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Information Technology Control Model for Wastewater Treatment Plant

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Disclaimer

Abstract

The Information Technology (IT) governance of a large wastewater treatment plant was examined with respect to the COBIT framework. The COBIT Quickstart prescription was used as the basis for a phase I current state assessment throughout this examination. Assessment tests were administered to the CIO revealing a strong need for IT governance within this domain. Following, interviews were conducted with individuals in an effort to illustrate the current state of IT governance and identify gaps. A sample of management practices from the four COBIT domains was explored. The department director, CIO and two IT department managers were interviewed and asked questions which were mapped to the four COBIT framework domains. The resulting current state COBIT model is presented here. This research can be used by other organizations within this domain as a model for examining their own IT governance for benchmarking and identifying gaps. Future work will include continued current state analysis and gap identification. This would be followed by a desired state definition for IT governance as prescribed by the COBIT Quickstart prescription.

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Introduction

Water is the most vital resource on earth and our management of it has far reaching effects on society. Today, computer systems play an important role in water management. These computer systems have grown in sophistication and complexity and managing these systems and the people who support them can be a daunting task. Many IT governance frameworks have been established which aid in the management of these complex systems. An examination of a local wastewater treatment plant reveals how their IT management practices fit the Control Objectives for Information and related Technology (COBIT) framework. The resulting current state model is presented here. This work can aid other wastewater treatment plants and possibly other municipal utilities with the management of their information systems.

Water

Comprised of one oxygen atom and two hydrogen atoms (H_2O) this simple molecule possesses extraordinary characteristics and makes life possible. Life exists in every occurrence of water and every living organism is comprised mostly of water (Kotz & Purcell, 1991). The human body is over 60% water (Kotz & Purcell, 1991). Water's asymmetric structure creates an electric dipole which allows water to act as a universal solvent. However, while water can dissolve many substances it is a poor solvent for proteins (Kotz & Purcell, 1991). This characteristic allows this molecule to transport nutrients into cells and eliminate waste without destroying cell protoplasm (Kotz & Purcell, 1991). Virtually every cellular activity is dependent on water (Kotz & Purcell, 1991).

H_2O exists naturally in all three phases, solid, liquid and gas (Kotz & Purcell, 1991). It has high melting and boiling points (Kotz & Purcell, 1991). Additionally, water has a greater

density when solid than liquid permitting lakes to freeze from the top down and allows life to exist (Kotz & Purcell, 1991).

Life on this planet is dependent on the global distribution of water (World News Digest, 2009). Approximately 95% of water is in the form of oceans (World News Digest, 2009). The majority of the remaining fresh water is locked in ice caps (World News Digest, 2009). This leaves 1% of the global water supply available for consumption by terrestrial organisms. The majority of this small fraction of fresh water exists in underground aquifers. Figure 1 illustrates the global water distribution (World News Digest, 2009).

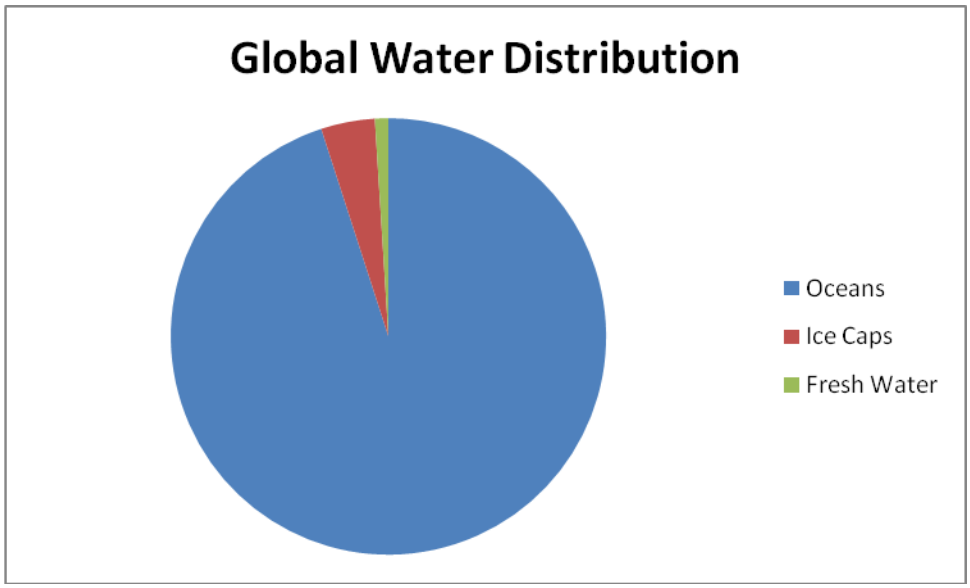

Figure 1: Global water distribution (Bortman, Brimblecombe, Cunningham (Eds.), 2003).

Along with its vital biological role water has many industrial uses including as a suspending agent (i.e., papermaking and coal slurrying), solvent, diluting agent, coolant, and source of hydrogen. It is used in filtration, washing, steam generation, hydration of lime and cement, textile processing, sulfur mining and hydrolysis (World News Digest, 2009). Water is

used to manufacture sulfuric acid, nitric acid, sodium carbonate, and ammonia. It is also employed to extract oil and sulfur from the ground (World News Digest, 2009).

The industrial age brought greater demands on the natural environment. Water was affected by many new industrial processes by being consumed and polluted. In 1969 the polluted Cuyahoga River in Cleveland, Ohio caught fire (Ohio History Central, 2005). The incident was believed to be caused by a passing train throwing sparks and igniting an oil slick in the river (Ohio History Central, 2005). This river previously caught fire and this event and a growing concern for environmental problems prompted the creation of the Environmental Protection Agency (EPA) in 1970 (Ohio History Central, 2005). This agency became the primary federal body dealing with water pollution for our nation (World News Digest, 2009).

EPA Definition of Polluted Water

Wastewater is defined as the spent or used water from homes, communities, farms and businesses that contains enough harmful material to damage water's quality (EPA, 2000). Wastewater includes both domestic sewage and industrial waste from manufacturing sources (EPA, 2000). Metals, organic pollutants, sediment, bacteria and viruses may all be found in wastewater (EPA, 2000). As a result, untreated wastewater can cause serious harm to the environment and threaten human life (EPA, 2000). The EPA regulates the discharge and treatment of wastewater under the Clean Water Act. The Clean Water Act became law in 1977 (EPA, 2000). It is enforced by the EPA and places stringent controls on water pollution. Permits are now required to discharge waste into the country’s waters and the EPA has the authority to issue penalties for violations. Municipal wastewater treatment plants (WWTP) are a vital piece of pollution control which aid in public health and safety as well as supporting this critical resource. The National Pollutant Discharge Elimination System (NPDES) issues permits to all

wastewater dischargers and treatment facilities (EPA, 2000). These permits establish specific discharge limits, monitoring and reporting requirements and may also require these facilities to undertake special measures to protect the environment from harmful pollutants.

U.S. Treatment Facilities

The United States census for 2000 gathered information regarding wastewater treatment facilities (EPA, 2000). The census defined these treatment facilities as structures designed to treat wastewater, storm water, or combined sewer overflows prior to discharging to the environment (EPA, 2000). Treatment is accomplished by subjecting the wastewater to a combination of physical, chemical, and/or biological processes that reduce the concentration of contaminants (EPA, 2000). Table 1 shows the census data for wastewater treatment facilities.

TREATMENT FACILITIES IN OPERATION IN 1996

Level of Treatment	Number of Facilities	Present Design Capacity (mgd)	Number of People Served	Percent of U.S. Population
Less than Secondary Treatment	176	3,054	17,177,492	6.5
Secondary Treatment	9,388	17,734	81,944,349	31
Greater than Secondary Treatment	4,428	20,016	82,928,182	31
No Discharge	2,032	1,421	7,660,876	2.9
Total	16,024	42,225	189,710,899	72

Table 1: U.S. Census data for wastewater treatment facilities (EPA, 2000).

Metro Wastewater Reclamation District

The Metro Wastewater Reclamation District (MWRD) is the wastewater treatment authority for the greater metro Denver, CO. area. It was formed by the Colorado State

Legislature in 1961 to provide wastewater transmission and treatment services to member municipalities and special connectors in compliance with federal, state, and local laws (MWRD, 2009). The Metro District collects approximately 140 million gallons of wastewater per day from neighborhood sewer lines and delivers it through approximately 250 miles of interceptor sewers to the Metro District's Central Treatment Plant in northeast Denver (MWRD, 2009). About 10 hours are needed to treat the wastewater before discharging it into the South Platte River where it makes up nearly 90 percent of the river for nine months of the year (MWRD, 2009). More than 95 percent of the pollutants are removed, making the treated water suitable for agriculture, fish and aquatic life, industrial use, water supply, and recreation (MWRD, 2009). The Metro District serves about 1.5 million people in a 380-square mile service area that includes Denver, Arvada, Aurora, Lakewood, Thornton, Westminster, and more than 30 other sanitation and water sanitation districts (MWRD, 2009). The Metro District's central treatment plant is the largest wastewater treatment facility between the Mississippi River and the West Coast.

