

## **JAWWA TECHNOLOGY ARTICLE**

By Roger Patrick and Ed Means.

### **INTRODUCTION**

Water utilities are in the midst of significant change. While the degree of pressure for change that individual utilities is experiencing varies, the industry faces the complex set of market, cultural, technological, and political pressures, such as a shortage of infrastructure funds, political gridlock on water allocation, and coping with growth in water-short regions. Preparing for change requires understanding those trends and their implications. Managers and governing boards that foresee and act on such trends will be best positioned to successfully lead their utility.

In order to characterize and respond to these trends, in the year 2000 the American Water Works Association Research Foundation (AwwaRF) commissioned a study of such trends and what they mean for water utilities. That project tapped the experience of water industry leaders and futurists, and identified and documented key trends that have been used by water utilities and their associations in their planning processes. Due to the acceleration of many key trends over the past four years, and the emergence of factors such as better information on climate change, crises in energy markets, and terrorism, this study was updated in 2004 by AwwaRF to provide water utility managers with a current strategic planning tool. This latest project used new trend research, futurists and future scenario development and is again engaging national water utility leaders to debate these trends and develop strategies for future utility success.

The consultant team (McGuire Environmental Consultants, Inc. and Competitive Advantage Consulting, Ltd.) developed a detailed paper documenting trend data in key areas of concern for water utilities, namely population and demographics, health and medical advances, regulations, climate change, total water management, employment and workforce trends, customer expectations, information technology, drinking water treatment technology, energy, automation, information technology security, physical security, current economic issues, utility finance/infrastructure, politics, regionalization and private sector involvement in water.

This paper is one of a series to be published in Journal AWWA during 2005, and summarizes the project's findings on trends in technology.

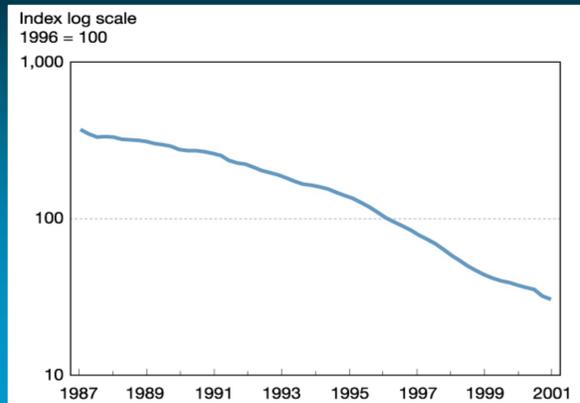
### **BACKGROUND**

#### **Information Technology**

##### **Fundamental Technology Trends**

Due to improvements in semiconductors, storage, and other components, price declines in computers (adjusted for quality) have actually accelerated since 1995.

## Computer price declines



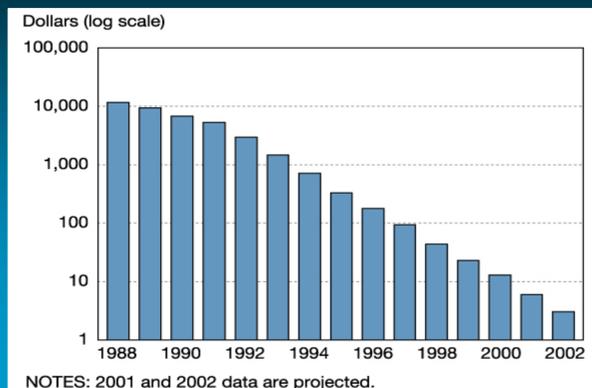
SOURCE: National Science Board, *Science and Engineering Indicators-2002*



A related trend is the migration of computing into other devices and equipment. Trends toward improvements in microelectronics are expected to continue. As miniaturization proceeds, it may lead to the emergence of nanoscale devices (devices with structural features in the range of 1 to 100 nanometers). Potential applications of nanoscale electronics 10–15 years in the future include sensor systems capable of collecting, processing and communicating massive amounts of data with minimal size, weight, and power consumption.

Disk drives and other forms of information storage reflect similar improvements in cost and performance.

## Cost per gigabyte of stored information: 1988-2002



SOURCE: National Science Board, *Science and Engineering Indicators-2002*



In addition, computers are increasingly connected in networks. The growth in networking is best illustrated by the rapid growth of the Internet, which has become key in information expansion by providing a common protocol for communication among devices. Networking is evolving in several ways: more people and devices are becoming connected to networks, the speed and capacity of connections are increasing, and more people are obtaining wireless connections.

There is the ever-increasing array of applications that make IT more useful. Over the past two decades, innovations in software have enabled applications to expand to include educational software, desktop publishing, computer-aided design and manufacturing, games, modeling and simulation, networking and communications software, electronic mail, the World Wide Web, digital imaging and photography, audio and video applications, electronic commerce applications, groupware, file sharing, search engines, and many others.

