

WHITE PAPER

Standardizing on LIMS: TCO and ROI for the Multilab Setting

Sponsored by: Thermo Electron

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EXECUTIVE SUMMARY

Over the past few years standardization of laboratory information management systems (LIMSs) on a single solution has been one of the key tools that companies with multiple laboratories have used to improve their information management operations by optimizing laboratory processes and the accompanying business processes. This harmonization of processes and standardization on a LIMS solution typically yields several key operational benefits, such as:

- ☒ Facilitates better analytics and consistency of reporting
- ☒ Provides easier access to data for both internal and external business customers
- ☒ Enables better record keeping for internal as well as regulatory reasons
- ☒ Improves overall quality of the laboratory information management process

For this study, IDC interviewed 12 companies that have deployed, or are deploying, a standardized LIMS solution. LIMS solutions chosen for standardization included primarily SampleManager from Thermo Electron. Additionally, three companies standardized on LIMS solutions from other vendors, and one company developed a modularized custom solution that it has rolled out to all its labs. Although the companies in the study typically chose to standardize primarily for operational reasons, they have enjoyed direct economic benefits as well:

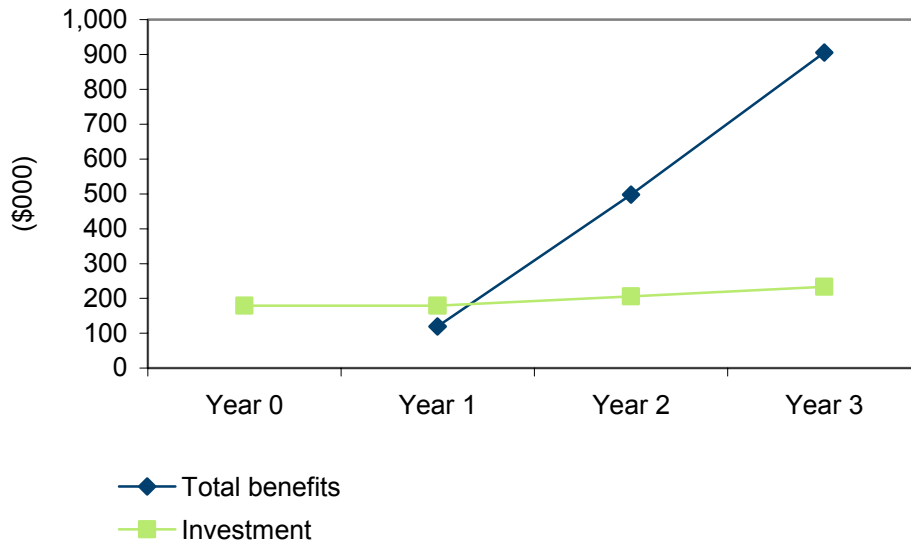
- ☒ Reduced the total cost of ownership (TCO) for LIMS (TCO includes hardware, software, services, maintenance, training, and staffing) by 40% (\$151,100 per lab)
- ☒ Saved \$35,162 per lab through automation of LIMS management
- ☒ Increased user productivity by 3.7%, generating \$115,461 per lab in positive benefits
- ☒ Increased the number of LIMS users per IT support person by 72%

Note: A more detailed breakdown of these same cost savings and productivity benefits accumulated over three years can be found in the Study Results section.

The total benefits, from reductions in TCO and increases in productive hours available, accumulated over three years, are estimated at just under \$1 million per lab (see Figure 1). Table 1 shows that based on a total investment of \$233,007 per lab, and benefits discounted at a 12% rate, enterprises in this study experienced, on average, a return on investment (ROI) of about 200%.

