



Memorandum from the Office of the Inspector General

January 12, 2016

Scott D. Self, SP 3A-C

**REQUEST FOR MANAGEMENT DECISION – AUDIT 2014-15063-05 – INFORMATION
TECHNOLOGY ORGANIZATIONAL EFFECTIVENESS – INFRASTRUCTURE DELIVERY**

Attached is the subject final report for your review and management decision. You are responsible for determining the necessary actions to take in response to our findings. Please advise us of your management decision within 60 days from the date of this report.

Information contained in this report may be subject to public disclosure. Please advise us of any sensitive information in this report that you recommend be withheld.

If you have any questions or wish to discuss our findings, please contact Sarah E. Huffman, Audit Manager, at (865) 633-7345 or Colonel J. Cline, Director, Information Technology Audits, at (865) 633-7385. We appreciate the courtesy and cooperation received from your staff during the audit.

David P. Wheeler
Assistant Inspector General
(Audits and Evaluations)
ET 3C-K

SEH:BSC
Attachment
cc (Attachment):

TVA Board of Directors
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OIG File No. 2014-15063-05



Office of the Inspector General

Audit Report

To Chief Information Officer,
Information Technology

INFORMATION TECHNOLOGY ORGANIZATIONAL EFFECTIVENESS – INFRASTRUCTURE DELIVERY

Audit Team

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Audit 2014-15063-05
January 12, 2016

ABBREVIATIONS

BIA	Business Impact Analysis
CIO	Chief Information Officer
COBIT	Control Objectives for Information and Related Technology
DR	Disaster Recovery
ECO	Enterprise Customer Operations
EO	IT Engineering and Operations
ID	Infrastructure Delivery
IT	Information Technology
IT1K	1,000 Days to Success
OIG	Office of the Inspector General
TVA	Tennessee Valley Authority

TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
BACKGROUND.....	1
OBJECTIVES, SCOPE, AND METHODOLOGY	2
FINDINGS	3
CURRENT ORGANIZATIONAL STATE.....	4
TVA VALUES	5
IT1K INITIATIVE	6
MANAGEMENT ACTION PLANS	6
RECOMMENDATIONS.....	6

APPENDICES

- A. TVA VALUES
- B. OPERATIONAL MATURITY LEVELS
- C. MEMORANDUM DATED JANUARY 6, 2016, FROM SCOTT D. SELF TO DAVID P. WHEELER



Audit 2014-15063-05 – Information Technology Organizational Effectiveness – Infrastructure Delivery

EXECUTIVE SUMMARY

Why the OIG Did This Audit

In 2008, the Tennessee Valley Authority's (TVA) Office of the Inspector General (OIG) performed an auditⁱ on the effectiveness of the Information Technology (IT) organization and made several recommendations for improvements. In 2011, TVA OIG completed a follow-up auditⁱⁱ and determined the actions taken were not carried through year to year, and as a result, effectiveness in many areas decreased. To assist IT in increasing effectiveness, the recommendations from Audit 2010-13366 were focused on creating sustainable processes. In addition, TVA's former Chief Information Officer (CIO) created a program titled 1,000 Days to Success (IT1K) to address findings from the audit as well as other observations he made as to the current state of IT, which included initiatives related to disaster recovery (DR).

In December 2013, IT informed us it had completed the management action plans to address the recommendations from Audit 2010-13366. Soon thereafter, IT informed us it had also completed implementation of the IT1K program. To assess the results of the management action plans, the IT1K program, and determine the current organizational effectiveness of IT, we scheduled follow-up audits of the individual operational groups within IT. This report covers our audit of IT Infrastructure Delivery (ID) which was combined with Enterprise Customer Operations (ECO) under the IT Engineering and Operations (EO) organization in 2015. The ID area of EO is responsible for delivering secure, reliable technology infrastructure services that enable and maximize the value of IT business solutions.ⁱⁱⁱ

To accomplish the mission related to engineering service, the ID organization is organized into three operational groups: (1) Platform Services, (2) Compute Services, and (3) Network/Communications Services. These three groups are responsible for the following areas:

- **Platform Services** focuses on providing secure and effective identity and access management services and Web infrastructure as well as administers reporting and integration infrastructure for TVA's applications.