US industry has invested heavily in IT especially over the past 10-20 years. Water utilities have lagged the private sector but appear to be catching up, with major current investment in CIS, CMMS, GIS, desktop computing, and emerging investment in IVR, web-services, AMR, asset management, and mobile applications. But recent research shows that IT investment has little impact on productivity unless it is accompanied by first-rate management practices, and that companies can significantly raise their productivity solely by improving the way they operate.

### **Internet and E-Commerce Trends**

Over the past few years the Internet has continued to revolutionize the way information and services are stored and moved. The Internet and its Web-enabled infrastructure will continue to grow; newly developed applications will make use of this infrastructure.

Dial-up access has also recently been superseded by “broadband”, a dramatic change since the last strategic review, when only 3% of online individuals had such access. Broadband connections represented 51% of home Internet users in July 2004.

Businesses are using the Internet to cut the cost of purchasing, streamline logistics and inventory, plan production and reach new and existing customers more effectively. Business to Business (b2b) e-commerce has now become business as usual, and has allowed businesses of many types to expand their services and restructure their processes.

The government has taken an interest in the so-called "digital divide" that separates technology haves and have-nots in the United States, but the evidence is that the gap continues to close. eGovernment is continuing to evolve to meet a multitude of needs, expanding and altering the way citizens deal with public agencies.

The biggest thing going on currently in Internet technologies is web services. Web services are accessed by client Web browsers. Web services can be accessed from anywhere with a network connection. Web services can also be offered by application service providers (ASPs), on a pay as you go basis.

### **Outsourcing and Offshoring**

The information technology revolution is now enabling the shift of some types of jobs to other countries. The availability and declining cost of high-speed communications systems, in combination with computing technology, is facilitating this trend. Offshoring is occurring first in countries where many people speak English as a first or second language.

There is an ongoing debate about the overall effect on the US economy, with some observers predicting a net benefit, and others a net loss. Whatever the result will be, the trend itself seems to be unstoppable. The list of jobs that is being sent overseas using IT and telecommunications is truly remarkable, and includes not only call centers but a huge number of other functions, including radiologists reading X-rays and MRIs, developing animated movies, insurance claim processing, completing US tax returns, mortgage underwriting, equity analysis, legal research, accounting services, and research.

It remains to be seen how much impact the offshoring trend will have in the public sector, directly, however access to such services from the private sector will certainly provide opportunities for public agencies to reduce their input costs and provide improved services.

### **Collaborative Tools**

IT offers more and more opportunities for communities of interest to form, share information, and work toward common goals. Some of these collaborative mechanisms are casual, such as online chat rooms and weblogs.

Other collaborative mechanisms are more formal, such as a team working on a design project. Businesses are increasingly using collaborative software programs to facilitate group discussion and decision-making. Such software allows participants to interact in dedicated online spaces, engage in discussions, and share and track information. It is expected that some of these tools will be important aspects of knowledge management in the future.

### **Wireless Networking and Mobile Devices**

At present, most people connect to the Internet through wires. The wireless trend has accelerated dramatically over the past few years, as more products are available to eliminate wires from the desktop to mobile media players, cell phones and PDA's. Wi-Fi will continue to grow in the home, and outside with free community/city sponsored hotspots and corporate networks.

Over the next few years, most mobile phones will obtain Internet access. By 2005, it is expected that all mobile phones will be data enabled and subscribers will be able to access data and Internet services via mobile phones.

### **Voice-over-Internet Protocol (VoIP)**

Instant text messaging applications and were forerunners of voice over Internet protocol, or VoIP. VoIP voice and data communications services will see explosive growth from

2004. Consumers and businesses will win as VoIP will enable lower cost long distance calling and better integrate the services provided by present telephone companies.

### **Security and Malware**

Network and computer security has become a hot issue. Spending on data system security will increase as companies try mitigating sharply increasing losses from worms, viruses, espionage, crackers and data theft.

The growing number of annoying and/or malicious aspects of the networked economy has necessitated a whole new taxonomy under the heading of malware. Malware includes destructive programs such as viruses, worms and Trojans, Spyware, Spam (already accounting for more than half of global e-mail), and Phishing, which is hacker-speak for fishing for passwords, social security numbers etc through fraudulent email, often by setting up bogus web sites made to look like the real thing. Unfortunately, an analysis of this field becomes fast out of date as the scammers develop new ways to damage confidence in the on-line world.

### **Open-source**

The difficulty of commercial software competing against Microsoft's monopoly has spurred rapid growth in non-commercial software under the banner of open source. The majority of these applications run on Linux, an operating system that is itself open source. For example, a cluster of more than 10,000 Linux servers handles Google's more than 200 million searches per day. As it becomes a mainstream business operating system, the market for commercial software running on Linux will expand greatly.

### **Smart Work Spaces**

There are numerous technologies and products that may be combined in the smart work spaces of the future. Smart work spaces will make use of numerous aspects of pervasive computing, that is, computing available everywhere it's needed. Smart spaces offer services provided by embedded devices, that are accessed and interconnected with portable devices carried or worn into the spaces. Then the combination of imported and local devices can support the information needs of users.

