



High-Performance Machining Center ROI: How to Determine a Machine's True Value

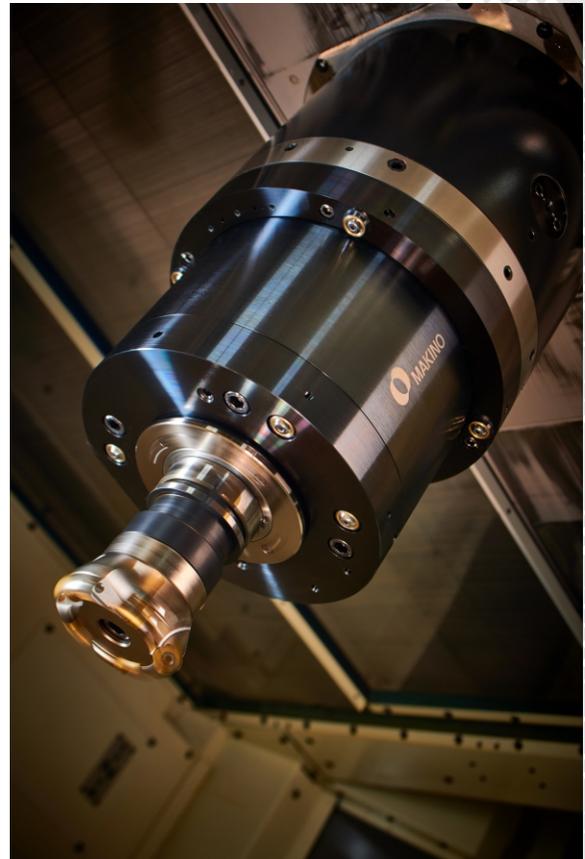
The Automotive Market

How to Determine a Machine's True Value

Justifying a capital equipment purchase by calculating its return on investment (ROI) can be challenging for many shops. Manufacturers often focus only on equipment price when making these calculations and fail to evaluate the total life cycle cost or anticipated performance of the equipment. In reality, the acquisition, operating, maintenance and decommission costs can all affect a machine's true ROI calculation.

It's important to carefully weigh ROI in order to make a solid decision about which equipment to purchase, as it can ultimately determine the payback period for the machine. This white paper discusses how to make a complete ROI calculation by addressing these areas:

- The factors of dynamic-production machines that impact ROI
- How automation can improve ROI
- How leasing versus buying affects ROI

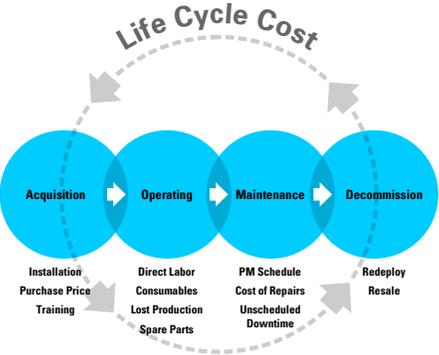


Factors that Impact ROI

Manufacturers typically purchase new equipment to obtain higher capacity or improved methods and technologies for production. In determining ROI for these new machines, the manufacturer carefully examines the purchase price. However, the costs for operating, maintaining and decommissioning these new machines may dwarf the original purchase price.

Acquisition costs include the purchase price, installation and training. Post-sale service, supplier reputation, warranty and support services offered are other important factors to consider. A vendor's availability to conduct operations and maintenance training and improve employee competency is something that can prevent productivity drag. Maintenance and repair costs should also be factored in.

