USING THEORY OF CONSTRAINTS TOOLS TO MANAGE ORGANIZATIONAL CHANGE: A CASE STUDY OF EURIPA LABS

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ABSTRACT

This paper illustrates the application of the theory of constraints (TOC) Thinking Process (TP) to a research organization. This paper initially discusses the TOC TP tools, and then applies them to Euripa Labs, a research organization which had an urgent need of organizational change to support its effort to earn the Association of Industrial & Technological Research Organization (AITRO) accreditation. Three key issues including leadership, organizational structure and performance appraisal were identified as the core problems, and the solutions that address the core problems were developed. This paper illustrates the utility of the TOC TP tools for analyzing and resolving dysfunctional managerial situations in a research organization, and concludes that the TOC TP tools provide promise as a strategy for management team grappling with difficult organization programs and working towards resolution of a wide variety of issues, including managerial and interpersonal organizational dynamics.

Key words: Theory of constraints, thinking process, organizational change, case study

INTRODUCTION

The theory of constraints (TOC) has evolved from an operations scheduling technique to a management philosophy focusing on continuous improvement process. In the early stage of development, the main focus of TOC was in the context of manufacturing. The Drum-Buffer-Rope (DBR) scheduling system, together with the five-step focusing process for continuous improvement, and the TOC performance measurement system were the key elements of TOC. Given that the major constraint to improvement was the resistance to changing the performance measures, Goldratt (1994) developed a set of tools known as Thinking Process (TP) that enable people to tackle organizational behavior or policy constraints (Dettmer 1998; Scheinkopf 1999; Schragenheim 1999; Cox, Blackstone & Schleier 2003; Boyd & Cox III, 1997). The development of TP has broadened the scope of TOC application beyond the manufacturing context. Some new applications of TOC include human resource management (Taylor et al. 2003), organizational behavior (Dettmer 1998; Patrick 2001; Mabin et al. 2001), business education (Cooper & Loe 2000; Sirias 2002), and strategic planning (Boyd et al. 2001). There has been a considerable growth of publications on TOC since the late 1990s (Mabin & Balderstone 2003).

The application of the TOC TP tools to change management is one of the new appealing applications of TOC. An organization can be viewed as a biological system which, in an ever-dynamic environment, needs to focus on continuous improvement, to change in order to survive and grow (Black 2000). However, improvements do not come free. The successful

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implementation of change depends on numerous prerequisites, including vision, mission, culture, leadership, successful experience of adaptivity (Gell-Mann 1995), capacity for honest communication throughout the organization, as well as the ability of an organization to define and comprehend what it particularly considers to be information worthy of being communicated (Bar-Yam 1997), and adequate participation of organizational members (Byrne 1998).

People refuse to comply with change when they fear where the change will lead them or have doubts that the change will produce positive consequences (Kanter 2001; Hathaway 2000). People become cynical about change when they are unsure if change is necessary, or if change can be effectively accomplished (Austin et al. 1997; Wanous 2000) or, even more importantly, when they believe change will adversely affect their own situation. Patrick (2001) associates the TOC TP tools with a series of layers of resistance that frequently appear in the process of improvement, positing that the TOC TP provides a 'coordinated set of tools to help take full advantage of resistance to change'.

Even though there have been a growing number of papers linking the change management literature to the TOC TP tools (Houle & Burton-Houle 1998; Dettmer 1998; Patrick 2001; Mabin et al. 2001), few case studies have been published. Mabin et al. (2001) present the application of the TOC TP tools in the New Zealand bank merger case, positing that 'the TOC frame helps lead and manage change by providing practical guidance on situation assessment, assumption surfacing, conflict resolution, planning and implementation of successful change'. This paper is an application of the TOC TP tools in a case study involving a research organization. This paper illustrates how the TOC TP tools are used in identifying core organizational problems and developing solutions that address these core problems, while dealing with layers of resistance in the change management process.

THEORY OF CONSTRAINTS

The theory of constraints (TOC), originally developed by Goldratt, is a management philosophy focusing on continuous improvement process. The central idea of TOC lies in the identification and exploitation of the system constraint in improving a system. TOC is based on the assumption that the performance of a system is determined by the system constraint, which is anything that blocks the system from accomplishing its stated goal, or in achieving a higher level of performance with respect to this goal. As the first step in improving a system, managers need to determine what constrains the system from reaching its goal. Constraints can be physical or nonphysical. When the constraints are physical, such as resources, raw materials, or supplies, they can be relatively easily identified by undertaking a capacity analysis. However, if constraints are nonphysical, such as policies, behaviors, or measures, they are harder to identify.

TOC TP was developed as a set of logical tools that enables people to tackle nonphysical constraints. TOC TP consists of a set of six logical tools including Current Reality Tree (CRT), Evaporating Cloud (EC)[1], Future Reality Tree (FRT), Negative Branch Reservation (NBR), Prerequisite Tree (PT), and Transition Tree (TT). Each of these six can be used together, or as stand-alone tools (Goldratt 1994).

[1] An alternative term is Conflict Resolution Diagram (Dettmer 1995).

HOW THEORY OF CONSTRAINTS LEADS TO IMPROVEMENT

The improvement process focuses on three questions: *What to change? What to change to? How to cause change?* These three questions must be answered in sequence to make the improvement process effective.

What to Change—Identify the Weakest Link

The first step in the improvement process is to determine what to change. Improvement requires change, but change does not always lead to improvement. Sometimes, change makes things worse. Change results in improvement only when it focuses on the right element to change. If we view a system as a chain composed of many links, the strength of a chain is determined by the weakest link. When the weakest link is strengthened, the change is an improvement. When a non-weakest link is strengthened, the change is not an improvement.

