



# **Manufacturing ROI:** **The Impact of** **Concrete Metrics** **on Training Returns**

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Today's modern companies must make sound business decisions based on accurately assessing their return on investment (ROI). With some decisions, ROI calculations are pleasantly straightforward. More commonly, ROI is difficult to calculate when multiple variables simultaneously interact.

ROI is particularly an issue with training initiatives. How do companies successfully determine overall cost savings directly resulting from a training investment? While some initiatives pose considerable challenges to this topic, Tooling U has found that the common training goals shared by **manufacturers** provide a basis for more concrete results and data that help to support an understanding of positive ROI resulting from training.

## Introduction

American manufacturing companies are facing pervasive challenges. Increased competition from overseas is shifting the focus away from commodity products and toward new technology, yet a growing skills gap continues to emerge as experienced workers retire. In the face of these challenges, companies look to provide training to their current workforce, and educational institutions look to prepare the next generation of skilled workers. Increasingly, both are turning to online training as part of the solution.

Manufacturing companies are accustomed to dealing with the bottom line. Material costs can be calculated and the volume of products produced can be counted. The cost of purchasing and installing a new machine can be weighed against the increased production it will yield. The products are a tangible item, sold for a net profit. The return on investment (ROI) can be clearly calculated.

An investment in employee training is often viewed as something that is much more difficult to calculate for ROI. Managers see the upfront costs of training and are afraid they will not realize any measurable return on their investment. However, by using many of the same ROI metrics used for traditional production and analyzing the Kirkpatrick model for effective training, it is possible to find clear correlations between investing in training and net returns on that investment.

## The Mandate for Training

Manufacturing companies face several issues regarding workforce training that must be addressed to remain competitive in the current global market. With new technologies and processes developing regularly, a company needs to keep its workforce up to date. A company may turn to new hires, but the hiring process and initial training to get a new

worker up to speed can be expensive. Excessive employee turnover can be devastating to a company's bottom line. It can be more cost effective to allocate resources to the continuing training of current workers in an attempt to cover any skills and knowledge gaps that may exist in their current workforce. If you cannot find skilled workers externally, you develop them internally.

The availability of qualified candidates is not the only issue at hand. Traditionally, there has been a gap between what is being taught in schools and what is being used on the shop floor. Schools may have machines and technologies that are significantly different from those used by modern companies, and companies need to be sure that new hires have not only general knowledge of the field, but also context-specific knowledge applicable on the job. Traditionally, few independent training programs have offered the customization and versatility that would allow the company to specify what knowledge its new workers would need to contribute as a long-term asset for the company.

## **The Acceptance of Online Training**

Recently, the development of online training has offered companies a potential solution for these problems. Online training can offer easily trackable metrics, such as test scores and time spent in classes, which can be turned into quantifiable results for a company, while simultaneously offering the most up-to-date knowledge available. Online training can enable new workers to learn new skills sooner, while offering them information customized to the needs of their specific shop. Lastly, online training offers a way for companies to expand their knowledge at a lower cost than traditional training methods.

While the need for training has in the past been a burden on the company in both time and money, online training is proving effective at reducing the burden. Companies as large as Caterpillar Inc. are seeing positive results through the use of online training. Though very few would disagree with the goals of training, any company will rightly ask to see if there is a quantifiable way to demonstrate results from such endeavors. This means moving beyond proof that online training costs less, and instead demonstrating that online training can increase the profits of a company as a whole.

Traditionally, finding such specific numbers about the effectiveness of training has proven difficult. It can be assumed that training will be beneficial to all sides, but such assumptions tend to exist without the support of numerical evidence to prove them. A carefully structured and executed ROI analysis, in a manner specifically tailored to the needs of manufacturers, can demonstrate that online training positively impacts training costs, and more importantly, the profits of a company.

