WHITE PAPER

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Enterprise Solutions
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CONTENTS

Achieving Business Value by Measuring and Managing the Cost of Computing

Many models have evolved to predict the cost of operating a distributed computing system. Recently, methods have been developed to apply these models to actual computing environments and utilize the output as a guide for improving process, skills, and technology. The end result of these improvements is a better return on an organization's technology investments. This paper outlines the measurement methodology and practices that reduce the ongoing operations cost of information technology, and provides a case study and other information that supports the utilization of Compaq products and services in a cost-efficient IT environment.

NOTICE

Measuring and Managing the Cost of Computing
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TCO Evolves to a Standard Metric

The concept of measuring all costs associated with an information technology (IT) project is not new. Several models for cost assessment and return on investment have been used since the 1960's, when computing investments first became mainstream business decisions. In the early years, no single methodology of return on investment (ROI) analysis was dominant because only large enterprises could justify the expense of computing. Therefore the market for standardized services and methods of cost measurement was still small. It is only since 1995 that the term "Total Cost of Ownership" (TCO) has been commonly applied to the measurement of PC-based business systems. Indeed, TCO as a metric of the relative value of technology and practice is still evolving, and there is no definitive or universal standard by which it is measured.

Increasing IT Focus on Measuring and Establishing Value

In a time moving more and more at "Internet speed," businesses are faced with increasing challenges to rapidly and accurately estimate of the value of their IT investments. With roughly 80% of the IT budget devoted to the maintenance of IT "dial tone" through existing systems, the focus on controlling operations cost and justifying investments becomes all the more acute.

According to a November 1997 study done by *Information Week* on 250 IT managers, the key decision metrics for IT investments were:

1. What are the business benefits of this investment?
2. Manageability/Asset Management
   -Enterprise Networked Applications
   -Support, Service and Integration
   -Custom Configuration
3. Scalability
   -Full Product Line
   -Multiprocessor/SMP Capabilities and Clusters
4. Stability of vendor
   -Can you be my strategic partner, and are you a strategic partner to my other key vendors?
5. Cost
   -Installation
   -Cost of Ownership
   -ROI

The issue of measuring business or economic benefits, the first metric above, should have the greatest weight in a decision. However, it is the metric most unique to an individual organization and there is no current, broadly accepted industry standard for measuring benefit. Compaq believes it is possible to develop a method for measuring business benefits that is broad enough to adapt to most situations. We are working very closely with key analysts, including Gartner Group and GiGa Information Group, as well as large systems integrators such as Andersen Consulting and EDS, to establish such a method.

Practices for measuring costs are more established. In addition to the issues of IT efficiency and productivity, costs include the impact of downtime and service level loss, which can have an enormous impact on economic value. This paper focuses on cost measurement and management. Future documents will focus more on general and specific application business value.

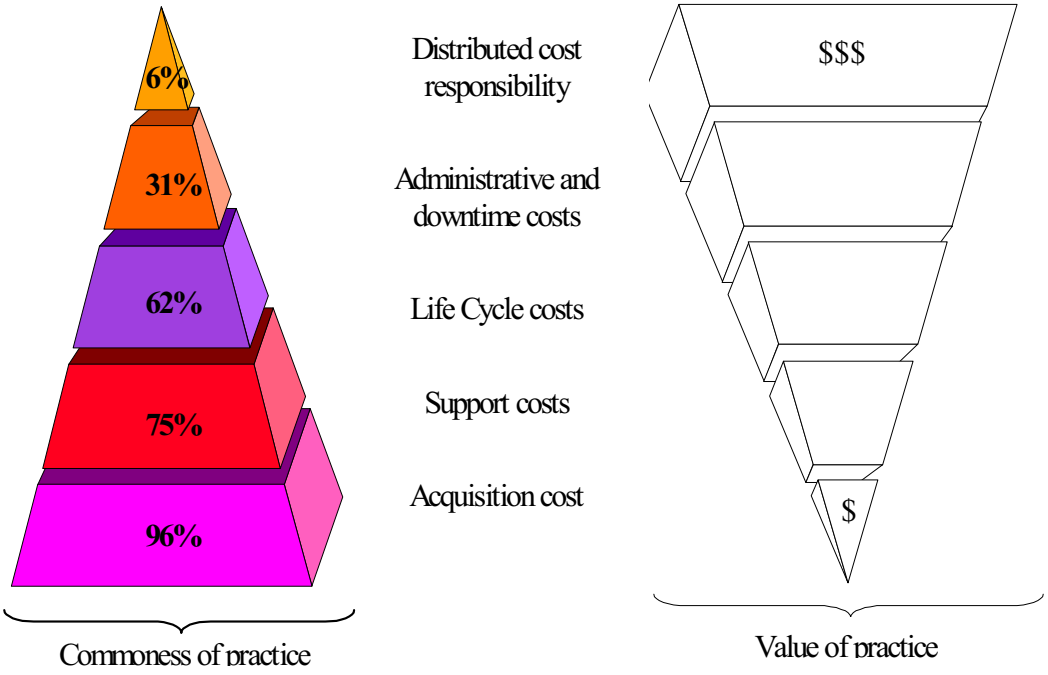


Figure 1 - Levels of TCO Reduction Practice

Customer Understanding of TCO

In late 1996 and early 1997, Compaq gathered information on various cost control practices used by Compaq customers in North America and Europe. We also collected information on the rate at which these practices are implemented, and customer understanding of Total Cost of Ownership. The surveys included both IT professionals and Chief Financial Officers, as well as other finance professionals. The broad cost categories of Acquisition, Support, Lifecycle, Administration, and Cost Allocation were the areas of focus for cost reduction activities. As the pyramid above suggests, cost reduction practices in the area of acquisition were implemented most often while practices dealing with interdepartmental cost allocation, the very tip of the pyramid, were implemented least often. Another significant discovery was that the ease of implementation for the different practices decreases as you move up the pyramid but the return increases. Finally, only a small percentage of customers had internal models which accurately reflected the full capital, IT labor and business unit impact of computing technology. However, they all recognized them as issues and showed a willingness to invest in technology, services, and practices if they could convincingly be shown to reduce cost.[1]

TCO Industry Average Models

The Gartner Group has been the largest and most vocal proponent of the TCO concept. Since the earliest proliferation of multiple hardware and software architectures (e.g. Windows 3.1, DOS, Macintosh, and terminals) imposed the problem of increasing complexity on IT organizations, Gartner has attempted to quantify the costs of IT investments as represented by the end-user client technology. Other analysts, such as Forrester Research, have developed competing views. Some of these views are focused on client topologies, others on other aspects of technology and IT practices. Some of these (GiGa and others) included less quantifiable aspects of computing benefit,

[1] See Appendix A: Study Summary: Customer Attitudes on Cost of Ownership Issues and Practices

in an effort to evolve computing decisions from having cost as the primary metric. In 1997, these models became commonly known to enterprise computing managers. They are excellent starting points for understanding issues in computing cost, but cannot by themselves assist a customer in identifying their own costs or how to control them. Further, the proliferation of competing cost models has confused IT managers. Compaq believes that it is critical for the industry to move towards a standard set of cost accounts and a process for measuring computing costs, and is working with the aforementioned analysts to make that happen.

IT managers must balance the need to reduce the total cost of ownership with the business benefits derived. This in effect translates to an acceptable ROI for an investment. So the issue of TCO is one of the total cost of benefits. This is discussed in more detail later.

All TCO models to date have had a division of cost in common. These costs are divided into two categories: in-budget and off-budget, and subdivided within the in-budget category into capital and labor.

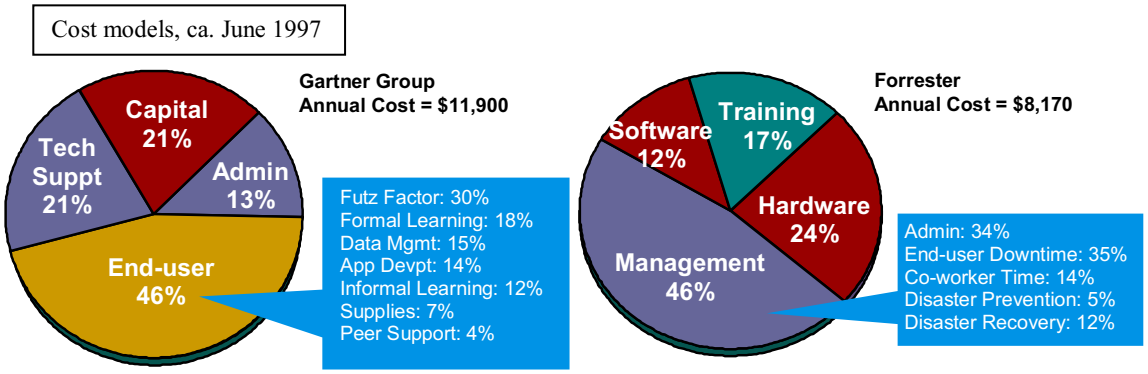


Figure 2 - Industry Analyst Cost Models, circa June 1997

In-budget Costs

In-budget costs are those that specifically capture the capital and labor cost of the organization's Information Systems infrastructure. These include all computer hardware and software, communications equipment (e.g. routers, wiring, etc.) related to computer networking, all labor costs of computer professionals, and all outsourced contracts for computing services. In these models it does not matter whether the costs are budgeted within the IS department or within business or other organizational units. These costs are of immediate concern to MIS because they are quantifiable and reducible. It is important to note that some models exclude computing resources such as mainframes and their terminals or supplies such as paper and toner.

In quantifying in-budget costs against industry averages, it is critical to have common points of reference and an understanding of the impact of technology infrastructure and complexity on the IT organization. IT groups which primarily serve knowledge workers or service organizations face different challenges and different capital and labor requirements than those serving a centralized utility, manufacturing company, or retailer. Consequently, as TCO models mature, they must take into account issues of technological complexity, IT organizational/structural type (centralized/distributed/replicated, etc.), and offer comparisons to similar organizations, industries, and world regions.

