

JULIE SMITH DAVID, DAVID SCHUFF,  
AND ROBERT ST. LOUIS

# MANAGING YOUR **IT** TOTAL COST OF OWNERSHIP

*Though the TCO of end-user workstations can always be reduced by sacrificing end-user service, careful planning can reduce the costs without the sacrifice.*

IN RECENT YEARS, EXPENDITURES ON INFORMATION technology (IT) have become an increasingly significant portion of corporate budgets worldwide. Despite the economic downturn beginning in 2000, *CIO Magazine* recently found that IT budgets continue to increase [4]. A recent Gartner Group survey [6] indicates IT budgets of companies worldwide amount to slightly more than 3.5% of revenue (see Figure 1). However, a *CFO Magazine* survey also found that 86% of the responding senior financial executives admitted their IT spending is not under “adequate control” [11].

Despite the perception that IT spending is not as under control as it should be, is widely accepted by

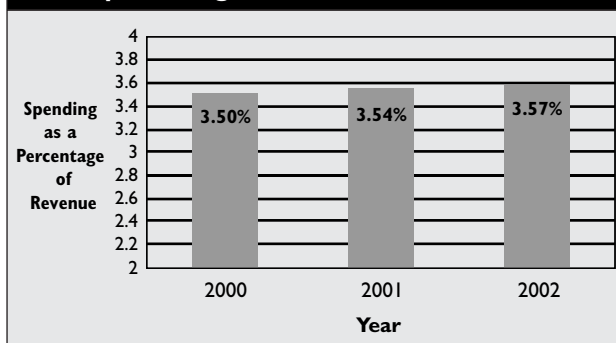
CEOs, CIOs, and CFOs that investing in the development of an IT infrastructure is critical to being competitive in practically any industrial or consumer market anywhere.

Research shows that computers are important contributors to public- and private-sector productivity growth, both directly and as agents of organizational change [2]. Given that expenditures on IT are both necessary and sizable for almost any organization today, and given that IT spending will be closely scrutinized for the foreseeable

future, corporate managers have to determine how to maximize the effectiveness of their IT expenditures.

Total cost of ownership (TCO) is a measure often used to assess the effectiveness of an organization's IT

**Figure 1. Worldwide IT spending as a percentage of revenue, 2000–2002.**



expenditures. As defined by Bill Kirwin of Gartner Group, TCO is “a holistic view of costs related to IT acquisition and usage at an enterprise level” [3]. In the context of this article, TCO includes all expenses related to owning and maintaining a personal computer or workstation within an organization. Unfortunately, reducing TCO can adversely affect IT service levels; in fact, IT costs are thought to be “directly proportional” to IT service levels [9]. In order to maximize the value of IT expenditures, organizations have to simultaneously reduce their TCO and maintain or improve IT service levels.

Centralization and standardization are two complementary methods for reducing TCO. Centralization seeks to consolidate software access, software distribution, and network administration in a few central locations. Standardization seeks to minimize the hardware- and software-configuration differences among individual workstations. Both policies seek to reduce IT costs by simplifying operations.

Research shows that centralization and standardization pay off. One study found potential cost reductions up to \$2,000 per end user, or 27% [10]. Moreover, a Gartner Group study on the effect of management control found that a single technician might support 77 end users (on average) in a tightly managed environment but only 18 end users (on average) in a loosely managed environment [8].

It is always possible to reduce costs by reducing service. Here, we explain how to simultaneously reduce costs and maintain or improve service levels. We describe the literature regarding the costs of IT and service levels, as well as the relationship between control costs and operations costs and between control costs and service levels. The result includes guidelines for simultaneously reducing costs and maintaining or

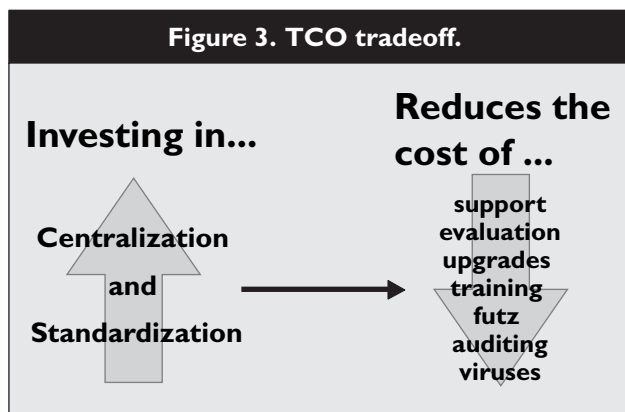
improving service levels.