MWRD is a small organization with 350 employees and an annual operating budget of $74 million (MWRD, 2009). MWRD recognizes some advantages over other WWTP's because it is cash funded from wholesale sales of treatment services to member municipalities (MWRD, 2009). Additionally, MWRD benefits from a simplification of sewage transmission due to gravity fed influent, requiring only four lift stations (MWRD, 2009). MWRD is not a combined treatment facility and only treats a very limited amount of storm water (MWRD, 2009). The Information Services (IS) department supporting MWRD has 29 employees and a $4 million annual operating budget which is 5.5% of total plants budget (MWRD, 2009). The IS department maintains, supports, develops and delivers dozens of critical applications and computer

infrastructure making the delivery and treatment of wastewater possible. Figure 2 illustrates the MWRD service area.

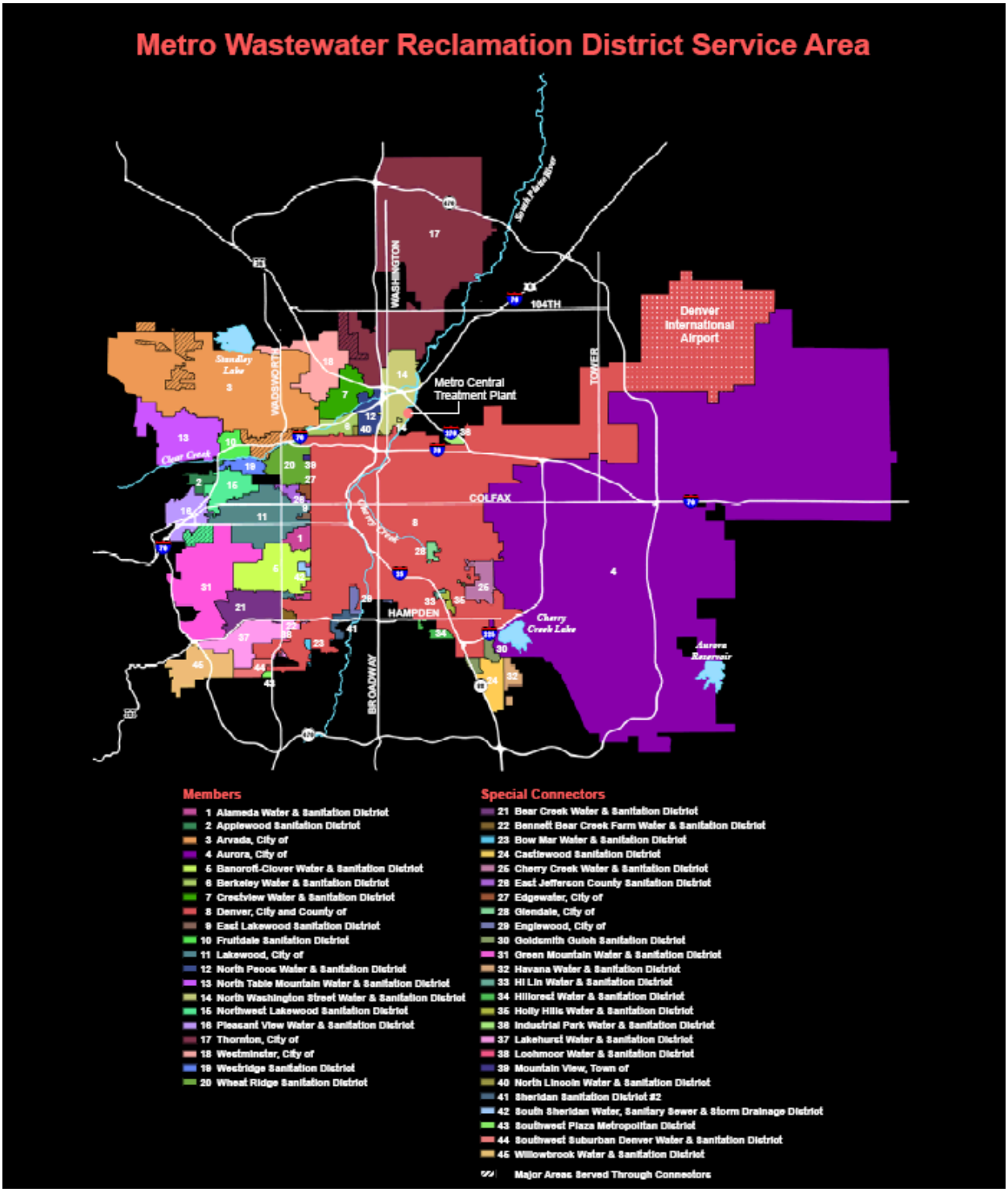

Figure 2: MWRD service area (MWRD, 2009).

Review of Literature and Research

Why examine IT governance at a wastewater treatment plant? IT governance is an extensively discussed topic however there is little written about it within the wastewater treatment domain. Prior to this research fourteen academic databases were searched for the combination of wastewater and COBIT terms and yielded zero results. Additionally, a discussion with a professor at the School of Mines teaching in the wastewater domain was unfamiliar with the COBIT framework.

This examination provides opportunities to improve IT control, IT value and IT reliability for a wastewater treatment plant's IT Functions. Additionally, this research outlines areas for reducing risk, creating efficient processes and strengthening overall IT governance within wastewater treatment.

The goal of effectively and efficiently managing the quality of water is vitally important for the sustainability of life. Information technology is now an integral part of modern water treatment plants. This work represents an example of applying a standardized framework within the wastewater treatment domain.

Luftman , Bullen, Liao, Nash, and Neumann (2004) defines IT governance as the selection and use of organizational processes to make decisions about how to obtain and deploy IT resources and competencies with the following:

- Who makes decisions (power)
- Why they make them (alignment)
- How they make them (decision process)

The IT Governance Institute (2008) defines IT governance as organizational leadership, and organizational structures and processes that ensure the enterprise's IT sustainability and extends

the organizations strategies and objectives. Gianella and Gujer (2006) in their investigation of IT governance in the public utilities domain state "governance establishes a framework of policies, procedures, standards and guidelines designed to ensure that the value of information assets are identified and exploited" (p.1).These authors focus on "what" an organization should be doing to effectively control IT resources while Grover and Segars (2003) in their investigation of strategic information systems planning argue there is a need to present cases on "how" organizations get the most value out of IT. This research explores "how" a wastewater treatment plant governs IT resources.

There has been considerable discussion regarding the roles and duties within organizations related to information technology. Many frameworks have been established and are accepted as good practices for managing technology and organizational goals. The IT Governance Institute (ITGI) presents information on aligning business goals with IT goals. The ITGI has facilitated the creation of the COBIT 4.0 IT governance framework. This framework serves as a tool for organizations to effectively manage IT and is a well accepted industry standard. Another example of IT governance discussion includes Larsen, Pedersen and Andersen's (2006) review of seventeen IT governance tools including the COBIT 4.0 framework. They evaluated which governance tools are best for a bio-tech company. Their paper demonstrates how different frameworks can and should be used in different domains. Other papers discuss and review different IT governance frameworks and how they can be combined and how they compliment each other (Salle & Mathias, 2004). IT governance frameworks have differing strategies for accomplishing their goals; however, several works have attempted to focus on the essential processes that IT performs. Luftman et al. (2004) defines thirty-eight IT processes performed by IT while the COBIT 4.0 framework defines thirty-four IT Processes.

While differing frameworks define different IT process there are many similarities. This paper examines a subset of the COBIT 4.0 framework processes and how they are represented within a wastewater treatment domain. This application utilizes the COBIT Quickstart implementation process. This process is recommended as a starting point for organizations with minimal IT governance resources and consists of six implementation steps (Appendix A) (ITGI, 2008).

Methodology

This investigation is exploratory, qualitative in nature, and uses an interpretive approach drawing on the opinions and experiences of professionals in the field of IT management. The purpose is to document the current as-is IT governance state at MWRD as prescribed by the COBIT Quickstart implementation process.

Prior to this study inquiries indicated there were no formal representations of the COBIT framework. Upon review of the COBIT framework I believe that this framework may be a good fit for a wastewater treatment plant because the domain is heavily controlled by regulations and has explicit parameters which must be met. This type of environment is ideal for COBIT implementation. While this framework is extensive and can involve considerable resources to implement there is an abbreviated form of the framework. The COBIT Quickstart is recommended for smaller organizations with increasing regulatory compliance and a critical dependence of business/IT processes (ITGI, 2008). This study covers the first two steps prescribed by the COBIT Quickstart framework implementation guide plus elements of the third and forth steps are represented. The first step of the COBIT Quickstart framework implementation includes suitability tests for organizations to evaluate their IT governance needs. The second step includes data gathering for a current state evaluation. Quickstart prescribed desired state metrics are included. Combined with the current state data, gaps in IT governance are revealed representing the third and fourth Quickstart steps. However, this study began with two suitability tests being administered.