Current Reality Tree (CRT) is used to identify the core problem by revealing causal relationships among the undesirable symptoms that an organization exhibits. Building a current reality tree begins with constructing a list of 'UnDesirable Effects' (UDEs) that are dysfunctional symptoms or behaviors. Once UDEs are identified, the second step is to seek causal relationships between these UDEs and possible causes. Which UDE is the cause of which other UDE? To identify, refine and audit the causal relationships, a set of rules, called the Categories of Legitimate Reservation (CLR) is used to find out if the logic presented makes sense.

- **Clarity:** Is the meaning/context of the words describing the UDE clear without ambiguity? Is the UDE written in a complete sentence? Does the UDE convey only one idea?
- **Entity existence**: Does the UDE actually exist? Are there adequate empirical data to support this UDE?
- **Causality:** Does the causality between two UDEs make sense? Does the cause, in fact, result in the effect?
- **Cause insufficiency**: Is the cause sufficient to explain the effect? Might the effect have additional causes?
- **Additional causes**: Is the UDE the only major cause? Is there anything else that might cause the effect on its own?
- **Predicted effect**: Do other unavoidable outcomes exist in addition to the stated effect from this UDE?

The process of connecting the UDEs using the IF-THEN logic continues until all UDEs are connected so that all UDEs can be traced to a few root causes. Conflict can result from differences of perspective about what the core problem is, but if there is any root cause to which at least 70% of UDEs can be traced, a strong case can be made to view this root as a core problem or the weakest link (Noreen et al. 1995).

There is an alternative method of constructing a CRT, which is called 'Three UDE cloud approach' or 'Generic Cloud approach' (Cox, Blackstone & Schleier 2003). The procedure for building a CRT starts with a Current Reality Branch (CRB), which is a logical tool for using cause-effect relationships to determine the causal linkages from actions or policies to

their effects in the current situation (Cox, Blackstone & Schleier 2003). A list of UDEs from different functional areas within the organization is constructed and three diverse UDEs from different functions are picked. The next step is to build the cloud for each of these three UDEs using the cloud template, and then build the Generic Cloud, which is the source of all UDEs. Once the Generic Cloud of the subject matter defined by the UDEs is identified, the CRT is used to validate the core conflict of the entire subject matter. Cause-effect logic is used to link the Generic Cloud to the UDEs. This new method is a holistic approach to constructing a CRT. However, people who favor the emphasis of both validation and the stringent use of the Categories of Legitimate Reservation (CLR) prefer the traditional approach to constructing a CRT (Cox, Blackstone & Schleier 2003). In our analysis, we use the traditional method of constructing a CRT.

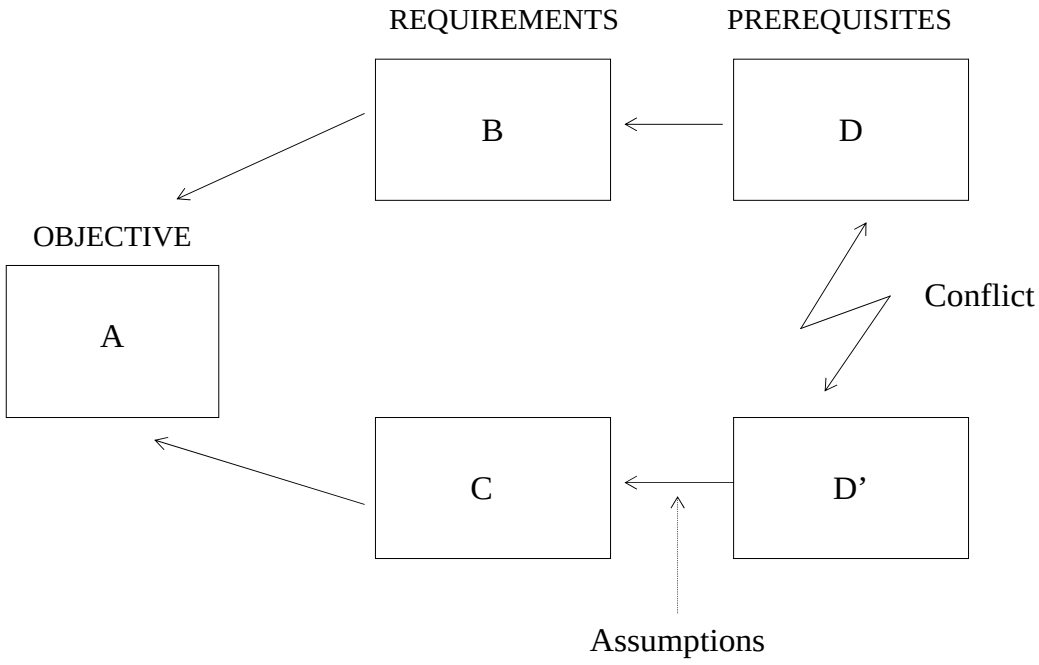
What to Change to?—Design a Stronger Link

The next step in the improvement process is to determine what to change to. Once the core problem is identified, the development of the solution may simply be the elimination of the core problem. However, eliminating the core problem can also be hampered by the existence of two opposing forces pulling the decision makers in opposite directions, resulting in a tension or conflict. The Evaporating Cloud (EC) is a tool that helps the decision makers search for a solution by challenging the assumptions underlying the conflict.