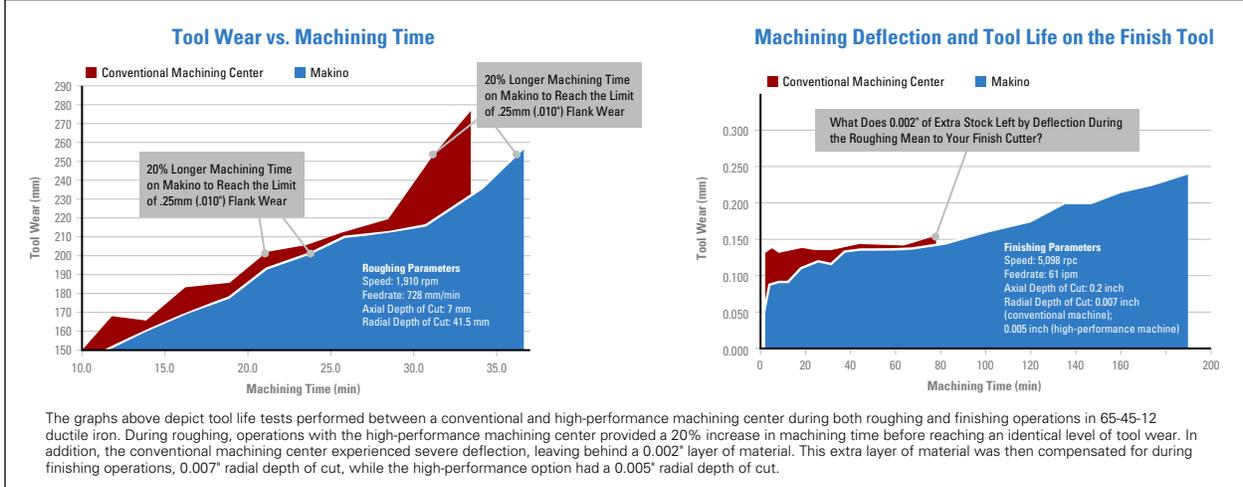
When it comes to *operating costs*, manufacturers must determine the impact this new equipment can have on productivity. The philosophy behind a machine's design and construction can greatly affect this. A high-performance machining center typically has a design and construction that improves key aspects of operation, including cycle time, tool life, part quality and reliability.



Factors that impact machine tool ROI extend throughout the life cycle of a machine. Although these factors may not demonstrate immediate ROI, it's important for manufacturers to realize that a bottom-line impact will be felt.

For example, a high-performance machining center has a high-power spindle that facilitates high-speed cutting and low-force machining. It also has the acceleration and deceleration available to reduce non-cut time. The spindle bearing is the main support for the tool, and a larger spindle bearing is better able to handle cutting forces. This bearing's type and position can also affect machine stiffness and the types of forces it can handle. A stepped column design contributes to machine strength and can be more stable. Machines that have a single-piece casting, three-point leveling, and a tiered column design can reduce machine vibration.

- Putting these high-performance machine design attributes to work, a true evaluation of part cycle time be completed. Multiple workpieces can be prepared in a single setup and the machine preprogrammed for each job. More parts per shift can be completed over commodity machines. Producing more parts and saving labor automatically lowers the actual cost per part and easily overcomes the original discounted purchase price.
- A high-performance machining center has been shown to deliver improved tool life and performance. Its rigid construction means fewer passes with the tool are needed, reducing processing times. Rotational deflection usually reduces tool life by leaving heavier stock or stock variations for the finish tools. A high-performance machine eliminates this. By controlling the forces and deflection, finish tool life is also extended because it does not have to take extra passes for certain features. For such features, this control can save up to 50 percent on perishable tooling costs. The stability of the high-performance machine allows for deeper axial depths, increasing the metal removed by each tool. A high-performance machine also maintains the integrity of the coolant, keeping out tramp oil and metal particles, which extends tool life.



- The costs related to better tool life include more than just the tool itself. Improved tool life leads to less operator intervention and reduces the cost per part. In the images above, tool life expenses are being compared. In Figure 1, the high-performance machining center incurred a \$60 replenish cost after tool wear. In Figure 2, the tool wear resulted in a \$924 expense to replenish inserts in addition to replacing the tool body on a conventional machining center. These expenses quickly add up. It's vital in calculating a true ROI to compare practical tool costs between high-performance and conventional machining centers. There's also the added labor related to swapping tools in the machine, updating tool information, transporting to the tool room, changing tools and measuring new tool length. Manufacturers benefit with increased part quality, accuracy and consistency, as well as reduced scrap costs by utilizing a high-performance machining center.