The two suitability tests were presented to the MWRD CIO. These tests are prescribed by COBIT as the starting point for implementation. The first suitability test defines seven dimensions and asks questions related to these dimensions, see Appendix B. The second

suitability test examines exceptions to the first assessment test. This second test helps an organization decipher if their domain has exceptions where extensive COBIT implementation may not be needed.

Continuing with the investigation, nine IT processes were selected from the thirty-two listed in the COBIT Quickstart framework. These IT processes where picked from the four domains, Plan, Acquire, Deliver and Monitor (reference Table 2: IT processes and corresponding domains chosen for investigation). Since there were previous indications of limited formal representation of this framework being used at MWRD, two processes from the beginning of each domain lists were chosen representing an initial or phase one approach to the COBIT prescription. This would be considered the starting point for a multi-phase project that would eventually include all thirty-two IT processes (Appendix C). Based on the time limitations for this study the first two IT processes from each of the four domains were selected. This allowed representations from each one of the four domains. A third process from the Plan domain was included because it fit the time constraints and because it was a known area of weakness within the organization. The Plan and Organize process of "determine technological direction" was skipped since the technology is strongly dictated by wastewater treatment engineering practices. The IT processes chosen for examination are listed in Table 2. Figure 4 illustrates where these processes fit in the overall COBIT framework. Appendix C includes all COBIT processes and priorities used for this research. This research corresponds to a phase one, priority one COBIT processes. Future research would address a phase two project to examine priority two processes and so on to address all processes according to their priorities. Additionally, an example project plan is included for COBIT implementation in Appendix D. This project plan illustrates possible phases, implementation steps, process priorities and timelines for each interview needed. The

time estimates include some time allotted for interview transcription and coding. The following table (Table 2) summarizes the COBIT domains and IT process that were examined in this study.

	Domain	**IT Process**	**Description**
1	Plan and Organize	Define a strategic IT plan	Ensure that IT strategy is aligned with and supports the overall business strategy.
		Define the information architecture	Establish an enterprise data model that incorporates a data classification scheme to ensure the integrity and consistency of all data.
		Define the IT processes organization and relationships	Establish transparent, flexible and responsive IT organizational structures and define and implement IT processes with owners, roles and responsibilities integrated into business processes.
2	Acquire and Implement	Identify automated solutions	Identify technically feasible and cost-effective solutions.
		Acquire and maintain application software	Ensure that application software provides efficient, effective and economical support for the enterprise.
3	Deliver and Support	Define and manage service levels	Identify service requirements, agree on service levels and monitor the achievement of service levels.
		Manage third-party service	Manage and monitor the relationship with, and services delivered by, third parties to verify adherence to agreements and to mitigate potential risks.
4	Monitor and Evaluate	Monitor and evaluate IT performance	Monitor and report process metrics, and identify and implement, performance improvement actions.
		Monitor and evaluate internal control	Monitor the internal control processes for IT-related activities and identify improvement actions.

Table 2: IT processes and corresponding domain chosen for investigation (IT Governance Institute, 2008)

Interviews

The second step after assessment tests was determining the current state of IT governance within the organization. This step included gathering data, interviewing key staff and reviewing the performance of IT processes. Once IT processes were chosen, 60 minute interviews were scheduled with IT management staff and executive management. The personnel who where interviewed included the Director of Administrative Services, the CIO, the Applications Supervisor and the Control Systems Supervisor. These interviews focused on management practices, control objective metrics and IT process metrics used at MWRD for the chosen IT processes. The questions were framed to the interviewee as, "What documentation and measurements are used for each management practice?" (Appendix F and G). The questions were presented in an open format and the interviewee was encouraged to speak freely and openly about the topic. A model was constructed from these interviews. This model additionally contributes to step four of the COBIT implementation, Analyze Gaps (ITGI, 2008). Missing or incomplete documentation or metrics immediately indicates gaps in IT governance.

Project Analysis and Results

As stated in the COBIT Quickstart documentation "COBIT Quickstart provides a baseline for control over IT in small to medium enterprises and other entities where IT is less strategic and not as critical for survival" (ITGI, 2008). This research began with the COBIT Quickstart suitability tests. These two tests were administered to the CIO at MWRD. The first suitability test assesses to what degree an organization should implement COBIT and examines seven dimensions. These seven dimensions and their scoring definitions are listed in Appendix B. The results of the first assessment test are illustrated in Figure 3. MWRD scored high in the Simple Command Structure, IT Sophistication, and IT Strategic Importance dimensions. The CIO explained that these high scores were caused because MWRD uses specialized IT equipment within the wastewater domain such as programmable logic controllers and inline instrumentation. Additionally, the high scores are the effect from specialized industrial equipment, including clarifiers, aeration basins and digesters. This specialization has significant impact on meeting permit requirements.

There are significant financial consequences for not meeting these requirements and contributed to the high scores. The COBIT Quickstart documentation states that organizations with low scores may not gain as much benefit from COBIT implementation as from organizations which have high scores on this test (ITGI, 2008). The second suitability test further investigates the level of IT governance needed. It finds exceptions which are not examined in the first test. These exceptions may indicate that even an organization which scores low on the first assessment test should consider extensive IT governance implementation. The results from assessment test two are shown below in Table 3. Both assessment tests indicate that MWRD will benefit from IT governance implementation.

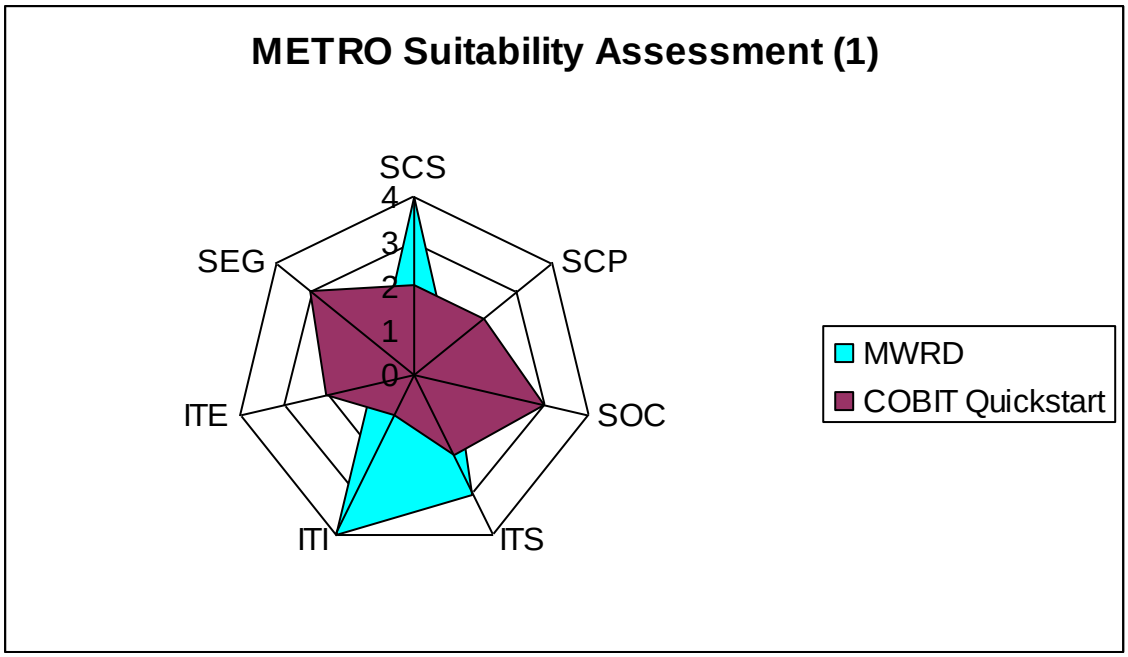

Figure 3: COBIT Quickstart suitability test one results. Simple Command Structure - SCS, Short Communication Path - SCP, Span of Control - SOC, IT Sophistication - ITS, IT Strategic Importance - ITI, IT Expenditure - ITE, Segregation – SEG See Appendix B for scoring and definitions (ITGI, 2008).