## History of Evaluating Training

In studying the effects of training, Dr. Donald Kirkpatrick proposed a basic model for evaluating how effectively a student was learning any material. In the years since its release in 1959, the Kirkpatrick model has become the most widely used standard for evaluating training in all fields. This model contains four levels of evaluation<sup>1</sup>. The four levels are:

- **Reaction:** On a very basic level, how does the student feel about the training they received? Did they enjoy it or feel that it was a waste of their time? Do they feel like they received valuable information and that it will help them in the future? Simple approaches such as surveys and course evaluations given to students at the conclusion of the training are traditional methods for measuring reactions.
- **Learning:** Do the students retain this information? How well have they learned it? Measurements at this stage verify what information the students retain. An evaluation needs to address what skills and demonstrable abilities the students have acquired during the training. Testing provides a good means of evaluating learning, and does provide a quantifiable result in terms of pass/fail ratios and percentages.
- **Behavior:** Do the students take what they learned and modify their behaviors based on it? This is not as quickly measured by a test or survey, but will most likely require observation by a manager or supervisor to see if the students are using the appropriate knowledge and skills.
- **Results:** Did this training produce any quantifiable results? As a result of a student's behavior, has there been any direct change in the status of the company? This is the stage of the Kirkpatrick evaluation process that seeks to find the numbers that define how well a training program worked for the company.

While this system became well-established for evaluating training, later users sought to refine some areas. Although it worked quite well for evaluating whether or not a given training program was having an impact on the company, it did not take into account the investment a company made in that training. If the effects of newly trained employees do not make up for the costs of the training in the first place, no matter how well employees learned the material, it cannot be viewed as a financial success for the company as a whole.

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<sup>1</sup> Donald Kirkpatrick. 1959

Jack Phillips set out to add a fifth step to the Kirkpatrick model for evaluation, the idea of Return on Investment (ROI)<sup>2</sup>. Phillips took an idea long used by accountants and financial advisors and applied it to the field of training. ROI is a percentage that comes from taking the net benefits of any venture, dividing it by the net costs of that venture, and multiplying that by 100 to convert it into a percentage. This percentage then is the return that a company realized on that particular venture.

## Calculating the Return on Investment

### First Half of the ROI Equation: Net Benefits

In the abstract, ROI is a simple equation to calculate. However, the actual numbers are frequently difficult to derive. The calculation of net benefits, for example, can be a huge and complicated task, but some simple steps taken during training can offer tangible results with relatively modest efforts. The easiest way to structure such an analysis of benefits is to base an evaluation on the original Kirkpatrick model, and work to convert each part of that model into a quantifiable value to enable a better estimation of the net benefits as a whole.

#### Level I: Reaction

Using Kirkpatrick’s original model for evaluation, generating a net benefit number becomes a bit simpler. First, consider the reaction. Quick surveys at the end of each class, designed to assess their feelings about the training they received, provide a good indicator of employee reactions to the training process. Such surveys can then be used to calculate a basic reaction to the classes and tests the students are taking.

Student Reaction Scores - Tooling U End of Class Surveys <sup>†</sup>	
"I find Tooling U classes motivating and enjoyable."	1.63 <sup>††</sup>
"Tooling U training improved my skills and knowledge."	1.56
"I plan to use or have used what I learned from Tooling U classes in my job."	1.53
"Tooling U Training will help me to increase productivity, cut costs, or otherwise benefit my company."	1.59

† Total Surveys: 3182  
 †† Scale: 1=Strongly Agree, 2=Agree, 3=Disagree

While this reaction cannot be converted directly into a monetary value for ROI analysis, it can be a pivotal part in calculating the estimate of improved efficiency. Conventional wisdom, backed by studies, states that happier employees are more productive<sup>3</sup>. More productive employees clearly translate to a better level of efficiency for any manufacturing company. This also can translate to what Phillips refers to as

<sup>2</sup> Jack J. Phillips. Return on Investment: in training and performance improvement programs. Gulf Publishing. Houston, 1997.

<sup>3</sup> Rost, Smith, and Dickinson, 2004.

“intangible benefits” of training, such as reduced stress, conflict, and tardiness. These intangibles affect overall productivity.