There are alternative methods of building the EC. The EC can be built from the CRT (Goldratt 1994; Noreen et al. 1995; Dettmer,1995; Houle et al. 1998; Mabin et al. 2001; Patrick 2001) or from the Generic Cloud (Cox, Blackstone & Schleier 2003). In our analysis, the EC is built from the CRT. The general format of the EC is displayed in Figure 1.

FIGURE 1

General Format of Evaporating Cloud (EC)



The construction of the EC starts with a desired objective (A), such as the opposite of the core problem identified in the current reality tree (CRT). Next is a determination of requirements (B & C) and prerequisites (D & D'). Requirements are the necessary conditions to achieve the objective, while prerequisites are the necessary conditions for requirements. The necessary conditions are verified using the 'IN ORDER TO…WE MUST HAVE…' logic. In order to have the objective A, we must have the requirements B and C. In order to have the requirement B, we must have the prerequisite D. But in order to have the requirement C, we also must have the prerequisite D'. As the two prerequisites D and D' are in conflict, the objective A appears to be unobtainable. The resolution of the conflict requires the hidden assumptions of the necessary conditions be surfaced and challenged. A solution that invalidates any of the assumptions is called an 'injection'.

EC helps determine the initial thrust or primary injection needed to create a future system that produces the desired effects. However, this primary injection is just the first step. To build a robust solution that actually will work, other injections need to be added to ensure that the primary injection achieves the desired results while not creating new, undesirable problems.

The Future Reality Tree (FRT) looks similar to the Current Reality Tree. While CRT is used to trace the undesirable effects to the root causes using IF-THEN causal relationships, FRT is the tool used in a similar fashion to CRT to show how the stated changes solve the problem without becoming the source of future problems.

How to Cause Change?—Operationalize this Stronger Link into the Chain

The last step in the TOC improvement process is the implementation of the solution. Its success depends on the degree of understanding and support participants in the improvement process might have about the implementation of the change. Participants might have doubts because they may perceive some critical obstacles that prevent the change from being implemented. The Prerequisite Tree (PT) is a tool used to identify these obstacles and to establish a series of intermediate objectives to overcome them. The last step in planning is a detailed action plan, embedded in the Transition Tree (TT).

The TOC TP tools are clearly useful in identifying root causes and the primary injection for change. They are also useful as communication tools to facilitate cooperation, collaboration and co-ownership of participants in the improvement process. As a team works together in employing these tools for the purpose of organizational problem-solving and continuous improvement, the team develops strong process skills and mutual trust in the process. Team members learn a common vocabulary and reflective process for communicating about organizational design, conflict management, action planning and organizational learning (Schon 1983).

A survey of the change management literature shows that people become less resistant to change when they participate in the process of defining the change and developing road maps and plans for the change (Kanter 1983). When the main sources of resistance to change in an organization are the lack of agreement among organization's members on the core problem and the direction for a solution, TOC TP can provide an effective set of tools for understanding and coping with the forces of resistance. This paper illustrates the application of several of these tools through the analysis of a case study, 'Euripa Labs Case', which is

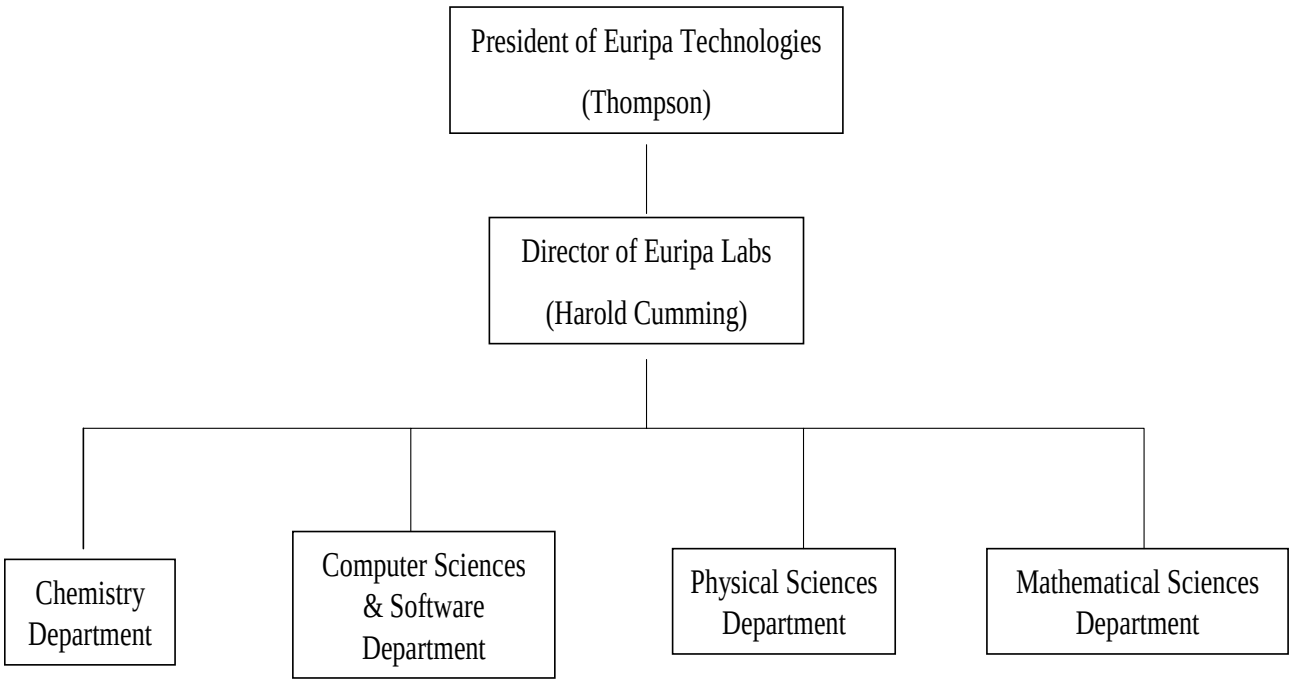
based on a disguised, real-life situation. The case highlights leadership, organizational structure, and performance appraisal issues in a situation that requires immediate organizational change. The case began upon arrival of a newcomer (John) at the Euripa Labs to start his job as a researcher of its Computer Sciences & Software Department.