	Definitely disagree	**Somewhat disagree**	**Neither agree nor disagree**	**Somewhat agree**	**Fully agree**
The IT infrastructure is an open, as opposed to closed, system (interconnections with customers, suppliers, etc.).	X				
There are IT-related regulations or contractual requirements applying to the enterprise.	X				
There is a need to provide outside assurance about IT.					X
Enterprise management is aware of IT issues and wonders whether a minimum baseline is sufficient.					X
Enterprise management has identified the need for significant formal training relative to IT.					X
Some IT practices and procedures have been defined, standardized and documented in a sustainable manner.					X
Enterprise management knows that common tools would make some IT processes more effective and efficient.					X
The IT 'expert(s)' of the enterprise are needed for developing/improving business processes.					X

Table 3: COBIT Quickstart suitability test two results (ITGI, 2008)

During the initial interviews, the organization indicated that a recent capability maturity evaluation using the Capability Maturity Model (CMM) was conducted within the applications group. The CMM was developed by Watts Humphrey and was originally created to assess the effectiveness of a given software development process (McGovern, Ambler, Stevens, Linn ,

Sharan, & Elias, 2004). It originated from the U.S. Department of Defense to objectively assess the capability of contractors and their ability to deliver software (McGovern et al., 2004). This tool has evolved into a framework which can be used to assess an organization's ability to deliver the development of products, services and acquisition of products and services. The CMM examines key activity areas, goals, and practices when grading the capability of an organization. This CMM evaluation at MWRD included an outside consultant's examination and scoring the applications group of the MWRD IT department based on the Capability Maturity Model (CMM). While a discussion of CMM is outside the scope of this project the results support the finding of this paper. The maturity of a process is described as the extent to which a specific process is defined, managed, measured, controlled and made effective (McGovern et al., 2004). The maturity stages are presented in Appendix E. The maturity evaluation performed for MWRD resulted in key findings which correlated to the CMM definition for level one maturity. CMM level one maturity defines the processes within the applications group as undocumented, in a state of dynamic change, uncontrolled and reactive driven by users or events (McGovern et al., 2004). This evaluation concluded that the applications group had low or poor maturity. This outside evaluation provides more evidence that MWRD would benefit from improving their IT governance.

Director of Administration Services Interview

The questioning during the interview with The Director of Administrative Services was interviewd first using two open-ended questions. First, how does MWRD align business goals with IT goals? The second question was how does executive management measure IT success? The Director of Administrative Services said that the MWRD's Board of Directors as well as executive management lacks IT expertise, but has a great deal of trust in the IT department. This

would leave one to believe there would be considerable misalignment between executive management and IT: however, it seemed to be the opposite. The director said he was pleased with IT performance and believed the organization's needs were being met. Continuing with the IT success question, the director mentioned only employee performance appraisals are the means by which executive management measures IT success. Other factors contributing to this success include the assignment of key IT staff to specific organization functions to facilitate continuous direct communication. The director communicated that both users and executive management have been very satisfied with the alignment between organizational goals and IT goals.

The Model

After the Director of Administrative Services was interviewed the remaining interviews were conducted. The resulting model *Table 4*: MWRD Documentation and Metrics mapped to nineteen COBIT management practices was developed based on the interviews. It represents four COBIT domains and nineteen management practices. Some elements contain a does not exist as MWRD (DNE). Table 4 also includes the prescribed COBIT metric and represents a desired state for IT governance.

Domain	**Management Practices**	**Governing Document/System**	**Metro Control and Process Metric**	**Prescribed Process Metric**
1. Plan and Organize	1. Define the necessary IT contribution to the achievement.	-Utility Plan -Strategic Information Plan	-Performance Appraisals -IT survey	-Approved strategic plan
	2. Translate the strategic plan into short-term IT operations.	-IT Road Map	-Performance Appraisals	
	3. Create and maintain one list; identify and describe the major data elements for the	-Operational Data Systems Data Model	DNE	-Approved data model

	enterprise and their syntax rules, and consider who can access and modify.			
	4. Define and implement measures to ensure the integrity and consistency of all data stored in electronic form, such as databases.	-Organizational structure	DNE	
	5. Assign IT-related roles and responsibilities clearly, with proper authority and reasonable expectations, and communicate to all; pay attention to responsibilities in the area of security and quality.	-Organizational structure -IT Road Map	DNE	-number of delayed business initiatives -Percent of stakeholders satisfied
	6. Regularly review that IT-related roles and responsibilities are understood and exercised properly. Assess that people have the resources to exercise these responsibilities and be aware that concentrated roles and responsibilities can be misused.	-Organizational structure -IT Road Map	DNE	
	7. Define where outside contracting and/or outsourcing can be applied and how they are to be controlled.	-Emergency funding policies -Pre-qualified outside expertise -Feasibility studies	DNE	

2. Acquire and Implement	8. Be clear on how the solution will change and benefit the business and supporting processes. Ensure that the solution's functional and operational requirements are specified, including maintainability, performance, reliability, security and compatibility with current systems.	-Project action request (PAR) -Metro Track -Functional requirement documents	-Metro Track milestones -Stakeholder review/signoff -IT Survey	-Percent of users satisfied with functionality delivered
	9. In line with the IT strategic plan, carefully consider whether to buy or build. Contemplate alternative solutions and their feasibility, not excluding upgrading existing systems, doing nothing or applying manual solutions.	-Engineering project specifications -Feasibility studies -IS budget	-IT survey	
	10. Use a standard selection process when acquiring IT products or services. Base supplier selection process on fair and formal practice, and invite more than one vendor to bid.	-Statement of Interest -Request for proposal (driven by budget) -Technical review	-Number of PARs soul sourced	
	11. Ensure there is a good set of functional and operational requirements and review (a) together with key personnel, to ascertain the set records that the application needs to		-Incident case counts	-number of projects where benefits were not achieved due to poor design or development

	achieve, and (b) with the supplier/developer to verify that the needs are understood.			
	12. Obtain an application data model, processing descriptions and user documentation from the supplier/developer.	-All major apps include	DNE	
3. Deliver and Support	13. Identify services delivered by IT. Define, agree upon and regularly review service level agreements. They cover service support requirements, related costs, roles and responsibilities, etc., and should be expressed in business terms.	DNE	DNE	-number of services not covered by formal SLA
	14. Consider the dependence on third-party suppliers and mitigate continuity, confidentiality and intellectual property risk by, e.g., escrow, legal liabilities, penalties and rewards.	-Incident cases	-Incident case counts	-Cost of disputes with external suppliers -Number of SLAs not met due to supplier deficiencies
	15. Assess the professional capability of third parties and ensure they provide a clearly identified contact whoever has the authority to act upon enterprise requirements and	DNE	DNE	

	concerns.			
4. Monitor and Evaluate	16. Ensure that management and IT, as well as users and IT, discuss and agree on a limited number of relevant and measurable results and performance indicators of IT to be tracked on an ongoing basis. Results should be acted upon with improvement initiatives.	-Service request system -Individual Time Tracking System	DNE	-Amount of reduction in the number of outstanding process deficiencies
	17. Consider, but with caution, how comparable enterprises address IT issues and major IT decisions.	DNE	DNE	
	18. Monitor the control mechanisms identified for the IT activities and assess whether they are performed as expected. Correct where needed.	-ITT system	DNE	-Number of major internal control breaches
	19. Obtain, where needed, competent external resources to review the IT control mechanisms, assess compliance with law or regulations and appraise observance of contractual obligations relative to IT. Leverage their knowledge and experience for	-CMMI study -Intrusion/security evaluation	-CMMI study -Intrusion/security evaluation	

	internal use.			

Table 4: MWRD Documentation and Metrics Mapping to Nineteen COBIT Management Practices (Including COBIT Prescribed Process Metrics).