## IT Cost Factors and Service Levels

TCO can be divided into two main sets of cost factors: acquisition costs and administration costs. A Gartner Group study found that only 20% of TCO lies in initial acquisition costs; the rest lies in admin-

Examples of TCO cost factors.		
Cost Category	Cost Factor	Examples
Acquisition costs	Hardware	Monitors, CPUs, servers.
	Software	Operating systems, database management systems, word processors.
Control costs	Centralization	Specialized hardware (such as intelligent self-monitoring components that notify a network management console when a problem occurs) and software (such as directory services and desktop management interfaces) are needed to implement and maintain a centralized system. Support staff has to be trained to use these systems.
	Standardization	Initially, nonstandard hardware and software may have to be replaced by hardware and software conforming to the selected standards. Users may have to be retrained on the standard software, and the standard hardware may be more expensive than nonstandard hardware.
Operations costs	Support	Either in-house staff or a support contract is required to address hardware and software problems as they arise.
	Evaluation	New/upgraded versions of applications, operating systems, and hardware are constantly being released. Before new hardware or software is installed, it must be evaluated to determine: Does it do what it is supposed to do? And is it compatible with the existing IT environment?
	Installation/upgrade	After a new technology is evaluated, it must be installed and upgraded. Hardware and software upgrades are often related; new software generally requires more powerful hardware, forcing hardware upgrades.
	Training	Training allows end users to get the most from their workstations. Training can take two forms: Formal training in a classroom setting and self-training as end users learn how to work new applications. Software and hardware installations/upgrades generally require some retraining of the end-user population.
	Downtime	Downtime arises not only when software or hardware failures occur, but also when software or hardware installations/upgrades occur. When a system fails, the organization incurs costs for the nonworking system, the nonworking employee(s), and whatever repairs are necessary to make the system functional again.
	Futz	Bill Kirwin of Gartner Group defines the “futz factor” as “using corporate technology for your own personal use.” This cost lies not in the system itself (it is already purchased) but in the time employees spend using the system for nonwork-related activities.
	Auditing	This is the cost of keeping track of an organization's technology assets. Computers move around a lot, especially in large corporations. To determine which department has which asset, some type of record keeping is required.
	Virus	Viruses increase a computer's TCO in two ways: they can destroy important data expensive to recreate, and they can cause a computer to crash completely, resulting in downtime.
	Power consumption	Published estimates put electric power consumption at \$240 per year per workstation. In addition, computers generate heat, which can increase air-conditioning costs.

Figure 2. Categories of TCO factors.		
Acquisition Costs	Administration Costs	
	Control	Operations
<ul style="list-style-type: none"> <li>• Hardware</li> <li>• Software</li> </ul>	<ul style="list-style-type: none"> <li>• Implementation and maintenance of centralization</li> <li>• Implementation and maintenance of standardization</li> </ul>	<ul style="list-style-type: none"> <li>• support</li> <li>• evaluation</li> <li>• installation/upgrades</li> <li>• training</li> <li>• downtime</li> <li>• futz</li> <li>• auditing</li> <li>• viruses</li> <li>• power consumption</li> </ul>



istration costs [3]. It is difficult for any organization to gain a competitive advantage by reducing the purchase cost of its hardware and software. Hardware and software products are now commodities, and almost all organizations get the same discount.

Organizations have significantly greater control over the 80% of IT expenditures they direct toward administering their IT systems. Many books, studies, and reports discuss the various cost factors contributing to TCO (see Figure 2); these factors relate to one another in complex ways. Before attempting to unravel these relationships, we'll outline the individual cost categories.

Every IT system incurs acquisition costs, since every system requires hardware and software. Control costs, on the other hand, do not have to be incurred. Instead, they are optionally incurred in an attempt to reduce operations costs and/or improve service levels. Operations costs are defined as the costs associated with the ongoing operation of an IT system, and, like acquisition costs, must be incurred. These costs have been discussed by a number of sources, including [5, 12]; Table 1 lists example costs associated with each category.