Similarly, an employee who is being trained by a company knows that the company is investing in him or her, and such an investment may convey a sense of being valued by the company. If employees feel that their company cares, they tend to feel an increased sense of loyalty to the company and a willingness or even desire to stay with that company longer, as studies suggest. Aside from the sense of improving their employees through training, a company with a good program can potentially look forward to improved employee retention as a result of their program.

While a company would need to conduct a detailed study to prove high retention and the effects of employee happiness following training, exit surveys can allow a company to decide to continue training or change their current plan. Table 1 shows data collected by Tooling U from end of class surveys from 2006-2007. The data indicate that a majority of the participants believed that the training would help them on the job. Though financial results may not be immediately tangible from this level of evaluation, long term analysis can show if such positive reactions impact the company at a financial level.

## **Level II: Learning**

The second level of the Kirkpatrick model, learning, again can be easily converted into numerical data. Online training uses assessment tests of overall knowledge combined with individual pretests before instruction to evaluate the starting baseline knowledge and ability of a student. Tooling U, for example, uses a comprehensive assessment, typically consisting of 100 to 200 questions, to evaluate the individual student, establish baseline knowledge, and identify core areas for training. Such assessments allow for a degree of customization in an online training program that very few other methods of training can provide, and which ensures that a company’s time and money are not wasted on unnecessary or redundant training.

Effective online training must have a follow-up test based on the objectives of the training. One of the major advantages of Tooling U online training is the ability to easily and efficiently track such test results to see a clear growth in the abilities of a student. Student performance on each of these tests is a good indicator of the level of learning reached by a student. In addition, questions on the post-class surveys ask students how they evaluate their own learning of the material. The surveys ask students to evaluate themselves at this level. While these results are not monetary in value, they indicate the basic levels of knowledge a student is attaining through a training program. Many traditional training programs never tested theoretical knowledge with the same intensity of an online training program, and most certainly did not provide such quantifiable results in a clear summary across multiple locations for management’s analysis.

It should be stated, however, that such tests are never meant to indicate that a student is ready immediately to begin performing the tasks or using the machines on the job. Online training works best in conjunction with more hands-on approaches to enable all students to learn in a way that suits each of them best. What online training does is provide a different way to learn material as well as a way to standardize knowledge throughout a company. Hands-on training then contextualizes that knowledge base.

### **Level III: Behavior**

Measuring behavior is more challenging. While an online training provider will not be able to evaluate employee behavior in the same way that it can provide test results and survey data, it can provide several tools to assist in the process. For example, Tooling U provides a Learning Management System (LMS), through which company-specific competencies can be set up for both online training and offline work to be measured by the training team and management. Training administrators can use this LMS to ensure that the content learned by students is turned into on-the-job abilities. Thus, when management representatives inspect the behavior of a worker to see the impact of training, they can then keep a record of the progress of the student in the same area as the student's test results, allowing a holistic perspective on the training process.

Though each company will want to examine how to convert such behavioral analysis into a monetary equivalent, Tooling U has compiled some concrete, measurable figures that can contribute to Kirkpatrick's behavioral analysis. These include, but are not limited to:

- Setup costs/time reduction
- Scrap amounts
- Reworking costs
- Tool wear/damage/repair
- Downtime
- Machine damage/repair
- Turnover
- Lost-time due to injuries
- Reduction in workers' compensation claims

Comparing these figures before and after training enables a company to arrive at a good estimate of improved efficiency that has taken place over the course of the training period.

In addition to such quantifiable variables as listed above, a company will also want to consider other changes in the basic behavior of their employees. Parker Hannifin, a world-class manufacturer of motion and control technologies and systems, has noted that after using Tooling U's online training, its employees developed a problem-solving culture that increased in conjunction with their learning and the application of their new

skills and knowledge<sup>4</sup>. When evaluating behavior, a company should understand that these intangibles can directly impact the overall gain resulting from a training program.