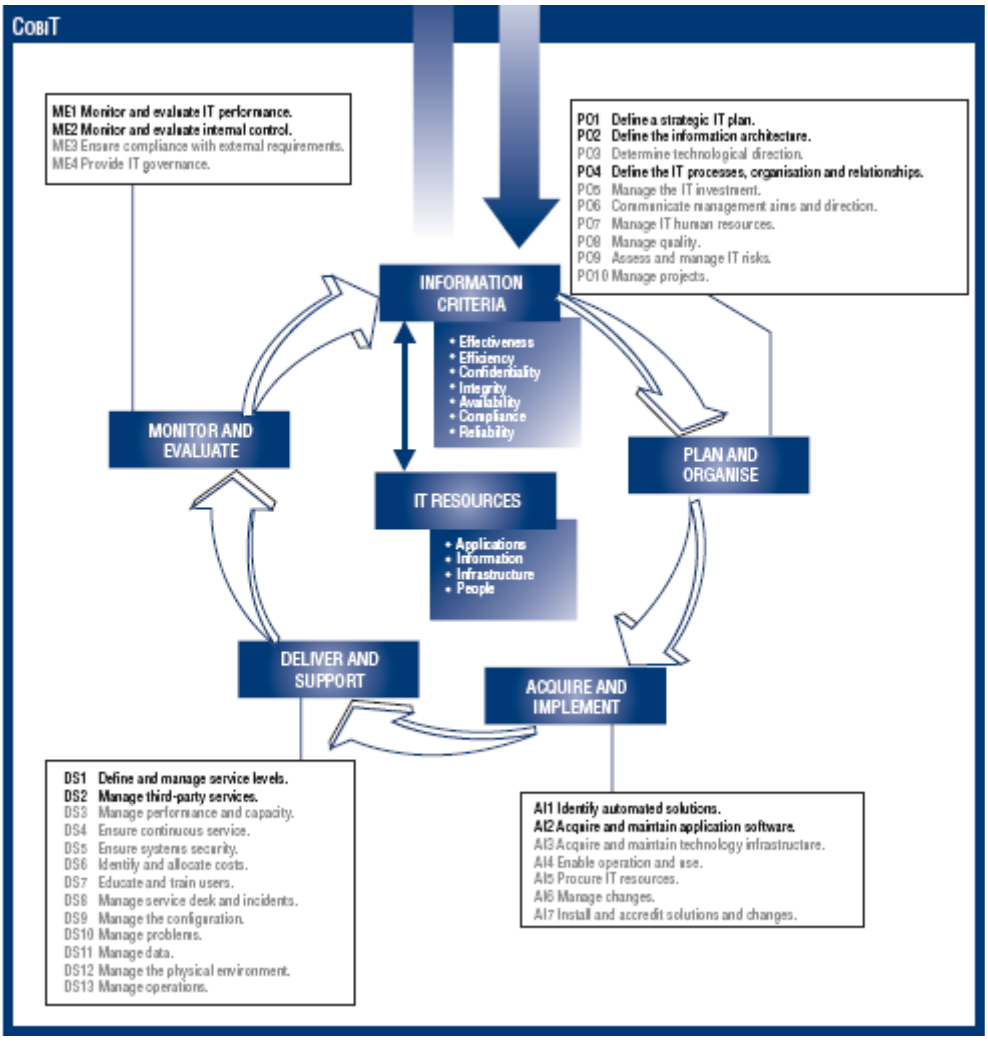

Figure 4: COBIT Framework (ITGI, 2008) Note. From COBIT Quickstart ITGI 2008 p 10. Copyright 2008 by IT Governance Institute. Reprinted with permission.

Conclusions

While IT governance is not formalized at MWRD, IT services are maintained at a successful level according to executive management. This is due in part to the direct access the members of the organization have with their IT staff, the centralization of IT, and an emphasis on customer service which is championed by the CIO. However this success is not objectively measurable. The success of the IT department is based more on feel than direct measurement. The lack of objective IT governance metrics puts the organization at risk because its performance is measured subjectively. Additionally, several indicators show that IT governance needs improvement at MWRD. Applying the first four steps outlined in the COBIT Quickstart implementation process, a current state model has been established for nine IT processes covering four IT domains. A prescribed desired state has been identified and this desired state shows gaps in IT governance. These gaps include missing documentation and standards, missing measurement metrics, or both. Additionally, processes where MWRD metrics are different from COBIT prescribed metrics may indicate further gaps in governance.

High scores in the areas of Simple Command Structure, IT Strategic Importance, and IT Sophistication from assessment tests indicate a need for improving IT governance at MWRD. MWRD has significant gaps in the Support and Deliver domain. This research provides the first steps in improving IT governance at MWRD and develops a framework that is suitable for other wastewater treatment plant IT departments.

References

Bakker, Dr. K. (2002). Good Governance in Restructuring Water Supply: A handbook. Federation of Canadian Municipalities. 24 Clarence Street Ottawa, Ontario K1N5P3.

Bortman, M., Brimblecombe, P., & Cunningham, M. (Eds.). (2003). *Environmental Encyclopedia* (3rd ed., 2 vols.). Detroit: Gale. Retrieved November 20, 2009, from Gale Virtual Reference Library via Gale: http://go.galegroup.com.dml.regis.edu/ps/start.do?p=GVRL&u=regis

Grover V., & Segars A. S. (2003). An Empirical Evaluation of Stages of Strategic Information Systems Planning: Patterns of Process Design and Effectiveness. Department of Management. Clemson University, 101 Sirrine Hall, Clemson, SC 29634

Gujer, S, & Gianella W. (2006). Improving the Information Governance of Public Utilities Through an Organizational Knowledge Base. Engineering Asset Management. London: Springer.

Holm M. L., Pedersen, M. K., & Andersen, K.V. (2006). IT Governance: Reviewing 17 IT Governance Tools and Analyzing the Case of Novozymes A/S. Proceedings of the 39th Hawaii International Conference on System Sciences. Retrieved August 14, 2009 from http://itu.dk IT University of Copenhagen.

IT Governance Institute. (2008). COBIT 4.1. Rolling Meadows, IL: IT Governance Institute.

IT Governance Institute. (2008). COBIT Quickstart 2nd Edition. Rolling Meadows, IL: IT Governance Institute.

IT Governance Institute. (2008). Understanding How Business Goals Drive IT Goals. Rolling Meadows, IL: IT Governance Institute.

IT Governance Institute. COBIT Case Study: Adnoc Distribution Implements COBIT for IT Value and Efficiency. Retrieved August 14, 2009 from www.isaca.org.

Kotz, J., Purcell, K. F. (1991). *Chemistry & Chemical Reactivity Second Edition*. Orlando, FL: Saunders College Publishing.

Luftman, J. N., Bullen, C. V., Liao, D., Elby N., & Neumann C. (2004). *Managing the Information Technology Resource.* Upper Saddle River, New Jersey: Pearson Education, Inc.

Mathias, S. (2004). IT Service Management and IT Governance: Review, Comparative Analysis and their Impact on Utility Computing. Trusted Systems Laboratory HP Laboratories Palo Alto.

McGovern, J, Ambler, S. W., Stevens M. E., Linn J., Sharan, V., & Elias, K. Jo. (2004). *A Practical Guide to Enterprise Architecture.* Upper Saddle River, New Jersey: Prentice Hall.

Metro Wastewater Reclamation District. (2009). Tables of Organization. Denver, CO.

Metro Wastewater Reclamation District. (2009). Service Area. Denver, CO.

Metro Wastewater Reclamation District. (2009). CMM Results. Denver, CO.

Ohio History Central. 2005. Cuyahoga River Fire. Retrieved from http://www.ohiohistorycentral.org/entry.php?rec=1642

U.S. Environmental Protection Agency (2000) Clean Water Needs Survey Report to Congress. Environmental Protection Agency Office of Wastewater Management, Retrieved from http://www.epa.gov/owm/mtb/cwns/2000rtc/toc.htm

Wilkins, A. (2002). E-mail Records and Knowledge Management: The Hidden Risk. Information Systems Control Journal, Volume 4, 2002. Retrieved August 14, 2009 from www.isaca.org.

World News Digest. (2009). Water Pollution. Retrieved from Facts On File News Services http://www.2facts.com.dml.regis.edu

Appendix A: COBIT Quickstart Implementation Process

Process Step	**Process Description**	**Deliverable**
1. Assess suitability.	Apply the suitability assessment tool provided in *Quickstart* to determine if the organization is a suitable candidate for the use of the *Quickstart* approach. The outcome will indicate whether the program can be used as is or as supplemented with some of the more detailed components of the full COBIT, or the full COBIT should be applied from the outset.	Decision on use of *COBIT Quickstart*
2. Evaluate current state.	Use the *Quickstart* baseline charts to define the organizations as-is position. Typical activities in this step involve basic data gathering, interviewing of key staff responsible for these processes, and review of performance results or audit reports. Alternatively, a working team of knowledgeable staff can be assembled to work with a facilitator to fast-track the process.	As-is process positions
3. Determine target state.	Consider the organization's operating environment and plot its to-be position on the *Quickstart* process tables. Typical considerations include: • Nature of the industry • Legal and regulatory requirements • Sensitivity of information handled • Technology dependency • Business and IT goals It is important that this positioning be developed by the organization's management and owners, if possible, but at least approved by them.	To-be process positions
4. Analyze gaps.	Examine the control practices associated with each process gap (difference between the as-is and to-be positions) to determine the nature and magnitude of improvements required.	Process change definitions
5. Define projects.	Group the individual process change requirements logically into improvement projects—projects that enable the organization to make effective progress in manageable stages.	Process improvement
6. Develop an Integrated governance implementation program.	Organize, prioritize and sequence the improvement projects into an integrated program plan taking into account the organization's immediate needs, project interdependencies and resource availability.	Integrated program plan

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Appendix B: Scoring for the Seven Dimensions of Assessment Test 1

The first COBIT Quickstart assessment test provides a tool to assist management decide if a more rigorous approach should be considered when implementing this framework. It is the starting point to COBIT implementation as prescribed by COBIT.

Simple Command Structure (SCS)

This dimension measures the degree to which authority, rules and control are institutionalized in the organization. This command structure varies from very informal and verbal to strictly formal and documented. Moreover, long-term/short-term orientation and the strategic/tactical direction imposed by the command structure are evaluated. The presence of more formal and documented structures and longer-term strategic views suggests that higher levels of control are needed.

Scoring

1. CS is informal and verbal, only short-term and tactical.
2. CS is primarily informal and verbal, somewhat short-term but largely medium-term-oriented, and still primarily tactical.
3. CS is primarily formal and documented, begins looking at the long-term but is more medium-term-oriented, somewhat tactical with strategic views emerging.
4. CS is strictly formal and documented, covers short-, medium- and long-term and is strategy-oriented.

Short Communications Path (SCP)

The communication path component indicates how many layers are situated between the head of the entity (HE) and the IT staff. This illustrates how directly, quickly and efficiently the HE can communicate with the IT staff, and is measured by determining how well the HE knows the staff's IT-related responsibilities. This assumes that the more direct the communication path, the better the IT-related responsibilities are known. The organization may need to look for control requirements beyond *Quickstart* if the HE does not know most people's IT responsibilities.