Cost factors are certainly important, but so are service level factors. Some authors [9] have argued that IT

costs are directly proportional to service levels; that is, as IT costs are reduced, service levels also are reduced. A number of metrics have been devised to measure service levels, including:

*System responsiveness.* Network load can significantly affect an information system's overall performance. Increased traffic might result in delays when workstations run software over the network.

*Service call frequency.* The number of end-user service calls often serves as a gauge of user satisfaction. Fewer support calls generally mean users are experiencing fewer problems.

*Queue time.* This is the elapsed time between when an end user reports a problem and when a support technician arrives to fix it.

*Resolution time.* After the technician arrives, quick resolution is desirable. Short resolution times have a positive effect on the perceived performance of the IT group.

*Downtime.* Downtime, which can result from a hardware or software failure, is an important measure of system quality. Most IT departments regularly publish downtime statistics for the systems under their control. For important systems, 99+% uptime is a widely accepted goal.

*Rework.* Speedy problem resolution is important, but to maintain an adequate service level, it is also important that when a problem is fixed, it stays fixed.

The following sections offer guidelines for how an IT group can reduce costs while maintaining, or even improving, service levels.

### Simplified Model of IT Costs

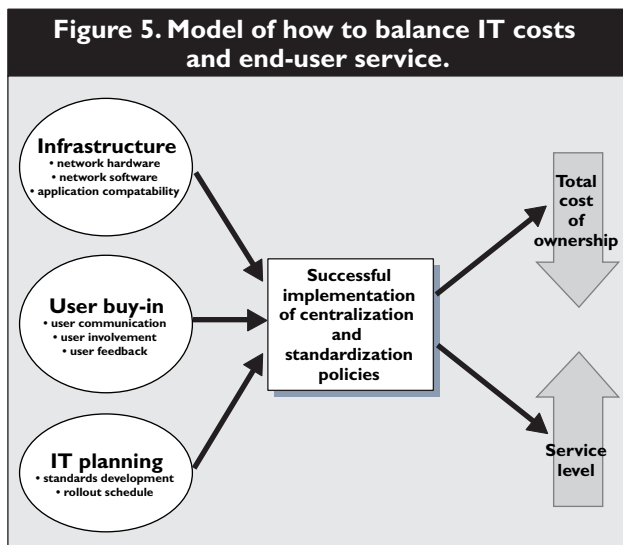
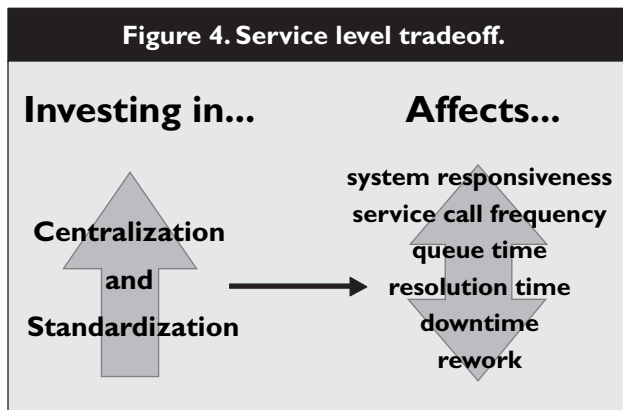
Using the information in Figure 2, the cost of maintaining a single workstation in an organization can be expressed as:

$per-seat\ cost = f(\text{hardware, software, centralization, standardization, support, evaluation, upgrades, training, downtime, futz, auditing, viruses, power consumption})$

or

$per-seat\ cost = f(\text{acquisition costs, control costs, operations costs})$

Unfortunately, this formulation does not help discern the relationships among the cost factors, the per-seat cost, and service level. For example, if centralization costs go up, arguments can be offered for both increases and decreases in the per-seat cost, the service level, and support costs. Some discussion of the



relationships among these factors is required in order to develop an informative model.

**Control costs versus operations costs.** There is a logical relationship between control costs and operations costs, including why expenditures on centralization and standardization lead to reduced operations costs. A recent survey by Lucent Technologies found that standardization and centralization are two of the three most widely used strategies for reducing the costs of network systems management [1]. Not surprisingly, two of the five most widely encountered barriers to reducing operations costs are a lack of integrated solutions and the complexity of products.

