THE SERVICE SECTOR:

Investing in New Technology to Stay Competitive

Quality and numbers count, but glitz can get you the business.

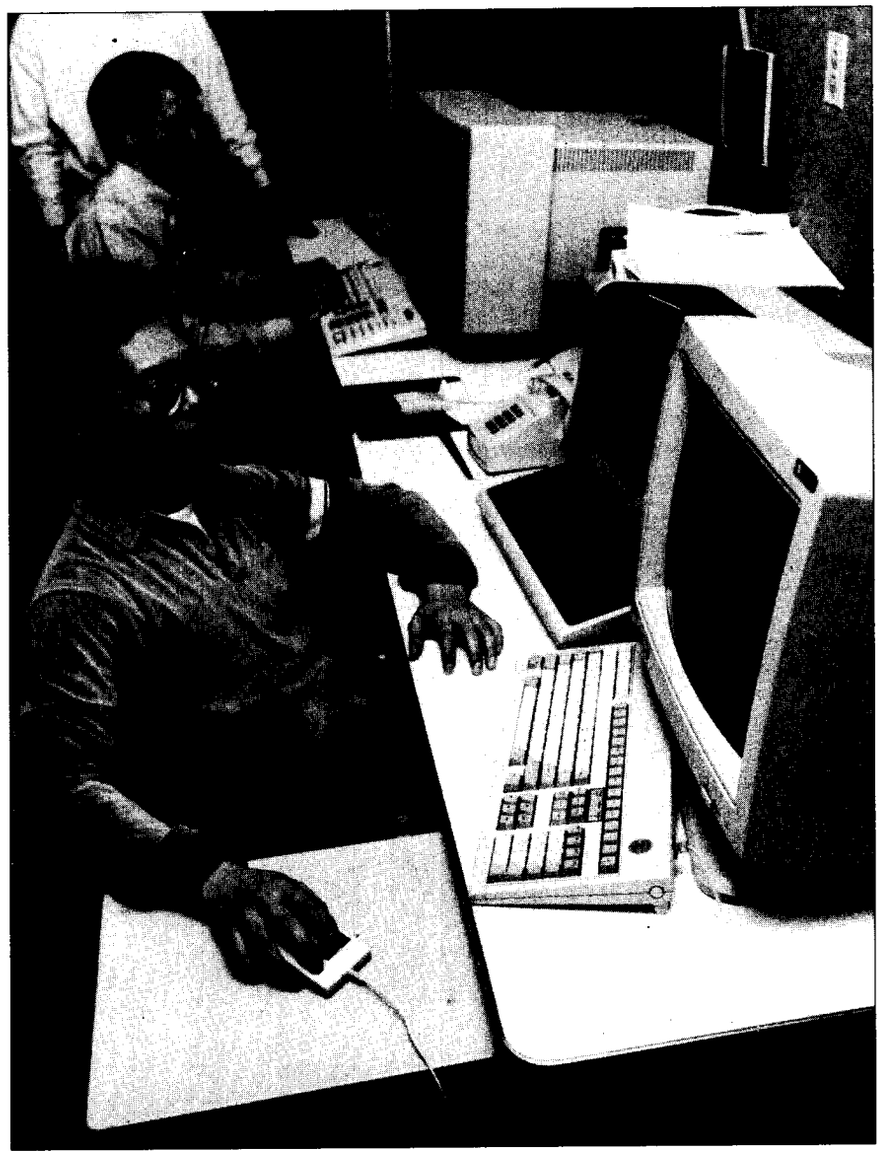
BY JOHN Y. LEE

"Our decision in no way reflected any doubt as to your firm's competence. We know the fine track record of UAI very well. The CEO of our company was greatly impressed by the long list of the respectable projects your firm had completed. It's simply that the presentation made by Yamamoto & Associates went well with our top management. Our management was overwhelmed by the state-of-the-art presentation of that Japanese firm's proposal on our new building drawing. I myself was flabbergasted by the 3-D demonstration. Fred, please don't take this too hard."