Off-budget Costs - Controversial and Difficult to Quantify

A cost model would not be accurate if it did not measure the financial impact of IT on the business and organizational units it serves. However, identifying a credible set of end-user costs and business unit metrics is much more difficult than isolating the IT capital and labor costs. Current models can be said to break these off-budget costs into three categories:

1. productivity impact,
2. end-user IT, and
3. business or revenue impact.

In 1997 the most prevalent model, from Gartner Group, included end-user data management, end-user informal application development, and informal learning. These are all instances of end-user IT costs. They are functions that do not directly contribute to the business or organization function of the individual end-user, but are informal processes of managing and enhancing computing resources. These types of costs are direct results of the utilization of technology. They are analogous to the time spent sharpening a pencil or creating a logical paper file system and cannot be eliminated entirely. However, they can be brought to an appropriate level through specific technology and IT and business unit practices and policies.

The second category of off-budget costs is productivity impact. Typically measured in lost wages, this is the time spent performing activities related to technology but unrelated to the user's job function. The most commonly understood instance of this cost is end-user peer support, or the time a knowledgeable user spends supporting other workers who choose not to call IT support for help. Other productivity impacts are more controversial, particularly the "futz factor": the time spent adjusting Windows wallpaper, playing Solitaire or unproductively browsing the Internet. Many organizations take great pains to reduce this type of productivity impact through system configuration and monitoring technologies, but true quantification of its impact is a questionable process. Consequently, Gartner has since dropped the futz factor from its model. Note also that system loss does not always result in productivity impact. If a desktop system is down while the user is in an offsite meeting, there is no productivity loss[2].

Business impact is the final category of off-budget costs. This is the bottom line cost of non-productive time due to computing issues in the organization. This category can have by far the greatest impact of any cost element, since its measurement is dependent directly on the users job function and how the inefficiency or unavailability of technology and information affects the business or organization. Specific items included in this category are end-user downtime and system response time, and also may include disaster prevention and disaster recovery costs. There are two approaches to measuring these costs: lost wages and lost revenue. Since there is no way to predict in an averaged model the impact of a particular downtime incident on revenue, most models and studies confine themselves to lost wages of the average user affected. However, any actual cost assessment done for a particular organization should attempt to measure the revenue impact of lost productivity due to technology and technology management issues. This often proves an order of magnitude greater in bottom line impact to the organization, and brings to light the most critical issues the organization must address in technology: people and practice.

[2] For an example of end-user off-budget costs and their impact, see Appendix E: TCO Assessment Case Study: Food Services Company.

Effective off-budget cost measurement and management must take into account distinctions between user job functions and the relevance of technology to that job function. There are two main variables to be considered: the functionality and structure of the task. A stock trader is a high function (high return to the organization) and highly structured (repetitive information requirement) position. Conversely, an office worker may be a low function (less return to the organization) and unstructured (multiple types of data and flexible information requirement) position.

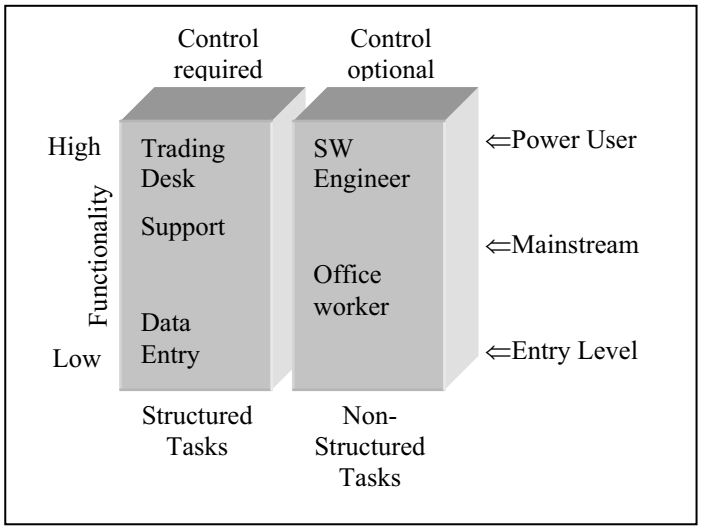


Figure 3 - User Types and System Lock Down Requirements

Valuation of IT Investment

Recently some analysts have begun to focus on quantifying the business benefits of distributed and network based computing, in addition to the costs. Compaq believes this is a critical step in the evolution of IT business impact measurement. Any IT assessment must include the expected return to the organization as measured by ROIC (return on investment) or EVA (economic value add) methods, particularly in the case of business unit-driven IT projects, such as an Enterprise Resource Planning (ERP) project. The planning and deployment costs, times and risks associated with the project, as well as the operational costs which are typically measured in TCO studies. At this point there is no common standard for such broad scale measurements, though there are many effective techniques in use in enterprise scale integrators and organizations. Compaq is working closely with key integrators, enterprise class IT organizations, and industry analysts, to develop a usable standard for this comprehensive assessment process. Although we have strong evidence of reduced planning and deployment costs in specific application areas such as SAP R/3 projects,[3] we do not expect to see a definitive standard on general distributed computing investments valuation in 1998.

However, this broadening attention does bring to light some of the limitations of using TCO, particularly industry average studies alone, as the primary metric for IT decisions. Compaq advises cautious use of industry average studies, and encourages IT decision-makers to invest in an organization cost assessment study prior to making cost-based decisions.

[3] Kulik & Lazarus Consulting Survey of Compaq SAP Customers, 6/97

Limitations of Industry Average TCO Models as Decision Metrics

Although it is tempting to utilize generic studies, such as those widely published by the Gartner Group, as decision points for technology and practice; there are serious risks in doing so. Only by doing an actual cost assessment can an organization be sure of the relationship of process to people skills to technology and the resultant costs within the organization. Following are some of the limitations involved in using published averages rather than actual cost assessments to make IT decisions:

TCO Focus is on Cost (vs. Benefit/Value)

TCO models focus entirely on the cost of computing and disregard the benefits. Clearly, if this were the only metric for technology decisions, no one would buy computers and IT organizations would cease to exist. Utilizing statistical studies to focus on cost to the exclusion of business benefits places the IT manager in a position of defending a cost center rather than promoting a tool essential to business advantage. However, an actual cost assessment can highlight the interrelationship of business units to centralized IT and promote development of business advantage.

TCO is Descriptive not Prescriptive

TCO industry average models indicate current practices and attempt to correlate them to technologies. For example, the January 1998 Gartner Group model indicates that organizations running Windows 3.1 on their client machines are averaging $10,768 per knowledge worker user per year, and those running Windows NT average $9,869 per year. However, with poor practice execution, it is likely that Windows NT will cost more to use than a well-tuned Windows 3.1 client. In addition, neither average takes into account the variables of company complexity, network and communications structure and practice, and prevailing application (e.g. SAP) requirements. Only by doing an actual cost assessment and comparing the results to similar situations can a company determine the cost problems and develop a plan to address them.

The “Where’s my check?” Issue

Often when embarking on a cost reduction initiative, the senior executives in an organization base their expectations on industry average studies, and burden the IT organization with directly reducing the bottom line to match reductions indicated by these studies. However, after doing an actual cost assessment, productivity and business advantage enhancements through increased IT efficiency and cooperation between business units and IT may be far more imperative than reductions in IT staff. The IT organization must maintain aggressive communications in order to manage executive expectations to match the true outcome of cost reduction engineering.[4]

Not “organizationally-aware”

Broad scale industry average TCO estimates cannot take into account the distribution of costs between the centralized IT, business unit "shadow" IT, and end-user computing costs. Only in a cooperative environment enhanced by financial incentives to reduce costs across the entire organization, including productivity impact, do cost control practices have their greatest effect.

[4] See Appendix E: TCO Assessment Case Study: Food Services Company

Cannot Distinguish between Evolutionary and Revolutionary Change

Although new technologies can be predicted to reduce the cost of day to day operations, IT must consider the cost of migration. Industry average TCO models do not take this cost into account. For example, the Network Computer (NC) architecture based solely on intranet technologies can potentially offer a reduced total cost per seat. However, the cost of additional network and server infrastructure, application development, lost productivity due to job disruption, training, and the availability of off-the-shelf applications and technical support are cost and risk factors that could easily extended delays on the return on investment for a radical change to NC's. Even the migration from an established 16-bit Windows 3.1 client environment to a higher productivity, easier to use 32-bit Windows environment can be prohibitive if not well planned and managed.

Compaq's TCO Initiative

TCO Initiative Objectives

Compaq's TCO Initiative was established in July 1997 with four major goals:

- Establish customer TCO reduction and financial advantage as metrics for Compaq's product and service development

  Each organization within Compaq is being driven to understand how its products, services, delivery mechanisms, and partnerships impact the financial success of end-user customers. This is an ongoing process improvement at Compaq, which is resulting in a series of quantitative and qualitative metrics and incentives for internal activities and decisions. These should result in demonstrable financial advantage to our customers.

  In particular, Compaq must recognize the economic impact of existing technology within customer sites. Integration of legacy systems and data provide the greatest risks for large enterprises, and Compaq product and service development teams must address these.

- Provide real world tools for measuring cost and estimating value
- Move Compaq and its customers forward in understanding and utilizing standardized cost measurement and control practices as an element in IT decisions
- Work with customers to elevate both their and Compaq's understanding beyond cost control to technology financial benefit

TCO Initiative Deliverables

As a result of these goals, Compaq has committed to specific deliverables as part of the TCO Initiative. These include:

- TCO Assessment services
- Credible, independent research on the value of Compaq technologies in well managed IT practice
- Working tools for TCO analysis and deployment planning
- Conferences on TCO measurement and reduction
- Presentation, marketing, and training materials for Compaq and Compaq partner sales and service personnel
- Sales tools
- Deployment tools
- ROI methodology and tools
- Case studies and solution stories demonstrating the value of Compaq technologies[5]

For more information about Compaq's TCO Reduction Philosophy and how Compaq implements it, see the section in this paper titled *Compaq Contributions to Lowering TCO: Enablers, Partnerships and Services*.