A centralized, homogeneous network reflects the following characteristics:

- Administered from a central location;
- Software stored either at a central location, so it is tamperproof, or each workstation configured in a way that prevents changes to its application files;
- Minimal number of different computer models (such as all Gateway or all Compaq); and
- Minimal number of different software packages (such as all Word or WordPerfect, not both).

Given this framework, it is easy to see how a centralized, homogenous workstation base can reduce operations costs (see Figure 3). Support becomes less expensive because troubleshooting can be done from a central location, and, in a corporate network of homogeneous workstations, the base of required knowledge shrinks. Also, since an established, bug-free configuration has much less downtime when users are not able to damage it, the number of required support people is reduced when changes to the application software (on a workstation or a server) are locked down.

Evaluation of new software is simplified because less diversity in the installed application base greatly simplifies the process of evaluating new versions of the applications. Moreover, if the software is centrally located on a few servers, the number of locations that might have to be upgraded is drastically reduced. Although centralizing software may not save on software license fees, it certainly saves IT labor time. In particular, if the software is distributed on each workstation but is tightly controlled through a network management application (such as Microsoft's SMS), new software can be installed on each end user's workstation automatically over the network through one-time delivery.

The cost of training is reduced in environments with standard, familiar software and hardware configurations. Any end user in the organization can attend a single set of training classes, and moving from department to department does not require retraining, since the environment remains familiar. Even the so-called "futz factor" can be reduced in a tightly controlled environment. Although network management tools cannot stop end users from using a word processor for personal use, it is possible to prevent the installation of software not approved by the organization.

Auditing costs are reduced because it is possible to install software that helps automate the inventory process and because less diversity in the computer hardware and software simplifies the auditing process. Finally, installation of virus-protection software with enforced settings (such as scanning each file as it's read or written to a local or network disk) reduces the cost of repairing virus-infected files by preventing them from becoming infected in the first place.

**Control costs versus service level.** The implementation of centralization and standardization control policies and procedures affects not only an organization's IT costs, but also the resulting IT service level. While it is easy to see why centralization and standardization reduce TCO, the effects of these policies on service levels are less clear. Implementation of control policies may either increase or decrease service levels, depending on how the controls are implemented (note the



double arrow in Figure 4). For instance, system responsiveness could be adversely affected by a policy of centralization. Additional load is placed on the network when applications in a central location are downloaded to each workstation for execution. These downloads may lead to delays when software is run. Careful monitoring of the system and/or purchasing new hardware might be required to maintain or improve system responsiveness.

The frequency of service calls also might either increase or decrease due to the implementation of centralization and standardization policies and procedures. Although centralization and standardization should increase system reliability, which should translate into fewer service calls, a change to a standardized environment is often met with resistance by end users. If the end users do not buy into the controls, support calls could actually increase as they register dissatisfaction with the new system. This phenomenon may also increase the amount of rework involved in revisiting the same problem.

A uniform workstation configuration should reduce both queue time and problem-resolution time. It is much easier to be knowledgeable about a few standard configurations than to be knowledgeable about the innumerable permutations that might exist when no control mechanisms are in place. Enforcing uniform configurations should decrease the time required to diagnose and resolve problems, thus enabling support technicians to move from desk to desk more quickly. However, queue time is highly dependent on call volume. If call frequency increases significantly, queue time might suffer.

Finally, increased call volume might also lead to increased end-user downtime. If end users do not believe the software is functioning properly, whether the system is up or down does not matter. Time spent waiting for support technicians is wasted regardless of whether the problem is real or imagined. In reality, neither an increase in service level nor a reduction in cost is a guaranteed consequence of implementing centralization and standardization policies. Which methods are most likely to increase the likelihood of achieving these desired consequences?

### **Balancing Costs and Service Levels**

The popularity of desktop management interface software and hardware, centralized software distribution schemes, and configuration control software is based on the expectation that implementation of these tools will reduce operations costs. However, a benefit/cost analysis should be performed before deciding whether to increase control. The benefit of long-term operations cost savings has to be balanced against the cost

of the software, hardware, and labor required to implement the control mechanisms, and the possible degradations in service levels.