#### **Level IV: Results**

The final level of the Kirkpatrick evaluation model, results, is inevitably the most scrutinized factor in any company's calculation of the net benefits of training. At this level, a company takes into account the other three levels, as well as some additional factors, and attempts to calculate the total net benefits of the program as a whole. This includes:

- Direct Labor Cost per Hour (Averaged)
- Burden/Overhead per Hour
- Hours per Shift
- Shifts per Day
- Days per Week
- Weeks per Year
- Number of Machines
- Machines per Worker
- Estimated Efficiency Improvement Percentage

The estimated efficiency improvement percentage is a figure that takes into account the other three levels of the Kirkpatrick model and attempts to arrive at a company's estimate of performance improvement. The process of arriving at this specific number will vary greatly, and depends largely upon how detailed a report a company desires to produce. A company can take into account not only its own experiences with a given training method, but also the results that other companies have realized in calculating this number.

Once all of these numbers are agreed upon, calculations are a simple process. To calculate the value of the results, and thus the net value of the process, the increase in weekly production hours should first be calculated with this formula:

$$\text{Days per Week} \times \text{Shifts per Day} \times \text{Number of Machines} \times \text{Hours per Shift} \times \text{Estimated Efficiency Improvement Percentage} = \text{Increase in Weekly Production Hours}$$

This number should show a clear increase in weekly production, but this is still not the monetary value sought for the final net benefits analysis. To convert this to a monetary value, another equation is necessary. This equation is:

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<sup>4</sup> TU Case Study

$$\begin{aligned} &[(\text{Direct Labor Cost per Hour} + \text{Burden/Overhead per Hour}) \div \text{Machines per Worker}] \times \\ &\text{Increase in Weekly Production Hours} \times \text{Weeks per Year} \\ &= \text{Increase in Yearly Labor Value} \end{aligned}$$

The increase in yearly labor value is finally a dollar amount that can be placed on the entire training process, and will work as the net benefit in the final ROI calculation. If a company is looking for an analysis of more short-term benefits, by taking the weeks per year out of the above equation, that company can arrive at a figure for the increase in weekly labor value.

## The Second Half of the ROI Equation: Net Costs

Net costs are, thankfully, much easier to calculate. In order to arrive at a final net costs value of a given training program, consideration needs to be given to more than just the cost of the program itself. Phillips provides these other costs to consider:

- Training program design/development.
- Program materials (textbooks, practice facilities/machinery, etc.).
- Instructor/facilitator fees, including time.
- Travel, lodging, etc. for trainees.
- Salaries of participants for time missed on the floor.
- Administrative/overhead.

Training program design and development can be a costly process and requires a significant time investment. Depending on the scope of training, such issues as text development, class syllabi, web content development, etc. can take a major toll on the bottom line of a training department. Online training has become a “go-to” resource for many in the white-collar world, but it is only recently a viable resource for the manufacturing sector as well. Tooling U, for example, offers over 400 different classes on a wide variety of manufacturing topics, and offers installation assistance and guidance on how to set up a program. While Tooling U cannot administer the entire program for a company, they can facilitate the process and offer significant cost reduction for content development.

Program materials include a range of items used in the training process. The key factors are textbooks and other instructional materials as well as computers and machines used for training. Depending on the level of detail required, this could also include paper used for handouts, pens, pencils, and almost any other supplies used in the process. Tooling U offers all of its online courses at rates that are far lower than buying textbooks for all of the relevant materials for each student. Conservatively, Tooling U has found that, to buy equivalent texts for all the courses available from its site, it would cost approximately 30 to 60 percent more for traditional textbooks.

While such online courses are indeed a core part of the training experience, nothing replaces hands-on training, and a company needs to find the best way to provide this training component. Costs should be careful to include this as a factor, whether it includes the cost of setting aside a normal productive machine for training, or the cost of training at a community college on their equipment. Though Tooling U does require computers for use in the training process, such computers need not be the newest and greatest, as the web-based program is designed for use on any computer with internet access. Many companies, such as the Toro Corporation, have students complete their online training at home, taking only the final tests during work hours in a proctored environment<sup>5</sup>. If the number of available computers is an issue, a rotating schedule for usage can be set up (which has other possible cost benefits, depending on the company).