Scoring

1. HE (Head of the entity) knows everyone's IT-related responsibilities.
2. HE knows most people's IT-related responsibilities.
3. HE knows IT-related responsibilities only for key personnel.
4. HE does not know all IT-related responsibilities of key personnel.

Span of Control (SOC)

While the previous step assessed the degree to which the HE knows everyone's IT-related responsibilities, this dimension measures the influence the HE has on those responsibilities. This influence is rated by indicating which IT related responsibilities the HE effectively directs and monitors, varying from directing and monitoring no IT-related responsibilities at all, to directing

and monitoring every IT-related responsibility. Not knowing IT responsibilities of at least key personnel is an indicator that a larger control framework is required.

Scoring

1. HE directs and monitors everyone's IT-related responsibilities.
2. HE directs and monitors most people's IT-related responsibilities.
3. HE directs and monitors only key personnel's IT-related responsibilities.
4. HE does not direct and monitor all IT-related responsibilities of key personnel.

IT Sophistication (ITS)

The IT sophistication component refers to the profile of the organization with regard to the adoption of new technologies and the complexity of the IT environment relative to industry and peers. This profile ranges from being a pioneer, adopting new technologies well before industry in a complex IT environment, to being a laggard, adopting new technologies well behind peers and industry while keeping the infrastructure simple. Taking a technology leadership position and working in a complex IT environment evoke the possibility of larger risks and wider control requirements.

Scoring

1. Laggard, well behind in technology adoption, with a simple IT infrastructure
2. Follower, adopting technology after peers, using more, but still standard, components
3. Leader, adopting technology before peers, customizing and integrating solutions
4. Pioneer, early adopter of new emerging technology well ahead of the industry, highly complex IT environment

IT Strategic Importance (ITI)

This dimension evaluates how dependent the organization is on IT to operate and function, and to achieve competitive advantage and success. This dimension is the equivalent of the traditional McFarlan quadrant 1, which positions organizations based on current and future dependency on IT. From the moment IT is critical to support current operations, additional controls may be needed to manage that criticality.

Scoring

1. Reliable IT is not critical to the functioning of the enterprise and is not likely to become strategically important.
2. Reliable IT support is critical to the enterprise's current operation, but the application development portfolio is not fundamental to the enterprise's ability to compete.
3. Uninterrupted functioning of IT is not absolutely critical to achieving current objectives but applications and technology under development will be critical to future competitive success.

4. Reliable IT support is critical to the enterprise's current operation, and applications and technology under development are critical to future competitive success.

IT Expenditure (ITE)

The IT expenditure component is closely linked to the IT sophistication and IT strategic importance dimensions, and ranks the organization based on its IT expenditure relative to profit and compared to peers. Furthermore, the increasing trend of the total IT expenditure is taken into account. If IT expenditure increases yearly, surpasses profits or differs significantly from industry peers, it is prudent to consider stronger controls. Not-for-profit enterprises usually can avoid referring to profits and, instead, judge IT expenditure based on peer expenditures and their own expenditure trends.

Scoring

1. IT expenditure is not more than profits and not much different from peers.
2. IT expenditure is different from peers and only marginally increasing every year.
3. IT expenditure is more than profits or significantly different from peers and is showing an annual increasing trend.
4. IT expenditure is significantly more than the entity's profits.

Segregation (SEG)

The segregation dimension checks whether the responsibilities for building, operating and influencing IT solutions and monitoring same are overly concentrated in one person or, instead, are distributed properly over more people. There is insufficient segregation when a single person executes too many of these functions. The fact that management has implemented a certain degree of segregation indicates a level of concern and risk that is more consistent with a larger control framework.

Scoring

1. Those who monitor have at least two other functions (build, operate or influence).
2. Those that monitor have at most building or operating as other functions. Those who influence also can have building and operating functions.
3. Monitoring is totally segregated, but building and operating can be executed by the same person. Those who influence have at most operating or building as other functions.
4. At most, influencing and monitoring is executed by one person.

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Appendix C: COBIT Quickstart Domains and IT Processes Prioritized for this Study

	Domain	**IT Process**	**Priority**
1	Plan and Organize	Define a strategic IT plan	1
		Define the information architecture	1
		Determine technological direction	2
		Define the IT processes organization and relationships	1
		Manage the IT investment	2
		Communicate management aims and direction	2
		Manage IT Human Resources	3
		Manage quality	3
		Assess and manage IT risks	4
		Manage projects	4
2	Acquire and Implement	Identify automated solutions	1
		Acquire and maintain application software	1
		Acquire and maintain technology infrastructure	2
		Enable operation and use	2
		Procure IT resources	3
		Manage changes	3
		Install and accredit solutions and changes	4
3	Deliver and Support	Define and manage service levels	1
		Manage third-party service	1
		Manage performance and capacity	2
		Ensure continuous service	2
		Ensure systems security	2
		Identify and allocate costs	3
		Educate and train users	3
		Manage service desk and incidents	3
		Manage the configuration	3
		Manage problems	4
		Manage Data	4
		Manage the physical environment	4
		Manage operations	4
4	Monitor and Evaluate	Monitor and evaluate IT performance	1
		Monitor and evaluate internal control	1
		Ensure compliance with external requirements	2
		Provide IT governance	4

Appendix D: Timeline for Research and Continuing Projects, (Phase 1 Complete).

	COBIT Implementation Step	Process Deliverable	Time (Hrs)/Manager Interview & Write up														
Phase 1																	
	1 Assess Suitability																
		Assessment Test 1	1														
		Assessment Test 2		1													
	2 Evaluate Current State																
		Priority 1 Processes			2												
	3 Determine Target State																
		Priority 1 Processes				2											
	4 Analyze Gaps																
		Priority 1 Processes					2										
Phase 2																	
	2 Evaluate Current State																
		Priority 2 Processes						2									
	3 Determine Target State																
		Priority 2 Processes							2								
	4 Analyze Gaps																
		Priority 2 Processes								2							
Phase 3																	
	2 Evaluate Current State																
		Priority 3 Processes									2						
	3 Determine Target State																
		Priority 3 Processes										2					
	4 Analyze Gaps																
		Priority 3 Processes											2				
Phase 4																	
	2 Evaluate Current State																
		Priority 4 Processes												2			
	3 Determine Target State																
		Priority 4 Processes													2		
	4 Analyze Gaps																
		Priority 4 Processes														2	
Phase 5																	
	5 Define Projects																
		…															
Phase 6																	
	6 Develop Governance Program																
		…															

This study represents phase 1 from the above timeline above. This timeline corresponds to each manager interviewed and includes time for write up after interviews and represents time for one manager.

Appendix E: Capability Maturity Levels

Level	**Description**
Level 1: Initial	Ad hoc and occasionally, chaotic with few processes defined.
Level 2: Repeatable	Basic project management processes established so earlier successes can be repeated.
Level 3: Defined	Documentation and standardization is integrated into processes.
Level 4: Quantitatively Managed	Detailed measurement of processes and quality are collected. Processes and products are quantitatively understood and controlled.
Level 5: Optimizing	Continuous process improvement is enabled.

(McGovern et al., 2004)

Appendix F: Interview questions

Questions began with “Describe the documentation and measurement metrics for the following management practices”.

1. How does the organization define the necessary IT contribution to the achievement?
2. Translate the strategic plan into short-term IT operations.
3. Create and maintain one list; identify and describe the major data elements for the enterprise and their syntax rules.
4. Define and implement measures to ensure the integrity and consistency of all data stored in electronic form.
5. Assign IT-related roles and responsibilities clearly, with proper authority and reasonable expectations, and communicate to all.
6. Regularly review that IT-related roles and responsibilities are understood and exercised properly. Assess that people have the resources to exercise these responsibilities.
7. Define where outside contracting and/or outsourcing can be applied and how they are to be controlled.
8. Be clear on how the solution will change and benefit the business and supporting processes. Ensure that the solution’s functional and operational requirements are specified, including maintainability, performance, reliability, security and compatibility.
9. In line with the IT strategic plan, carefully consider whether to buy or build. Contemplate alternative solutions and their feasibility, not excluding upgrading existing systems, doing nothing or applying manual solutions.
10. Use a standard selection process when acquiring IT products or services. Base supplier selection process on fair and formal practice, and invite more than one vendor to bid.

11. Ensure there is a good set of functional and operational requirements and review (a) together with key personnel, to ascertain the set records that the application needs to achieve, and (b) with the supplier/developer to verify that the needs are understood.

12. Obtain an application data model, processing descriptions and user documentation from the supplier/developer.

13. Identify services delivered by IT. Define, agree upon and regularly review service level agreements. They cover service support requirements, related costs, roles and responsibilities, etc., and should be expressed in business terms.

14. Consider the dependence on third-party suppliers and mitigate continuity, confidentiality and intellectual property risk by, e.g., escrow, legal liabilities, penalties and rewards.

