Do We Really Need Consultants?

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Do we really need consultants?
There is a propensity in managers to spend inordinate amount of time looking for new ideas outside the company. In our experience, we find that managers do so because they are intimidated by new-age terminology or lack confidence in their managers and employees to solve their own internal problems. We remember Wickham Skinner’s address to the *Production and Operations Management Society* in 1997, Miami Beach, Florida as the president elect of the society. He said that there were over 250 different names for process improvement programs – most of which are just bubbles and will not stand the test of time. In fact, we find that what was Total Quality Management (TQM) is now Six Sigma, what was Just-in-Time (JIT) is now Lean Manufacturing, and what was Reengineering is now Management of Innovation. While there are cosmetic differences between new and old versions, no one can dispute that basic principles underlying these ideas are the same. While old wines are continually sold in new bottles, managers buy these ideas thinking they are different somehow and end up taking their organizations through a roller coaster ride of consultants and programs. The chances are that your company has gone through a round of TQM, JIT, Reengineering, Lean, and is now going through Six Sigma. How is it possible to go through these programs year after year and yet show dismal improvement in performance? The problem is that managers waste their time in looking for quick fixes outside the company (i.e. through consultant services) and spend very little time in developing deep problem solving capability inside the company. At the core of any world class process improvement idea is basic problem-solving and creativity.

The initial development of problem-solving capabilities within a firm to support process improvement efforts are often accomplished through the hiring of consultants. Our claim is that while consultants can play an important role in developing problem-solving capabilities within firms, the roles given to these consultants by most client firms are often out-of-alignment with the best interests of the organization. In other words, consultants are not properly utilized to achieve the deep problem-solving capabilities needed to sustain process improvement efforts. In our experience, the out-of-alignment of consultant roles with organizational needs often leads to the abandonment of most programs within two years of inception – with little of the expected benefit accruing to the adopting firms. To illustrate, we offer the following example.
Many of us with families have had to entertain a trip to a hospital emergency room on more than one occasion. What if during one of our visits, we were first greeted by a board-certified physician with 20 years of experience who took our vital signs, personal and insurance information, and then showed us to a waiting room. When our time to be treated arrived, we were shown to an examination room where a first-year medical school student was poised to diagnose our case and suggest corrective treatment. Most of us would react negatively, suggesting to the hospital that the medical student perform the easier tasks of collecting the vital signs and paperwork, while allowing the experienced physician to perform the more difficult tasks of conducting the diagnosis and suggesting treatment alternatives. While this scenario seems absurd, a similar phenomenon is repeated daily in many manufacturing firms that utilize professional consultants. In our experience, we find that the actual needs of the client organization are often out-of-alignment with the way the organizations tend to utilize their consultants. In our experience with process-improvement programs in the U.S. military, manufacturing and services, and non-profit organizations, we find that consultants are utilized primarily for solving relatively easy problems while the more difficult problems are often left up to managers and line employees who are relative novices in process-improvement techniques – at least during the initial years of an improvement program. In other words, we find that consultants who are experts in process-improvement tend to solve easier problems that have a high probability for showing early success – thus lending credibility to their efforts – and leave the more difficult problems to managers and workers. We define a relatively easy problem as one in which the root cause of a process failure and its solution can be found within the existing expertise in an organization. Once the consultant leaves the project, the work is relegated to managers and line employees who must then address problems left undone by the consultant. We find that these are often the most difficult and time consuming problems – requiring enormous effort in recognizing root causes and developing alternative solutions. In addition, the implementation of these solutions may require a number of years to complete and do not show quick results. It is in this context where the out-of-alignment occurs and where many process-improvement programs are prematurely abandoned – often within two years of implementation.
Out-of Alignment