FIGURE 1

Three-Year Benefits and Investment for Standardized LIMS (per Lab)



Source: IDC, 2004

TABLE 1

Summary of ROI for Standardized LIMS

Category	Mean
Three-year discounted benefit per lab (\$)	698,281
Investment per lab (\$)	233,007
Net present value per lab (\$)	465,274
ROI (%)	199.7
Payback in months	9.27

Note: ROI = NPV/nondiscounted investment

Source: IDC, 2004

IN THIS WHITE PAPER

Introduction

The use of laboratory information management systems is going through a set of transitions that reflects the larger business environment. Historically, a LIMS tended to be installed and customized to the requirements of a particular lab conducting a fairly narrow set of research or testing operations. As each lab transitioned from paper to electronic systems, it tended to buy and then heavily customize a packaged LIMS product, or develop a custom LIMS from scratch using standard database tools such as an Oracle RDBMS or Microsoft SQL Server. The functional requirements were driven by the particular workflow and practices in the laboratory along with the requirements to interface with the key instrumentation being used to generate data. This latter issue was often highly influenced by chromatography data collection from GC and HPLC instruments.

Buying decisions tended to be made at the level of the individual lab and be focused entirely on meeting the needs of that lab, with little thought to external communication, knowledge sharing, or harmonization and standardization from lab to lab. In the years since those early implementations of LIMSs, much has changed:

- ☒ LIMS adoption has spread across many labs.
- ☒ The initial perceived attractiveness of the "homegrown" solution has waned significantly as laboratory managers and IT executives have more fully understood associated implementation and maintenance issues.
- ☒ The regulatory environment has become more and more stringent, and validation of LIMSs can be a major overhead burden for quality assurance/quality control (QA/QC) laboratories in pharmaceutical and other regulated industries.
- ☒ IT networks have become a common and critical part of the infrastructure — LIMSs are no longer isolated systems.
- ☒ Lab-to-lab and lab-to-management communication is expected; common data structures and processes facilitate better reporting and decision making.
- ☒ Companies have merged or been acquired, leading to a proliferation of LIMS solutions within a single enterprise. The increased complexity and inefficiency of such multiple LIMS solutions have caused a countermove by companies to simplify by standardizing on fewer LIMS solutions.
- ☒ Business executives have come to require that IT and other technology investments show reduced cost of ownership and solid contributions to productivity.
- ☒ More recently, the process analytical technology (PAT) initiative being driven by the Food and Drug Administration (FDA) will have further implications for LIMSs in pharmaceutical operations, requiring a much wider view of data collection and integration throughout manufacturing processes.

The confluence of these factors has created a trend toward reducing the number of LIMS solutions and associated data collection systems in a company through harmonizing both processes and solutions. In some environments, such as early drug discovery, harmonization of processes is not always possible or desirable. However, R&D managers may still choose to standardize on a particular LIMS solution to simplify support and concentrate the development of in-house expertise on configuring and customizing a single solution. In process manufacturing environments in particular, such as chemical manufacturing, pharmaceutical manufacturing, food and beverage processing, and oil refining, harmonization of processes and standardization on a single LIMS solution are easier to accomplish.

As desirable as it may be from a business perspective to harmonize and standardize LIMS, the actual process of implementation is often difficult for an organization. It requires the hard work of reviewing processes; negotiating changes; finalizing designs; creating data structures; implementing the changes; migrating data off legacy systems to new systems; training administrators, help desk, and end users; and rolling out the new system. This process can take several months and is a significant investment. Many of the challenges can be mitigated through up-front planning. And more and more companies are engaged in harmonizing and standardizing laboratory processes and the supporting LIMS. They are doing this because they believe the benefits significantly outweigh the costs.

This white paper quantifies those benefits by exploring the experiences of companies that have gone through, or are in the process of going through, such a transformation. It develops a model for total cost of ownership and some indications of ROI for harmonizing laboratory practices and LIMS solutions.