[5] See Appendix B: Table: Practices to Lower Cost of Ownership and Compaq Contributors and Appendix C: TCO Measurement and Management Resources

TCO Measurement Techniques

What Drives TCO?

Figure 4 - TCO Drivers

One of the risks of looking at TCO by client type (e.g. Windows 3.1, NC, Windows Terminal, etc.) is the tendency to view the client type as the primary driver in cost escalation and cost control. This is absolutely a dead end view. It is not possible to reap the benefits of cost reduction technology without complementary investments in people and process. The solution to the problem of computing costs is a balance of people, processes, and technology[6]. The training and skills of both the end-users and IT professionals establish the effectiveness of the organization. Processes control efficiency and speed response, and technology enables both. In order to identify the proper areas for investment, however, the organization must first undertake a study to determine what the possible areas for improvement are. This is the first step in the TCO Lifecycle Process.

TCO Lifecycle: the TCO Assessment Process

Compaq supports the Gartner/Interpose TCO Lifecycle Process for assessing computing operational costs. Although this process does not capture IT project planning and deployment costs, or business value, we believe it is an effective starting point for assessing the costs of an organization's computing implementation and how to improve it.

[6] TCO Drivers, ™ Gartner Group

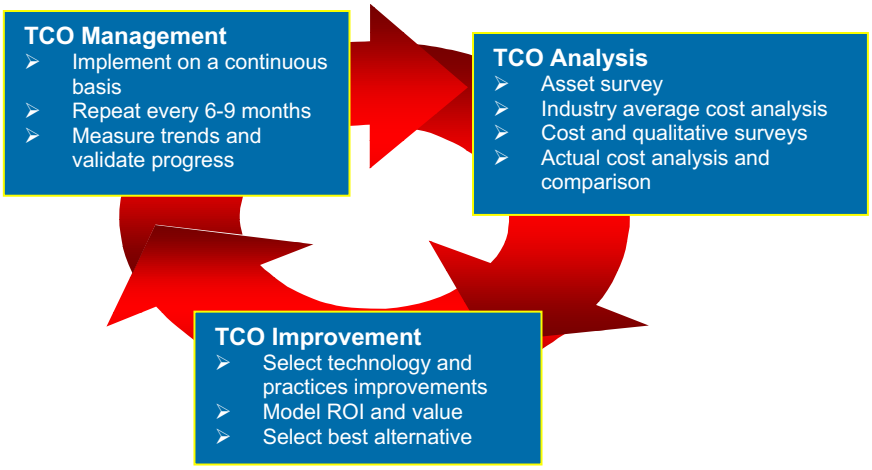


Figure 5 - The TCO Life Cycle

This is an iterative process, which requires investment in tools, services, personnel, and IT skills, but results in a comprehensive indication of operations costs and a mechanism to capture and reduce them on a routine basis. A full implementation of this process can result in the evolution of not only the IT department, but the organization as a whole into a cost-control-conscious entity, at least insofar as computing technology, skills, and process are concerned.

The process begins with a TCO Analysis, which is an intensive process that captures the organization's current total computing operations cost profile. The team performing the survey will typically consist of a service provider's consultant to guide the process, an IT executive as sponsor, and an IT project manager and team to gather and expedite information. Typically the analysis begins with a survey of hardware and software assets, including their financial value. The next step is to gather information on the day to day tasks of the IT department, and distribute those costs across the assets and departments which they support. The survey team gathers information directly from end-users to assess their productivity and the impact of computing technology and IT practices. Finally, the information is gathered into a software tool that automates the analysis and provides comparisons to other organizations with similar computing and business requirements.

After the analysis is complete and cost issues identified, the TCO analysis team makes a recommendation on technology, process, and people skills improvements that address the issues. The team now has the internal skills to do a follow up assessment once the implementation of the cost reduction recommendation is complete. This completion of the cycle and repetitive iteration allows the organization to stay on top of technology and business changes that can produce unexpected shifts in costs, and maintain a competitive edge balanced on cost, efficiency and effectiveness.

TCO Lifecycle Benefits

There are some fundamental benefits to incorporating a TCO Lifecycle process into the routines of business and IT management. These include:

- Creating accurate and measurable costs
- Improving decision making and justification process
- Improving forecasting and change control
- Better IT cost management and budget controls
- Access to standard and consistent data

- Establishing higher business value
- Generating higher customer satisfaction
- Improving performance
- Enhancing productivity and functionality

To complete a measurement process for the most sophisticated and complex organizations, Compaq also recommends implementing a continuous cost measurement and management program such as ASI's AssetPRO, or similar outsourced services by providers such as Compaq Capital. This will allow finer grained analysis of computing costs, and enable the distribution of support and administrative cost allocations to departments to balance internal or external service level agreement performance.

Best Practices to Reduce TCO

High TCO Drivers: Top Cost Issues

The following are the most commonly reported issues driving high computing operation costs, as determined by TCO Lifecycle process customers. Each of these can cause significant growth in computing costs as the organization grows. In addition, they can even cause data loss and system downtime as they drive unmanaged complexity into the organization. These issues are problems that Compaq is providing technology and services to address.[7]

1. **IT budget/staff cuts that have driven support costs to end-users**
   There is a common tendency for end-users to take IT management into their own hands, as a result of IT budget cuts or a failure to invest in IT to keep pace with business growth. This includes escalating peer support and ad-hoc application development. End-user IT of this type is usually less productive and efficient than IT professional services and can significantly impact business productivity.

2. **Complexity of the environment and lack of standards/policies**
   Organizations that grow through acquisition or without established and enforced IT standards often increase their technical complexity at a pace far faster than IT can manage, and without measured return.

3. **Poor change control and implementation of management tools**
   Due to the low cost per unit of PC client hardware and software acquisition and upgrades, change management is often an afterthought. This puts the IT manager at the mercy of the market and the desire of end-users to enhance their computing experience, which can drive unforeseen and even unknown changes into the environment.

4. **Faulty help desk processes and tools**
   End-user and network help desks are often understaffed and do not have processes in place to avoid repetitive end-user calls and inadequate help desk answers. This drives up not only the number of call instances and peer support costs, but also drives down end-user satisfaction.

5. **Inadequate IS and end-user training**
   Especially in organizations with high turnover in people or technology, lack of "Just In Time" Training programs that focus on the immediate and priority technical information needs of the IT professional or end-user result in confusion and lost productivity.

6. **Unreliable environments**
   Organizations that do not plan for scalability and availability to meet business growth or the shift of critical business information from mainframe to network systems, risk the greatest impact on the bottom line: business downtime. When this surfaces as an issue within an organization, it usually supercedes all other technology problems.

7. **Lack of real understanding of issues and improvement plans**
   Often the most difficult problem to address is the cultural or organizational barrier that sets up centralized IT as an adversary to the business unit. This can prevent the complete implementation of any cost reduction program, and requires significant high-level organization education and management to address.

[7] For information on how Compaq addresses these issues, see the Compaq Contributions to Lowering TCO: Enablers, Partnerships and Services and Appendix B: Table: Practices to Lower Cost of Ownership and Compaq Contributors sections of this paper.

Best Practices to Lower Cost

Following are the top practices that will impact the key cost drivers listed in the previous section, organized by the functional layers of computing costs: Acquisition, Support, Lifecycle, Administrative, and Interdepartmental Cost Allocation (Best Practices). For a more exhaustive list, refer to Appendix B: Table: Practices to Lower Cost of Ownership and Compaq Contributors, or the latest updates at www.compaq.com.

1. Reducing Acquisition Costs

Focus on Total Delivered Cost

When choosing hardware, software, and service suppliers, make sure that all acquisition costs are managed, including purchase or lease cost, existing equipment disposal cost, freight, software setup and installation. Recognize that suppliers should be chosen for the life of a project, or for the expected life of the asset, in order to take advantage of the benefits of standardization.

Choose Suppliers Friendly to Prevailing Applications

When selecting hardware, operating system, database, systems management, service, and other suppliers, make sure that each layer of technology supplier has formal, active development and support agreements with the others, and particularly with the chosen prevailing application (e.g. e-mail, office automation, ERP package, etc.). These agreements will allow for more accurate planning of actual hardware and software requirements, and prevent upgrade cost overruns. They will also contribute to lowering support costs by eliminating "finger-pointing."

2. Reducing Support Costs

Standardization: Hardware, Software, Policies

Standardization is the first practice to employ within an organization to eliminate support costs. By establishing single standards for hardware, software, services and IT policies, costs become predictable, support training can be minimized, and support efficiency improved.

Architecture Change Affects Apps, Training, Culture

Standardization also applies over time. To move a 1000 client network from one desktop standard to another can cost as much as $500,000 over a 1 year period in administrative, support, and training costs. A major software change for the same network can cost three times that.[8]

Save More by Utilizing Ubiquitous Standards

By focusing on ubiquitous standards like HTML and Ethernet as well as de facto standards like Windows NT Workstation or Microsoft Exchange, support costs can be reduced further through the broad availability of trained support personnel and extensive knowledge base.

Centralize the Help Desk and Enhance End-user Training

Economies of scale in the call center can be achieved by consolidating calls to a central location. Problems are better centrally tracked with common problems being identified and pro-actively eliminated. Integrating inventory configuration information speeds and increases the accuracy of problem diagnosis and resolution.

[8] Compaq customer studies, Inacom Information Systems

Training of both help desk professionals and end-users should be on a just in time basis and maintained regularly to enhance retention and relevance to the task.

3. Reducing Lifecycle Costs

Change Management

Change is inevitable but should be managed to the lowest amount necessary to maintain or advance business advantage. Choose vendors with a proven history of reliable products and appropriate product lifecycles, and institute policies that promote change only when necessary. Utilize technologies like electronic software distribution, proactive vendor change notification, and change management database and integration to lower the impact of necessary change.

Leasing and Financial Asset Management

Although the driving reason for leasing is often reducing the cost of capital, a leasing arrangement also often includes enhanced services for asset management, which can significantly enhance the efficiency of systems administration and help desk functions. Additionally, leasing often also includes technology refresh programs that formalize and simplify change management.