We find that a stunning number of process improvement programs fail each year because they are implemented in the similar manner. From the outset, these programs are doomed because they are out-of-alignment with what the consultant/experts should be addressing and what they are often directed to do by the client organization. Consider what happened in a Fortune 100 Telecommunications company’s repair facility in the Southeastern United States. First, to jump-start their process improvement program they hired a consultant who has an excellent reputation in implementing process improvement programs. The consultant was hired to provide training in problem-solving to employees and then to lead process-improvement efforts during the training. In the beginning, the consultant began training managers and line employees in basic problem-solving techniques. As part of the training process and to show quick results, the consultant addressed a few relatively easy problems. In these problems, the solutions already existed within the company. The consultant collected information on root causes and their solutions directly from existing employees – using very little of his personal expertise in the area. Prior to the arrival of the consultant, managers had never engaged in formal problem-solving and therefore had not developed deep problem-solving capabilities within the company. The process improvement program achieved some early successes and the consultant continued to train employees in how problem-solving can proceed in a smooth and rational manner. Within a few months the consultant fulfilled his contract and passed the baton to managers who were given the responsibility to continue the process improvement program.

Almost immediately, the managers, like the consultant, engaged in problem solving with employees. However, the time and effort needed to identify the root cause of the remaining problems and their solutions became increasingly difficult. The process improvement program did not appear to the participants to go as smoothly as before but the managers continued to drive the program. While there were a few successes, the impacts on performance were not as large as the earlier successes. After a few months, the managers were eager to pass the baton to line employees. After all, what could be nobler than making your employees empowered to participate in a process improvement program? While the line employees had received training in problem-solving, they had only practiced its application for a few months – and still considered themselves as novices in problem solving. Unfortunately, the root causes and
alternative solutions of the new problems they were facing were increasingly difficult to discover. The problem-solving process was no longer occurring in the neat sequential manner as they had been taught. It now appeared irrational - often bouncing around randomly from one stage to the next. The line employees often tried alternative solutions, then gathered more data, then tried other solutions, then proposed alternative root causes, etc. – an apparently non-systematic process. As a result, the line employees became increasingly frustrated and angry. Both managers and employees worked hard to salvage the program; but unfortunately, after a few more months, the process improvement program was completely abandoned.

After abandonment of the program, follow-up interviews with managers were conducted to ascertain why the investment in the process improvement program had not reaped the promised rewards to the organization. The most common reason given was that while the consultant did a good job, the line employees did not possess the necessary skills and interest to continue the project. After reviewing the documents from the implementation, we found an interesting theme emerging. We found that in almost every case where the consultant had large successes, the problems were relatively easy. In other words, the consultant had primarily achieved success by organizing the gathering of known problems from managers and line employees, and then organizing the gathering of known solutions from similar groups. The real contribution of the consultant was his skill in gathering knowledge that already existed in the company, not in uncovering new root causes or alternative solutions. However, to the managers it appeared as though the consultant was generating most of the ideas and solutions himself. These early efforts ended up reaping large rewards to the company and enhancing the credibility of the consultant. After reviewing the cases where the consultant had to utilize a greater degree of his expertise in the area to ascertain the root causes and their solutions, his efforts were not as successful. We then reviewed our experiences in other firms and found a similar phenomenon. Based on these experiences, we propose that the expertise of the consultant should have been utilized later in the implementation process when the problems and solutions were more difficult. As it was, the consultant left the project by the time the problem identification difficulty increased, the problem-solving process was no longer occurring sequentially, and the known problems had been dealt with. This left the relative novices in problem-solving - both managers and line
employees - to deal with the most difficult issues. This misalignment between the needs of the company and the utilization of the consultant eventually led to the failure of the program.

While experiences may differ from one company to the other, we propose many companies experience alignment problems because they simply implement their process improvement program in the wrong way (see Figure 1). Figure 1 shows an experience curve developed from 12 firms comparing the relative improvement in performance (X-axis) compared to the relative difficulty of identifying and solving the problem (Y-axis). Ideally, the relationship should be linear – where performance improvement is realized with both difficult and easy problems and regardless of whether the effort is driven by consultants or employees. However, Figure 1 clearly demonstrates how consultant-lead efforts tend to solve easier problems to show large benefits while the more difficult problems are addressed by line employees who are able to achieve only minor improvements in performance. In addition, we also found that the variance (distance between the two lines) in the improvement from problem-solving project to another also increased as the managers and line employees took over.