ⁱ Audit Report 2007-11348, Information Services Organizational Effectiveness, March 27, 2008.

ⁱⁱ Audit Report 2010-13366, Information Technology Organizational Effectiveness, April 5, 2011.

ⁱⁱⁱ The ECO portion of EO was covered in Audit Report 2014-15063-04, Information Technology Organizational Effectiveness – Enterprise Customer Operations, September 22, 2015.



Audit 2014-15063-05 – Information Technology Organizational Effectiveness – Infrastructure Delivery

EXECUTIVE SUMMARY

- Included in Platform Services is Database Management Services which focuses on delivering resilient and compliant database infrastructure for TVA's applications and administers database platforms.
- **Compute Services** focuses on building and maintaining hardware infrastructure and resources to host TVA applications.
 - Included in Compute Services is Business Continuity Services which focuses on providing effective backup of critical data, data storage infrastructure, and DR capability.
- **Network/Communications Services** focuses on delivering effective and secure connectivity between TVA locations in the service area and beyond and secure Internet service to TVA business units throughout the service area.

In addition, there are two Senior Program Managers in place to oversee technical projects and programs as well as continuous improvement across the groups. Oversight of technical programs and projects includes the responsibility for timely and effective delivery of infrastructure projects and provides work and change management coordination to IT groups. ID's continuous improvement program focuses on identifying, prioritizing, and implementing improvements necessary to move the organization forward.

The OIG performed this audit to determine ID's (1) current effectiveness, (2) actions completed in the implementation of management action plans from Audit 2010-13366 and IT1K initiatives related to the DR program, and (3) design of the management action plans and IT1K program and identify gaps related to any outcomes not met.



Audit 2014-15063-05 – Information Technology Organizational Effectiveness – Infrastructure Delivery

EXECUTIVE SUMMARY

What the OIG Found

ID has responsibility for Platform Services, Compute Services and Network/Communications Services. We conducted current state assessments on these areas and determined they were operating in varying levels of maturity as shown in Figure 1. In addition, ID has supporting programs established to oversee technical projects and programs as well as continuous improvement across the groups.



* Areas not assessed in Audit 2010-13366, therefore, results are based only on current state.

Figure 1

Definitions of the maturity ratings for Figure 1, which were developed from the Control Objectives for Information and Related Technology (COBIT)^{iv} 4.1 framework, are summarized below and described in detail in Appendix B.

- 0. Nonexistent – There is a complete lack of policies and processes.
- 1. Initial/Ad Hoc – There are no standardized policies and processes.
- 2. Repeatable and Intuitive – Policies and processes are developed; however, there is a high reliance on the knowledge of individuals to ensure compliance.
- 3. Defined – Policies and processes have been standardized, but it is unlikely that noncompliance would be detected.
- 4. Managed and Measurable – Management monitors and measures compliance with procedures and takes action where processes appear not to be working effectively. Automation and tools are used in a limited or fragmented way.
- 5. Optimized – Processes have been refined to a level of good practice, based on the results of continuous improvement and maturity modelling with other enterprises.

^{iv} COBIT is an IT governance framework and supporting toolset that emphasizes regulatory compliance, helps organizations to increase the value attained from IT, enables alignment, and simplifies implementation of the enterprises' IT governance and control framework.



Audit 2014-15063-05 – Information Technology Organizational Effectiveness – Infrastructure Delivery

EXECUTIVE SUMMARY

While ID's operational maturity is well defined, there are opportunities to improve the DR program to enhance and further mature processes developed as result of the IT1K initiatives and management action plans made in response to Audit Report 2010-13366.

In addition, TVA management has identified communication improvements to be made within Compute Services to improve employee morale and engagement.

TVA's values are the fundamental beliefs used to guide the actions, behaviors, and decisions in how to achieve its mission. TVA has recently adopted the following values that are being introduced to employees: safety, service, integrity, accountability, and collaboration. Observed activities within ID were compared to the TVA values, and no issues were identified.