BACKGROUND ON THE EURIPA LABS

Euripa Labs is the research laboratory of Euripa Technologies, located in the Silicon Valley, California. Euripa Lab's research focus is on information and communication technology, systems and networking, wireless systems and technology, and mobile networking. As shown in Figure 2, Euripa Labs has four departments: Chemistry, Computer Sciences and Software, Physical Sciences, and Mathematical Sciences.

FIGURE 2

Organizational Chart at Euripa



Euripa Labs developed as an outgrowth of a major lab housed on the outskirts of and affiliated with a large university. It grew from less than twenty members in 1980, including research personnel and system administrators, to approximately two hundred members in 2002. Euripa Labs has a lab director and four departments, each with its own department head. The size of each department seems to bear no relationship to the number of research projects each department undertakes. In the early stage of institutional growth, Euripa Labs focused on the foundation areas of scientific study in the field of chemistry, physical sciences and engineering, and computing and mathematical sciences. Euripa Lab's focus then shifted from 'department-centered' research in the foundation areas to 'cross-departmental' research, representing areas of scientific study spanning multiple fields of technology.

John arrived at Euripa Labs about one year ago and jumped right into his first set of research projects. Because John had been an opportunistic and last-minute hire, he was working in an area of the lab with colleagues who were not in his department, and was astonished to hear a constant flow of complaints about the Euripa Labs, about the Lab Director (Harold Cummings), about the working conditions and lack of equity in assignments and recognition. As a new member of an organization, in a new community, John did not want to alienate potential friends, so he simply listened to the grumbling and tried to focus on his work. What he learned in his first month was that Euripa Labs was about to undergo the process of the AITRO (Association of Industrial and Technological Research Organizations) accreditation which represented a worldwide recognition as a symbol of quality research organization. The AITRO accreditation was viewed as confirmation that research organizations were serious in setting, achieving and maintaining high standards for industrial and technological research. Even though the accreditation would be critical to the reputation of Euripa Labs, and Euripa administrators had invested tremendous amount of time and energy in the accreditation effort, there was doubt among many of the research personnel that Euripa Labs would earn the AITRO accreditation. John was shocked to know that the morale within Euripa Labs had deteriorated to the point where members of each department were openly hostile to members of the other departments, sometimes even to members of their own department. At Euripa Labs, John attended two full staff meetings during his first year, neither of which generated full attendance. The first meeting was advertised as a strategic planning workshop, which included breaking into groups to brainstorm and then to debrief the ideas. At no point did idea-generation turn into action planning, and the cynical attitudes John heard in advance of the workshop—that strategic planning was a useless exercise—indeed proved to be the case. The second full-staff meeting was billed as a 'start of the new year' get-together, with the agenda centered on discussing ways to assess research productivity. Two members of the staff had been investigating how other research organizations which were already AITRO accredited measured productivity, and gave a PowerPoint presentation of their findings. The meeting ended with no discussion or guidance on how to apply the information presented.

At this point, about six months into John's time at Euripa Labs, he decided to foster some of the collegiality he had experienced at his prior job. He invited several colleagues, including department chairs, to dinner, but the discussion focused exclusively on how the number of contracts was dropping off and going to the competition, and how miserable it was to work with constant anxiety and frustration. Co-workers complained that Harold, the lab director, seemed to be away a lot, attending conferences and meetings. Since he never reported back what he did while away, there was speculation in the lab that he used these occasions for personal family visits or for socializing with counterparts, rather than attending to the business of the lab. The department heads complained that Harold failed to demonstrate his leadership and commitment to the AITRO accreditation effort, even while he emphasized the importance of the accreditation for the future of Euripa Labs. John became friendly with two long-term Euripa Lab members—Marjorie at the Chemistry Department, and Arthur Potter at the Physical Sciences Department. Both Marjorie and Arthur were very enthusiastic for work and their opinions were worth listing to. Both agreed that the AITRO accreditation effort would be in vain unless Euripa Labs made fundamental changes.

At this time Harold decided to form a special Task Force aimed at the facilitation of the accreditation effort due to his own growing concerns about the AITRO accreditation, as well as the deterioration of employee morale within Euripa Labs. The Task Force consisted of

three members including Marjorie, Arthur and, surprisingly, John, who had reservations about accepting this assignment based on his newness to the lab, and based on what he had experienced thus far. Because of his respect for Arthur and Marjorie, he thought that this team could lead Euripa Labs into the accreditation project, improve the working environment, and build clients and respect from the external stakeholders. Furthermore, John felt that the added responsibility would be interesting and would keep him busy resolving, rather than bemoaning, the problems he recognized as standing in the way of Euripa Labs being an excellent, high performance team. Arthur and Marjorie, knowing that John had background in the AITRO accreditation process at his prior lab, strongly encouraged him to join the Task Force. Even though there was no job description, and although the parameters of the new job were completely unclear, John took the leap.

What to Change?