Figure 1: Incorrect Implementation
This phenomenon is caused because managers first invite a consultant/expert, who shows early successes in the short term - achieving phenomenal returns. Then managers take over the programs and achieve some level of success, but over the long-term their successes have less and less impact on performance and opportunities for improvement more difficult to find. By the time process improvement programs are handed over to line employees, the opportunities for success are severely limited because the easiest problems have been solved and the only ones left are relatively difficult. While trained in problem-solving, these line employees have not developed the necessary skills and experience to address most of the difficult problems. In other words, they have not yet developed deep problem-solving skills. They take significantly more time than consultants or managers, with very little or no increase in performance. In short, out-of-alignment problems occur because consultant/experts begin most programs by solving relatively easy problems in order to gain credibility - leaving novices to identify and solve the more difficult problems. We propose that this process is at odds with the needs of the firm and eventually leads to the abandonment or under-performance of many process improvement initiatives.

Alignment
Alternatively, we suggest that consultants should be utilized primarily for training in the early stages of a process improvement program and then allow the managers and line employees to deal with relatively easy problems on their own while they develop problem-solving skills. Then, as the problems and their solutions become more difficult, the consultant should play a much greater role later in the problem-solving process. We propose that this utilization of consultancy is more in alignment with the needs of the firm than the more traditional approach. Figure 2 demonstrates our proposed revision of the consultancy process. As Figure 2 shows, the rate of improvement for early manager and line employee driven programs may not have as large an impact as under the early consultancy driven program; however, the utilization of the consultant during the more difficult periods should increase the sustainability and success of process improvement programs.
What is meant by a Problem Solving Process?

Successful process improvement implementation depends on the ability to identify and solve problems. A problem is defined as a deviation between what should be happening and what is actually happening. Problem solving is the process of changing the state of what is actually happening to what should be happening. In general, these models consist of four to six steps. The problem solving programs we experience are typically a five-step process. The technique begins with **problem identification**. The problem needs to be correctly identified before any attempt is made to solve a problem. In fact, Albert Einstein considered that formulation of a problem is far more essential than its solution – meaning that an eloquent solution to an incorrectly identified problem is worthless. Generally, the next step in problem solving is **information gathering**. To study a problem from a variety of angles and uncovering all that were previously obscured, overlooked, or unnoticed. The purpose is to perform a thorough assessment by considering information from many sources, discovering hidden patterns or relationships among the pieces of information. For many models, the next step in problem solving is **generating alternative solutions**. This is often done through brainstorming. The objective of brainstorming is to generate a large quantity of new ideas and defer judgment (or criticism) until after the analysis. Working with many diverse – and sometimes absurd ideas – is crucial to innovation because failure can expose important gaps in knowledge. The next stage in
problem solving is evaluating solutions. One way to evaluate solutions is to design an experiment with ideas on a trial basis (i.e., in a laboratory or pilot production processes), obtain objective data, and study results. Experimentation not only serves to evaluate alternative solutions, but also demonstrates the benefits of various solutions to shop floor employees. By making the benefits visible, many people can be persuaded that improvements are really possible. Thomas Edison often espoused that the measure of success is the number of experiments than can be packed in a 24-hour period. The last stage of problem solving is implementing the best solution(s). The most stupendous improvement plans will be ineffective unless translated into practice. There has been little research on how to implement solutions because some researchers feel there is very little creativity involved in the process. However, others feel that the greatest need for creativity is in the implementation stage. Frequently, extraordinary efforts are necessary to lead people into new ways of working.