In October 2003, the *Leading Indicators in Life Sciences* study published by Life Science Insights, a subsidiary of IDC that provides market intelligence at the intersection of information technology and the life sciences, showed that of the 39 panelists involved in drug development, 31% indicated they are using several disaggregated LIMSs, while 26% are currently on a centralized LIMS environment. As panelists projected their status in 12 months, the percentage expecting to be on several disaggregated LIMS dropped to 21% and the percentage expecting to be on a centralized LIMS setup increased to 36%. Although not all intentions are necessarily carried out, this does indicate a direction in LIMS deployments and a clear move to centralize on fewer LIMS solutions within the pharmaceutical space. We expect that similar trends exist in other industries with laboratories that require LIMS support.

The Companies

Companies that we interviewed for this study included the following: three large multinational pharmaceutical companies, one large and one medium-sized biotech firm, one large agrobiotech company, two multinational companies from the food and beverage industry, one of the top 5 multinational oil and gas companies, two of the leading multinational chemical companies, and one set of commercialization labs for an academic institution.

Table 2 shows average characteristics of the firms interviewed for this study with regard to the number of labs and LIMS users.

TABLE 2

Study Profile for the Chemical, Healthcare, Biotech, Pharma, Food and Beverage, and Academic Industries

Category	Mean
Employees	24,000
Labs using LIMS	18
Direct users of LIMS	506
IT staff supporting LIMS	5
Users accessing LIMS	1,200

Source: IDC, 2004

HOW THIS STUDY WORKS

Analytical Method for TCO and ROI

IDC believes that total cost of ownership for software includes more than just the cost of software licensing plus annual maintenance contracts and upgrades. TCO estimations should also take into account the following:

- The costs of implementing new software
- Associated IT hardware costs
- Ongoing internal IT maintenance and support
- Application-specific IT help desk costs

In a situation such as standardizing on a single LIMS solution across multiple labs, the ROI should take into account both changes in overall TCO from the previous situation and any improvements in user productivity and reductions in downtime. Although downtime in some QA/QC labs has a direct connection to lost revenue, this model does not have sufficient data to include those types of projections. Thus, our characterization of benefits relies on reductions in TCO and the impact on productivity due to reduced downtime from the LIMS solution.

LABORATORY PROCESS HARMONIZATION AND LIMS STANDARDIZATION

Motivations for Harmonization and Standardization

Some of the key reasons that companies harmonize processes and standardize on a particular LIMS solution include the following:

- Reduce the number of personnel needed to support LIMS solutions
 - Facilitate better analytics and consistency of reporting
 - Provide easier access to data for both internal and external business customers
 - Provide better record keeping for internal as well as regulatory reasons
-

Variability by Type of Lab

Although there are similarities in processes across many types of labs, there are also significant variations. Drug discovery and development labs play a different role in a pharmaceutical organization than do quality assurance/quality control labs. The labs supporting discovery and development often have more specialized and fast-changing requirements, leading many to develop custom LIMS or highly customized versions of standard LIMS packages. By contrast, manufacturing QA/QC is much more regimented and consistent even though it resides in the same corporate organization. And QA/QC labs across industries have similar requirements and operations even though the substances tested vary considerably. Another important variation is the degree to which LIMS solutions need to be tightly integrated with ERP systems such as those provided by SAP. In cases where that integration is critical, the ease of integration with the ERP system can become crucial, heavily influencing the choice of LIMS vendor.

Metrics for TCO and ROI

Cost Savings and Benefits

IDC quantifies the total business benefit by examining the dollar value of cost savings and additional revenue that occur in the ways discussed in the following sections.

IT Budget Savings

IDC measures four areas of reduction in actual hard costs associated with laboratory management and support:

- Equipment purchase avoidance.** Standardized LIMS may enable better utilization of hardware and software resources, enabling businesses to reduce annual support and maintenance costs and meet growing demands without adding systems.

- ☒ **IT staff efficiency.** Automation enables IT staff in direct support of users or servers to do more with less and therefore downsize or redeploy IT staff or — in a high-growth user environment — to postpone or eliminate additional hiring. The net result is an increase in the ratio of LIMS users to IT staff. Cost reductions resulting from improvements in IT staff efficiency are based on the loaded annual salary (1.4 multiplied by hourly salary).
- ☒ **IT and user training.** Training costs are reduced because IT and users have to be trained on only one system rather than multiple systems.
- ☒ **Elimination of outsourcing contracts.** Improved reliability and automation enable IT staffs to perform at a higher level, and their companies can cancel outsourced network management, break/fix, or downtime response contracts.