The full staff meetings were held at Euripa Labs, and the meetings were dedicated to developing a list of UDEs—dysfunctional symptoms or behaviors that Euripa Labs exhibited—and constructing Current Reality Tree (CRT) to identify the core problems. After the explanation of the purpose of the meeting, the TOC TP tools, and the importance of the participation in constructing CRT, participants broke into small groups for brainstorming. Later, the lists of UDEs presented by each group were merged together and examined in the full meeting. After two full staff meetings, twenty UDEs were identified as follows:

UDE 1. The number of contracts has decreased.
UDE 2. The employee morale at Euripa Labs has deteriorated.
UDE 3. There is role ambiguity for administrators.
UDE 4. Employees complain about lack of equity in assignments, pay and recognition.
UDE 5. Employees have doubts about the ultimate success of the accreditation effort.
UDE 6. There is insufficient cooperation between internal organizational work teams.
UDE 7. The reputation of the lab is rapidly going down.
UDE 8. Department egoism is strong.
UDE 9. Employees are not participative in the accreditation effort.
UDE 10. Staff meetings are often hostile and rarely productive.
UDE 11. Employees have different perspectives on performance expectations.
UDE 12. Employees make decisions based on self-interest rather than the organization's goal.
UDE 13. Employees do not know what decisions are good for the organization.
UDE 14. There is lack of efficient leadership to facilitate the accreditation effort.
UDE 15. Qualified employees are leaving the lab.
UDE 16. Employees have anxiety and frustration.
UDE 17. Employees' decisions are sometimes contradictory to the organization's goal.
UDE 18. Accountability and performance of research teams are difficult to monitor.
UDE 19. Allocation of resources to projects is inefficient.
UDE 20. There is lack of communication and exchange of information between departments.

Once the UDEs were agreed upon, the team started the second step—constructing the Current Reality Tree (CRT) to search for a causal relationship among these UDEs using the IF-THEN logic. For example, UDE 16 was connected to UDE 2, through the logic: 'IF (UDE 16) Employees have anxiety and frustration, THEN (UDE 2) the employee morale at Euripa Labs

has deteriorated'. The process of connecting UDEs using the IF-THEN logic continued until all UDEs were connected. The complete causal road map was constructed not only from the UDEs listed, but also included other entities or conditions that were necessary to make the IF THEN logic hold. These were read using the IF-AND-THEN logic. For example, IF (UDE 11) Employees have different perspectives on performance expectations, AND (UDE 27) Employees do not understand mission/goals/objectives of the organization, THEN (UDE 13) Employees do not know what decisions are good for the organization. A complete causal road map showed that all UDEs were consequences of a few core problems including:

- UDE 14 There is lack of efficient leadership to facilitate the accreditation effort.
- UDE 28. Current organizational structure is not supportive of the organization's needs.
- UDE 33 Job performance expectations of employees are not clearly defined.

The Director's leadership, the lab's organizational structure, and performance appraisal surfaced as the three key issues.[2]

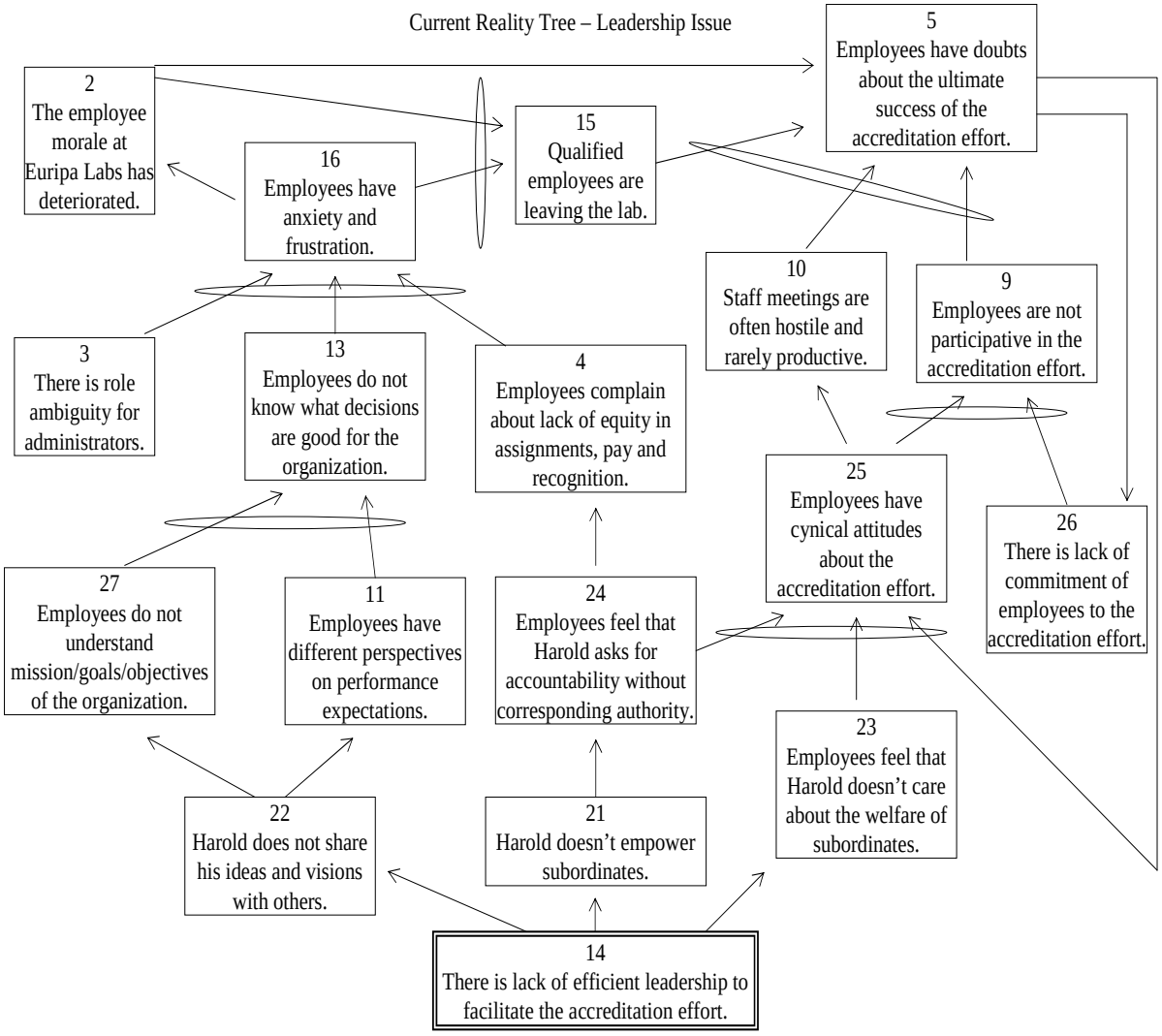
What to change to?—Mending the Leadership Link