How Do Experts Solve Problems Differently Than Novices?
Our experience suggests that the gap in performance between the results of experts and novices is partially created because experts tend to solve problems very differently than novices. Experts have extensive experience and perhaps, more formal education that offer them the skills for solving difficult problems. They have become an expert because they have been solving increasingly difficult problems during their career. Generally, difficult problems excite them because these problems stretch their creative ability to develop new and innovative solutions. In this manner, they are able to boost their problem solving capability and have a sense of accomplishment. For example, professional marathon runners find running a 1-mile race very easy. Considering the time it takes to warm-up and prepare for a race, they could just as easily run 5 miles or more with the same effort it takes to run 1 mile – but the payoffs are very different. In contrast, a novice at running will likely find a 1-mile race very challenging and a 5–mile race impossible. A lack of physical conditioning makes the 1-mile race a challenge – requiring that the novice spend enormous effort to be competitive. However, the 5-mile race which the expert easily completed easily would be impossible for the novice to complete.

For consultants in the process improvement program, the choice of attacking an easy or difficult problem may not be that obvious. Sometimes, in order to show fast results and provide easy
problems for training purposes, consultants steer away from addressing difficult problems in favor of those that are relatively easy. At other times, managers often steer consultants toward easier problems that show fast results in order to lend credibility to the process improvement effort. In many cases, the problems and solutions are so routine that consultants need not go through all five steps of the process, but often do to give the impression to the managers that they are indeed engaged in serious problem solving. In other words, they perform a complicated analysis of what is obvious. This makes the problem solving process appear smooth and rational. To illustrate our point, Table 1 describes how a consultant gets involved in solving an easy problem.

Table 1: Expert Solving an Easy Problem

ABC, Inc is a wholesaler of light residential building company with annual sales of about $100 million in the Southern United States. The in late 1990s they had two facilities- one in Marietta, GA and the other one in Duluth, GA - about 40 miles away. The size of each facility was about the same; however, both were inadequate for housing the company’s apparent need for inventory. Because the company started from the Marietta facility, other than sales and shipping, many functions were centralized in that facility. The purchasing department bought the component parts and the manufacturing group turned them into completed millwork orders for door or window items. The completed units were then transferred to the Duluth facility for shipping to individual customers.

Problem Identification
The consultant studied and found their facility space problem was due to an excessively high level of inventory in all three categories of raw material, work in process, and finished goods. While sales increased about 5% to 10%, during the same period total inventory increased about 15% to 20%. The process mapping confirmed that there were numerous problems associated with their value chain - order processing, shipping, manufacturing, and purchasing. These problems were difficult and challenging, and required several months to analyze and recommend solutions. While managers recognized these problems, they wanted to carry out these improvements later – focusing instead on building new warehouses. In addition, the managers argued that their level of inventory was significantly lower than their competitors’ levels and was therefore appropriate. The managers wanted the consultant to solve the space problem fairly quickly.

The consultant interviewed some key managers and employees within the organization. One of the employees said that “Duluth facility only keeps completed units, and the Marietta facility keeps both the components and completed units. What needs to be done is to receive all the components at the Duluth facility. The components should be transferred from the Duluth facility to the Marietta facility. The transfer is not going to incur additional cost. Currently a truck transfers manufactured units twice a day – returning empty. This truck could be used to deliver component parts for manufacturing on the return trip to the Marietta facility. He also said that he had mentioned to his supervisor, but the supervisor did not consider it a worthwhile effort. After visiting the Duluth facility and conducting some minor analysis, the consultant concluded that this solution could actually work. A few managers and employees also agreed with the solution idea. Instead of going ahead with the implementation of the solution, the consultant proceeded to gather detailed information.

Information Gathering
The consultant gathered detailed information. First, he used exponential smooth with seasonality and trend, to project sales growth for three years. Using the projected sales growth, inventory levels of component parts were determined and translated into warehouse square footage requirement. Second, warehouse capacity was maximized at the Duluth facility with minor changes in the internal layout. Third, truck capacity calculations were performed to ensure that the volume of component parts could be transferred with the current truck schedule.
In addition, the consultant checked the availability of rental space nearby the facility and found two warehouses with available space. The consultant gathered detailed information about their space availability and their lease agreements. He also prepared two preliminary floor layouts and inventory flow through these rented facilities. He then coordinated several meetings with architects and builders to develop estimates for a new facility. After two weeks, the architects provided preliminary estimates of new facility. Since the company owned land around the Marietta facility, the cost of new warehouse did not include the cost of land.