4. Reducing Administrative Costs

Asset Management

Accurate hardware and software configuration information is critical to reducing the administrative costs of maintaining the servers, network infrastructure and clients in a modern distributed system. Asset management should include both configuration information and configuration management functions that maintain the known optimal, supported state for each managed device.

Fault Management

Although the greatest impact of robust fault management technology and practice is on lost end-user productivity and revenue (by reducing downtime), it can also have a large impact on the cost of administration. By utilizing remote management and automated recovery technologies and integrating them with enterprise management systems and practices, organizations can maintain distributed computing resources more effectively without adding additional personnel.

5. Reducing Lost Productivity and Lost Revenue: Best Practices

High-availability Systems

The greatest single impact an IT organization can have to the bottom line, through cost reduction practices, is through the implementation of the appropriate level of availability for the application. Lost revenue from system downtime can range from $14,000 per hour in an average bank's ATM network fees to $6.5M per hour for a stock trader.[9]

Policy-based Client Management and Technology Choice

Implementing policy-based management limits the access of users to specific applications, data, and control. By limiting the users to just the right amount of computing power, management and support costs are reduced through control while productivity and scalability are maintained.

[9] Contingency Planning Research; Dataquest

Architect for Change and Growth

When designing office automation and specific business requirement, IT projects utilize technologies that will scale, provide mechanisms to accommodate significant technology enhancements, and utilize broad standards to integrate into future requirements. In particular, the Windows NT operating system on Compaq servers and clients provides a platform for growth, and utilization of standard Internet protocols and development tools allows for quicker and more risk-free integration with future data types and business requirements. These practices reduce the risk of unplanned expenses and costly network and software re-work.

TCO Lifecycle Services

By measuring TCO on a regular basis, tracking the progress of cost reductions, and verifying returns from IT investments, budgets and spending are optimized.

Service Level Agreements and Interdepartmental Cost Allocations

In complex organizations, establishing formal service level agreements will establish expectations and success metrics for IS. In order to encourage the end-user organizations to actively participate in the SLA and work within standards, establish complementary agreements for allocating support, disaster recovery, and administrative costs to the end-user organizations.

Compaq Contributions to Lowering TCO: Enablers, Partnerships and Services

Any successful TCO reduction plan requires a balance of people, practices and technologies. Although the customer ultimately must make the investments in training, developing skills and implementing the appropriate practices, the integration of technologies and services that reduce TCO is the essential third aspect of the TCO Drivers triangle. Compaq has invested significantly in delivering the right technologies and services, and integrating our technologies with the right third party technology and services providers, to create the optimum basis for TCO reduction.

Compaq's TCO Reduction Philosophy

To fulfill our commitment to being the lowest TCO provider, Compaq aggressively pursues four key TCO strategies:

- Compaq is committed to the core values of our customers, which include the purchase of high-quality, well-tested, cost-effective, and compatible products that support a variety of solutions offerings.
- Compaq is committed to a network design approach that delivers a full range of products, tools, and services that are developed and optimized for highly available network environments.
- Compaq is committed to increasing the manageability of the systems and the environment by delivering and integrating enterprise systems management solutions.
- Compaq is committed to a partnership-based business model, allowing customers to choose the most cost-effective and optimized solutions for their business needs. Working together, Compaq and its partners deliver proven, integrated solutions that minimize customer risk.

Each of these philosophies is borne out in the specific enablers, partnerships and services listed below. This is by no means a comprehensive list, but is meant to cover the items that will typically provide the greatest return in most enterprises.

TCO Reduction Enablers

Optimized Distribution Model

Compaq's Optimized Distribution Model (ODM) is designed to eliminate inefficiencies across the supply chain in order to provide the optimized cost and delivery time for the specific customer's operational needs. ODM combines the strengths of customized and rapid delivery through Compaq's channel partners and high volume manufacturing and parts supply from Compaq, and eliminates unnecessary inventories throughout the supply chain to the customer. This reduces cost and increases predictable deliveries while maintaining the customer's requirements for flexible business arrangements, thus ensuring the lowest total delivered cost.

Compaq Capital

Compaq Capital provides leasing, asset management, and technology refresh services, with flexible invoicing and terms to meet a broad range of customer requirements, including third party hardware and software.

High Availability

Compaq pioneered high availability in industry standard servers with the first RAID systems, redundant CPU's, and failover and recovery technologies. With the recent integration of Tandem Himalaya, ServerNet, and NSK technologies into the Compaq product line, and our pioneering work with Microsoft on the Windows NT Clustering Server, Compaq has the broadest range of highly available systems to meet the uptime specifications of any application.

Scalability and Broad Product Line

Besides offering sizing tools to decrease the risk that inadequate planning will cause cost overruns or performance bottlenecks, Compaq ProLiant servers offer some of the greatest scaling of Windows NT application performance, with a clear migration path within the product line that preserves customer investment. Additionally, no other manufacturer offers a broader commercial product line, from handhelds and Armada portables, Netelligent network products, the broadest and most successful line of business desktops in the Deskpro line, market leading ProSignia and ProLiant servers, all the way to non-stop and completely scalable Tandem servers. Customers can take advantage of this broad product line to fulfill all their systems and network product needs, establishing a strategic relationship with a complete enterprise supplier.

Business-focused Products and Lifecycles

Compaq focuses development resources to meet business requirements. The TCO Initiative is more evidence of how Compaq drives technology to increase customer advantage. Compaq's broad commercial product line is designed for business requirements, what Compaq calls "useful innovation," not to accommodate the consumer buying cycle or technology crazes with unproven business return. Longer lifecycles and rigorous testing provide customers with more confidence to deploy Compaq products in the most demanding applications, in long project roll outs, and in high return projects where they cannot afford risks due to unstable or changing hardware/driver combinations.

Compaq Management and Manageability Products

Compaq pioneered manageability in the first manageable servers starting in 1993, introducing the first manageable desktops in 1995 and the first manageable portables in 1996. Since then, many of the technologies that Compaq pioneered have been adopted as industry standards, such as SMART hard drives, SNMP monitoring of Windows NT and NetWare servers, and DMI. Other's technologies remain leadership areas for Compaq: automated server recovery; pre-failure component replacements in servers, desktops and portables; and the industry's most complete integration of hardware enablers and software agents with LAN, domain and enterprise systems management applications.

Intelligent Manageability

Intelligent Manageability is Compaq's name for comprehensive manageability solutions to manage Compaq clients, such as Desktops, Portables and Workstations, from a single point on the network. Intelligent Manageability solutions address each critical stage of a client's lifecycle: Initial Deployment and Configuration, Asset Management and Security, Software Updating and Management, and Fault Notification and Recovery. Intelligent Manageability solutions are based on industry standard building blocks like Net PC Technologies, Wired for Management, DMI 2.0, and SNMP, and tightly integrate with off-the-shelf management solutions. Compaq Insight

Manager complements these management solutions by providing hardware and software diagnostic information to ensure high availability of systems and productivity of users with low downtime.

Reducing TCO through Integration with Partner Technology and Services

Integrated Manageability

Compaq recognizes that only through process and integration of hardware enablers, software agents and LAN, domain and enterprise consoles, can an enterprise begin to bring technology under management. Therefore, Compaq has extensive formal development and service agreements with the industry's leading management applications. The benefits of this integration are cumulative. That is, fully manageable systems integrated through comprehensive management technologies in an enterprise with appropriate processes and people skills will provide a financial benefit far greater than less well-integrated solutions.[10] Additionally, Compaq's integration expertise, enabled through Compaq services and partner services, breaks down the barriers that often prevent full implementation of management solutions.

Enterprise/Distributed Systems Management

Enterprises undertaking the broadest, most demanding distributed computing environments can take advantage of Compaq's integration work with Computer Associate's Unicenter TNG or Tivoli's TME10. Compaq and these partners provide extensive integration information and specific advantages such as direct integration of Compaq Insight Manager into the enterprise console, MIB integration for SNMP alerting, and scripts to automate software distribution, not to mention extensive development and testing. Utilizing these industry leading enterprise management projects as top level management consoles, and Compaq Insight Manager to provide in-depth looks at Compaq server and client products, allows the customer to establish processes to avoid business loss from downtime.

Application/Service Level Agreement Management

BMC's PATROL application and service level agreement manager product integrates with Compaq Insight Manager to provide robust alerting and diagnosis of potential application performance risks before they become bottlenecks and affect end-user satisfaction or, in extreme circumstances, cause downtime.

Client Management

Compaq and its partners have the most extensive integration available in the industry to manage client PC's. Intel's LanDesk, Microsoft's SMS, Novell's ManageWise and CA's Unicenter TNG all have special functions to connect with Compaq Deskpro and Armada client systems to gather configuration information, report on system health, and actively manage configurations. Compaq Insight Manager provides an extra level of diagnostic services to assure the most rapid and complete management of client PC's available.

Windows NT 5.0 and Zero Administration Windows

Windows NT 5.0 will provide a Zero Administration Windows (ZAW) option that allows for robust, server-managed client configuration. It refers to a set of core technologies that will give IT professionals new levels of control and manageability over their Windows-based environments by automating such tasks as operating system updates and application installation, and providing tools for central administration and desktop system lock downs. Compaq was one of the designers of the

[10] See the section below: Proof Points on Compaq's impact: Measured Impact of Systems Management, and the IDC study "The Business Case for Investing in Manageable Systems"

NetPC specification that provide the hardware, ROM, and driver hooks to enable ZAW, and all current Compaq Deskpro PCs support the full implementation of ZAW.

Service Partners Deliver the Solution

Compaq's extensive dealer network gives enterprise customers around the world the choice of service levels to meet the most demanding situations. Compaq's Accredited Service Engineer (ASE) and ASE-Pro training sets a high standard for knowledge and is one of the most desired technical accreditation's available in the industry. From full service systems integrators to dealers specializing in fast product turnaround, Compaq's dealer network delivers the right mix of efficient delivery and services to meet the goal of lowest total delivered cost.