However, simply adopting this policy of centralization and homogeneity to reduce TCO is not enough. The degree to which these costs are affected, and the degree to which the service level is affected, depends on how well the implementation is executed. An organization can assess the degree to which a policy of greater control might succeed by assessing its own infrastructure, level of user buy-in, and extent of IT planning (see Figure 5).

**Infrastructure.** How can IT management tell if its IT infrastructure is ready for centralization? Centralizing control over workstations can increase throughput demand on a network. Bandwidth requirements may increase as a result of placing applications in a central location to be downloaded to each workstation. When workstation administration takes place from a remote location, the smooth operation of the network becomes mission critical. An organization that wants to implement a centralization plan has to evaluate its network infrastructure, including the following aspects of the network:

**Network hardware.** Routers, file servers, workstation network interface cards, and other network hardware have to be configured to handle the increased bandwidth; additional network hardware might be required.

**Network software.** Server operating systems and other network software have to be optimally configured for the additional traffic.

**Application compatibility.** Corporate application programs have to function well within the centralized configuration; some applications are not installed easily from a centralized location, and others cannot be run from a remote location (such as a file server).

**User buy-in.** How can IT management ensure user buy-in? Research has found that end-user participation in the development of an information system increases the likelihood of its acceptance [7]. In order for IT departments to increase their control over corporate workstations, individual end users have to relinquish control, believing it is in their best interest to do so. The link between a user's perceived "best interest" and the IT service level is straightforward. That is, changes due to a policy of increased centralization and standardization must be shown to increase, or at least not decrease, the overall level of service for the user community. Maintaining or increasing the perceived service level can be accomplished in several ways:

- Establishing special communication channels to provide end users with information regarding the changes that will occur and how they will benefit from them.
- Involving end users in the planning process, thus accomplishing two things: giving end users a sense of control over the environment, and giving IT departments useful information about end-user needs.
- Collecting user feedback through surveys and face-to-face meetings, providing the information needed to diffuse and correct problems (and tensions) before they become crises.

**IT planning.** How can IT management determine if it has an adequate plan? The successful implementation of a centralized, homogeneous network requires careful analysis of the computing needs of the entire end-user base. To achieve the goal of homogeneity, the configuration the IT department chooses must satisfy the greatest number of end users with the least amount of variation. To achieve the goal of centralization, the network management software tools have to be installed in such a way as to take full advantage of their capabilities. Examining the network infrastructure and obtaining input from the end-user community are important early steps in the planning process. The next step is to create an implementation plan that includes the following components:

**Standards.** Standards development is essential for maintaining consistency across an organization's networked workstations. Unless ground rules are established, workstations inevitably drift away from the initial configuration. Ground rules should include both a standard workstation "image," or set of configured software components that can be replicated across many workstations that cannot be changed, and standard access rights to both local and remote file systems.

**Rollout schedule.** The rollout schedule should be closely linked to input from the end-user groups. The most cooperative end-users can serve as pilot users, ensuring good feedback and tolerance during testing.

## Conclusion

IT costs represent a significant portion of almost every organization's overall operating budget. Control mechanisms can help reduce IT costs. Control can be exercised in two ways: centralization of software and network administration; and standardization of software and hardware configurations throughout the end-user community.

However, the decision to implement control mechanisms should be accompanied by a careful examination of both costs and service levels. Previous research showed the reduction of IT operations costs is often associated with a reduction in IT service levels. Careful planning is required to avoid this consequence. We have explained that if the network infrastructure is evaluated carefully, if user buy-in is obtained, and if a comprehensive implementation plan is developed, it is possible to simultaneously reduce costs and maintain or improve service levels. This outcome enables IT departments to maintain both a low workstation TCO and a high level of end-user satisfaction. ■

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**JULIE SMITH DAVID** ([julie.smith.david@asu.edu](mailto:julie.smith.david@asu.edu)) is an associate professor in the School of Accountancy and Information Management at Arizona State University, Tempe, AZ.

**DAVID SCHUFF** ([schuff@temple.edu](mailto:schuff@temple.edu)) is an assistant professor in the Department of Management Information Systems at Temple University, Philadelphia, PA.

**ROBERT ST. LOUIS** ([st.louis@asu.edu](mailto:st.louis@asu.edu)) is a professor in the School of Accountancy and Information Management at Arizona State University, Tempe, AZ.

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