**Generating Alternative Solutions**
The consultant developed three possible alternative solutions, (1) a new company-owned facility near the Marietta warehouse; (2) rental space from another warehouse close to the Marietta facility; or (3) redesign the use of both the Marietta and Duluth facilities to maximize current capacity and increase effectiveness.

**Evaluating Solutions**
The consultant and the managers met for several hours and carefully evaluated each alternative. The managers discarded the idea of building new facility because this was a expensive proposition and was unsupported by the projected sales growth for three years. The managers also discarded the idea of renting space from nearby businesses because their lease agreements were very restrictive and required long-term (> 5 years) commitment. Upon deliberations, the managers unanimously approved the move the component parts inventory from the Marietta facility to the Duluth facility.

**Implementing the Best Solution(s)**
This implementation was a huge undertaking, requiring coordination across different departments – shipping, manufacturing, and purchasing, and among managers and employees of both facilities. A detailed implementation plan was prepared which consisted of three major steps. First, Duluth facility’s internal layout was redrawn and after several discussions with the warehouse employees (e.g., pullers, forklift operators, etc.) the layout was approved. The layout changes necessitated moving many electrical outlets and building an additional ramp. Second, over several weekends, without disrupting the production schedule, inventory of component parts was moved to the Duluth facility. Third, adjustment was made in truck transfer schedules, necessary paper work was developed to follow transfer parts between the facilities, a receiving function was developed at the Duluth facility, and the suppliers were informed to send deliveries to Duluth versus to Marietta. There was some resistance from the manager and employees at both the facilities. Since everyone had to make a little adjustment, they agreed to carryout the changes. To entire implementation took about three months.

After monitoring the implementation at both the facilities for several weeks, the consultant left the company. Soon after, managers and employees held meetings and, using their existing process map, started to push process improvement. The managers and employees identified several problems in their existing value chain and prioritized various problems among themselves. Initially, they were enthusiastic as they were able to solve some problems; however, not long after the consultant left the problem solving process became increasingly difficult. Meanwhile, to keep pace with the increasing demand production had to ramp up and the purchasing department had to buy additional component parts. As inventory of component parts increased, overtime the transfer between the two facilities developed many problems. The additional space at the Duluth facility was now utilized, and the material was constantly shuffled
from one location to the other. This created some chaos and confusion due to the wrong parts being transferred. Managers and employees from both facilities started to blame each other for their predicament. Within one year, they abandoned their process improvement program, and built a new and a bigger facility adjacent to the Marietta facility - moving the entire inventory of component parts from the Duluth facility into the new facility. While the consultant’s recommendation for transferring parts would have still alleviated the space problem – it required maintenance to ensure that no obsolete parts were being ordered, completed orders were sipped on time, excessive WIP inventory was not being held, and accurate transfer records were being maintained. The managers and workers failed to maintain the system – choosing instead to build a new warehouse to hold large levels of buffer inventory.

Even with training, the managers and workers at both facilities were considered as novices. They did not have extensive experience in process improvement, less formal education, and were equipped for solving relative easy problems. Generally, easy problems excited them because these problems stretched their creative ability to develop new and innovative solutions and initially allowed them to present ideas they had developed over number of years. In this manner, they were able to practice formal problem solving and have a sense of accomplishment. As in the case in Table 1, the novices had to tackle difficult new problems of running the transfer operation – they did not have the luxury of picking and choosing the problems they attacked. In the end, they did not have the skills to work through many of the issues they faced in the new system, and the consultant was no longer available to assist them. They failed to recognize the root causes of the problems. They did not understand how to properly analyze the data. They could not reach consensus on which solutions to implement, and therefore the compromise (rather than the best) solutions were implemented without success. They tried hard to work through the problem solving steps sequentially, but the process no longer worked for solving problems. Eventually, this led to a great deal of confusion, anger, and animosity among the employees. The problem solving process was occurring in an irrational manner. Table 2 reports a case of a plastics company for which we were able to observe the problem-solving process in detail.
Table 2: Novices Solving a Difficult Problem