Lab Operations Savings

A LIMS solution can impact lab processes and workflow. Standardizing on a single LIMS solution may lead to reduction in inventory error. Better tracking of lab results means elimination of duplicate trial runs and reruns.

IT Productivity

IT productivity measures how IT managers and their staff use their time. By decreasing the time required to execute various deployment, user administration, and operations functions, standardizing on a single LIMS solution frees up managers and staff for more proactive, business-related activities. IT staff productivity is a "soft" cost. The value is estimated as hours saved multiplied by loaded hourly salary.

User Productivity

Availability is defined as the time that business application services are fully available to internal and external users. After harmonizing processes and implementing a standard LIMS solution, our survey respondents reported that they reduced their application downtime. The result was that internal users were able to work additional hours using applications, and therefore the value of their loaded salaries is regained. Because users are not completely idle during periods of downtime we only count a portion of the downtime impact. Most companies experience a productivity loss of between 20% and 50% due to downtime.

Impact of Downtime on Revenue

Downtime in external-facing systems means delayed or lost revenue. The impact of downtime varies widely depending on the nature of the business. For example, financial institutions can lose over \$1 million per hour of downtime, while many companies suffer no loss of revenue at all.

Deployment

Because IT products require a deployment period, the full benefits of the product are not available during deployment. To capture the delayed impact of the benefits, IDC prorates the benefit on a monthly basis and then subtracts the deployment time from the first-year savings. In addition, IDC adds the deployment time onto the financial payback period. In this study the average deployment time was 7.8 months.

Investment

Investment includes costs for initial purchase and installation to include all hardware; software; outsourced installation services; in-house time and training, which take place in year zero; three-year annual upgrades and changes; and direct support and maintenance.

Financial Method of Computing Benefits: Net Present Value

For this model, IDC used the payback and net present value (NPV) methods for evaluating the return on investment for the LIMS software. The NPV method calculates the value in today's dollars for the three-year returns on an investment. Payback period is the point at which cash flow exceeds investment. IDC uses a very conservative approach. Rather than discount the cash flow, we discount only the benefits (at 12%). The investment is not discounted; rather, it is treated as if it were all spent in the first year. Therefore, NPV is the discounted benefit less the total nondiscounted investment. ROI is NPV divided by nondiscounted investment. For this study we have added the average deployment time to the traditional payback period. Payback period is deployment time plus the nondiscounted investment divided by average annual benefits multiplied by 12 months.

Study Results

IDC found in the study that all participants experienced business benefits in multiple areas, including a reduction in TCO from previous solutions and a positive ROI. As with most deployments, not all benefits could be quantified, but three areas were strongly supported by all participants:

- Reduced TCO for LIMS
- Increased IT productivity
- Increased LIMS user productivity

Combining the TCO savings and the increases in productivity created, on average, \$301,723 in total benefits per lab, per year. The following sections break down and detail those savings and benefits.

Reducing the Costs of LIMS

Fully 50% of the benefits of standardization are in hard-cost reduction. TCO was reduced by 40%, or \$151,100 (per lab per year). The ability to generate hard-cost reductions is especially valuable, given that soft costs are tracked less assiduously in many organizations.

