UNITED TECHNOLOGIES CORPORATION FIRE & SECURITY: FIELD OPERATIONS

Teaching Note

Objectives

This teaching note provides analyses and class discussion guidance to instructors emphasizing root cause analysis by employing tools such as fishbone diagram and 5 whys to identify the key causes of issues. Possible elements of mistake-proofing plans, Standard Work, and global process design are discussed to guide the instructor regarding a global program of improvement management.

Abstract

UTC Fire & Security, one of the business units of United Technologies Corporation (UTC), is a global leader in the fire safety and security solutions industry. Of its revenues, 60% come from the service and installation side of the business, which is branch-based with more than 400 branches located globally. Success in this business is heavily dependent on its field operations and their effectiveness. Because many of the service and installation businesses across the global network have been missing their profitability targets, Tony Black, senior vice president of global operations, reaches out to the Frank Daly, managing director of international businesses, to investigate this issue.

Daly flies to one of the regional headquarters to review the financials of one of the businesses. After a gemba walk at one of the branches, Daly notices that a marquee project’s actual margin is more than $100,000 short of the expected margin. He knows that Black will not be pleased to learn that a large job was closed with a −5% net recovered margin (NRM). After finding that similar issues existed at other branches as well, Daly embarks on the design and deploys a global initiative aimed at the issues driving the negative NRM performance.
Assignment Questions

1. Explore the possible drivers for the cost over-runs and develop a cause-and-effect diagram.
2. Determine the possible root causes for the cost of overruns and consider how to verify the hypotheses.
3. Plan corrective actions and develop mistake-proof plans for the identified root causes.
4. Which approaches and tools would most likely be needed first in a global NRM improvement program?
5. How would you recommend initiating and managing the improvement activities necessary to address the negative NRM performance?

Analysis

Students can hypothesize the causes of the cost overruns and consequently a negative return margin (NRM) by using a fishbone diagram (also known as a cause-and-effect or Ishikawa diagram after its originator, Kaoru Ishikawa). Each cause is a possible source of variation in cost overruns or NRM. Causes are usually grouped into major categories to reveal potential explanations. Some of the possible drivers of the cost overruns are presented in the questions grouped under appropriate subheadings below:

Sales personnel

- Did sales personnel have the incentive to prevent cost overruns?
- Did sales personnel have the data to make appropriate sales quotes?
- Were there any constraints that sales personnel face while visiting a site?
- Was a thorough operations validation done by sales personnel at the client site?

Forecasting project costs

- Was the cost of materials prepared in accordance with current market conditions?
- Were the quantities of direct labor and variable overhead based on Standard Work sheets?

Management

- Were the customer requirements and specifications of the design and installation project properly documented?
• Was proper training to perform the contract administered to the employees and subcontractors?
• Did branch managers validate the experience the employees and subcontractors had to perform the installation?
• Did branch managers factor in the unique environment variables before coming up with the margin plan?
• Did branch managers deploy resources in an optimal manner?

Process
• Was the proposed fire/security system designed according to UTC FS specifications?
• Was this information properly dispersed to installation employees and subcontractors?
• Was the design changed drastically during the installation?
• Was the system design standard or unique to the specific installation?
• Was there a formalized work process for bidding on a contract

Environment
• Did the installation site have specific regulatory requirements?

Equipment
• Was the correct equipment used?

Material
• Was the amount of material needed estimated accurately?
• Was the material handled properly and was it contaminated?
• Was the supplier’s process defined and controlled?

Subcontractor process
• Were the subcontractors from an approved list of subcontractors with whom you already have contracts?
• Did the contract negotiations go smoothly with the subcontractors?
• Were the subcontractors bought in at an appropriate time during the project?
• Were the subcontractors flexible in adjusting the scope of their work?
Disruptions

- Were there significant disruptions during the project’s installation process?
- Did the branch manager consider retrofitting the infrastructure of the old building?

Measurement system

- Was the positive NRM expectation conveyed to the workers?
- Did the branch manager oversee the installation process?
- Were proper metrics in place to prevent cost overruns?

A possible fishbone diagram based on these questions is depicted in Figure 1.

Figure 1. Fishbone diagram for UTC FS.

The causes presented in the fishbone diagram can be explored further with the 5 whys technique. The following are potential major root causes:

- Incorrectly forecasting costs
Lack of granularity: If we knew which costs were incorrectly forecast or which workers consumed the most resources, we could better manage these pieces.

Portfolio management: If you can tell which products are more profitable than others, then attention could be paid to the more profitable products.

Design process specifications are not communicated clearly.