It was the third defeat of this quarter for Fred Lake, a project manager at United Architects, Inc. (UAI), a mid-sized architectural firm located in Southern California. His team had worked hard on the just-turned-down proposal, a drawing project for a new building in downtown Los Angeles. It would be one of the "major" additions to the existing skyline and was within the expertise of the UAI professionals under his supervision.

The defeat was particularly depressing because all bids the company had lost in the current quarter were not due to any technical (in the conventional sense) incompetence, high cost quoted for the proposed project, or the quality of the proposal.

The primary reason was that the competition used far more advanced generation technologies, such as the top-level computer-aided design and drafting (CADD) with 3-D perspectives. Presentations look more impressive when state-of-the-art technologies are used. With 3-D, companies appear sophisticated and reliable. Among the many benefits of new technologies, that one is the most visible. Fred Lake knew this—he just hadn't been able to convince management to upgrade UAI's current equipment to match the competitors' technology.



Scientists at Jet Propulsion Lab in Pasadena, Calif., are working with high-technology stations. Investment in new technology is important in service organizations also.

Fred's story is the background to a case study of the problems experienced by many companies in the service industry today. Deregulation and stiff competition challenge service firms more than ever, so to stay competitive, they need to invest in new technologies.

Justifying an investment, however, is difficult in an environment with high hurdle rates. Those used by U.S. firms—more than 20% in most industries—discount future cash inflows severely. For new technologies, such as robotics, flexible manufacturing systems (FMS), computer-integrated manufacturing (CIM), and computer-aided design (CAD), the adverse effect is compounded because of their longer useful lives.

Other factors also work against investment in new technologies. In the process of justifying an investment, they become built-in biases that penalize high-tech investment. In Fred Lake's case, conventional capital budgeting techniques worked against him. It took some creative thinking by a controller to help him present his case to management effectively. What worked for Fred Lake and UAI could work for other companies in service and manufacturing sectors when they try to justify a high-tech investment.

CAN WE BECOME MORE PRODUCTIVE?

United Architects, Inc., founded in 1965 in Los Angeles, is a medium-sized architectural firm with 75 licensed professionals. It has built a good reputation in the area on the basis of three principles held high by the founder and chief architect Herman Heller: quality of work, meeting the deadline, and service-oriented attitude.

UAI is a typical architectural firm involved in designing and developing buildings, parking structures, and similar edifices. As is the case with most service firms, architecture is labor intensive. The labor cost is a major component of project costs, and overhead is allocated to projects on the basis of direct labor hours each project consumes.

Recently there was a significant change in the way architectural contracts are drawn. It no longer is possible to bill a client for any labor and overhead plus a guaranteed markup, as was done previously. Most contracts now involve a lump sum fee awarded to the architectural firm with the lowest bid.

This change in the industry has forced companies to strive for greater efficiency and productivity. Without a high level of productivity, firms sometimes have to sustain losses on contracts to be competitive in pricing.

To increase productivity and profitability, architectural firms have turned to new technologies. Computer-aided design and drafting (CADD) is the most significant new technology available to the industry.

The whole process of producing architectural drawings is affected fundamentally by the CADD because the software can perform a number of functions that are nonexistent in paper drawings. For example, the CADD:

- Can draw any line, shape, or figure that is needed in a standard architectural drawing;
- Can draw a three-dimensional (3-D) structure and rotate it so the designer can see it from different angles;
- Can zoom in to study the drawing in more detail, such as a specific part of the object's structure; and
- Can store hundreds of figures and shapes in memory because of its formidable speed and capacity.

These CADD capabilities already have transformed the tasks of many drawings into a process of simply retrieving appropriate shapes and figures and plugging them into place.