### **Water and Other Utility IT Trends**

There is a growing use of information systems to support utility activities and better serve customers. Work management systems such as mobile dispatch, laptops, and computerized maintenance management systems are supplementing the more common plant automation and SCADA systems. Some of these systems are increasingly linked with GIS and other technologies.

There is also an accelerating trend towards using IT to improve customer service. Almost all utilities now at least have a web page with basic information. Increasingly, customers are able to conduct transactions on-line, including paying bills, tracking service disruptions, viewing GIS data, applying for permits, and applying for service connections.

Those utilities that have integrated their CIS with other systems, such as work management systems and automatic meter reading (AMR) systems, are also seeing many service and efficiency benefits. For example, such integration is improving first call resolution as the CSR can answer many more questions while the customer is on the phone.

Interactive voice response systems (IVRS) are increasingly being deployed to improve call routing and provide automated information such as account balances and days to disconnection.

e-Commerce is being used to a limited extent by water utilities for purchasing and supply. The primary uses are for bid-notification, communication of purchasing policies, routine purchasing, product searching, information exchange with suppliers and reference checking. A few water utilities are starting to use the Internet for receiving bids.

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### **IMPLICATIONS**

#### **Information Technology**

The rapid ongoing developments in computing power and applications of information technology imply that water utilities, and industry research bodies, should boost their awareness of such developments and how they can assist in efficiency and performance improvement. For example, developments in knowledge management systems indicate that water utilities should examine how they can use IT to capture a hidden opportunity from the upcoming baby boomer retirements.

But, as mentioned above, IT investment must be accompanied by first-rate management practices in order to improve performance. Therefore, water utilities need to work out how their prospective IT investments will actually improve operations, even for systems that are being replaced due to obsolescence.

Growing maturity in e-commerce and the closing of the “digital divide”, particularly in contrast to the situation at the time of the last strategic review in 2000, indicate that utilities and research bodies should re-examine potential applications and approaches that may have been prematurely written-off. Also, they should stay up to date with how customers and other utility stakeholders are using the Internet in their daily lives. Such potential applications include streamlining procurement, dealing with customers, and collaboration with a wide range of existing and emerging stakeholders.

The rapid growth of IT security and malware issues, and the threat of cyber-terrorism, compel the water industry to stay up to date, develop backup plans, and be flexible in their approach to IT, such as selective outsourcing of security functions to specialists.

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### **STRATEGIES**

#### **Information Technology**

The water industry should actively support the development of IT-rich equipment and devices to improve asset management and optimize operations and maintenance. This is too big a task for any individual utility, and therefore should be done in a co-operative manner, at an industry-wide level, and in partnership with equipment suppliers.

The water industry should maximize the use of the Internet to communicate with stakeholders, co-ordinate efforts, centralize functions, collaborate, and otherwise make use of network effects.

Water utilities should seek out IT applications that will reduce cost and improve service, not just to provide a form of basic infrastructure. Obvious cost saving developments to take advantage of in the near term are VoIP and open-source applications.

Water utilities should focus on management practices that will result in productivity improvements from their IT investment, as research shows that without this, no productivity improvement arises.

Water utilities should use IT to turn the baby boomer retirements from a problem into an opportunity. The emergence of knowledge management applications and web-services are recent examples that could result in better knowledge transfer than is currently the case, and cost savings through centralization/outsourcing.

The water industry should consider forming a central clearinghouse to provide advice on IT equipment and application selection, since the IT field can be especially confusing and hard to keep up with and is not a core competency within the industry.

Water utilities should re-examine their procurement procedures to maximize benefits from e-commerce, including co-operative purchasing and process streamlining, removing artificial rules and impediments as needed (over 50% of rates are to pay for purchased inputs, which include almost all capital costs as well as most operating costs except personnel).

Water utilities should use IT to help secure their facilities against cyber-threats.

#### **REACTION FROM INDUSTRY LEADERS**

At a workshop of industry leaders conducted in December 2004, the overall reaction was that rapid change in IT is creating opportunities (and some risks) that are not clearly understood by water utilities.

Participants expressed the view that water utilities need to develop an IT strategy before taking tactical decisions such as on application selection and outsourcing. This strategy was seen as needing to be responsive to customer needs. IT was also seen as a potential tool to better communicate with customers, including enhancing communications to different audiences.

Opportunities were seen in many areas such as remote sensing/data collection, tools to improve customer satisfaction, regulatory compliance/reporting, using knowledge management applications as an antidote to the baby-boomer retirements, and incorporating real-time data into actionable information. But participants also recognized the need for culture change to obtain the benefits offered by the technology.

Concerns were expressed at the need for a more technologically sophisticated workforce and culture change needed to handle prospective IT developments, the need to find the required capital investment, and the general trend to information overload.

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#### **About the Authors**

Roger Patrick is the President of Competitive Advantage Consulting Ltd., and is a specialist in improving the management of water and wastewater utilities. Ed Means is Senior Vice President of McGuire Environmental Consultants Inc., and .....*(Ed say a few words here.)*