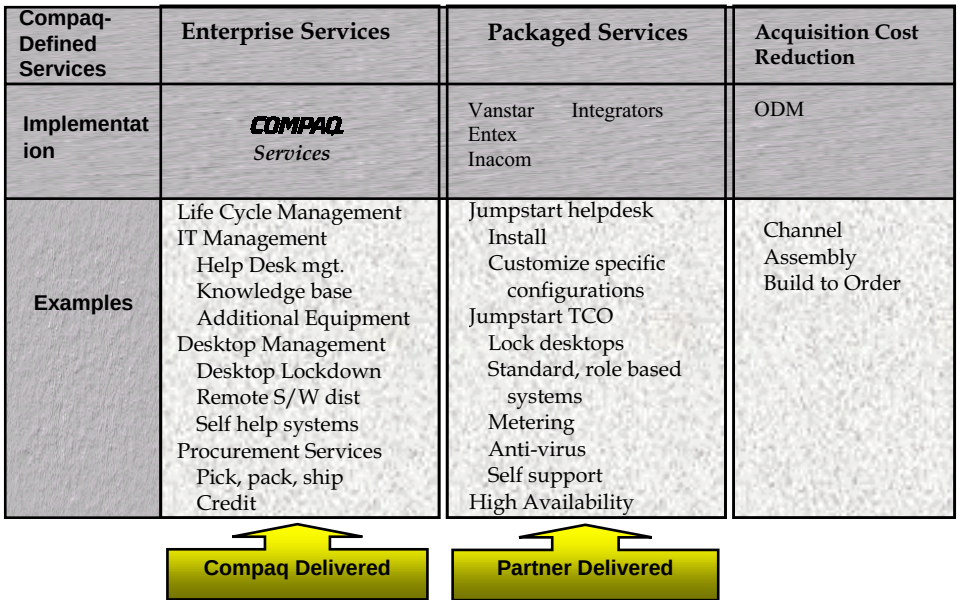


Figure 6 - Compaq and Partner TCO Reduction Services

TCO Reduction Services

Global Sales, Service and Support

Compaq does business in almost every country of the world, and has one of the industry's most extensive dealer networks providing local support and service. For enterprise customers requiring uniform pricing and service across the globe, Compaq offers the Atlas program. This can assure the customer more confidence in the budgeting process, and ease concerns on high risk, worldwide technology projects.

Application Integration Services

Compaq pioneered the concept of competency centers to streamline the planning, deployment, and operations of critical business applications. With competency centers in the U.S. and Europe focused on SAP, TCO, and systems management (with other applications to follow), Compaq can provide customers with confident shortcuts to successful enterprise projects. Compaq also provides enterprise architecture consulting services through its Enterprise Consulting Services and Professional Services organizations, including system planning and proof of concept. Backed by

extensive engineering support and years of partnership with leading application developers, these services can reduce the risk of implementation and shorten a customer's time to market, as well as minimize cost and time overruns later in the project.

TCO Lifecycle Services

Compaq supports the Gartner TCO Lifecycle process through its Enterprise Consulting Services organization in the U.S., and through dealers and consulting professionals all over the world. Compaq recommends a structured cost analysis through this process as the starting point for any TCO reduction project targeted at day-to-day operations.

Proof Points on Compaq's TCO Reduction

Compaq TCO Reviews

Compaq has received extensive reports from customers who have reduced cost and business risk by using Compaq technologies. For more information on this, see *Appendix D: Compaq Customer TCO Reduction Quotes*.

Manageability: Measured Impact

Effective systems management is one of the most effective mechanisms for reducing computer operations costs, and one that requires a balanced approach of good processes, appropriate personnel and skills, and the right set of integrated technologies. In 1997, IDC performed a study with 15 large Compaq customers to assess the impact of such integrated management practices on the cost of operations.[11] In summary, the 15 customers who participated reported an average of $410,000 per year saved, per 100 users.

The survey asked customers for comparative assessments of three measurements of IT effectiveness:

- *Efficiency*--scalability of the IS management staff, based on the number of servers or desktops each administrator can manage;
- *Productivity*--time required for administrators to perform activities that maintain or improve network, systems, and application performance; and
- *Availability*--the frequency and impact of users inability to access the network and computing resources.

IDC compared current measurements to those prior to implementation of management, and evaluated the impact of the management processes, skills, and technologies used. The greatest financial impact came in availability, as measured by lost wages. Network and server uptime, as well as stability of the client hardware/software environment, significantly improved the availability measurement. Remote management and configuration tools and processes enabled the IT staff to support more users without additional staff or travel time. Automated configuration and maintenance tools and processes increased the IT administrators' productivity.

Table 1. Life Cycle Value

Life Cycle Value of Manageable Systems and Complementary Management Tools ($)					
	Efficiency	Productivity	Availability	Total	Payback
Annualized Savings	46,000	104,000	260,000	410,000	77 days
5 Year NPV				$1,640,000	
Source: International Data Corporation, © 1997					

The report also includes three case studies, which give detailed reports on the impact of management practices and technologies. For specific details, see the *IDC report* or *Appendix F: Case Study: Regional Bank* in this document.

[11] International Data Corporation, "The Business Case for Investing in Manageable Systems"

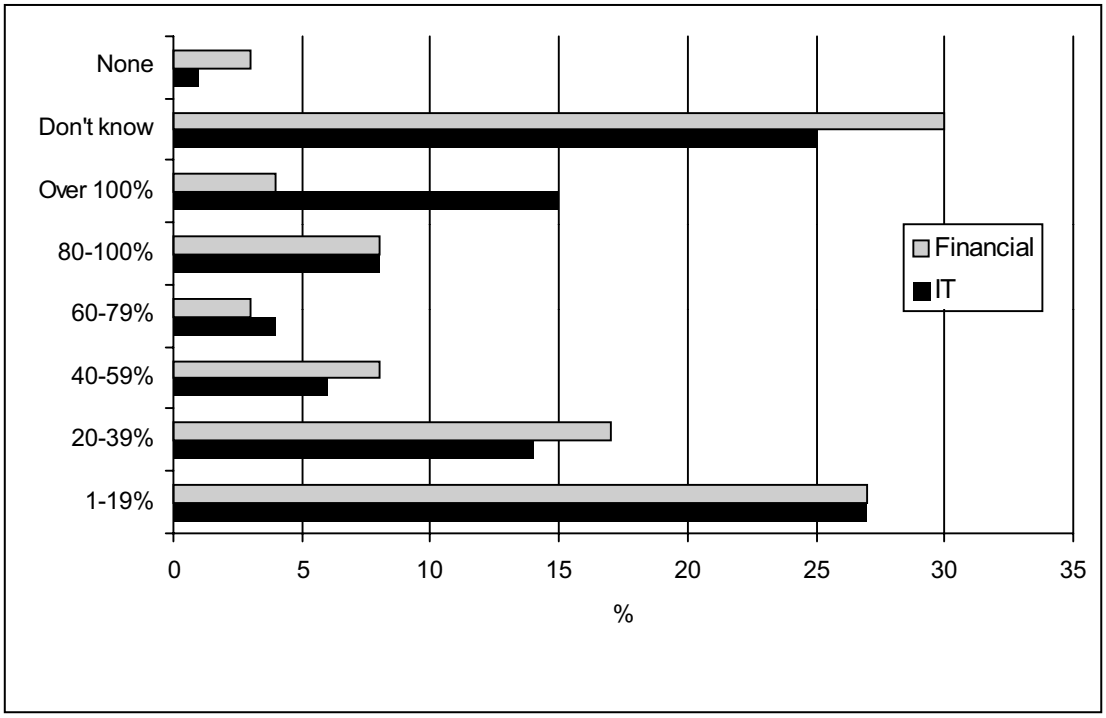
Summary

- The emerging customer value equation is Total Benefit of Ownership. Total Cost of Ownership is a critical variable in this equation.
- There are emerging standards for measuring Total Cost of Ownership. Following these standards to measure TCO in a TCO Life Cycle Process provides necessary metrics for any TCO reduction project.
- Improving IT practices can significantly lower cost of ownership. Practice improvements work in balance with people skill improvements and technology improvements to create the best financial return.
- Compaq is developing industry standard building blocks, tools, and solutions to lower cost of ownership at every level of IT practice sophistication.
- Compaq is proven to lower acquisition, support, lifecycle and labor costs.
- Whichever way you look at it, Compaq costs you less.

Appendix A: Study Summary: Customer Attitudes on Cost of Ownership Issues and Practices

In late 1996 Compaq commissioned a study in the U.K. through Benchmark Research to measure the awareness of TCO as an issue. Study participants were 252 IT directors/managers and 250 financial directors/managers. In 1997, Compaq followed this study with a U.S. study. These two studies bring to light an important issue. Although almost all financial and IT executives see the cost of computing relative to its return as an issue, few have accurate assessments of what those costs are in their own organizations, and their definitions of cost vary widely. This has made the varying claims of vendors and analysts less credible as executives seek for a reliable benchmark of IT costs and value. Here are some of the results of the surveys:

Figure 7. Awareness of TCO as an Issue



Question: **Over the PCs lifetime, what is the additional cost of supporting the PC as a proportion of the capital cost?** Note that the largest segment did not know the relative costs of labor to capital, and only 4% of the financial managers and 15% of the IT managers realized that the relative cost of labor was greater than 100% of capital.

The survey also measured specific cost reducing practices.

1. Asset management practices were not well implemented. 69% Of organizations audit the number of PCs by manually counting them. For 31% of organizations, this takes longer than six days. 25% Of organizations do not know how long this process takes and therefore do not control the cost of auditing PCs. 38% Use no network software to audit their PC inventory and, of those that do, only a handful tie the results of the electronic audit back to help desk databases and financial asset records where the data will have the greatest impact.
2. For the use of fault management, a surprising 38% of organizations do not track hardware failure and hence its associated costs.