COSTS OF INVESTING IN CADD

The costs of installing a CADD system range from about $60,000 for a standalone PC system to more than $500,000 for mainframe systems that have all types of functions. UAI installed a small version of CADD a few years ago. A standalone PC system, it required the following expenditures:

Hardware	$ 28,500
Software	10,060
Training	6,700
Total	$ 45,260

It was a good investment because the staff could apply the new technology to tasks, and everybody was excited about the acquisition at the time. UAI management was delighted that the new system saved labor costs. Al-

TABLE 1/CAPITAL BUDGET ASSUMPTIONS

Initial cash outlay	$ 572,000
Annual operating costs (new system)	116,000
Annual operating costs (existing system)	20,000
Increase in operating costs	96,000
Annual reduction in labor costs	65,000
Other productivity gain due to the versatility of the new system	110,000
Increase in cash inflows	175,000
Discount rate	20%
Useful life	
— For the project	10 years
— For tax purpose	5 years
Tax rate	33%
Depreciation: Straight line	

CAPITAL BUDGET
Investing in the "Mini & Graphic" CADD
Alternative: Status Quo

Year	Cash Outflow	Cash Inflow	Net Cash	Tax Savings	After-Tax Cash Flow
0	$ – 572,000	$ –	$ – 572,000	$ –	$ – 572,000
1	96,000	175,000	79,000	37,752	90,682
2	96,000	175,000	79,000	37,752	90,682
3	96,000	175,000	79,000	37,752	90,682
4	96,000	175,000	79,000	37,752	90,682
5	96,000	175,000	79,000	37,752	90,682
6	96,000	175,000	79,000		52,930
7	96,000	175,000	79,000		52,930
8	96,000	175,000	79,000		52,930
9	96,000	175,000	79,000		52,930
10	96,000	175,000	79,000		52,930

Net present value: $ (237,186)

so, the payback period was very short: The company recovered the investment fully after just two years.

When UAI lost those big projects, what frustrated Fred Lake, the project manager, was not that the competitors were using CADD and UAI was not. UAI had the technology, but it was a scaled-down version so the quality of work and the flexibility in meeting the demands from different specialties UAI could provide were limited.

UAI's competitors who have installed the state-of-the-art CADD system—mini- or mainframe-based systems with full line graphics capabilities—can generate drawings of far superior quality, can maximize the labor utilization, and can cultivate multiple markets of diverse specialties such as government projects.

Technological innovations have made the cost of CADD decline steadily. A minicomputer-based system with full graphics options, which Lake believes will be adequate for UAI for more than a decade to come, nevertheless still costs a bundle.

A recent quote on such a CADD system showed the following costs:

Initial Outlays

Hardware	$ 459,000
Software	92,000
Training	21,000
Total	$ 572,000

Annual costs of operating such CADD systems, obtained from industry sources, are estimated to be:

Hardware maintenance & upgrades	$ 58,000
Software maintenance & upgrades	15,000
System operation	14,000
Training	11,000
Other (space, utilities, insurance, and supplies)	18,000
Total	$ 116,000 *

(*Compared to the current CADD annual operating costs of about $20,000.)

CAN MANAGEMENT'S ATTITUDE BE CHANGED?

Management at UAI has been reasonably sympathetic with Fred Lake's capital purchase requests, which mostly were investments in equipment that would improve productivity, including the current CADD system. The amounts of those investments were not very significant, generally under $10,000. The payback prospect almost always was excellent, and the payback period usually was under two years.

An architect is working with a CADD system.

If the investments were combined for an extended period of time, however, the aggregate amount would be significant. In that atmosphere, most managers were reluctant to submit a capital acquisition plan involving a large sum of initial cash outlay.

Accordingly, previous capital expenditures that were requested and approved in UAI usually covered acquisitions of items that promised immediate efficiency and productivity increases and required small initial outlays. Herman Heller, now semi-retired from the operations of UAI, has a strong belief in justifying investment on the basis of cost reduction and/or productivity gain. The management succeeding Heller are perceived to follow the same policy.

NEGATIVE NET PRESENT VALUES

Fred Lake has tried twice—unsuccessfully—to convince management to invest in the "minigraphic" CADD. Under the aforementioned policy, management would not approve of any investment that did not produce a positive net present value, and the capital budget for the investment in the new CADD system had never yielded positive NPV.

Table 1 shows the assumptions Lake used for the capital budget and the resulting budget analysis. Management's response to the proposal went like this, as expected, on the basis of the negative NPV: "We are willing to make a major capital investment commitment if the analysis produces a positive NPV. That is our policy. As long as we are consistent in following our established policies that have worked well for the last few decades, managers should accept the decision.