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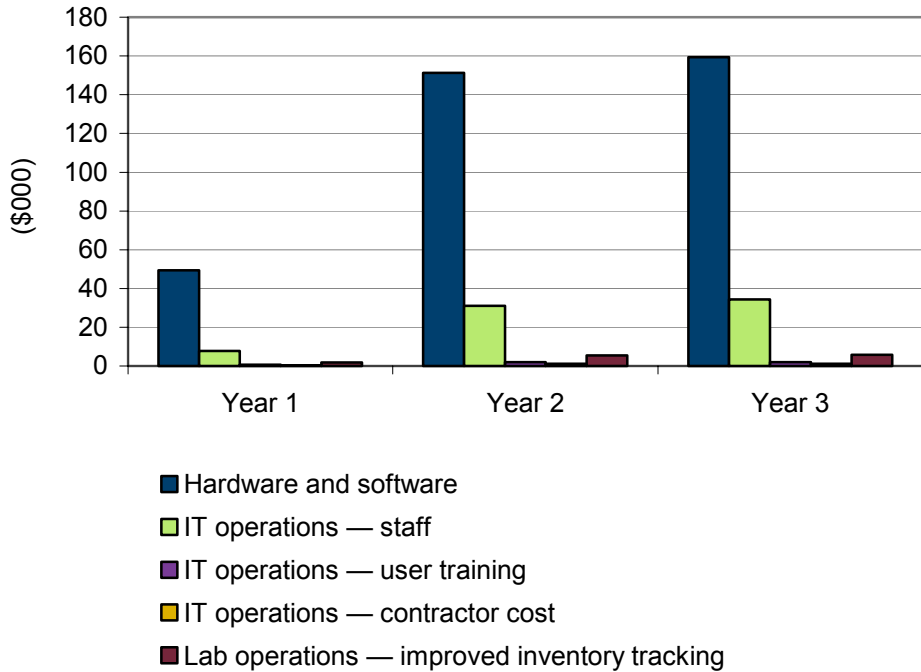
Equipment Purchase Avoidance: Hardware and Software Savings

Although standardization requires an initial investment in new systems, the resulting consolidation and replacement reduce the costs of now-redundant systems and the annual upgrades and maintenance to support those systems. The net result is the reduction of overall hardware and software costs, which in this study varied based on the degree of consolidation (in some cases 3 to 1) and the ages of the systems replaced.

Hardware and software cost reduction accounted for nearly 80% of total hard-cost reduction (as seen in Figure 2). On average, every \$1 spent on deploying a standardized LIMS was offset by \$1.50 in hardware and software savings.

FIGURE 2

Three-Year TCO Savings from LIMS Standardization



Source: IDC, 2004

IT Operations Savings

Savings in IT operations are broken out in the following ways:

☒ **IT staff efficiency.** Typically, IT staff costs account for 40–70% of total IT costs. Unlike hardware and software costs, which tend to be weighted in the year of deployment, IT staff costs rise at the rate of adding users. Standardization means the ability to integrate labs without additional software to support. Reports can be compiled automatically. LIMS management is largely automated. As a result, companies standardizing on a single LIMS solution, such as SampleManager from Thermo Electron, were able to change their user-per-IT staff ratio from 50:1 to 86:1. This average 72% change in efficiency ratio meant that some companies could grow their user base without adding staff, while others were able to reallocate IT resources to other areas, and some companies were able to reduce staff. The net result was the reduction by 57% of IT staff directly supporting LIMS.

Companies standardizing on a single LIMS solution were able to change their user-per-IT staff ratio from 50:1 to 86:1.

- ☒ **Training savings.** Standardization allowed companies to eliminate IT and user training on multiple systems, saving up to \$250 per user per year. In large organizations with multiple labs, those savings alone could add up to \$100,000 plus in savings.
- ☒ **Reduced contractor costs.** The greater efficiencies created through standardization allow companies to reduce the outsourced man-hours required for support or, in some cases, to bring support functions back in-house. In other cases, standardizing on a single LIMS solution simplifies the process of outsourcing LIMS management and support.

Lab Operations Savings

Better inventory tracking was enabled by having an integrated and standardized methodology for tracking lab results, which reduced lost results and eliminated the need to duplicate lost data. Labs were able to save an average of \$5,000 per lab per year.