At the time of this study the plant was a member of the plastics division of Constar, Inc. - a member of the Fortune 500 group. The plant is classified as a continuous extrusion facility located in the southern United States and was one of 20 plants owned by Constar. The plant employed 300 engineers, technicians, managers and line employees who processed Polyethylene (HDPE and LDPE), PVC, Polypropylene and Nylon resins. It utilized 20 production lines comprised of Bekum, Fisher, and other custom equipment. One characteristic of this industry is that technology has not progressed to a point of permanent resolution of all manufacturing process problems, i.e. the process still require a certain degree of art. This makes the process somewhat dependent on intrinsic knowledge of its line employees. The company decided to hire a consultant to help it address excessive downtime problem created by material shortages.

The company is typical of a manufacturer specializing in extrusion processes that organize manufacturing lines around a single piece of processing equipment. Each line also contains anti-static treatment units and case erectors. A typical plant operates in both a "make-to-order" and "make-to-stock" environment. A typical line operator oversees 3 production lines. At the time of this implementation, the company was holding an estimated 5% of the domestic plastic container market (4 oz to 3 gal size).

To institute a process improvement program, a consultant was hired. The consultant’s job was to conduct formal training over a two-week period and lead the process-improvement effort through at least one major problem to demonstrate the process. One of the problems facing the company was the large amount of downtime due to material shortages. Many plastic resins (plastic raw material) had to be feed into the equipment by hand due to its weight. If an operator was busy, they might not replenish the material in time to prevent a stoppage of work. This led to unnecessary downtime and loss of productivity. To address this problem, the consultant led the effort through the problem identification, data gathering, and generating solutions phases of the program. The group could not generate a single feasible solution. So, the consultant visited all of the remaining 20 plants to see how they handled the problem. In one facility, he found a new state-of-the-art delivery system that had the capacity to deliver the heavier resin automatically and prevent much of the downtime. The supervisors were not aware fo the new technology and agreed to install the new system. After the new unit was installed, few material shortages were noted on the operator's reports, and after the completion of the training sessions, the company released the consultant. However, over time, the supervisors noted a new problem - that downtime due to routine maintenance had increased by 10%. The line employees searched for a reason behind the increase in maintenance time, but according to discussions with operators, they were not taking more time than usual to repair a problem. The line employees in this example did not treat maintenance downtime as a problem because it is a symptom, not a root cause of productivity loss. In order for formal problem solving to work, root causes must be identified.

Generating Alternative Solutions
Managers and line employees (who were now leading the problem-solving efforts) were experiencing frustration with this problem. Since they could not identify a root cause, alternative solutions were solicited through brainstorming. Arguments ensued over suggestions such as more training on how to perform maintenance (which operators felt was unnecessary), better tools (which engineers felt was unnecessary), steps to reduce absenteeism (which could not be logically tied to the problem), and more security in the plant (which would reduce what some employees thought was sabotage).

Evaluating Solutions
The line employees conducted an experiment to discover whether or not actual maintenance had increased. They obtained standard time to perform maintenance from manufacturers repair manuals and compared it with before and after procedures the line employees followed. They discovered that operator's actual maintenance time had not increased. However, at this point the employees did not see how any of the alternative suggestions could work.

Information Gathering
The line employees decided to gather all data on maintenance records over the previous 12 months to verify maintenance time. They reviewed the records, and verified that maintenance time had not changed. However, one line employee discovered that the downtime problem occurred in the same month as the implementation of the material handling system. In addition, he noticed that when the material system was down for two weeks, the old
system was temporarily reinstituted. During this two week period, downtime due to maintenance had dropped.

**Problem Identification**
The line employees devoted one full day to brainstorm ideas. At the end of the day, there was consensus that operators had been performing maintenance during times when the production line was down for other reasons – such as material shortages. This meant that the downtime was reported as material shortage, not maintenance, and actual maintenance time was understated and hidden. When suggested to operators, they confirmed this fact, although they admitted they had never connected the two issues.