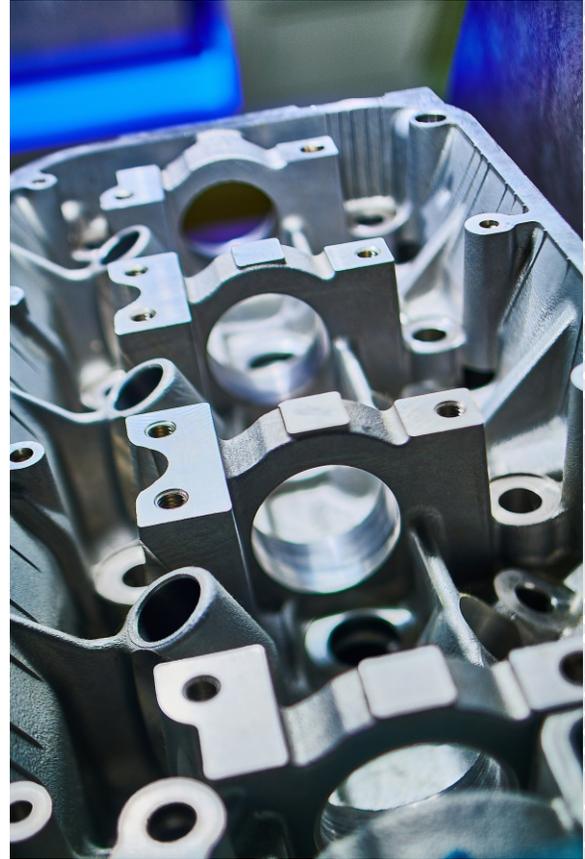


Figure 1. Tool wear observed on a high-performance machining center after 38 roughing passes in 4140 alloy steel. Replenish cost was \$60 for four new inserts.



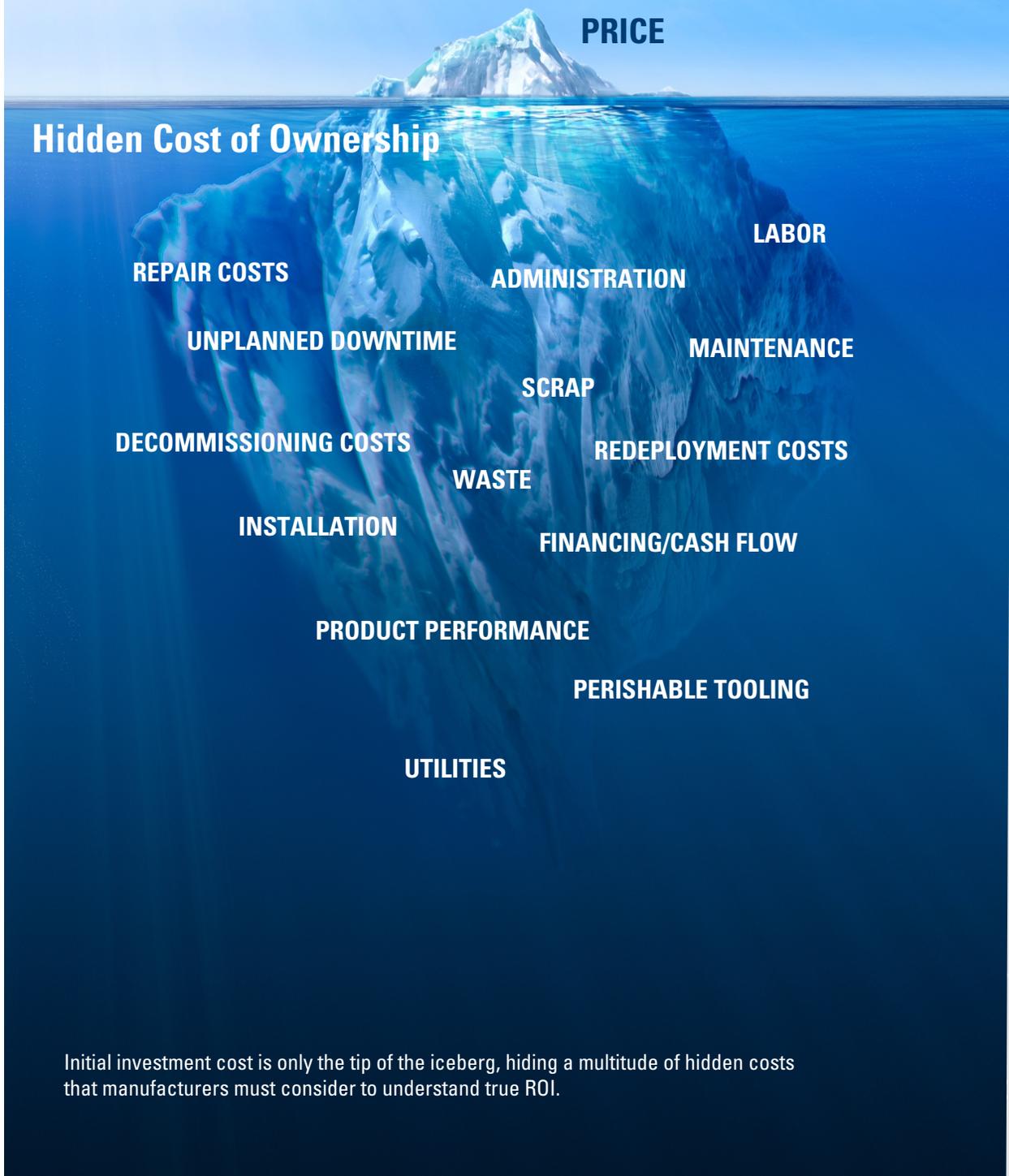
Figure 2. Tool wear observed on a conventional machining center after 28 roughing passes in 4140 alloy steel. Replenish cost was \$924 for four new inserts and a tool body replacement.