Appendix B: Table: Practices to Lower Cost of Ownership and Compaq Contributors

People/Process/ Technology Improvement	Benefit	How Compaq helps
Implement policy-based management	Implementing policy-based management limits the access of users to specific applications, data, and control. By limiting the users to just the right amount of computing power, management and support costs are reduced through control while productivity and scalability is maintained. With policies, much of the End-user IS costs can be eliminated, providing for a system that does not allow non-productive applications and changes to be run, and which provides access to only applications that the user has been trained upon.	Remote configuration and management standard on all Compaq Deskpro and Armada clients supports policy-based management. The broadest manageable product line in the industry plus industry leading system configuration tools and expertise help customers design their policy-based managed systems.
Standardize your desktops and network	A standardized desktop platform and network architecture will allow for economies of scale in purchasing, support, and management. Purchasing can be performed in volume to get better pricing. Components can be quickly replaced because they are swappable and spares can easily be made available. Support and management are reduced because each system and network is identical, reducing training and re-education expenses, and allowing common issues to be identified and engineered out of the organization at once.	The broadest commercial computing product line in the industry allows customers to standardize on Compaq for all end-user needs. Compaq's paramount development, compatibility testing, longer cycles between product changes, and commitment to product support across product life cycles through technologies like the Universal Video Driver and Integration Server, take the benefits of product standardization even further.
Automate your asset Inventory	Non-automated Inventories are 20% inaccurate on average, resulting in misstatements within accounting data and incorrect tax reporting. In addition, up to 50% of the time in every help desk call is spent on understanding the hardware and software configuration. Providing access to the inventory data at the help desk can reduce call time.	Compaq's Deskpro, Armada and video monitor Intelligent Manageability provides the greatest amount of inventory information detail available in the industry, and is accessible through DMI and Management Solution Partners products like Intel LanDesk, Tally NetCensus, Microsoft SMS, ASI AssetPRO, Bindview, McAfee ME, and others.

People/Process/ Technology Improvement	Benefit	How Compaq helps
Utilize virus protection and elimination	With the proliferation of data sharing via e-mail and the WEB, the chances of virus infection has increased dramatically. Preventative virus protection helps maintain user productivity and eliminate costly administration fees in identifying and eradicating viruses. Viruses can take up to 14 person hours to eliminate from a network and cause 4 hours of downtime for each infected machine. An organization with 1000 computers is expected to encounter at least seven infections over a 12-month period. A proper virus protection plan and tools eliminates the risk of infections and provides a means to more quickly recover should an infection occur.	Compaq's partners McAfee and Symantec provide industry leading virus protection and elimination products. Compaq integrates Raptor firewall protection on Compaq ProLiant and ProSignia servers through SmartStart, helping to eliminate the influx of virus through unauthorized internet access or outside intrusion attempts.
Implement centralized network management	By implementing network management products and centralizing the management of performance information and alerting, administrators can better set policies and pro-actively avoid issues. Be sure to include the up-front labor and consulting costs that are involved in providing this functionality in the ROI analysis.	Compaq pioneered manageability in 1991 with SystemPro and Insight Manager. Compaq has the most complete fully manageable product line in the industry, including servers, clients and communications and network technologies. To understand the quantified benefits of using Compaq management technologies, see the IDC white paper "The case for investing in manageable systems."
Centralize the help desk and support knowledge base	By consolidating calls to a central location economies of scale in the call center can be achieved. Problems are better centrally tracked with common problems being identified and pro-actively eliminated. Combined with an inventory system that can display configurations of the system having issues and a desktop remote control capability, the help desk can be dramatically improved, reducing the duration of calls from an average of 17 minutes by some 50-70%, and reducing call frequency. Beware however that help desk support needs to continually monitor service levels to assure performance. In most organizations, help desks do not provide adequate knowledge and response times to meet user expectations. Users then turn to peers for support. Outsourcing of the help desk is a valuable option in consolidation programs. Again, service level measurement and guarantees is the most important criteria in selecting a help desk provider.	Compaq's Deskpro, Armada and video monitor Intelligent Manageability provides the greatest amount of inventory information detail available in the industry to support help desk software providers. Compaq's service partners and self-servicing customers have access to Compaq extensive knowledge base, making problem resolution easier. In addition, Compaq requires significant training commitments from its support and service partners in order to maintain authorization, so support quality levels are maintained. In the eventuality the customer or service provider needs to call Compaq directly for problem resolution, Compaq's response time and quality of service lead the industry.

People/Process/ Technology Improvement	Benefit	How Compaq helps
Consolidate Servers	Servers are often scattered throughout departments and workgroups in an organization. In many instances these distributed servers, particularly those performing file and print services are under-utilized. In addition, they are often configured on sub-standard hardware, purchased by individual organizations rather than IS. By consolidating servers into high availability systems that are centrally managed, reliability can be improved, while management and consolidating servers into high availability systems that are centrally managed reduces management and administration costs. This is best done at the same time as a server operating system upgrade.	Compaq has the broadest range of fully manageable server products, covering every need from ProSignia departmental servers to enterprise level ProLiant servers, clusters and Tandem Non-stop Himalaya systems. Compaq provides system configuration and sizing tools to make server consolidation and capacity planning easy and confident. Compaq provides the industry's most proven high availability solutions at every level of server technology.
Improve end-user and IS training	Training is one of the most important ways to increase productivity and reduce both direct and indirect IS costs. Over 30% of the TCO components can be improved through proper training programs for both IS professionals, and users. For users, you may wish to consider requiring formal training prior to new application rollouts, and implementing a just in time training system to provide the skills and help information when a user needs it. For IS professionals, you should review certifications and implement incentive programs to increase the number of certified team members. As well, especially with the outsourcing of application platform and operating system rollouts, skills that are gained during these experiences are not transferred to the help desk and administration staff. It is vital to re-tool skills as the network changes and to be sure that outsourcing is performed in a cooperative way to assure knowledge transfer.	Compaq service and reseller partners provide leading training programs for customers wishing to implement a complete training program. Compaq provides these partners with up to date training on Compaq products so that IS professionals and end-users alike can be kept fresh on Compaq products. Compaq also offers an Accredited Service Engineer program for IS professionals who maintain and support Compaq products, in addition to certifying resellers and service partners.

People/Process/ Technology Improvement	Benefit	How Compaq helps
Backup data and plan for disasters	Most organizations backup their server data, but do not backup client information, and rarely are prepared with continued operation or recovery plans for a disaster. Many keep the backup tapes next to the server being backed up … in a site disaster the server and the tapes are both destroyed! A good disaster recovery plan includes tested policies for data protection, emergency team formation and alternate site setup. Specialized consultants are available to assist in developing and implementing these plans.	Compaq's fault management and enterprise storage products make backup easier and more automated. Proactive backup can back up server and client data in the event of an impending failure, and Compaq's high speed and high capacity storage and backup devices lead the industry.
Do better planning of projects	A better plan and up-front analysis avoids costly mistakes later. A team oriented planning methodology provides structure to the planning process. A plan involves multiple members from representative organizations with defined roles, vision, scope and most importantly a method for identifying and mitigating risks. TCO management is one planning method that lets you reduce costs, identifying trouble spots through measurement, and simulating plans prior to improvement.	Compaq provides sizing, planning and ROI tools to make project planning easier and more accurate. Compaq Enterprise Consulting Services in the U.S. and Canada provide expertise for enterprise system design and can greatly assist in planning, including TCO audit and management. Compaq's service, integrator and reseller partners also offer a wide range of planning services.
Design and implement a scalable architecture	Business is continually changing and competition continually increases. As a result, the organization you manage today is not the same one you managed a year ago. It is vital, in order to reduce costs, that you develop an architecture that provides for scalability and flexibility to meet the changing business needs. Re-engineering of the infrastructure on a continuous basis is costly. Select an architecture that is scalable to reduce total costs.	Compaq's development relationships with key application developers such as SAP, Oracle, Baan and Peoplesoft, technology firsts such as Windows NT clustering, and high performance servers and clients, provide scalable architectures to meet all customer needs. Compaq sizing tools help you plan for growing needs and make the right investment today to accommodate tomorrow.
Invest in component application software	Similar to a scalable architecture, it is important to create a scalable application development environment, one which can build to meet growing business needs, and flexible enough to be quickly changed and maintained to meet changing business requirements.	Compaq's development relationships with key application developers such as SAP, Oracle, Baan and Peoplesoft, technology firsts such as Windows NT clustering, and high performance servers and clients, provide scalable architectures to meet all customer needs.

People/Process/ Technology Improvement	Benefit	How Compaq helps
Centralize and streamline purchasing	The capital expenditures of computer hardware and software can be greatly improved by centralizing the purchasing of all assets, obtaining maximum cost savings through volume license and hardware purchasing agreements. Centralized purchasing can cause issues and cause the user to circumvent the system if too many restrictive policies are introduced coincident with the project. It is vital to balance the cost savings against the natural tendency to restrict control and flexibility.	Compaq Capital Corporation and Compaq reseller partners can provide centralized purchasing and leasing services designed to simplify procurement and ongoing maintenance of IT assets.
Measure and agree on service levels goals	By reducing costs it is often the case that organizations do so at the expense of service to the business units and users they are supporting. As part of the cost reducing projects that you implement, service levels should be monitored and minimum required service levels should be established. A cost-reducing program that drops service levels beyond the minimums is one that should be re-considered. Monitoring the quality of the delivered services is essential.	Compaq Enterprise Consulting Services and some authorized resellers provide audits and services to evaluate support levels, and resellers can provide outsourced support services for organizations that prefer this alternative.
Motivate IS professionals	A service organization such as IS and help desk support requires motivated individuals who are dedicated to meeting customer expectations and delivering superior service. An IS professional who is not happy with his/her job and is not motivated to delivering superior service will not be able to perform up to expectations. This is costly in both hard dollar terms, and in the quality of delivered services.	Working with quality equipment and first rate reseller support reduces personnel stress. Compaq's manageable systems reduce unplanned downtime and configuration headaches, making for a more efficient IS organization.
Do capacity planning and load balancing	Adequate scaling of resources and allocation of computing power to meet user and customer needs is essential. Too often, resources are purchased and managed for capacities that may be too low, or too high. This causes misappropriation of hardware and software expenses, and worse, downtime or over-management of resources that are heavily taxed and are over-capacity. By monitoring the requirements of the business and users, resources can be allocated and maximized for needs.	Compaq Insight Manager provides capacity risk alerts, and Compaq provides sizing and configuration tools that minimize the likelihood of overtaxed systems. Compaq resellers can provide additional services to manage and size asset requirements.