"Yes, we know new technologies will do a lot more than just reduce labor costs. That's why we do not take issue with the cash inflow you estimated in the proposal for other productivity gain due to the versatility of the new system. If there are any other factors you would like to justify for inclusion in the analysis, you are encouraged to do so."

THE DIFFICULTY OF QUANTIFYING BENEFITS

Fred Lake was frustrated but still hopeful that something could be done to justify the investment. Management did not close the door completely, so he could prepare another proposal based on a new and innovative analysis. The problem was how to quantify the future benefits of the new CADD system. It would be relatively easy to quantify operational cost savings, and even the productivity gains, because there are "reference" figures available in the company. Some are past cost data. Some are based on nonfinancial performance measures, such as drawings completed per person and complexity factors in the work.

Lake asked Controller Pete Lone for help: "How do we quantify the ex-

pected but hard-to-prove improvement in the competitive position of our firm? I know it is there. You guys do something."

Now the problem belonged to the controller, who was sympathetic with Lake's view that, without doing something, the firm certainly would lose many more bids in the months and years to come.

Market competition had been getting tougher and tougher. Recently, even the Japanese architectural and engineering firms had entered the arena. Because so many downtown Los Angeles skyscrapers now were owned by the Japanese investors, it was not difficult to foresee the entrance of even more Japanese competitors into the market.

The controller took the project and collaborated with Lake's team. In the new analysis, a major change was made to the assumptions used for the capital budget: Instead of the "status quo" as the alternative to the investment in the CADD system, lost contribution margins for the projects that UAI would bid for but would lose were entered. It was not very difficult to quantify the lost margins as Lake's team already had lost in three biddings in the current quarter.

'How do we quantify the expected improvement in the competitive position of our firm?'

The assumptions and the results of the new capital budgeting analysis are presented in Table 2.

The inclusion of the estimated lost contribution margins from the projects UAI would miss altered the outcome of the capital budgeting analysis: It now showed a positive NPV of $605,607!

Fred Lake was ecstatic. By quantifying the intangible benefit that traditionally had been ignored, the controller transformed an unsuccessful investment proposal into a promising one. The assumptions used for the lost margins were based on Lake's recent experience, and he knew that management still remembered those facts. He was almost positive that UAI management would change its mind and invest in the latest CADD technology!

STAYING ALIVE

The UAI scenario could happen in other companies also. In today's competitive environment, both service and manufacturing sectors find it increasingly difficult to survive without taking full advantage of new technologies. Conventional capital budgeting practices, nevertheless, do not produce desired results, as the UAI case revealed.

New approaches to justifying investments in the latest technologies should be developed and employed. UAI's approach might shed some light on what other companies could do to overcome the deficiencies in their existing capital budgeting analyses. ■

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TABLE 2/NEW ASSUMPTIONS

Initial cash outlay	$ 572,000
Annual operating costs (new system)	116,000
Annual operating costs (existing system)	20,000
Increase in operating costs	96,000
Annual reduction in labor costs	65,000
Other productivity gain due to the versatility of the new system	110,000
Increase in cash inflows	175,000
Alternative to the investment proposed: Lost contribution margins (12 projects lost per year at the average contribution margin of $25,000)	300,000

Discount rate, useful life, depreciation method, and tax rate do not change.

CAPITAL BUDGET
Investing in the "Mini & Graphic" CADD
Alternative: Lost Contribution Margins

Year	Net Cash	Tax Savings	After-Tax Cash Flow	Increased CM After-Tax
0	$–572,000	$ –	$–572,000	$ –
1	79,000	37,752	90,682	201,000
2	79,000	37,752	90,682	201,000
3	79,000	37,752	90,682	201,000
4	79,000	37,752	90,682	201,000
5	79,000	37,752	90,682	201,000
6	79,000		52,930	201,000
7	79,000		52,930	201,000
8	79,000		52,930	201,000
9	79,000		52,930	201,000
10	79,000		52,930	201,000

Net present value: $ 605,607