the current version of the PIMS application.

User Guide Conclusions

We found that the User Guide fails to adequately perform its stated function. Recommendations include:

1. Update the User Guide to accurately reflect the current version of the PIMS application
2. Restructure the User Guide to provide step-by-step instructions detailing how to run a PIMS projection

3. Develop a formal yearly review plan for the User Guide to ensure that it remains accurate as the PIMS application is updated

Pension Insurance Modeling System (PIMS) Input Data Structure vFY09.1 and PIMS Data Dictionary

The purpose of the Pension Insurance Modeling System (PIMS) Input Data Structure vFY09.1 and PIMS Data Dictionary is to provide the user with a description of all input tables and parameters that are used in the PIMS model and how they relate to each other. Due to the connected nature of the two documents, we decided to evaluate them together.

The Input Data Structure document provides a single-page flowchart showing how each input table is related to all of the others. The flowchart provides the name and a minimal description of each table. We found that this document would be useful for an experienced user of PIMS, but of lesser value to a new user, absent the information in the Data Dictionary. In addition, we found that this document had not been revised since 2009. Without a current description of the PIMS model input data structure, we were unable to evaluate the accuracy of this document in relation to the current model.

The Data Dictionary provided to us comprised over 100 separate HTML documents, each of which provided the name, a short description, and the source of each parameter. The descriptions provided varied in detail, sometimes providing the possible input values for a parameter and sometimes not. As with other documents, we found that the dictionary could be useful for an experienced PIMS user but would prove confusing and/or unhelpful for a new PIMS user due to the lack of detailed description of each table and the parameter contained within. Normally this would not be considered a significant issue. However, the missing information is not included in other documents and as such should be included here. The current PIMS input database is now accessed using the PIMS Database Manager; we were not provided any tool or functionality with this name, nor were any documentation provided regarding its operation. Due to the non-existence of this most up-to-date documentation, we were unable to evaluate the accuracy of the Data Dictionary.

We found that the both the Input Data Structure document and Data Dictionary could provide significant utility to an experienced PIMS user but do not contain the detail necessary for a new PIMS user. Because the code level review (Subtask 4.6) has not yet begun, we were unable to evaluate the accuracy of either document, but note that neither has been updated in several years. Based on our review, we recommend the following:

1. Combine the Input Data Structure and Data Dictionary to create one comprehensive document describing the entire PIMS input data structure.
2. Update both documents, as necessary, to reflect the current state of the PIMS input data structure.
3. Update the documents to contain detailed descriptions of each table and parameter. Each table description should include details regarding the table itself and how it relates to adjacent tables,

as shown in the Input Data Structure document. Parameter descriptions should provide sufficient information on each parameter and a detailed list of all possible values, or an expected range of values, for those parameters with a finite number of values.

Additional Recommended PIMS Operational Documentation

As part of our review, team members participated in a meeting at which the PBGC staff demonstrated how to use the PIMS system. We found that two major portions of the PIMS system, as seen in the demo, were not addressed in any of the operational documentation provided:

1. Pre-processing procedures using SAS – During the meeting, PBGC staff demonstrated several applications of SAS scripts used to create a set of input parameters in PIMS projection runs. We received these SAS scripts and found that the comments contained within the SAS code were extremely detailed, providing sufficient instruction to implement the code. However, neither the SAS scripts nor the comments contained therein are mentioned in any other operational documents. Furthermore, none of the documentation details how to import the created parameters into the PIMS model in making a projection.
2. Development of other Run Parameters – During the meeting, the PBGC staff demonstrated the new PIMS Database Manager (DB Manager), which provides access to all of the input parameter tables contained within the PIMS system. The staff stated that the DB Manager is the system used to create/alter the different scenarios used in any PIMS projection. However, the DB Manager is not mentioned in any of the provided documentation.

We recommend the following additional documentation for the PIMS system:

1. Draft a new section in the PIMS User Guide. The section should describe the SAS scripts required to run a PIMS projection, including how to access them, how to change them as necessary for different projections, and how to export the created values to the PIMS system.
2. Draft a new section in the new combined Data Structure/Data Dictionary document. The section should describe how to access the DB Manager, and how to update tables and parameters.
3. Create an updated process flow chart for each model. This would not only make it easier for users to understand the model functionality, but also make editing the model easier, potentially reducing the costs associated with updating/editing its design.

Evaluation of the Technical Documentation

In addition to the operational documentation, the PBGC provided several documents describing the technical functionality of the PIMS model. We performed a preliminary evaluation of these documents that will be concluded in Subtask 4.6, “Evaluate the Coding of the Models.” Our preliminary evaluation of each document is provided below.