The successful achievement of organizational change requires the strong leadership of management to set direction from the top (Beer & Nohria 2000). Top management must be visionary, consistent, persuasive, and capable of translating vision into workable action plans. The successful achievement of organizational change also needs to engage employees at all levels where the change will impact. Frequent communications about the change with an adequate number of organization stakeholders are key (Kanter 1983). However, most of the researchers and staff at Euripa Labs agreed that the deterioration of employee morale and the lack of organization-wide commitment of employees to the accreditation effort were, at least partially, caused by the poor leadership of the Director, Harold Cumming. Harold was viewed to be neither a task-centered leader who paid close attention to the job and work procedures involved with that task, nor an employee-centered leader who developed cohesive work groups and ensured employee satisfaction. Many viewed Harold as an 'impoverished manager' (Blake et al. 1964). Figure 3 shows that Harold's poor leadership played some part in creating dysfunctional symptoms or behaviors such as '(UDE 4) Employees complaint about lack of equity in assignments, pay and recognition' and '(UDE 25) Employees have cynical attitudes about the accreditation effort'.

[2] For convenience sake, the overall CRT is broken down into three CRTs according to the core problem of each CRT. These CRTs are shown in Figures 3, 5, 7. As indicated in Figures, these CRTs are interconnected by some UDEs such as UDE 13 and UDE 16.

FIGURE 3

Current Reality Tree – Leadership Issue



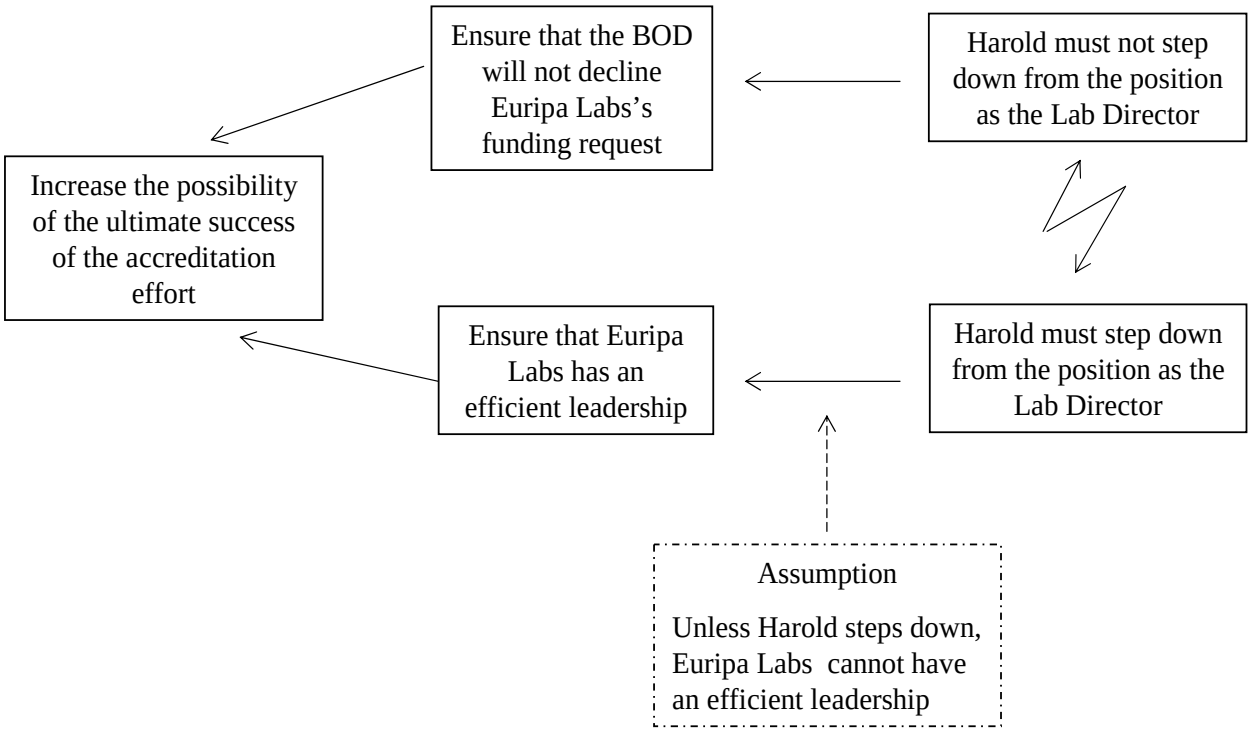
Although appointed by Harold, when the accreditation Task Force began making the changes necessary for accreditation, resistance to their leadership grew in the ranks—especially from Harold. The Task Force decided to approach Mr Thompson, the president of Euripa Technologies, to ask that Harold be removed and Thompson appoint an interim lab director until a new lab head could be found. In the meeting with Thompson, the Task Force presented the Current Reality Tree (CRT), arguing that one of the core problems was leadership and that the best solution was the removal of Harold from his position as the director. Thompson hesitated to accept the Task Force's request, even though he agreed that Harold's leadership was one of the key issues. Harold was appointed by Thompson six years ago as a replacement of the former director who was forced to step down due to his involvement in an alleged bribery scandal. Thompson worried that the request for Harold's resignation made by the key members of Euripa Labs, after such unsettling problems with his predecessor, would further harm the reputation of Euripa Labs. Even more important was Thompson's worry that a shift in leadership at this juncture would alarm the Board of Directors to the point that they would not fund the lab's latest planned expansion.