15. Assess the professional capability of third parties and ensure they provide a clearly identified contact who has the authority to act upon enterprise requirements and concerns.

16. Ensure that management and IT, as well as users and IT, discuss and agree on a limited number of relevant and measurable results and performance indicators of IT to be tracked on an ongoing basis. Results should be acted upon with improvement initiatives.

17. Consider, but with caution, how comparable enterprises address IT issues and major IT decisions.

18. Monitor the control mechanisms identified for the IT activities and assess whether they are performed as expected.

19. Obtain, where needed, competent external resources to review the IT control mechanisms, assess compliance with law or regulations and appraise observance of contractual obligations relative to IT.

Appendix G: Interview Transcripts

Interviewer: Ray Sandoval

Interviewees: 1. Director of Administration Services

2. Information Services Officer

3. Control Systems Supervisor

4. Applications Supervisor

Interviewees were asked to describe the documentation and/or systems and control and process measurement metrics for management practices. The question was in the form of a description of the management practice.

Interview with Director of Administration Services 8/6/2009

Interviewer: How do you align organizational goals with IT goals?

Interviewee: Our board lacks IT expertise and we rely on the expertise of our IT department. We have steering committees and update meetings where IT projects are guided and evaluated but overall we have a great deal of trust and faith in our IT department.

Interviewer: How do you measure the performance of IT?

Interviewee: We rely on performance appraisals. Project timelines and goals are contained within appraisals and this is the primary mechanism we use to monitor performance.

Interview with Information Services Office 9/17/2009

Interviewer: How does the organization define the necessary IT contribution to the achievement?

Interviewee: Executive management creates the 20 year utility plan. This is the overall plan and direction the plant is headed with projects, capacity and permit requirements. I do not view this as strategic, it is an operational document.

Interviewer: Translate the strategic plan into short-term IT operations

Interviewee: I create the Stategic Information Technology Plan (SIP) document which is updated annually. This specifies the IT department's strategy. In the past there was considerable discontent with IT performance. We have since centralized IT and become far more service oriented. This shift is reflected in the SIP. Another document I use is the IT road map. This document lists all applications and systems we manage, category, upgrade cycle, users, critical nature and primary staff. It outlines the short-term IT operations. Additionally I conduct an IT services update meeting biannually. I present this update to executive management, the comprehensive planning committee and some board members.

Interviewer: Create and maintain one list; identify and describe the major data elements for the enterprise and their syntax rules, and consider who can access and modify.

Interviewee: This has not been well documented however our current ODS project has captured a great deal of this information. We have had a firm come in and do a systems analysis and requirements gathering project which is where this info resides.

Interviewer: Define and implement measures to ensure the integrity and consistency of all data stored in electronic form, such as databases.

Interviewee: Our IT managers are responsible for this. It is not well documented.

Interviewer: Assign IT-related roles and responsibilities clearly, with proper authority and reasonable expectations, and communicate to all; Pay attention to responsibilities in the area of security and quality.

Interviewee: Our department structure and the IT road map document this.

Interviewer: Regularly review that IT-related roles and responsibilities are understood and exercised properly. Assess that people have the resources to exercise these responsibilities and be aware that concentrated roles and responsibilities can be misused.

Interviewee: Due to our size we have considerable overlap in duties. Our tech services department has the best separation of duties.

Interviewer: Define where outside contracting and/or outsourcing can be applied and how they are to be controlled.

Interviewee: We have no formal documentation of how contractors are controlled. This is done on a project by project basis. If funds were available contractors would be used for project management. Project management is an overall weakness.

Interviewer: Be clear on how the solution will change and benefit the business and supporting processes. Ensure that the solution's functional and operational requirements are specified, including maintainability, performance, reliability, security and compatibility with current systems.

Interviewee: We use the PAR system which contains basic project information, stake holders, phase and status. There is only limited timeline information and no budget information. We use another system called Metro Track to record budget, timeline and milestones. IS works with users to develop system requirements.

Interviewer: In line with the IT strategic plan, carefully consider whether to buy or build. Contemplate alternative solutions and their feasibility, not excluding upgrading existing systems, doing nothing or applying manual solutions. If there is no clear idea about how to improve business processes, do not inject technology

Interviewee: We do not track feasibility study information but these are rarely on time but I control the budget so they stay on budget.

Interviewer: Use a standard selection process when acquiring IT products or services. Base supplier selection process on fair and formal practice, and invite more than one vendor to bid.

Interviewee: Anything over 25K we formalize with purchasing and send out RFPs. The dollar amount drives which process we use.

Interviewer: Ensure there is a good set of functional and operational requirements and review (a) together with key personnel, to ascertain the set records that the application needs to achieve, and (b) with the supplier/developer to verify that the needs are understood.

Interviewee: We do not have SLAs but this is an area we know we can improve upon.

Interviewer: Obtain an application data model, processing descriptions and user documentation from the supplier/developer.

Interviewee: We have these for our major applications.

Interviewer: Identify services delivered by IT. Define, agree upon and regularly review service level agreements. They cover service support requirements, related costs, roles and responsibilities, etc., and should be expressed in business terms.

Interviewee: doesn't apply.

Interviewer: Consider the dependence on third-party suppliers and mitigate continuity, confidentiality and intellectual property risk by, e.g., escrow, legal liabilities, penalties and rewards.

Interviewee: This is not documented but I handle when there are problems.

Interviewer: Assess the professional capability of third parties and ensure they provide a clearly identified contact who has the authority to act upon enterprise requirements and concerns.

Interviewee: The size of the application and critical nature dictate quick service. Internally we have issues with unclear roles when one staff thinks another is handling an issue while the other thinks the same. We are currently revising our on call services due to this.

Interviewer: Ensure that management and IT, as well as users and IT, discuss and agree on a limited number of relevant and measurable results and performance indicators of IT to be tracked on an ongoing basis. Results should be acted upon with improvement initiatives.

Interviewee: None of this is well defined and we need to improve. We get some of this from our IT surveys. Our time tracking software has been used to identify where to much time was being spent writing reports for our financial application.

Interviewer: Consider, but with caution, how comparable enterprises address IT issues and major IT decisions.

Interviewee: This is pretty hard to compare, we are very specialized and very few plants our as big as us. We do some bench marking on the tech services side with number of PCs and maintenance budgets.

Interviewer: Monitor the control mechanisms identified for the IT activities and assess whether they are performed as expected. Correct where needed.

Interviewee: We don’t have any other mechanisms other than time tracking. An example where we just corrected some issues is with our help desk ringing to all techs.

Interviewer: Obtain, where needed, competent external resources to review the IT control mechanisms, assess compliance with law or regulations and appraise observance of

contractual obligations relative to IT. Leverage their knowledge and experience for internal use.

Interviewee: We hire an outside firm to test our network security and intrusion. We have always done well in this area. A major control breach we currently have is our division head can change operational data without IS knowing.

Interview with Control Systems Supervisor 8/28/2009

Interviewer: How does the organization define the necessary IT contribution to the achievement?

Interviewee: I consider the utility plans as our bible it allows us to schedule projects, plan resources and understand the capacity and systems we need. The utility plans describe what IT needs to support.

Interviewer: Translate the strategic plan into short-term IT operations.

Interviewee: Essentially I assign different resources to different areas and projects. These individuals are responsible for their areas and I am continually evaluating if we have the capacity and skill set to manage the control systems. We are working closely with the treatment division daily to make sure their needs are being met.

Interviewer: Create and maintain one list; identify and describe the major data elements for the enterprise and their syntax rules, and consider who can access and modify.

Interviewee: The PI system really holds all the data points we configure. This is a proprietary system and their documentation is used as the source for syntax. All personnel in our group can modify these elements but responsibility assignment provides some segregation of who modifies what elements.

Interviewer: Define and implement measures to ensure the integrity and consistency of all data stored in electronic form, such as databases.

Interviewee: Our PI system really dictates this. We don't consider this that much and have to correct data often. We have users that can change data and this causes us issues.

Interviewer: Assign IT-related roles and responsibilities clearly, with proper authority and reasonable expectations, and communicate to all; Pay attention to responsibilities in the area of security and quality.

Interviewee: We have pretty clear responsibility roles. Like I said our staff is dedicated to specific areas.

Interviewer: Regularly review that IT-related roles and responsibilities are understood and exercised properly. Assess that people have the resources to exercise these responsibilities and be aware that concentrated roles and responsibilities can be misused.

Interviewee: This is continually reviewed; our users are happy and are we are getting the job done. This is reviewed with each new project. I use intuition to select staff for projects. I look at their skills, past performance, dynamics of project and even politics of projects.

Interviewer: Define where outside contracting and/or outsourcing can be applied and how they are to be controlled.

Interviewee: We define where outside contracting is needed even before projects start or at least in the project definition phase. We have already identified that we have enough resources for the south plant upgrades but not enough for the new north plant project. We also have emergency budgeting for issues we need to expedite. We pre qualify outside contractors and venders for this purpose. If we have problems we need help with we know exactly who to call and we know they have the skills and we have the budget.