People/Process/ Technology Improvement	Benefit	How Compaq helps
Institute change management and control	Vendors and users are continually putting pressure on the IS organization for change. This change demand is only going to increase over time. It is essential that an IS organization realize that change demands are continuous and put in place a system to control and manage change in an orderly and planned fashion, avoiding users from skirting the system to implement the systems and applications they demand. It is key to embrace, manage and control change rather than fight it.	Compaq changes its product lines only to provide useful innovation, not to source the cheapest parts available or the latest technology simply for marketing's sake. And when change is necessary to support new software or fix bugs, Compaq technologies like Info Messenger and Integration Server make the decision to update easier and the process simpler and trouble-proof.
Invest in fault tolerant systems and network technologies	If network resources were available 96% of the time, better up-time than most networks experience, a 300 user network would still be faced with losses of $840,000 each year in productivity, the inability of users to accomplish their work, and revenue; the bottom line revenue impact of not being able to perform mission critical transactions. A fault tolerant network that implements fault tolerant storage (RAID), servers, and network components can increase uptime and eliminate costly resources.	Compaq pioneered advanced fault prediction and avoidance in servers and clients with RAID, pro-active backup, automatic server recovery and other technologies. Integration of these features with Compaq Insight Manager and key partner software reduces the risk of downtime. For an analysis, see the IDC white paper "The case for investing in manageable systems."
Make upfront investments in the right systems	An organization that invests more in technology up-front can eliminate costly upgrades later on. Buying an extra 8 Mbytes of memory per machine can cost $50 per system today. But an upgrade later will require not only the purchase of the memory, but the labor associated with purchasing and installing the memory, an estimated expense of $250 per computer. Similar expenses can occur by under-specifying hard drives, monitors, multi-media, network resources, printers, and other similar assets. Spending up front can eliminate costly labor expenses later.	Compaq sizing tools can help the IS professional predict the long term requirements as user and application demands grow, and help the organization invest in the right hardware capacity up front. Many customers optimize for the second year of a three year desktop life cycle.

People/Process/ Technology Improvement	Benefit	How Compaq helps
Cycle desktops every three years	Typical organizations attempt to hold onto computer assets for as long as possible. The extra expense of troubleshooting, repairing, upgrading and maintaining older computer assets for many organizations far outweighs the benefit of a four to five year lifecycle. With today's lower prices, and the NetPC being introduced this summer, desktop computers should be retired after three years and replaced with the latest hardware. This extra capital expense will have returns in lower administration and support expenses, and should yield gains in productivity as the new PCs are able to run 32 bit operating systems and applications. Leasing is also a viable option to assure that initial capital outlay is low, and technology is cycled on a continuous basis. Many leasing companies offer great rates, track assets, and include maintenance contracts for minimal fees.	Compaq Capital Corporation provides leasing and asset management services to implement the best technology refresh plan for your organization.
Institute software usage monitoring and licensing	How many of the applications are really being used by end-users. Many IS professionals do not know who is using the installed software and how many licenses are purchased that didn't need to be. By monitoring usage, consolidating the software, and negotiating usage based licenses, you can optimally purchase software licenses and reduce software expenses.	Compaq's partners such as ASI provide software that can automate and optimize this process.
Implement balancing service level agreements and cost allocations	In complex organizations, establishing formal agreements on service levels required – availability, service response, response time, and help desk responsiveness – will establish expectations and success metrics for IS. In order to encourage the end-user organizations to actively participate in the SLA and work within standards, establish complementary agreements for allocating support, disaster recovery and administrative costs to the end-user organizations.	Compaq partner software such as BMC enables the monitoring of performance levels and the identification and removal of bottlenecks to maintain the agreement. Compaq Insight Manager provides the planning and diagnostic tools to proactively manage the hardware so that it does not become a barrier to meeting SLA requirements.
Perform TCO lifecycle management	By measuring TCO on a regular basis, tracking the progress of cost reductions, and verifying returns from IT investments, budgets and spending are optimized.	Compaq's partners such as Gartner and ASI provide software that can automate and optimize this process. Compaq and partner services for TCO analysis provide spot checks on cost elements and cost reduction progress.

People/Process/ Technology Improvement	Benefit	How Compaq helps
Train and Certify IS personnel	Training for network, systems, and storage management personnel is vital to optimize the network and provide adequate service levels. As well, support personnel must be trained on the operating systems, computers, network and applications they are supporting to adequately provide value-added services.	Compaq provides Accredited Service Engineer training for customer as well as reseller personnel.

Appendix C: TCO Measurement and Management Resources

TCO Assessment Service Providers

Compaq Enterprise Consulting Services (U.S. only)
P. O. Box 692000
Houston, TX 77269-2000
(281) 370-0670
http://www.compaq.com/large/consulting.html

Gartner Group
56 Top Gallant Road
P. O. Box 10212
Stamford, CT 06904-2212
(203) 316-3600
www.gartner.com

ENTEX Information Services
Six International Drive, Rye Brook, NY 10573
(914) 935-3600
www.entex.com

Inacom
www.inacom.com

TCO Reduction Technology Solution Sources

All the following documents may be obtained from the vendors' web sites.

Compaq White Papers: http://www.compaq.com

Compaq On-Line Recovery Server, October 16, 1995

Compaq SMART-2 Array Controller Technology, February 5, 1996

Compaq Insight Manager, June 3, 1996

Intelligent Manageability, March 4, 1996

Backup Basics, February 1996

Compaq Recovery Server Solutions for SAP R/3, December 1996

Compaq Solutions for Remote Server Management

High Availability Features for Compaq Net-Flex-3 Controllers

ServerNet Technology

Eliminating Single Points of Failure and Enabling Rapid Recovery in Server Subsystems

Remote Server Management with Integrated Remote Console

Compaq Netelligent Network Management Overview

Various implementation white papers under Windows NT, Unix, Netware Citrix, Oracle and OS/2

Microsoft: http://www.microsoft.com

Reducing the TCO of Computers

Manageability Initiatives

Windows NT Server: Controlling the total cost of ownership

Network PC System Design Guidelines

Systems Management Server: Microsoft Reaffirms Commitment to Zero Administration Initiative for Windows

The Zero Administration Initiative for Windows

BMC: http://www.bmc.com

Apps Control from the Ground Up

Cost Savings for SAP R/3 with Patrol

Enterprise-Wide Analysis of Network-Based Application Performance

Patrol Architecture - Raising the Application Management Standard

Comprehensive Backup and Recovery

Why Bother with Recovery Time?

There are various papers on specific application management, including generic SQL, Oracle, SAP, Baan, and many others.

Computer Associates: http://www.cai.com

Computer Associates Enterprise Management Strategy: Managing the New Enterprise

Automation Systems: The role of Automated Systems products within the overall Enterprise Management vision

CA and Cheyenne Enterprise Management Collaboration

Appendix D: Compaq Customer TCO Reduction Quotes

"The very reason we chose Compaq over other competitors was the long-term cost of ownership. We looked at the statistics that were available, we tested some machines ourselves, we did our own analysis and we determined Compaq was the best cost-benefit for the hospital."

Riverdale Hospital Toronto

"Not only is the initial price getting better compared to competitor's products, the total cost of ownership makes the Compaq decision a superior one."

Georgia Pacific

"Compaq does the (SAP) platform validation and benchmarks in their labs. This saves Lyondell hundreds of thousands of dollars, with less risk than if we had to implement everything on our own."

Lyondell Petrochemical

"Compaq offered us a complete line of PC's -- the complete solution from soup to nuts… we are now standardizing on the new Compaq Deskpros due to their built-in desktop management features, which we expect will result in a significant reduction in our overall cost of computing."

Johnson & Higgins Insurance Brokerage

"Compaq provides systems management tools that are usable today. They're good and they work. The other major vendors can only tell you what they will have in the future. Compaq management tools are more open and they are easier and less expensive to use than competitors'."

Carl Karcher Enterprises, Inc.

Appendix E: TCO Assessment Case Study: Food Services Company

Following are the results of a TCO assessment completed at a large food services company:

Company profile and scope of work:

The organization is multinational and highly distributed. The assessment was made solely at the company's headquarters site. The analysis process required 6 weeks with 150 person hours of consulting and corporate personnel time expended during each week. At the site, there are:

- 204 servers
- 5,693 clients
- 612 printers
- 184 hubs
- 28 routers

Results overview:
Industry average: $49M ($7,080/client/year) Actual $59M ($8,466/client/year)

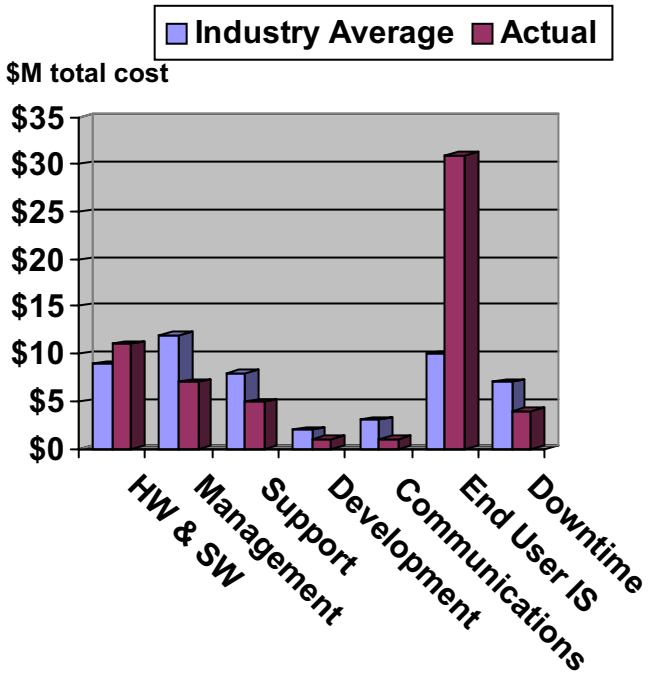


Figure 8. TCO Assessment Case Study

Analysis overview:

Hardware and Software:

- Older equipment upgrade expenses are 30% higher than expected
- Multiple vendors with no technology exchange or refresh program

Issue: Management Staff Cuts

- 75:1 users to administrators ratio
- Win 3.1 industry average - 40:1

Issue: Help Desk Staff Cuts

- 256:1 users to support staff ratio
- Win 3.1 industry average - 100:1
- 20 % abandon rate, 7 minute hold time
- 5 minutes average duration per call (call time only)

End-user Self and Peer Support:

- 8% lost productivity due to self/peer support (almost 500 FTEs)
- 2x more likely to seek support from peers
- 10 hours of peer and self support per month per user (4 hrs avg.)
- Involve 1.6 peers in solving each problem
- Receive little/no training (4 hrs/yr. vs. expected 3 days/yr.)