Figure 4 shows the Evaporating Cloud (EC) for the leadership issue at Euripa Labs. The EC in Figure 4 shows that in order to increase the possibility of the ultimate success of the

accreditation effort, the Task Force must ensure that Euripa Labs has an efficient leadership, and at the same time the Task Force must ensure that the BOD of Euripa Technologies will not decline the funding request.

FIGURE 4

Evaporating Cloud – Leadership Issue



To ensure that Euripa Labs has an efficient leadership, Harold must step down from the position as the Lab Director. To insure that the BOD will not decline Euripa Labs's funding request, Harold must not step down from the position as the Lab Director. 'Harold must step down' and 'Harold must not step down' cannot be done simultaneously. In order to solve the conflict, the underlying assumptions must be surfaced and challenged. What are the underlying assumptions of the statement: 'In order to ensure that Euripa Labs has an efficient leadership, Harold must step down from the position as the Lab Director'? One assumption is that Harold is not an efficient leader, and the only way to invalidate this assumption is that Harold proves his efficient leadership. Another assumption is that as long as Harold remains as the director, Euripa Labs cannot have an efficient leader. What can invalidate this assumption? If there is a way that Euripa Labs has an efficient leadership while Harold remains as the director, the conflict is resolved.

The short-term solution that Thompson proposed was the creation of a three-person team consisting of the Lab Director and two "Associate Directors" acting as a triumvirate in the administration of Euripa Labs on an interim basis until the accreditation process would end. Harold, remaining as the Lab Director, would be accountable to Euripa Labs administration and the AITRO accreditation process. One associate director would be charged with developing external links and support for Euripa Labs and enhancing the delivery and subscription of the research programs. The other associate director would focus on the

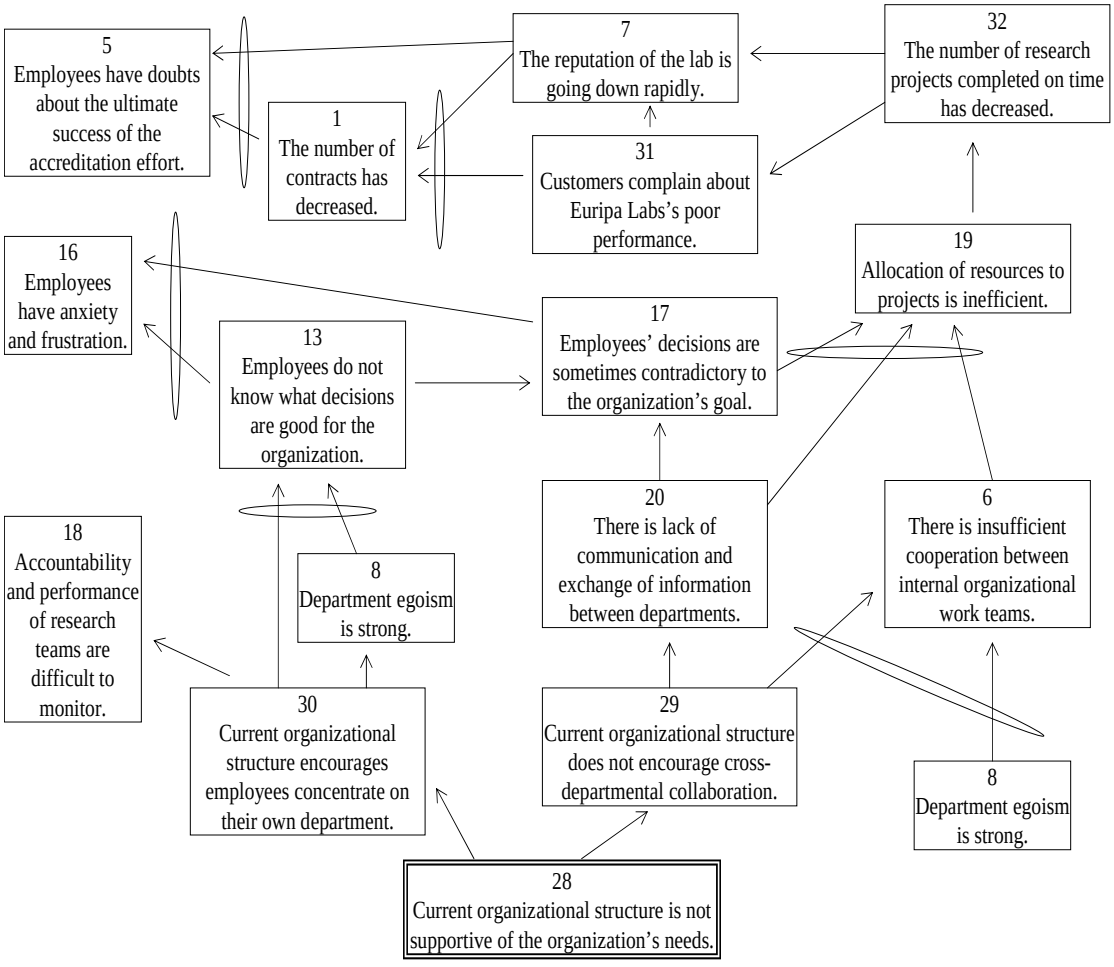
internal affairs of the organization and would administer the research program. Arthur and Marjorie accepted the positions of associate director. Thompson assured that Harold, Arthur and Marjorie fully collaborate as a team for the facilitation of the accreditation effort, since he negotiated with Harold that once accreditation had been earned and funding secured, Harold would be offered an excellent early-retirement package that would enable him to depart with pride and in good financial shape.