Interviewer: Be clear on how the solution will change and benefit the business and supporting processes. Ensure that the solution's functional and operational requirements are specified, including maintainability, performance, reliability, security and compatibility with current systems.

Interviewee: We meet with our users groups to define this. These meetings are held monthly with treatment, engineering and superintendant. Project meetings are held outside these monthly meetings. User requirements are captured at projects meetings and monthly meetings are for planning and assessment of needs.

Interviewer: In line with the IT strategic plan, carefully consider whether to buy or build. Contemplate alternative solutions and their feasibility, not excluding upgrading existing systems, doing nothing or applying manual solutions. If there is no clear idea about how to improve business processes, do not inject technology.

Interviewee: We are really dependent on the systems we purchase and our contracts with our venders. We user their proprietary hardware and software, they won the bid so now we are locked into using their systems. It would be traumatic to switch some of our systems at this point. Even upgrades can turn into significant projects. A lot of this is driven be the engineers feasibility studies. Engineering hires contractors to do studies and these consultants write up the feasibility studies.

Interviewer: Use a standard selection process when acquiring IT products or services. Base supplier selection process on fair and formal practice, and invite more than one vendor to bid.

Interviewee: We work with the engineers and purchasing for bids and statement of qualifications but because of our vender contracts and prequalification process this has a low priority.

Interviewer: Ensure there is a good set of functional and operational requirements and review (a) together with key personnel, to ascertain the set records that the application needs to achieve, and (b) with the supplier/developer to verify that the needs are understood.

Interviewee: We do not have any formal SLAs or records of down time but we submit incident cases to venders. We currently have 10 open cases with our vender.

Interviewer: Obtain an application data model, processing descriptions and user documentation from the supplier/developer.

Interviewee: This is well documented from ABB.

Interviewer: Identify services delivered by IT. Define, agree upon and regularly review service level agreements. They cover service support requirements, related costs, roles and responsibilities, etc., and should be expressed in business terms.

Interviewee: This is not a formal process we accomplish this through our monthly and projects meetings.

Interviewer: Consider the dependence on third-party suppliers and mitigate continuity, confidentiality and intellectual property risk by, e.g., escrow, legal liabilities, penalties and rewards.

Interviewee: We are very dependent on our venders, we user their proprietary systems we have to maintain those relationships.

Interviewer: Assess the professional capability of third parties and ensure they provide a clearly identified contact who has the authority to act upon enterprise requirements and concerns.

Interviewee: This is pretty clear, like I said we have prequalification processes and emergency plans, responsibilities and emergency budgets in place.

Interviewer: Ensure that management and IT, as well as users and IT, discuss and agree on a limited number of relevant and measurable results and performance indicators of IT to be tracked on an ongoing basis. Results should be acted upon with improvement initiatives.

Interviewee: We don't really have any formal in place. Our permit compliance and user satisfaction are our performance indicators.

Interviewer: Consider, but with caution, how comparable enterprises address IT issues and major IT decisions.

Interviewee: We have compared our IT challenges to elements of the upstream oil and gas industry. Nothing formal but we do see many similarities.

Interviewer: Monitor the control mechanisms identified for the IT activities and assess whether they are performed as expected. Correct where needed.

Interviewee: Historically we have discussed that IT needed more control with projects. We've learned that IT needs to be involved with the engineering pre-design or else the project will fail.

Interviewer: Obtain, where needed, competent external resources to review the IT control mechanisms, assess compliance with law or regulations and appraise observance of contractual obligations relative to IT. Leverage their knowledge and experience for internal use.

Interviewee: Out of time.

Interview with Applications Supervisor 9/9/2009

Interviewer: Create and maintain one list; identify and describe the major data elements for the enterprise and their syntax rules, and consider who can access and modify.

Interviewee: All our major applications contain this information. We have primary and secondary responsibilities defined for access and modification.

Interviewer: Assign IT-related roles and responsibilities clearly, with proper authority and reasonable expectations, and communicate to all; Pay attention to responsibilities in the area of security and quality.

Interviewee: We have specific roles defined.

Interviewer: Regularly review that IT-related roles and responsibilities are understood and exercised properly. Assess that people have the resources to exercise these responsibilities and be aware that concentrated roles and responsibilities can be misused.

Interviewee: We do this through performance appraisals and project management.

Interviewer: Define where outside contracting and/or outsourcing can be applied and how they are to be controlled.

Interviewee: The scope of projects really define outside resource needs. We use outside help to scope projects, define complexity. We've used outside help for EAM, intranet, Ceridian, payroll and HR systems. Once we started down an Oracle upgrade and suddenly needed outside help due to staffing changes.

Interviewer: Be clear on how the solution will change and benefit the business and supporting processes. Ensure that the solution's functional and operational requirements are specified, including maintainability, performance, reliability, security and compatibility with current systems.

Interviewee: An example of this would be our ODS replacement project. We work with stakeholders to define functional requirements. We give them an opportunity to review functional requirements, they have always been satisfactory.

Interviewer: In line with the IT strategic plan, carefully consider whether to buy or build. Contemplate alternative solutions and their feasibility, not excluding upgrading existing systems, doing nothing or applying manual solutions. If there is no clear idea about how to improve business processes, do not inject technology.

Interviewee: We work with our stakeholders to align our efforts; we use contractors to perform feasibility studies and document requirements. These feasibility studies typically take longer and cost more than we plan. We don't formally document this but we do have notes in the project plan.

Interviewer: Use a standard selection process when acquiring IT products or services. Base supplier selection process on fair and formal practice, and invite more than one vendor to bid.

Interviewee: We have a pretty standard process for hiring contractors. We work with purchasing to find contractors who are interested in doing the work and require a statement of qualifications, this is reviewed. Once the project is defined request for proposals are sent out. There are technical reviews and reviews by stake holders. This is all pretty standardized.

Interviewer: Ensure there is a good set of functional and operational requirements and review (a) together with key personnel, to ascertain the set records that the application needs to achieve, and (b) with the supplier/developer to verify that the needs are understood.

Interviewee: We have functional requirements for all major applications. We do not have any formal SLAs or quality assurance plans in place.

Interviewer: Obtain an application data model, processing descriptions and user documentation from the supplier/developer.

Interviewee: We have data models and documentation for all major systems.

Interviewer: Identify services delivered by IT. Define, agree upon and regularly review service level agreements. They cover service support requirements, related costs, roles and responsibilities, etc., and should be expressed in business terms.

Interviewee: We do not have anything formal in place. Most of this performance success or failure is obtained through IS survey.

Interviewer: Consider the dependence on third-party suppliers and mitigate continuity, confidentiality and intellectual property risk by, e.g., escrow, legal liabilities, penalties and rewards.

Interviewee: We typically rely on vender incident desks. Mark deals with costs and legal liabilities.

Interviewer: Assess the professional capability of third parties and ensure they provide a clearly identified contact who has the authority to act upon enterprise requirements and concerns.

Interviewee: We use statement of qualifications to assess professional capability. We have had some time lost incidents due to overlapping roles and responsibilities.

Interviewer: Ensure that management and IT, as well as users and IT, discuss and agree on a limited number of relevant and measurable results and performance indicators of IT to be tracked on an ongoing basis. Results should be acted upon with improvement initiatives.

Interviewee: We do not have anything formal for this. Our service request system and now our ITT system capture some of this information.

Interviewer: Consider, but with caution, how comparable enterprises address IT issues and major IT decisions.

Interviewee: It is difficult to bench mark due to the uniqueness of our environment. We rely on our users.

Interviewer: Monitor the control mechanisms identified for the IT activities and assess whether they are performed as expected. Correct where needed.

Interviewee: Again we rely on user meetings, surveys, service requests and time tracking.

Interviewer: Obtain, where needed, competent external resources to review the IT control mechanisms, assess compliance with law or regulations and appraise observance of contractual obligations relative to IT. Leverage their knowledge and experience for internal use.

Interviewee: We use venders to evaluate our performance, last year we did poorly on a maturity evaluation.

Glossary

CIO - Chief Information Officer, An individual responsible for managing all information technology needs.

CMM - Capability Maturity Model, a framework for assessing and improving the software development process.

COBIT - Control Objectives for Information and related Technology, a framework tool for managing information technology and ensuring alignment between business objectives and information technology objectives.

EPA - Environmental Protection Agency, is the federal agency responsible for reducing pollution and protecting the environment.

ITGI - Information Technology Governance Institute, the organization responsible for developing the Control Objectives for Information and related Technology framework.

ITT - Individual Time Tracking, the software application used at Metro Wastewater Reclamation District for tracking information services employees.

MWRD - Metro Wastewater Reclamation District, the wastewater treatment authority for the greater Denver metropolitan area.

NPDES - National Pollutant Discharge Elimination System, a Clean Water Act provision which prohibits discharge into the nations waters without special permit.

PAR - Project Action Request, the system in place and Metro Wastewater Reclamation District for initiating and tracking projects.

WWTP - Wastewater Treatment Plant, an industrial site responsible for reducing pollutants in wastewater.

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