No Standard Work. There may not be Standard Work because there is no standard project. There can still be standard processes.

Lack of communication between people who perform the estimation

Lack of communication with owners of the building about minimizing disruptions that introduce variability into processes. Modeling this variability produces better forecasting.

Manager accountability.

**Countermeasures**

1. Implement Standard Work.
2. Redefine work day to minimize disruptions.
3. For the estimation, bring a member of the installation team along with the estimator to more accurately estimate the costs and then direct both parties to finish the project within budget and on time.
4. For the subcontractor multitask assignment, create resource planning document.
5. For the standard communication processes implementation, create a communications plan.
6. To define expectations for “closing gaps,” create risk and expectations plan.

**Deployment**

Given the global opportunity and Black’s commitment to make the company’s NRM positive in 2010, students could be asked what elements of a plan to deploy a global program will address the issues driving the negative NRM and how much emphasis ought to be placed on grass-roots, branch-level ACE activities. The instructor could start the discussion about the implementation at the corporate or regional level by asking the following questions:

- Which approaches and tools would most likely be needed first in a global NRM improvement program?
- How would you recommend initiating and managing the improvement activities necessary to address the negative NRM performance?
Grass-roots, branch-level ACE activities are important. Make an argument at the lowest level so everybody understands, comes on board, and takes ownership. Prove to people that it yields results.

1. Implement Standard Work.

Diagnose the current situation and best practices across each of 400 different branches with sales, design, and implementation people. Look at other branch sites ACE Gold and Silver certification and who have developed standard processes and good practices to maintain consistencies. Get members from these sites to kaizen events at other sites to share their experience. Kaizen events are launched to create processes that can lead to significant improvement.

2. Implement these standard practices as part of a pilot program in one or two branches.
   a. List Standard Work opportunities.
   b. Develop a sample branch.
   c. Visit the branches to observe the work in process.
   d. Identify steps in the design process common to all branches.
   e. Assemble a set of standard best-practices to execute those steps.

3. Create a standard due diligence practice that includes a checklist with certain questions needing to be answered before any project begins. A checklist alerts managers to the mistakes typically associated with a project and gives them the chance to change orders and avoid them. This procedure also ensures that the regulations and client specifications are followed in real time. Labor overrun in a project is usually the result of orders that were not changed and lack of communication across the entire process. The root cause is manager accountability.

   In the case, the branch manager either did not know about the positive NRM goal (lack of communication) or ignored it. If he ignored it, then there is no accountability. If the manager is held accountable, then he will conduct utmost due diligence beforehand to make sure that the planning process has the goal of achieving a positive NRM.

4. Regional ACE coordinators should approve checklists and record potential pitfalls either predicted or observed by the manager during the process. A standard due-diligence preinstallation plan should be incorporated and shared with other managers.

5. Corporate policy deployment—compliance audits, ACE audits

6. Ace audits of the manager should be conducted and a grade assigned. Project managers can attain achievement levels only if they are in a plant by themselves. Managers and teams could be rewarded not only by their progress up the ranks but for consistency, ability to stay within budget (also audited to make sure managers do not over budget), and sharing of best practices. Public distinctions for a group or a manager (as well as monetary rewards) would go a long way in incentivizing the development of the group.
7. Subcontractor selection management process: A prebid check-list should be signed by the sales person and the technician before the job is bid. If there are cost overruns that didn’t get covered in the prebid checklist, then these are turn backs. In this case, the prebid checklist should be changed accordingly. The prebid checklist should also contain a firm fixed-price quotation from the subcontractor and list subcontractor safety aspects and the quality of the subcontractor’s installation.

8. Clear communication articulating the goals of the project must be made to all parties.

9. Design-estimation-bidding process

10. Metrics system design

Questions, Comments, Takeaways, and Wrap-up

Comment: The whole issue about variability is important because every branch is different. In a retrofit environment, every job is different. In such an environment, validating the current state of operations is very important. Salespeople need to have all the data to make an appropriate sales quote. It is difficult to get data on what caused the cost overruns. Working together as a team is a big issue.

Question: Is NRM really a good metric?

Comment: Root-cause thinking—Estimating is a big root cause. If you estimate accurately, why shouldn’t NRM be zero? If the NRM is too high, then are they padding the cost estimates?

Comment: Consider looking at change orders as positive. Some firms like change orders if they sell the change orders. Change orders can provide a positive NRM. In the end, the job is better. Change orders can be a very good thing. A change order is like a new miniproject with the same issues as the original project.

Question: Should change orders have their own NRM?

