Decision Support Systems for Wastewater Facilities Management

During the past few decades, wastewater utilities have invested significant funds and efforts in automation and information technology (IT). Yet, the current view shared by many professionals in the water and wastewater industry is that these investments have largely produced isolated islands of automation and that the benefits have been limited. This report provides analyses of the issues related to decision support and provides a conceptual but implementable solution.

The scope of this research is broad because wastewater utility management includes a wide variety of decision-making processes on several levels (strategic, tactical, and operational). By nature, operational decisions such as closing gates or valves require short-term decisions, whereas tactical decisions, as in the case of scheduling crews or sensor calibration, have a longer time constraint. Strategic decisions have the longest time constraint and involve more resources (facilities expansion, for example). To address these diverse issues in a consistent and coherent way, it is necessary to adopt an approach that makes sense across the range of business needs and issues.

DSS Defined

Decision support systems can be defined as a set of hardware and software tools that provide meaningful information, guidance, and support in the execution of business processes. The term has been used to describe systems that vary greatly in scope, functionality, and architecture. In many wastewater utilities, specific business processes have been addressed by stand-alone and separate IT solutions that focus on a specific business domain such as maintenance management, laboratory, process control, or mathematical models. Generally, these

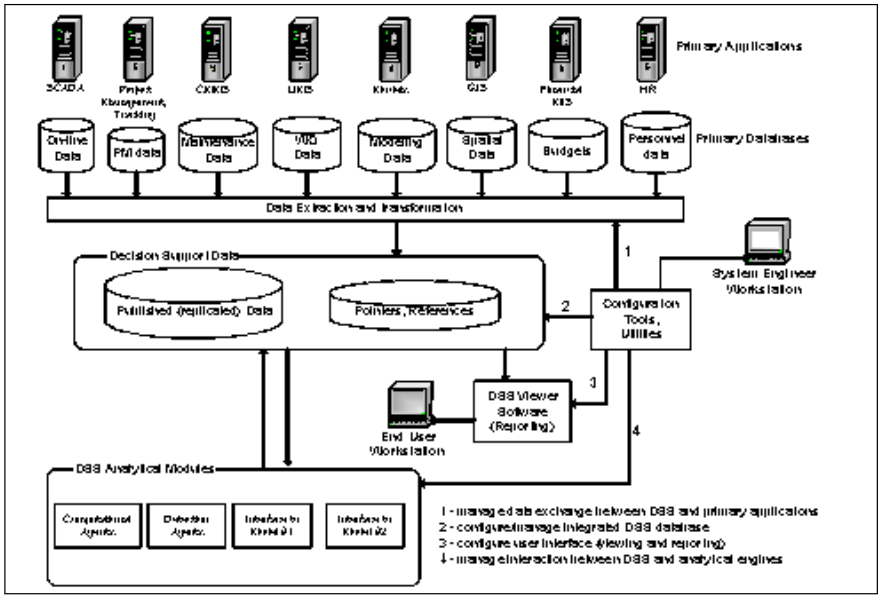

Figure 1. Context for DSS: Generic View of Components within Overall Architecture.

BENEFITS

- Assists decision makers to better use their information technology resources.
- Highlights the diversity and complexity of decision support system applications.
- Describes how investments into IT are best leveraged to improve the management of wastewater agencies.
- Defines the specific functional requirements for DSS for a wastewater agency.

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systems were developed to tackle specific business needs of groups that have a narrow business focus. The need for system-wide or integrated solutions, however, is beginning to emerge in wastewater utilities. In this regard, this project recommends a DSS tool that integrates information spanning more than just one functional domain, and supports decisions from multiple domains. It aims to convert data into knowledge—usable and actionable.

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User-Friendly DSS

The nature of a DSS depends on the nature of the business process that it supports. The research team reviewed DSS applications in the private sector that have some similarities with the wastewater industry which is mostly in the public sectors. The recommended DSS would allow the user to do the following:

- Easily view and assess the status of the business process in terms of the performance indicators.
- Create scenarios that describe different alternatives. These alternatives could be operational (e.g. process control), tactical (e.g. scheduled maintenance), or strategic (e.g. development of a facility plan).
- Provide the user with the ability to simulate and assess the impact of different alternatives and observe the results in terms of the relevant performance criteria. For a strategic business process such as facility planning, decision making may be difficult to define. Some of the performance criteria may also be elusive, such as public acceptance of specific projects.
- Present the results of the analysis in a visual, user-friendly way.

DSS Architecture/Implementation

Following are the suggested DSS components for a wastewater facility:

a) An equivalent of a "dashboard" that would show all the necessary indicators of performance; different dashboard formats and content may be required for operational, tactical, and strategic issues.

b) A scenario builder that would allow the user to configure the alternatives that need to be evaluated.

c) One or more "analytical engines" that would process the defined scenarios and predict the impact on the performance indicators.

d) A data broker that can access information that resides in different computer systems.

A conceptual layout for such a system is shown in Figure 1. The scope of the DSS presented here is system-wide, across all the critical IT components that are included in a typical utility that manages wastewater treatment plants. The development of the DSS can be done in phases.

Conclusion

There are significant differences in the need for integration between different wastewater agencies. Some agencies have already implemented specific automated systems and computer applications, and thus they see an immediate need for integration. Some other municipalities are only now considering automation and computer tools. Although some of them view integration as something they might have a need for in the future, there are benefits from considering integration issues early in the process of automation. The content of this research report is intended to provide useful information to municipalities on both sides of the spectrum.

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