Increased IT Productivity

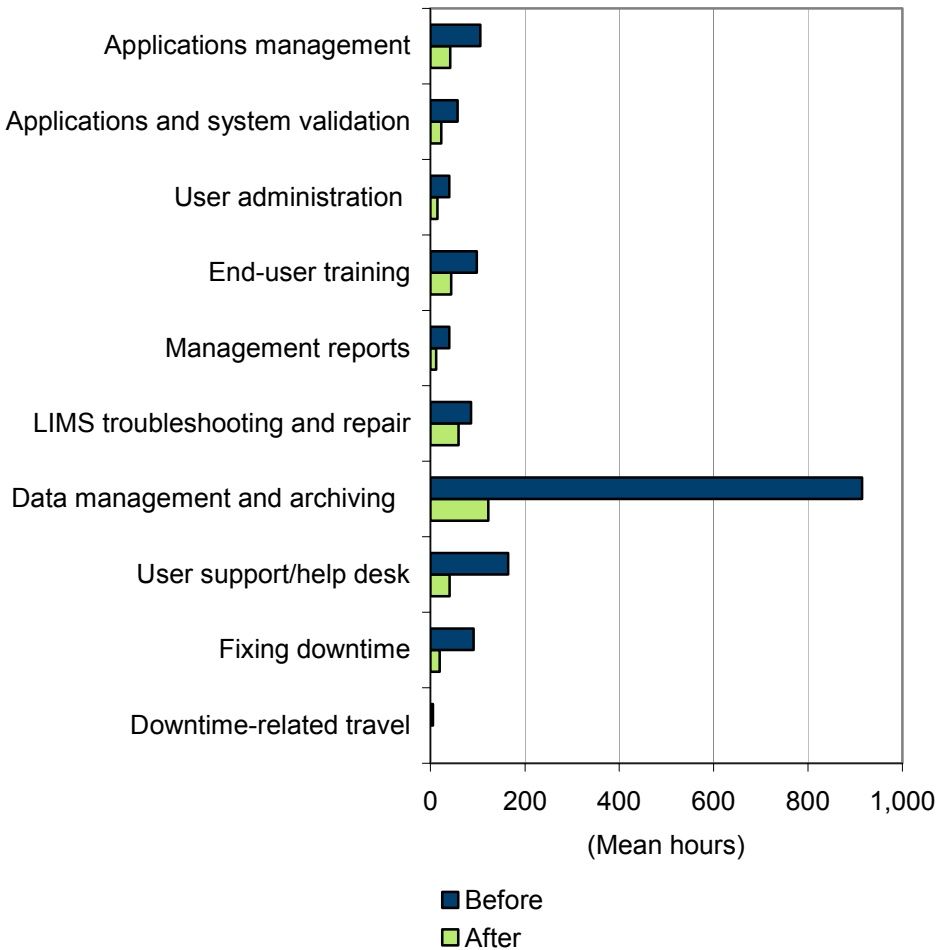
Standardization of operations across all labs enabled greater automation, reducing the manual nature of many of the IT administration and support tasks. Consolidation and centralization of control reduced both the amount of downtime and the level of IT activities required to troubleshoot and repair. Figure 3 shows that, despite the user environments growing at 7% per year, LIMS support requirements declined in four key areas:

- ☒ User support activities such as help desk and user administration declined by 55–75%.
- ☒ Applications management and applications validation were reduced by 50%.
- ☒ Downtime response activities such as troubleshooting, travel, and repairs were reduced by 30–90%.
- ☒ Data management, archiving, and reporting — all critical operations for LIMS — were reduced by 70–87%.

As a consequence, IT staff were then freed up to contribute to more business-related activities such as laboratory operations planning, tracking results, data mining, and creating applications to integrate laboratory operations with other corporate activities. The average dollar benefit from increased IT productivity was \$35,162 (per lab, per year).

FIGURE 3

IT Task Reduction Time



Source: IDC, 2004

Increased LIMS User Productivity

Implementing a standardized LIMS solution probably has the most benefits for the users of the information, including the users in each laboratory, who need access to the data and data tools to do their jobs, and a wider audience of those users who need to follow the information or are involved in the reporting of the information. Overall, user productivity increased by 3.7%, generating an average benefit of \$115,461 (per lab per year).