**Generating Alternative Solutions**
Three alternative solutions were identified. Better operator training to reduce maintenance time. Do maintenance on shifts when the production lines are not operating. Redesign lines to require less maintenance.

**Evaluating Solutions**
There was no immediate solution to the problem. The production lines were no longer down for material shortages, and had to be shut down specifically for maintenance. Since the plant operated 24/7, there was no other time to perform maintenance. Since it was determined that the operators had sufficient training, the only alternative solution was to redesign the production lines to need less preventative maintenance – and the technology did not exist to do so.

**Implementing the Best Solution(s)**
Since the technology to redesign the line did not exist at the time, the problem was turned over to engineering. After 30 days nothing had been done, because engineers had other priorities and did not want to tackle a difficult problem. Managers however were determined that a solution be found, because it was costing the company productivity and offsetting many of the gains achieved with the new material delivery system. During 3 months of brainstorming ideas, the engineering department decided to redesign the line so that some preventative maintenance could be done while the machine was operating. They relocated lubrication points to the exterior of the equipment, and installed dual cutting mechanisms so that one could be stationary and maintained while the other was operational. This meant that the line could be partially maintained while still operating.

This example presents a clear picture of how a difficult problem is often addressed by novices. It took a long time to conduct (over a two-month period) which is unusual for most process problems. To outside observers, the process appeared irrational with the line employees bouncing-around from one idea to the next with little guidance. To participants, it was frustrating. Workers rejuvenated the phrase, “This problem-solving program is not working as touted – again”. There was argument over which solutions to try first. Once employees realized that none of the solutions worked, they argued whether the solutions were incomplete or the problem was misidentified. There was a great deal of confusion, anger, animosity, and blame among line employees. The arguments wasted a number of resources and often required managerial intervention. Others blamed the failure on the problem solving training provided saying that it did not work as expected. These events also caused frustration on the part of managers, some wanting to abandon the process. It is evident from the experience that problem solving did not proceed in a smooth and rational manner. We suggest that the reason was that
these relative novices in the problem solving process were engaged in solving difficult problems and, in the earlier example in the millwork company, experts in problem solving skills were engaged in solving easy problems. In both cases, the use of consultants was out-of-alignment with the needs of the company.

**What is the Problem?**

Hayes and Wheelwright (see, “Restoring Our Competitive Edge: Competing Through Manufacturing”, John Wiley & Sons, New York, 1984.) coined the phrase ‘world class manufacturing’ to describe a set of six practices that help companies achieve outstanding performance (Table 3). Many studies have shown that these practices have stood the test of time and they truly contribute to world class performance. In fact, at the core of these practices is the notion of developing a deep problem solving capability within a company. However, we find that a stunning number of companies in both manufacturing and service, do not push deep problem solving within their companies. Often times, managers and employees are provided training in functional areas (e.g., Accounting, Sales, Machine Operations, etc.) or motivational or leadership but, no training on basic problem solving. Consultants are often utilized to help initiate problem solving programs, but are not used properly during the most critical parts of the programs. Ironically, in many companies, managers and employees are evaluated on their ability to solve problems.