- In side-by-side testing between a high-performance machine and a commodity machining center, the design of the high-performance machine can increase tool life by as much as 36 percent. Just a simple 15 percent improvement in tool life has been shown to reduce part cost by as much as 2 percent, increase return on capital by 6 percent, and improve gross profit margin by 2 percent.
- The accuracy and precision of a high-performance machine also affect part quality. When secondary operations like spotting, hand finishing or long EDM processes can be eliminated or reduced, turnaround times and lead-times are affected. Even parts with complex geometries come off the machines with tight tolerances and high-quality surface finishes, lowering labor costs and enabling a manufacturer to take on more orders.
- Reliability also factors in to ROI, especially when it is related to both the machine and the supplier providing that machine. When machine suppliers can maintain close ties with customers and support them on a high level, it saves time in the long run. Special programming features also mean that operators do not have to continually stand at the machine to recall programs, and the equipment can run uninterrupted or unattended. It is also important to remember that warranties are not an insurance against downtime. Free replacement parts do not make up for the cost of lost productivity resulting from machine downtime. The ability to reliably and consistently produce parts is more valuable than the perceived benefits of a warranty.



Equipment ROI

Does your ROI calculation consider all costs of ownership?



Initial investment cost is only the tip of the iceberg, hiding a multitude of hidden costs that manufacturers must consider to understand true ROI.

Finally, there are those operational factors usually ignored in a typical ROI approach. When examining these hidden costs of ownership, a manufacturer should consider the following factors:

- What is the expected performance of the machine—will there be less scrap, less waste and higher quality parts being made?
- Does the equipment and its processes give the company an advantage over the competition?
- How often will the company use this equipment?
- Can the business eliminate floor space because it's using fewer machines?
- For each conventional machine that the high-performance machine replaces, how much corresponding costs will be saved from fixtures, tooling, coolant, utilities, operators and supervision which may no longer be needed?
- The financial impact of inventories and work in process (WIP).
- Are there any advantages surrounding utilities and energy efficiency?

There are many often uncalculated costs associated with maintenance. It is important to remember that once production starts, unscheduled downtime can quickly erode any savings on purchase price. Because maintenance budgets are typically incorporated into operating costs, they are probably not directly accounted for in a capital equipment ROI calculation. The costs associated with repair, a preventive maintenance schedule and any cost for unscheduled downtime should be considered. With a high-performance machine, these costs are not the same as they would be if a company kept an inefficient, less reliable machine running.

When purchasing equipment, manufacturers also need to consider decommission costs. The residual value of the machine should be

Maintenance Example:

With a hypothetical ballscrew, the replacement of the part can be \$3,700 to \$4,900. Installation and labor are an additional \$1,500 to \$2,000. There is also the cost of scrapped parts, unplanned downtime and overtime to catch up on lost production. Production goes to zero until the part is fixed. It's also important to remember that the ballscrew failure didn't happen instantly. The machine was likely declining in performance before anyone realized what went wrong, affecting part quality. There are often many uncalculated costs associated with maintenance. Also, one should not confuse a warranty as an insurance policy against downtime. If the machine is down, the cost of this unplanned event is far greater than the repair costs. A company's profitability is dependent on efficient operations.

accounted for in the actual ROI. Typically, after the contract or payments are up, manufacturers must decide what to do with the machine. They can dispose of the machine or keep it running for another four to 10 years.