Comment: It can be an effective way to generate a positive NRM, and one might incentivize the whole organization for generating change orders. In the general contracting world, it’s a change-order business. In the construction industry, general contractors in general sell at zero or low margins and make all their profit in change orders.

Question: Should the organization create a change-order mentality? If so, how?

Comment: Time is a critical factor as well. Some projects take years to complete. The forecasts done at the start of the project obviously differ from the actual costs in such projects.

Comment: Standard Work, SOP and policies are good, but in a much decentralized branch organization, policies are just a piece of paper. You can provide policies, provide metrics and
tools, but if the discipline culture isn’t built within the organization from the leadership, improving NRM can be a difficult middle-management set of responsibilities.

**Comment:** Hands-on local help provided by ACE pilots is critical for implementation. ACE pilots work with the leadership to ensure that correct processes are put in place. This management system structure is a very important part of UTC. There is also a companywide incentive system at the P&L level above the sales reps and the installation manager. There is a business unit regional structure at the country level. The regional operational manager’s job is to take this process and deploy it across the branches. The sales manager’s job is to take the global sales-management process and deploy it across the branches. These regional staff positions are really important in deploying these processes. The structural ACE coordinator role coupled with the regional operational manager role ensures the deployment of Standard Work and processes.

**Comment:** The amount of time and effort required to get an entire organization moving under the ACE operating system may be significant. UTC and its companies have been at this for years, and yet there is still much opportunity for growth and impact of the ACE tools and system of improvement. In the case situation, it seemed like the entire sales/design/estimating phase was largely untapped in terms of lean thinking. Rolling out ACE on that scale (400 branches) is a sizeable investment of time, energy, and money; as well as the up-front planning of the appropriate organizational mechanisms for focus and implementation.

**Other major takeaways**

- Regardless of the setting, there is always an opportunity for continuous improvement.
- Management needs to ensure that the appropriate culture and organizational structures are in place to drive a major undertaking such as the design and implementation of a standardized global business process.
- It is very important to understand the present situation/business processes and customize your new approaches using the tools of ACE (fishbone diagram, 5 Whys, Standard Work, and RRCA). A fishbone diagrams take a lot of time and thought. Listing out the major categories (people, process, and equipment) and then digging deep and identifying the root cause is a helpful technique.

**Checklist perspective**

- We need a strategy for overcoming failure, one that builds experience and takes advantage of the knowledge that people have but somehow also makes up for the inevitable human inadequacies. This strategy is a checklist.
- Human memory and attention are fallible, especially when it comes to mundane, routine matters that are easily overlooked under the strain of more pressing matters.
- People can lull themselves into skipping steps even if they can remember them.
Checklists remind us of the minimum necessary steps and make them explicit. They instill a disciple of higher performance.

The steps in a checklist are no-brainers that have been known and taught for years. Yet, they are routinely skipped.

Checklists establish a higher standard of baseline performance.

Preparation for any task is the real difficulty. Almost routinely, someone or something is missing.

Checklists catch mental flaws (flaws of memory, attention, and thoroughness) and raise wide, unexpected possibilities.

People need to make sure to get the stupid stuff right.

Checklists can help avert failure of simple or complex problems.

Once a checklist has been created, send it out to the entire team to be double-checked for correctness and that nothing has been missed.

A checklist can specify communication tasks that detail who talks to whom, by which date, and about what aspect of the project. Such a checklist takes others’ concerns into account, discusses unplanned developments, and points the way forward. A list forces people to discuss things as a team rather than as individuals, to coordinate, and then accept responsibility, thereby identifying and averting serious problems. Checklists can prevent failure of communication. Lists can make priorities clearer and prompt people to function better as a team. The key is to give people the room in which to act and adapt based on their experience and expertise while talking to one another and taking responsibility.

Checklists help to detail instructions meant for people below to ensure they do things the way we want. Lists mention the smallest detail of every critical step people are expected to follow and when.

Under conditions of complexity, checklists, which make room for judgment aided by procedure, are required for success.

Checklists can help foster teamwork by giving everyone the chance to weigh in on critical plans and concerns.

Checklists should be precise, easy to use even in the most difficult situations, provide reminders of only the most critical steps, and, above all, practical. They must define a clear pause point at which the checklist is supposed to be used.

Train people to use checklists because they work.

Checklists are either DO-CONFIRM or READ-DO. Create one that makes the most sense for your situation.

A DO-CONFIRM checklist gives people greater flexibility in performing their tasks while stopping at key points to confirm that critical steps have not been overlooked.
• The checklist is not a formula, but it helps you at every step of the way to be systematic about decision making and ensures that you have the critical information you need when you need it.

• A checklist can help improve the outcome with no increase in skill.