What the OIG Recommends

The TVA OIG recommends the CIO, IT:

1. Expand DR activities by (a) leading an IT-wide effort to update the 2011 business impact analysis, (b) leading a single point of failure analysis of production IT data center infrastructure and facilities, (c) identifying the startup order of required applications for critical TVA systems, and (d) identifying the software platform subcomponents of the systems in part (c).
2. Continue working with Compute Services management to address identified communication improvements.

TVA Management's Comments

In response to our draft audit report, TVA management agreed with our findings and recommendations and requested wording changes in one recommendation.

See Appendix C for TVA management's complete response.

Auditor's Response

The OIG reviewed TVA management's comments and updated the report to reflect the requested changes.

BACKGROUND

A key aspect of the Tennessee Valley Authority's (TVA) mission and vision is to provide affordable electricity to rate payers. TVA's Information Technology (IT) organization's contribution to this mission and vision includes operating effectively. In 2008, TVA's Office of the Inspector General (OIG) performed an audit¹ on the effectiveness of the IT organization and made several recommendations for improvements. In 2011, the OIG completed a follow-up audit² and determined the actions previously taken were not carried through year to year, and as a result, effectiveness in many areas decreased. Accordingly, to assist IT in increasing its effectiveness, the recommendations from Audit 2010-13366 were focused on creating sustainable processes. In addition, TVA's former Chief Information Officer (CIO) created a program titled 1,000 Days to Success (IT1K) to address findings from the audit as well as other observations he made as to the current state of IT.

In December 2013, IT informed us it had completed the management action plans to address the recommendations from Audit 2010-13366. Soon thereafter, IT informed us it had also completed implementation of the IT1K program. To assess the results of the management action plans, the IT1K program, and determine the current organizational effectiveness of IT, we scheduled follow-up audits of the individual operational groups within IT.

After reorganization in 2015, the IT Engineering and Operations (EO) organization was formed from two groups formerly known as Enterprise Customer Operations (ECO) and IT Infrastructure Delivery (ID). This audit includes only the areas of EO that were previously known as ID, which are responsible for delivering secure, reliable technology infrastructure services that enable and maximize the value of IT business solutions. The ECO portion of EO was included in OIG Audit 2014-15063-04.³

To accomplish the mission related to engineering services, the ID organization is organized into three operational groups: (1) Platform Services, (2) Compute Services, and (3) Network/Communications Services. These three groups are responsible for the following areas:

- **Platform Services** focuses on providing secure and effective identity and access management services and Web infrastructure as well as administers reporting and integration infrastructure for TVA's applications.
 - Included in Platform Services is Database Management Services which focuses on delivering resilient and compliant database infrastructure for TVA's applications and administers database platforms.

¹ Audit Report 2007-11348, Information Services Organizational Effectiveness, March 27, 2008.

² Audit Report 2010-13366, Information Technology Organizational Effectiveness, April 5, 2011.

³ Audit Report 2014-15063-04, Information Technology Organizational Effectiveness – Enterprise Customer Operations, September 22, 2015.

- **Compute Services** focuses on building and maintaining hardware infrastructure and resources to host TVA applications.
 - Included in Compute Services is Business Continuity Services which focuses on providing effective backup of critical data, data storage infrastructure and disaster recovery (DR) capability.
- **Network/Communications Services** focuses on delivering effective and secure connectivity between TVA locations in the service area and beyond and secure Internet service to TVA business units throughout the service area.

In addition, there are two Senior Program Managers in place to oversee technical projects and programs as well as continuous improvement across the groups. Oversight of technical programs and projects includes the responsibility for timely and effective delivery of infrastructure projects and provides work and change management coordination to IT groups. ID's continuous improvement program focuses on identifying, prioritizing, and implementing improvements necessary to move the organization forward.

One of the recommendations from Audit 2010-13366 was related to DR, which is currently within the responsibilities of Compute Services. In response to those recommendations, TVA's IT committed to complete (1) a business impact analysis (BIA), (2) a top-level DR plan, and (3) a reconstitution plan. In addition, ID has the responsibility for sustaining the DR program from the IT1K initiatives. The objectives of this initiative included (1) an agency-wide business continuity and DR program, including policy, standards, a strategic plan, and an awareness program; (2) a BIA and risk assessment; (3) the implementation of IT business continuity and DR requirements and methods reports; and (4) agency-wide DR plans, including test plans and results.