Standardization improves the business processes associated with LIMS, namely the collection, reporting, and analysis of data. LIMS users were more productive. They eliminated the manual entering of data. They were able to build reports dynamically and conduct analysis quicker. Fifty-eight percent of the companies credited standardized LIMS with reducing their time to market, while 77% felt standardized LIMS improved product quality. On average, companies were able to add 6.3 hours of productive time to each LIMS user per month.

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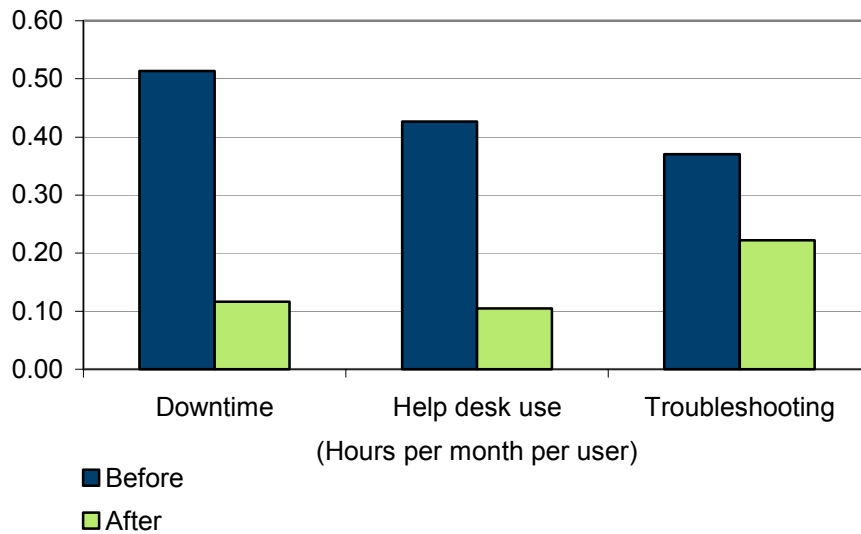
Although an extra 6.3 hours per month, per user of productive time does not sound like much, when one calculates the impact across an average of 500 users per company it works out to approximately 3,200 productive hours per month. When calculating final benefits, these hours are multiplied by the average per-hour labor cost of users and then subjected to a discount factor of 50% because not all time freed up by these efficiencies will be converted to productive time.

Within the first year of implementing a standardized LIMS, companies in this study saw their LIMSs, applications, and network downtime drop 77% from an average of 0.5 hour per month to only 0.11 hour (see Figure 4). In addition to downtime reductions, users also experience less time spent with the help desk (75%) and troubleshooting (43%).

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FIGURE 4

Reductions in Nonproductive Hours by User

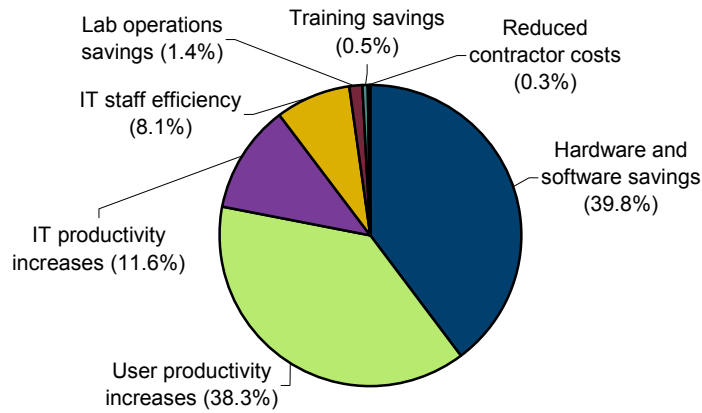


Source: IDC, 2004

Altogether, the companies recognized benefits of around \$300,000 per lab annually from implementing a standardized LIMS. Figure 5 shows that cost reductions such as hardware and software savings, IT staff efficiency, and reductions in lost inventory accounted for the largest portion of the benefit (49%), with LIMS users recognizing another 38% in productivity. Because of the small IT staff directly associated with the LIMS, IT staff productivity yielded only 12% of the total benefits.