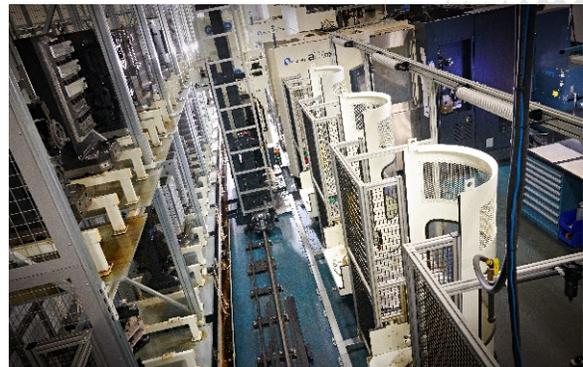
Because the low-cost machine is fully depreciated after three years, it looks inexpensive on the accounting books. This type of thinking leads many manufacturers to keep the machine running in the shop long after it should have been removed. Typically, with a lower-cost machine in years four through 12, maintenance costs skyrocket, part quality suffers and scrap increases, all while perishable tooling costs escalate. At the end of three years, the machine has minimal value. In contrast, a high-performance machine can extend component life and reliability, reduce maintenance costs and retain 50 percent of its value at the end of three years. These benefits should be factored into actual ROI.

How Automation Can Improve ROI

Many manufacturers don't take into consideration the fact that automation can increase machine utilization by as much as 95 percent, because machines are kept in cycle. The minute one part is completed, the next part goes into production, sometimes running 24/7. Faster part turnaround results from eliminating direct setups on the machine. More throughput helps the business become more profitable. By factoring in better machine utilization through a high-performance machining center, machine count can also be reduced. Businesses can purchase fewer machines—while minimizing subsequent fixtures, tooling, coolant, utilities floor space, and operations cost—to achieve desired production volumes.

Automation also allows for flexible production quantities. Part mix and part volumes can be changed quickly and reliably in order to address the customer's evolving needs. Lead-times are reduced. Automation also reduces cycle times, eliminates repetitive movements, improves tool life and reduces labor, all while resulting in more parts per shift. The outcome brings higher quality parts with less scrap and lower part costs. The manufacturer is able to gain a competitive position in the marketplace due to reduced labor and part expenditures. All of these factors reinforce the fact that automation should be included in any ROI calculations.

As a very basic, rudimentary example, with a typical standalone installation, the capital investment would be amortized over 2,000 hours per year. However, with automation, the machines, fixtures, tooling, and automation costs could be spread out over 4,000 to 6,000 hours of manufacturing per year.



Protecting Uptime and Investments

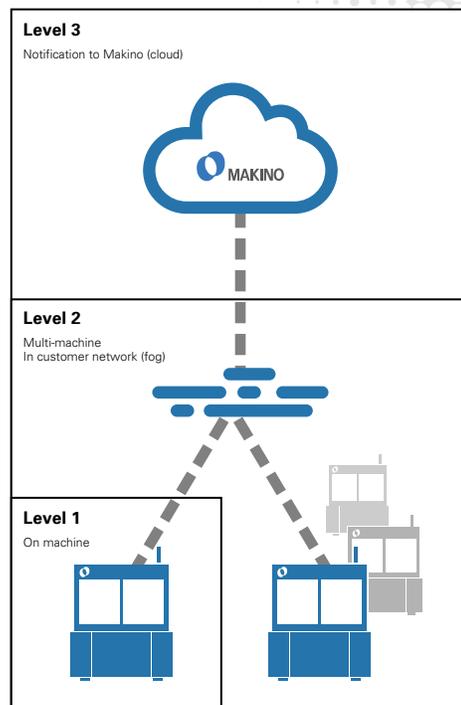
The surest way to hurt a manufacturer's bottom line is unplanned downtime. When the pressure is on to produce quality parts on time, a manufacturer can't afford the cost of unforeseen machine maintenance. Expedited parts and emergency service can fix the problem, but at a premium. After the machine is back online, sorting suspect parts and paying overtime to catch up from the issue also incurs significant recovery costs. Makino's Health Maximizer (MHmax), is a truly game-changing predictive technology specifically designed to allow manufacturers to proactively reduce unplanned machining center downtime.

MHmax pairs a sensor package with Makino's proprietary learning software in order to monitor key equipment functional areas that are critical to the sustained health of the machine. In creating MHmax, Makino carefully examined over fifteen years of customer support data, identifying the leading causes of unplanned downtime inherent to machinery used in a variety of production scenarios. From this analysis, four leading critical machine systems became the focal point of MHmax—the spindle, coolant, hydraulics, and the tool changer.