OBJECTIVES, SCOPE, AND METHODOLOGY

The objectives of this audit were to evaluate the effectiveness of organizations within IT in meeting TVA's mission and values (see Appendix A). To accomplish this, the audit team (1) evaluated the current effectiveness of operational groups within IT, (2) validated the outcomes of management action plans and whether the IT1K program met expectations, (3) evaluated the implementation of management action plans and the IT1K program in relation to achieving outcomes, and (4) reviewed the design of the management action plans and IT1K program for gaps related to any outcomes not met. The scope of this report covers the results for the ID groups of Compute Services, Platform Services, and Network/Communications Services.⁴

⁴ Audits have been completed for the following four operational groups in IT:

- Audit Report 2014-15063-01, Enterprise Information Security and Policy, issued June 4, 2015.
- Audit Report 2014-15063-02, Enterprise Architecture and Programs, issued August 4, 2015.
- Audit Report 2014-15063-03, Operations Solutions Delivery, issued September 3, 2015.
- Audit Report 2014-15063-04, Enterprise Customer Operations, issued September 22, 2015.

In addition, a separate audit report will be issued for Enterprise Solutions Delivery.

To achieve the objectives of this audit, the audit team:

- Interviewed a sample of ID employees to determine background, understanding of job duties, team dynamics, and leadership capabilities.
- Reviewed the work performed to complete the management action plans developed in response to previous audit findings.
- Reviewed the work performed to complete IT1K initiatives.
- Reviewed metrics associated with ID's programs.

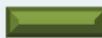
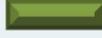
Sample selections for interviews were performed using random method and auditor judgment based on position, title, and location on the IT organization chart. Due to the use of nonstatistical sampling, we cannot project the sample results to the population.

Documentation (e.g., metric data, value definitions, and IT1K objectives and outcomes) used for this audit was provided by TVA. Fieldwork for this audit was completed between July and September 2015.

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

FINDINGS

IT's ID has responsibility for Platform Services, Compute Services, and Network/Communications Services. We conducted current state assessments on these areas and determined they were operating in varying levels of maturity as shown in Figure 1. Definitions of the maturity ratings for Figure 1, which were developed from the Control Objectives for Information and Related Technology (COBIT) 4.1 framework, are described in detail in Appendix B.

	0 Nonexistent	1 Initial/Ad Hoc	2 Repeatable but Intuitive	3 Defined	4 Managed & Measurable	5 Optimized
Platform Services				2015* 		
Compute Services				2015* 		
Network Communications Services				2015* 		

* Areas not assessed in Audit 2010-13366, therefore, results are based only on current state.

Figure 1

In addition, ID has supporting programs established to oversee technical projects and programs as well as continuous improvement across the groups.

CURRENT ORGANIZATIONAL STATE

IT's ID has worked to improve infrastructure services by (1) standardizing and documenting processes, (2) working to update outdated infrastructure, and (3) working to automate the creation of additional virtual infrastructure resources to support TVA enterprise applications. While there have been improvements to the DR program, gaps still remain.

Platform Services

Platform Services supports identity and access management services, infrastructure to support Web-based applications, reporting services, application integration infrastructure, and database management services for TVA's enterprise application portfolio.

Platform Services has documentation that standardizes its processes. Platform Services' employees reported good collaboration and support with other IT groups. There appears to be a positive work environment with management support, training opportunities, and a manageable workload. However, there is concern that succession planning is not a high enough priority, especially in areas where individuals are approaching retirement.

Platform Services' staff expressed concern around knowledge transfer and succession planning for positions held by employees approaching retirement. TVA is in the process of addressing this issue by improving succession plans as part of their effort to address findings from the OIG Evaluation Report 2013-14950, Review of TVA's Succession Planning, issued September 19, 2013.

Compute Services

Compute Services supports TVA's enterprise software applications by building and maintaining traditional computer systems as well as an internal cloud environment. In addition, a team is in place that provides data backup and storage and DR planning and testing. Compute Services has developed and deployed automated tools for creating systems to support applications. These tools reduce the time necessary to expand IT system capacity and promote system standardization. However, some systems are still configured manually. Compute Services is in the process of further development to expand these capabilities to include all systems.