Recommendations Overview:

1. Staff is not at critical mass - re-staff in key network and systems management areas
2. Standardize the desktop environment and consider a refresh program and leasing.
3. Implement a more manageable and controlled desktop environment
4. Implement end-user training program on new technology
5. Outsource the help desk, or implement improvement program and tools

Appendix F: Case Study: Regional Bank

The following is excerpted from the International Data Corporation report "The Business Case For Investing in Manageable Systems," plus additional material from the source study:

For the IS manager of a major regional bank, whose network consists of over 10,000 desktops and 1,000 servers scattered over 600 locations *"Reliability and manageability of our system and network elements are very important to maintaining profitability. If a user at a remote location cannot communicate to the central databases, business grinds to a halt."* The bank relies on its network to provide superior service to its customers and their MIS plan is even part of the company's overall business plan.

They rely on NetView, Optivity, NetWare NDS and Insight Manager for management tasks. The most important capability that a server can provide, according to the company's network manager is remote management. *"I don't want to have to stand in front of the box to know what is going on. And I don't want to have to rely on fancy tools to do it!"*

He wants tools to be robust, but easy to use. He wants server manufacturers to incorporate real time monitoring components as part of the design. This is just as important for enterprise server vendors such as HP, IBM and Compaq as it is for workgroup server vendors.

One of the most critical features of the Compaq servers is the ability to identify a potential problem long before it becomes a problem. This makes it possible to be proactive and lessens the risk having to take the server down because of a problem that could have been prevented.

For example, if a hard drive fails without any prior knowledge of a potential problem, determining what happened becomes a major diagnostic project. *"With Compaq's robust alert system, our network managers not only can identify a wider range of conditions, but the managers can be alerted of changes in conditions."* The record of these changes is a very important metric that makes it possible to keep the network's availability very high.

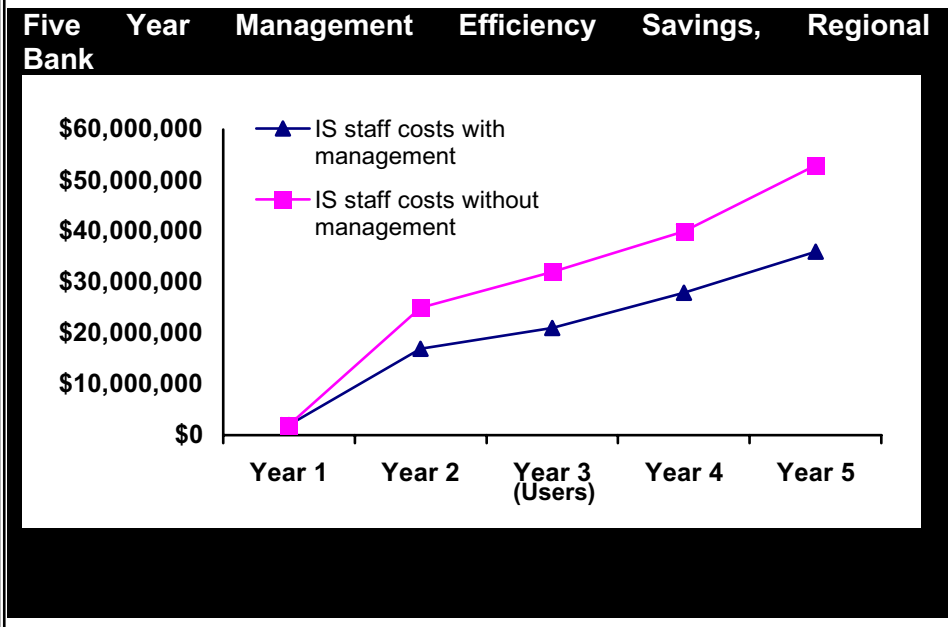


Figure 9. Management Efficiency Savings

The real value in manageable systems for the bank has been the reduction in support costs, but, they also recognize that without management they could not launch and support their enterprise network.

Their operation currently supports 600 remote locations, as well as the links between them. The network that they built over the last few years to support all of these locations could not have been done without the remote monitoring capabilities. It would have been much too expensive to justify. Because of the leverage generated by manageable systems and management tools, they can support the entire network with 199 IS managers.

By their own admission, they would have required two or three times the support staff to accomplish day-to-day management and in addition, they would have needed at least one person at each site to perform any special maintenance or the alternative would have been a huge increase in travel budget.

The net result is that despite rolling out network services to more sites and generating a higher level of support, over the last year, they have increased their user to manager ratio by 30%. Over the five years they expect to enjoy savings of over $45 million in reduced headcount growth while they provide more and higher quality services to a network growing at, by their estimate, 22.5% annually.

The company currently has an outsourcing contract for about 80% of their desktop support. They feel that their outsourcing, however, is much less expensive because each time there is a problem, IS can provide the contractor direction and focus. Instead of guessing whether the problem is a modem or a server, they know what needs to be repaired 99% of the time. Because the contractor knows the nature of the failure and the component to be replaced, they do not need to bring a truck-load of diagnostic equipment and experts with them to the site. In addition, inventory costs have been reduced.

Table 2. Before and After Management Measures, in Total Hours per Month

Hours per Month Before Management		Hours per Month After Management	
SW Evaluation	3,750	SW Evaluation	3,000
Client Setup, Configureation	7,500	Client Setup, Configureation	6,000
SW Installation, Upgrades	3,750	SW Installation, Upgrades	3,000
User Administration	1,728	User Administration	960
Network Performance Management	6,080	Network Performance Management	3,800
Server Support	1,440	Server Support	800
User Support	14,000	User Support	8,000
Server Setup, Configuration	6,000	Server Setup, Configuration	4,800
Capacity Planning	960	Capacity Planning	960
Backups, DB Management, etc.	230	Backups, DB Management, etc.	200
Asset Management, others	320	Asset Management, others	320
TOTAL	45,758	**TOTAL**	31,840

Appendix G: Distributed Computing Chart of Accounts

Compaq believes that a standardized categorization of computing costs is a necessary step to rigorously assess the cost and benefits of technology, process, and people skills decisions. We are working in particular with the Gartner Group to promote the creation, evolution and adoption of a standardized list and definition of cost categories. The first documentation of this is available in Gartner Group's paper *The New GartnerGroup TCO Model - Distributed Computing Chart of Accounts*, which we summarize here. Please refer to the original document for definitions of the cost categories.

Direct (In-Budget) Costs

Hardware and Software Costs
- Hardware Costs
  - Acquisition Fees
  - Memory
  - Storage
  - Peripherals
  - Connectivity hardware
- Software Costs
  - Operating system
  - Application software
  - Utility software
  - Connectivity and communication software
- Monthly Costs
  - Leased asset fees
  - Other monthly costs

Management
- Network Management
  - Troubleshooting and repair (Tier III support)
  - Traffic management and planning
  - Performance tuning
  - User administration (add/move/change)
  - Operating system support
  - Maintenance labor
  - Tier II support labor
- Systems Management
  - Systems research and planning
  - Evaluation and purchase
  - Software licensing and distribution
  - Asset management
  - Application management
  - Security and virus protection
  - Hardware configuration / reconfiguration
  - Hardware installation / disposal
- Storage Management
  - Disk and file management
  - Storage capacity planning
  - Data access management
  - Backup and archiving
  - Disaster planning and recovery
  - Repository management
  - Outsourced management fees
  - Maintenance contracts

Support
- Operations Labor
  - Administrative assistance
  - Executive and mobile management
  - Casual learning (IT)
  - Vendor management
  - Training course development
  - IS training (delivery and time)
  - End-user training (delivery)
  - End-user training
  - Travel time
  - Purchasing and procurement
  - Other operations labor costs
- Operations Fees
  - Support contracts
  - Training course / certification fees
  - Travel
  - Purchasing and procurement
  - Other operations fees
- Help Desk (Tier1 Support)
  - Labor costs
  - Key help desk metrics

Development
- Development Labor
  - Design and development
  - Testing
  - Documentation
- Development Fees
  - Design and development
  - Testing
  - Documentation

Communications Fees

Indirect (Unbudgeted) Costs

- End-user IS Costs
  - Peer and self support
  - Casual learning (end-user)
  - End-user scripting and development
  - End-user IS metrics
- Downtime
  - Planned downtime/lost productivity
  - Unplanned downtime/lost productivity

Bibliography

The following documents were used in the preparation of this white paper.

Gartner Group

GartnerGroup's Best Practices List, TCO Manager and TCO Analyst v3.5

The New GartnerGroup TCO Model - Distributed Computing Chart of Accounts

TCO Analyst: A White Paper on GartnerGroup's Next Generation Total Cost of Ownership Methodology

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Best Practices and TCO: Impact of Vendor Programs

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Documents referenced in Appendix C

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The Business Case For Investing in Manageable Systems