SE-PIMS Programmer's Guide: A Brief Description of PIMS's Source Code

The purpose of this document is to provide a general description of PIMS's computer code, including the code's basic architecture. The document begins with an overview of the basic code structure, providing a description of specific code functions in subsequent sections. Our preliminary review found the document to be well organized and informative. However, we note that while the document has not been updated since September 2010 we are aware that the SE-PIMS model may have changed little during that time period.

PIMS User Notes: Edit, Compile, and Execute PIMS Code

The purpose of this document is to provide instructions regarding how to view, edit, and compile PIMS code. The document provides a summary of the program files contained in PIMS and a general description regarding how to update these files. We found that the document was very specific to the computer environment used at the time of document's creation. We also note that, like many of the documents, the User Notes have not been updated since January 2010. While this long absence of updates is potentially not an issue for SE-PIMS, we understand that ME PIMS has undergone substantial changes and in fact, there is no mention of ME-PIMS within the document.

Additional Documents

PBGC staff also provided a number of other documents which, although not directly related to a user's operation of the PIMS model or the technical design, are helpful in the overall understanding of PIMS:

1. Pensions Insurance Modeling System: PIMS System Description for PIMS SOA "Core" (vFY09.1) – Provides an overview of the SE-PIMS model and how it performs its primary function
2. Multiemployer PIMS System Validation Document: Key Differences Between SE-PIMS and ME-PIMS – Used in conjunction with the PIMS System Description, this document describes certain differences between SE-PIMS and ME-PIMS
3. SE-PIMS Environment Plan FY11 – Provides a detailed description of the hardware and software necessary to create and support the PIMS system modeling environment
4. PIMS Technical Architecture vFY09 – A one-page flowchart describing the function of each piece of PIMS hardware
5. PIMS Overview 2011 – Provides a brief overview of the PIMS Model and its primary purpose but includes no information relevant to this review
6. A Brief History of PIMS – Provides a brief history of the PIMS model, including how and why it was created but includes no information relevant to this review
7. Pension Insurance Modeling System: Data Development Manual – Provides detailed instructions describing how to import firm and plan level data from the relevant external sources
8. ME-PIMS Post-Rollout Specs – Contains detailed descriptions regarding changes to the ME-PIMS model code

Best Practices

Creating and maintaining system documentation is critical to understanding the end-to-end lifecycle of an application. System documentation includes user manuals related to running the application and information on application infrastructure. From a user's perspective, task-based documentation rather than descriptions of product features are generally preferred, with learning efficiency being an important goal. Below are several best practices:

1. Understanding the needs and competencies of actual and potential users is the first step in creating task based-documentation. Leverage and input insight from technical resources to understand the level of information that needs to be included in the documentation.
2. Documentation should focus on specific features of the application, clearly linked to its final objective, and create meaningful tasks so that the users understand what do with the results.
3. Structure the documentation in a logical manner consistent with regard to how the application is run.
4. Documentation should include all prerequisite information and/or processes that happen before the application is executed and include any required post-processing. Understanding the upstream and downstream dependencies will help the user better understand the process.

Technical documentation is also critical for the maintenance of an application including any potential future updates or changes. Information on the architecture of the application, such as operating system, source code programming language, and database structure is critical. Such documentation should include a technical overview, an entity relationship diagram, end-to-end process flow, and a source code manual. For applications that have periodic changes to the source code, outlining the path of the program execution is critical for anyone who may be asked to make a change to the logic. Equally critical is the completeness and accuracy of commentary in the source code. Having robust technical documentation is also very useful in supporting FISCAM⁴ (Federal Information Security Control Audit Manual) audits.

A policy should exist within the organization to periodically review and assess system documentation on at least an annual basis. Updates should be made to reflect any system changes or enhancements made since the prior review.

⁴FISCAM provides specific guidelines for testing the confidentiality, integrity, and availability of information systems. Given the importance of their output in policy making decisions, FTI has assumed that the PIMS Models are included in the PBGC's system controls audits.

Overall Conclusions

Upon completion of our review, we found that all documentation provided was substantially out of date, often containing descriptions of system features that no longer exist, or referencing documents neither we nor PBGC staff were able to locate. In addition to updating the existing documents, we recommend that the PBGC consider adding the missing or non-existent documentation described above. In areas where the PBGC believes the SE-PIMS documentation would be sufficient, the SE-PIMS version should be updated to specifically clarify that it covers both SE-PIMS and ME-PIMS versions.