During the process of advancing automation capabilities, management has been more focused on the development of these new technologies rather than staff. As a result, (1) training opportunities were not allocated in a consistent manner, (2) a nontechnical lead assigned tasks to individuals that were not in their skill set, and (3) the Knoxville staff felt disconnected due to the project focus in Chattanooga, which has impacted team morale. In addition, management

communications were not consistent/clear enough for the team to properly understand the role of technical experts. This has led to confusion that technical experts have more management authority than intended. Management is aware of these issues and is working to address them.

IT has made improvements to the DR program over the past few years by completing a BIA and documenting and testing DR plans. However, there are still gaps in the program, including startup sequencing of critical applications, documented application interdependencies, and single point of failure analysis. According to TVA personnel, IT has not updated the BIA since 2011 due to staff and budget limitations.

Network/Communications Services

Network/Communications Services provides network connectivity within TVA's administrative and operational headquarters in Knoxville and Chattanooga and between TVA locations and Internet service throughout the service area.

Network/Communications Services has documentation that standardizes its processes. Network/Communication Services employees reported good collaboration and support with other IT groups. There appears to be a positive work environment with management support, training opportunities, and a manageable workload.

TVA VALUES

TVA's values are the fundamental beliefs used to guide the actions, behaviors, and decisions in how to achieve its mission. Observed activities within IT's ID were consistent with the TVA values.

Integrity

The TVA value of integrity is defined as conducting business according to the highest ethical standards and earning the trust of others through words and actions that are open, honest, and respectful. ID appears to be following this value in their interactions with each other and those outside of ID.

Accountability

In alignment with the TVA value accountability, producing effective results includes being accountable for all process deliverables. ID is demonstrating accountability by meeting metrics for system and network availability. In addition, the team members interviewed appear to be highly motivated in their work and desire to support TVA to the best of their ability.

Collaboration

Communication is a key element of collaboration, another TVA value, in developing teamwork and effective partnerships. A high level of collaboration and consistent leadership communications within ID was noted within most teams.

IT1K INITIATIVES

As part of the IT1K initiative effort for disaster recovery (DR), IT established:

- An agency-wide business continuity and DR program, including policy, standards, a strategic plan, and an awareness program.
- A business impact analysis (BIA) and risk assessment.
- Implementation of IT business continuity and DR requirements and methods reports.
- Agency-wide DR plans, including test plans and results.

IT completed a risk assessment and a BIA in 2011 followed by a business continuity plan and a DR plan in 2012. These efforts included requirements, methods, reports and test plans. In 2012 and 2014, IT completed testing of the DR plan, including complete reports of the tests performed and the results.

MANAGEMENT ACTION PLANS

In response to Audit 2010-13366, TVA's IT committed to complete a BIA, DR plan, and reconstitution plan. In 2011, TVA completed a BIA which included mission critical applications as identified by IT management. However, according to TVA personnel, IT has not updated the BIA since 2011 due to staff and budget limitations. In 2012, TVA reviewed continuity capabilities and completed a DR plan which included the reconstitution plan.

RECOMMENDATIONS

The TVA OIG recommends the CIO, IT:

1. Expand DR activities by (a) leading an IT-wide effort to update the 2011 BIA, (b) leading a single point of failure analysis of production IT data center infrastructure and facilities, (c) identifying the startup order of required applications for critical TVA systems, and (d) identifying the software platform subcomponents of the systems in part (c).
2. Continue working with Compute Services management to address identified communication improvements.

TVA Management's Comments – In response to our draft audit report, TVA management agreed with our findings and recommendations and requested wording changes in one recommendation. See Appendix C for TVA management's complete response.

Auditor's Response – The OIG reviewed TVA management's comments and updated the report to reflect the requested changes.