FIGURE 5

Distribution of Three-Year Benefits



Total = \$905,167

Source: IDC, 2004

CHALLENGES/OPPORTUNITIES

Challenges

Standardization is by no means an easy process. It requires meticulous planning and extensive cooperation across multiple organizations. In any attempt to standardize there are a number of challenges. Some of those are illustrated by the following quotes from the interviews we conducted:

- Internal politics often complicate the move to standardize:
 - "Most scientists don't like to be under such tight control. They don't like LIMS until they figure out that they can get their data faster and more efficiently."
 - "The systems are truly global, and when you have labs in different locations, you're going to have some process differences."
- How much customization will still be needed can be underestimated:
 - "We needed more customizations than we had hoped for."
 - "I would say that the biggest one was that we thought our needs were much more generic than it turned out to be. It was easy to customize, but we didn't anticipate the detail involved. I don't think there were enough people devoted to the initial deployment."

- ☒ Accommodating new technologies can also be an issue:
 - ☐ "The change in technologies in the research labs. To give you an example, every year, the mass spec people come out with a new model, and the users always want it incorporated into the LIMS."

It should be noted that the companies citing these challenges were obviously among those that obtained the economic benefits we have analyzed and reported previously. The following section, as well as the models explained previously, illustrates why companies are willing to engage in the process of standardization despite the challenges.

Opportunities

There are many opportunities for companies to benefit from harmonizing processes and standardizing on a single LIMS solution across multiple labs, illustrated in the following comments from interviewees:

- ☒ "People always say, 'How did we do it without standardized laboratory systems ... and we can't even imagine it.' Other business units can take what we've done and do it in 3–4 weeks because of the standardized template. In the past a system would take 6 months."
- ☒ "We probably would have spent more to develop the interfaces if we didn't have a standard platform like SampleManager (Thermo Electron). For each new LIMS, the interfaces for each SBU would be twice as much as using an old one."
- ☒ "We were spending a large amount of time doing nothing but generating reports for plant people ... engineers to look at data that had already been accumulated. But they didn't have direct access to the data for trending or other reports. Now, these people can do their own reports."
- ☒ "Top benefits of standardization: 1) The huge reduction in IS support costs, and the reduction in business support costs. 2) Instrument integration. Before, we had a lot of manual transcription. And now it's completely automated, so it's more reliable data, more accurate data. And the labs aren't having to do that. The standardization was definitely worth it. We don't do things like we did 10 years ago ... building little customized systems for a lab isn't allowed, as part of our procedure."
- ☒ "The costs for interfacing to SAP have dramatically gone down. [Since standardizing on SampleManager from Thermo Electron] ... and the reliability of the interfaces has gone up considerably. The more reliable data and operations, and the reductions in the lost business opportunities, are where the value is."
- ☒ "Today, there is one group that supports both types of LIMS. If we were to add more types of LIMS, we'd have to hire more people. Now, if we just add labs, or processes, we don't have to add people necessarily. I say it could be 2–3 times, but in reality ... it would probably cost 20–50% more per SBU to support."

CONCLUSION

Process harmonization and LIMS standardization on robust platforms such as SampleManager from Thermo Electron have become a leading strategy for companies to improve the quality of information management and reduce the TCO within multilab settings. We have also seen that these companies enjoy many additional benefits ranging from improved time to market to more efficient reporting and greater availability of productive hours to LIMS users.

Although LIMS standardization is not an easy or inexpensive undertaking, the results are extremely positive, yielding significant reductions in LIMS costs and quantifiable increases in LIMS user productivity. On average, the companies in this study will see an estimated three-year ROI of about 200% and, depending on deployment time, a payback of the initial investment in a little over nine months.

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