A specialized processor continually analyzes thousands of data points to both monitor the status of the machine as well as predict probable or developing issues based on proprietary trend analysis algorithms. This instinctive capability allows communication of items that require attention before unplanned downtime causing events occur and can be used to send notifications to the machine, the manufacturer's network and designated staff members via email or text messages.

The choice of three levels of connectivity between MHmax and upstream systems are included and are selectable in order to accommodate various stages of IT/security clearance restrictions. The first level displays analysis and alerts only on the stand-alone machine. The second level connects the machine to the manufacturer's network, using servers to deliver email or mobile text alerts. The third level pushes alerts to the Makino dispatch system which facilitates a proactive response from Makino's Customer Service team. Regardless of the connectivity level chosen, MHmax sends real-time proactive alerts before a failure occurs.



The predictive and proactive capabilities of MHmax assist manufacturers in eliminating unplanned machine downtime and maximizing machined parts production. By preventing unforeseen issues and proactively planning maintenance during a time that won't affect production, higher profit margins and increased ROI can occur.

The Impact of Leasing vs. Buying

After evaluating the cost per part from acquisition, operating, maintenance and automation, a manufacturer should next determine the best way to pay for the equipment.

There are two ways to pay for equipment: with cash or through financing. Paying cash enables a business to own the equipment as soon as the transaction is completed. The company can amortize the cost over the lifetime of the equipment. However, buying can also reduce the company's availability of cash for other investments, such as plant expansion or improvement, marketing or purchasing future equipment. This liquidity risk should be carefully factored into the equation.

Financing enables a company to better match monthly cash flow being generated from the equipment to the obligation of the monthly payment due under the financing vehicle. There are two ways to finance a purchase: through a traditional loan or by leasing the equipment. With a traditional loan, the borrower pays a certain amount monthly and then owns the equipment at the end of a term. Leasing equipment can be an alternative acquisition strategy that can lower the operating cost of high-performance equipment. Of all of the financing options, leasing offers the most flexibility to meet a company's unique business needs.

When buying an asset, it is critical to consider the long-term costs of ownership, such as maintenance and downtime that can mount when a company holds onto an asset over time. Through leasing, a company can further improve its cash flow while obtaining better equipment and better ROI. Leasing gives flexibility in capacity and financing. The company is able to add another machine if the customer asks for increased production. It can return equipment at the end of the contract, if desired, or purchase it at the end of the lease.

If a company's production run lasts only three years, it makes more sense to lease because the company pays just for the machine's depreciation; yet the company is still receiving the

full benefits of a high-performance machine. Alternatively, if a lower quality machine is purchased with the intention to discard it at the end of three years, the overall costs end up being the same as if the company had leased a high-performance machine, except that the company is not enjoying the benefits of a high-performance machine.

Leasing can save cash flow on a monthly basis that making loan payments or paying cash for equipment cannot. This is because the company is paying for the value of the machine being used over the lease term only. There are two types of leases: Capital and Operating.

A **Capital Lease** is very similar to a term loan. The asset and lease liability is recorded on the company's accounting books, which show the monthly depreciation and interest expenses. At the end of the lease, the company can purchase the equipment for a nominal amount. In a capital lease, the company is paying for the entire cost of the machine over the lease term and owns it at the end, just like a traditional loan.

An **Operating Lease** is very much like renting the machine over an agreed-upon time period. The monthly payment obligation is expensed as operating costs. An operating lease gives a company the lowest monthly payment obligation, as the company is paying only for the value of the equipment being used during the term of the lease. The value of the equipment at the end of the term is the most important cost driver for determining the monthly payment obligation. At the end of the lease, the company determines if it wants to extend the lease, purchase the equipment or return the equipment.

High-Performance Machining Center ROI

Conclusions

To be competitive today, manufacturers must take advantage of the most advanced technology available on the market and put it to work in its full capacity. Buying a high-performance machine tool can dramatically improve a company's ROI by delivering long-term reliability, accuracy and performance.

- Low-cost machines have minimal value at the end of three years, but a high-performance machine retains about 50 percent of its value.
- The design and construction of a high-performance machine improves operating costs and productivity.
- Buying the low-cost solution ends up costing a business more in higher part costs, shorter tool life, increased scrap, unplanned downtime and higher maintenance costs.
- The high-performance machine retains its value over time.
- The way the machine is financed can affect long-term cost of ownership.

Investing in high-performance machining centers instead of the lower-cost option can ultimately be a better, more profitable solution for the business.