TVA VALUES

The Tennessee Valley Authority (TVA) values are fundamental beliefs that guide TVA's actions, behaviors, and decisions. TVA has defined the following values:

- **Safety:** We share a professional and personal commitment to protect the safety of our employees, our contractors, our customers, and those in the communities that we serve.
- **Services:** We are privileged to be able to make life better for the people of the Valley by creating value for our customers, employees, and other stakeholders, being good stewards of the resources that have been entrusted to us, and by being a good neighbor in the communities in which we operate.
- **Integrity:** We conduct our business according to the highest ethical standards and seek to earn the trust of others through words and actions that are open, honest, and respectful.
- **Accountability:** We take personal responsibility for our actions, our decisions, and the effectiveness of our results, which must be achieved in alignment with our company values.
- **Collaboration:** We're committed to fostering teamwork, developing effective partnerships, and valuing diversity as we work together to achieve results.

OPERATIONAL MATURITY LEVELS

Operational maturity levels were determined using Control Objectives for Information and Related Technology (COBIT) 4.1 operating standards as shown in Figure 1. COBIT 4.1 is an information technology (IT) governance framework and supporting toolset created by ISACA that allows managers to bridge the gap between control requirements, technical issues, and business risks. COBIT emphasizes regulatory compliance, helps organizations to increase the value attained from IT, enables alignment, and simplifies implementation of the enterprises' IT governance and control framework.

Rating	Summary Criteria
5 Optimized	IT policies and processes have been refined to a level of good practice, based on the results of continuous improvement and maturity modeling with other enterprises.
4 Managed and Measurable	Management monitors and measures compliance with IT policies and processes and takes action where processes appear not to be working effectively. Processes are under constant improvement and provide good practice. Automation and tools are used in a limited or fragmented way.
3 Defined	IT policies and processes are standardized, documented, and communicated. Management has mandated these processes should be followed; however, it is unlikely deviations will be detected. The procedures themselves are not sophisticated but are the formalization of existing practices.
2 Repeatable but Intuitive	IT policies and processes have developed to the stage where similar procedures are followed by different Strategic Business Units. There is a high degree of reliance on the knowledge of individuals.
1 Initial/Ad Hoc	There are no standardized IT policies and processes; instead, there are ad hoc approaches that tend to be applied on an individual or case-by-case basis.
0 Nonexistent	Complete lack of any recognizable IT policies and processes.

Figure 1

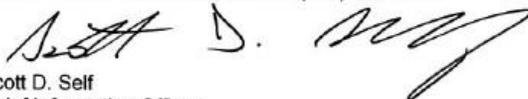
January 6, 2016

David P. Wheeler, ET 3C-K

RESPONSE TO REQUEST FOR COMMENTS – DRAFT AUDIT 2014 -15063-05-
INFORMATION TECHNOLOGY ORGANIZATIONAL EFFECTIVENESS -
INFRASTRUCTURE DELIVERY

Our response to your request for comments regarding the findings of the subject draft report is attached. Please let us know if your staff has any concerns with TVA's comments.

We would like to thank Colonel Cline, Sarah Huffman, and the audit team for their professionalism and cooperation in conducting this audit. If you have any questions, please contact Valerie Anderson at (423) 751-8915.



Scott D. Self
Chief Information Officer
Information Technology
SP 3A-C

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OIG File No. 2014-15063-05

AUDIT 2014-15063-05
Information Technology Organizational Effectiveness - Infrastructure Delivery
Response to Request for Comments

ATTACHMENT A
Page 1 of 1

	Recommendation	Comments
1	<p>The TVA OIG recommends the CIO, IT:</p> <p>Expand DR activities by (a) updating the BIA, (b) completing a single point of failure analysis, (c) developing a startup sequence of critical applications, and (d) documenting application interdependencies.</p>	<p>Management requests the following change in wording for clarification:</p> <ul style="list-style-type: none"> • Current Wording: Expand DR activities by (a) updating the BIA, (b) completing a single point of failure analysis, (c) developing a startup sequence of critical applications, and (d) documenting application interdependencies. • Proposed New Wording: Expand DR activities by (a) leading an IT-wide effort to update the 2011 BIA, (b) lead a single point of failure analysis of production IT data center infrastructure and facilities, (c) identify the startup order of required support applications for critical TVA systems (d) identify the software platform subcomponents of the systems in part (c).
2	<p>Continue working with Compute Services management to address identified communication improvements.</p>	<p>Management agrees.</p>

SDS
1/6/16