**Table 3: Hayes and Wheelwright (1984)’s World Practices**

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<th>Description</th>
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<tr>
<td>[1]</td>
<td>Continuous development of workforce skills and capabilities through on-going training programs and cooperative arrangements with vocational technical institutes.</td>
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<tr>
<td>[2]</td>
<td>Continuous development of the technical competence of managers through training, hiring managers with technical degrees and rotating managers through technical functions.</td>
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<tr>
<td>[3]</td>
<td>Competing through continuous quality improvement focused primarily on new product development and customer involvement.</td>
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<tr>
<td>[4]</td>
<td>Encouraging workforce participation in the improvement process through the development of a culture and policies that foster a cooperative environment.</td>
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<tr>
<td>[5]</td>
<td>Rebuilding manufacturing engineering through the development of new equipment and workers that can maintain and improve that equipment.</td>
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<tr>
<td>[6]</td>
<td>Developing an environment that strives to make incremental improvements.</td>
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The world class companies push deep problem solving capability within their firms to drive their process improvement programs. For example, in writing about how ingrained problem solving is in Toyota, Spear and Bowen write “… Toyota uses rigorous problems-solving process that requires a detailed assessment of the current state of affairs and a plan for improvement that is, in effect, an experimental test of the proposed changes. With anything less than such scientific rigor, change at Toyota would amount to little more than random trail and error – a blindfolded walk through life.” Further, while summarizing Toyota’s core practices in four rules, they write “Rule 4: Any improvement must be made in accordance with scientific method [problem solving], under the guidance of a teacher, at the lowest possible level in the organization.” (For a detailed account of Spear and Bowen’s article, see “Decoding the DNA of the Toyota Production System,” HBR September-October, 1999.) In fact, many do not know that Shigeo Shingo, widely recognized as co-developer of the Toyota system, considered scientific thinking as the backbone of process improvement. The central theme behind scientific thinking is to provide a consistent methodology for employees to engage in active problem solving. Frequent problem solving coupled with company-wide harnessing of individual creativity is at the core of all process improvement programs. Companies can begin their journey to become world class operations by pushing deep problem solving capability within in their companies.

Aligning Your Process Improvement Program
First, in order to align your process improvement program, develop deep problem solving capability within the company. This involves providing training to employees using some formal problem solving technique – if necessary, a consultant. The technique begins with problem identification, information gathering, generating alternative solutions, evaluating solutions, and ends with implementing the best solution(s). Then have managers guide the employees, who are novices in problem solving skills to solve the easier problems in the company. As employees practice their problem solving skills they gain confidence by improving performance; however, these initial stages are often time consuming and take much longer than a consultant led process. As easy problems are solved and problem solving becomes somewhat difficult, managers should increase their participation in the problem solving process. However,
as problem solving becomes more difficult, the gains through process improvement typically decline. As managers and workers feel overwhelmed, a consultant, who is an expert in problem solving, should be engaged. The consultant then leads the group of managers and employees through a few difficult problems as they gain experience. In short, the process improvement program will be in alignment - novices will be engaged in solving easy problems and experts will be engaged in solving more difficult problems.

References
None. We may choose to include a complete reference list.
Founded in 1892, the University of Rhode Island is one of eight land, urban, and sea grant universities in the United States. The 1,200-acre rural campus is less than ten miles from Narragansett Bay and highlights its traditions of natural resource, marine and urban related research. There are over 14,000 undergraduate and graduate students enrolled in seven degree-granting colleges representing 48 states and the District of Columbia. More than 500 international students represent 59 different countries. Eighteen percent of the freshman class graduated in the top ten percent of their high school classes. The teaching and research faculty numbers over 600 and the University offers 101 undergraduate programs and 86 advanced degree programs. URI students have received Rhodes, Fulbright, Truman, Goldwater, and Udall scholarships. There are over 80,000 active alumnae.

The University of Rhode Island started to offer undergraduate business administration courses in 1923. In 1962, the MBA program was introduced and the PhD program began in the mid 1980s. The College of Business Administration is accredited by The AACSB International - The Association to Advance Collegiate Schools of Business in 1969. The College of Business enrolls over 1400 undergraduate students and more than 300 graduate students.

Mission

Our responsibility is to provide strong academic programs that instill excellence, confidence and strong leadership skills in our graduates. Our aim is to (1) promote critical and independent thinking, (2) foster personal responsibility and (3) develop students whose performance and commitment mark them as leaders contributing to the business community and society. The College will serve as a center for business scholarship, creative research and outreach activities to the citizens and institutions of the State of Rhode Island as well as the regional, national and international communities.

The creation of this working paper series has been funded by an endowment established by William A. Orme, URI College of Business Administration, Class of 1949 and former head of the General Electric Foundation. This working paper series is intended to permit faculty members to obtain feedback on research activities before the research is submitted to academic and professional journals and professional associations for presentations.

An award is presented annually for the most outstanding paper submitted.