Instructors are another major expenditure of the training process. Manufacturing requires a different type of instructor than white-collar training, as the best instructors are often the ones with hands-on experience and knowledge of the process. As such, many manufacturing companies may find that the best instructors of such courses are already on-site, working in the shop itself. However, while many of these workers are very knowledgeable about operating in the shop, their ability to explain the theoretical ideas behind such work may not be the best, as experienced individuals at times struggle to “recalibrate” their knowledge to students new to the topic at hand. Online training can offer a good solid theoretical basis for such initiatives, at a fraction of the cost of an outside instructor.

Travel expenses must be factored into any analysis of training. Employees may need to travel to offsite locations for classes, hands-on work, and so forth, incurring the associated travel costs. Such expenditures can drive up the cost of training greatly depending on the numbers of employees involved and the travel distance. With a combination of online learning and in-shop hands-on learning, travel expenditures can be minimized to a large extent, if not eliminated.

One of the hidden costs of training programs is the cost of missed time for training. In manufacturing, this can have a direct impact on the bottom line of a company’s finances. For every hour a worker is not out on the floor, that worker cannot produce parts. While the training will eventually make up for this loss in the benefits reaped from it, the time spent on the training should be minimized if possible so that less time is spent off the shop floor. Though no training can keep workers on the floor at all times, a good training program can make sure that not a minute of the worker’s (and company’s) time is wasted.

Tooling U offers several benefits to maximize the results of training time. With programs that work at the learner’s pace, Tooling U classes make sure the student does not have to sit through unneeded explanations of material that the student already knows, while

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<sup>5</sup> TU Case Study

being able to focus as long as needed on new material that needs to be learned. In addition, the potential for rotating schedules while using Tooling U training allows for as few or as many workers to remain on the floor at any one time as needed, thus minimizing group time off the floor and allowing training to adjust based on production needs.

Finally, administrative and overhead costs need to be calculated and included in any cost analysis. The time that management spends on training policy creation and enforcement also needs to be included here. Whoever is in charge of the training program will need to take time away from his or her normal activities to monitor the progress of training, which could be costly. Tooling U, through its LMS, offers an efficient way for administrators of a training program to check student progress and evaluate the status of the program as a whole. This saves management time and money.

Once all these costs have been accounted, simply add all the numbers to compute the net cost of a training program. This can be a sobering experience for a company, and it may be without even calculating the ROI percentage that a company will want to begin to find alternatives. Even so, a company should always be sure to complete the ROI process, as a high cost training program may prove to be worthwhile if the net benefits are realized in a relatively short time frame.

Training companies are conscious that keeping costs down is key to providing excellent service. Ninety-one percent reported feeling some pressure from outside their own companies to lower costs and overhead<sup>6</sup>. Such an awareness of cost requirements has motivated online training providers to help companies lower the costs of running a good training program. The Toro Company, a leading worldwide provider of outdoor beautification products, saw an estimated annual savings of \$81,000 when it switched its training program over to Tooling U<sup>7</sup>. Such savings can have a major impact on the ROI percentage, and can have an immediate effect on the bottom line of a company.

### **Putting It All Together: Calculating the ROI Percentage**

Once both net benefits and net costs are known and accounted for, the final calculation is a relatively painless process. The equation is:

$$\text{Return on Investment} = (\text{Net Benefits} \div \text{Net Costs}) \times 100$$

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<sup>6</sup> In a survey of training providers conducted in early 2008 by Expertus and TrainingIndustry.com,

<sup>7</sup> TU Case Study

A brief example is useful for illustrating how a good training program can provide an ROI a company. This will be based on an imaginary company, and will use this imaginary (but plausible) data:

<b>VARIABLES</b>	
Direct Labor per Hour (avg)	\$21.00
Burden/Overhead Rate per Hour	\$42.00
Hours per Shift	8
Shift per Day	1.5
Days per Week	5
Weeks per Year	49
Number of Machines	75
Machine per Worker	1

Using this as sample data from a manufacturing company, a simple net benefit can be calculated. Assuming a very minimal level of estimated efficiency of 1%, the formulas work out as:

$$5 \text{ Days per Week} \times 1.5 \text{ Shifts per Day} \times 75 \text{ Machines} \times 8 \text{ Hours per Shift} \times 1\% \text{ Estimated Efficiency Improvement Percentage} = 45 \text{ Hour Increase in Weekly Production Hours}$$

$$[(\$21.00 \text{ Direct Labor Cost per Hour} + \$42.00 \text{ Burden/Overhead per Hour}) \div 1 \text{ Machine per Worker}] \times 45 \text{ Hour Increase in Weekly Production Hours} \times 49 \text{ Weeks per Year} = \$138,915.00 \text{ Increase in Yearly Labor Value}$$

Such an estimated efficiency improvement is conservative, but shows already that at a small company of only 75 workers/machines, a drastic impact can be seen in terms of benefits alone.

Calculating costs can be a bit more difficult and will vary per company and program drastically. Online training as a whole, however, has shown a definite decrease in costs when compared to traditional training.

Assume a reduction of X% in costs just based on usage of an online training program such as Tooling U. If the company used in the cost analysis above normally allocated Y dollars to training, Tooling U could possibly save them as much as (Y times X %) dollars, which means their final training cost would be (Y-(Y times X%)) dollars.

To calculate the final ROI on this imaginary company's training, the final formula looks like this:

$$(\$138,915.00 \div (Y - (Y \text{ times } X\%))) \times 100 \\ = Z\% \text{ Return on Investment}$$

While this is intended as a sample, and also uses a very conservative estimate of increases based on training, a clear benefit can be seen from this sample.

## What does the ROI mean?

Every effective training program produces an ROI exceeding 100 percent. A lower value indicates the need to rethink and restructure the training program. Cutting costs is usually the easiest way to go about increasing ROI. The big expenditures of a project should be the first issue examined, as this is a prime focus for the biggest cuts in cost. The largest expense in many training programs is that of the materials used for the course. By cutting down on material costs, a company can boost their training ROI. By using an online program such as Tooling U, the cost of materials such as textbooks for a course can be reduced by 30% or more, depending on what books were planned to be used. In addition, online training offers a degree of customizability not found in more traditional textbooks.

Yet cutting costs is only one part of the equation that can be assisted by a change in training materials. The net benefits of training can be increased by implementing a different training program. The management of Parker Hannifin has stated that changing their training increased plant efficiency, as well as provided new skills and learning that employees could use on the job<sup>8</sup>. For Steve Freshour of Rochester Medical Implants, the observed benefits of the Tooling U program include increased teamwork and the ability to establish a baseline level of knowledge among workers. Such results increase the net benefits side of the equation, raising overall ROI significantly. Though these benefits are not specifically represented in the equation above, they would most certainly play a part in any company's estimated increase in efficiency.

## Conclusion

An ROI calculation is an invaluable tool for evaluating the effect of training in increasing company profits. ROI shows that the training has been effective and puts the result into quantifiable terms. This demonstrates the effectiveness of the training and also allows a company to compare various methods and find the one that returns the most money for every dollar invested into the program. Specifically, online training offers a cost-effective way to train, as well as tools that make the evaluation of such training easier for all involved.

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<sup>8</sup> TU Case Study

In order to compete on a global scale, manufacturers based in the U.S. need to examine the best ways to both use their existing workers and bring on new workers to expand their operations. With the growing shortage of skilled manufacturing workers looming on the horizon, efforts to keep current employees up-to-date and bring new workers onto the floor must increase. Online training allows companies an unprecedented level of control over the process as well as measurable results. Such an approach will surely be pivotal in the coming years to facilitate the continued growth and excellence of the American manufacturing sector.