What to change to?—Mending the structural link

The second issue in this case was its organizational structure. Research personnel belong to one of the four departments according to their academic qualifications and expertise. When Euripa Labs started as a small lab located at a university, it focused on fundamental scientific research, and it undertook only government contracts. As Euripa Labs grew, its research focus shifted to more 'application' areas of scientific study spanning multiple fields of technology. In addition to that, Euripa Labs began to carry out commercial contracts, which had grown rapidly to the point that 60% of Euripa Lab's revenues came from commercial contracts. However, Euripa Labs has recently experienced the declining number of commercial contracts due to its poor due-date performance. Among many possible reasons for the poor due-date performance was the lack of coordination among four departments as shown in Figure 5.

FIGURE 5

Current Reality Tree – Organizational Structure Issue

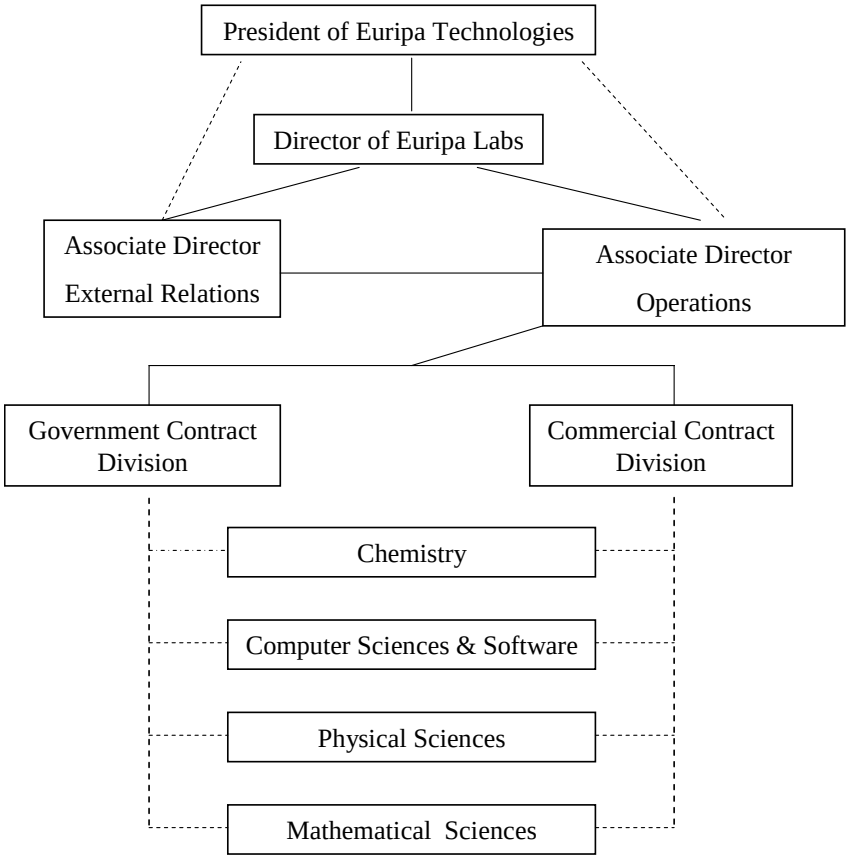


Euripa Lab's research personnel perform research projects in the matrix environment. The four functional departments—Chemistry, Computer Sciences & Software, Physical Sciences, and Mathematical Sciences—perform tasks for many projects. It is common for an individual researcher to be involved in several research projects simultaneously. The department heads must allocate resources to research projects according to their requirements. The planning of activities is based on the projects' work plans, and these activities cannot be performed completely independently. There needs to be some degree of communication and cooperation among four departments for the efficient allocation of resources to projects.

In addition, commercial contract projects are different from government contract projects by nature, which make the allocation of resources among projects more complicated and increases the necessity of integrated information system and coordination among functional departments. However, research personnel at Euripa Labs felt that the current organizational structure was not efficient in promoting cooperation and coordination among four departments. Euripa Labs needed to establish cross-functional teams to work collaboratively. The Task Force suggested that organizational structure at Euripa Lab be more 'product departmentalized' than 'functional departmentalized'. Two cross-functional divisions called 'Government Contract Division' and 'Commercial Contract Division' were at the heart of the organizational structure for the facilitation of collaboration among four functional teams. The suggested organizational chart is presented in Figure 6[3].

FIGURE 6

Interim Organizational Chart at Euripa



[3] As there was no 'conflict-involved' issue in changing organizational structure, EC was not necessary for the issue of organizational structure.

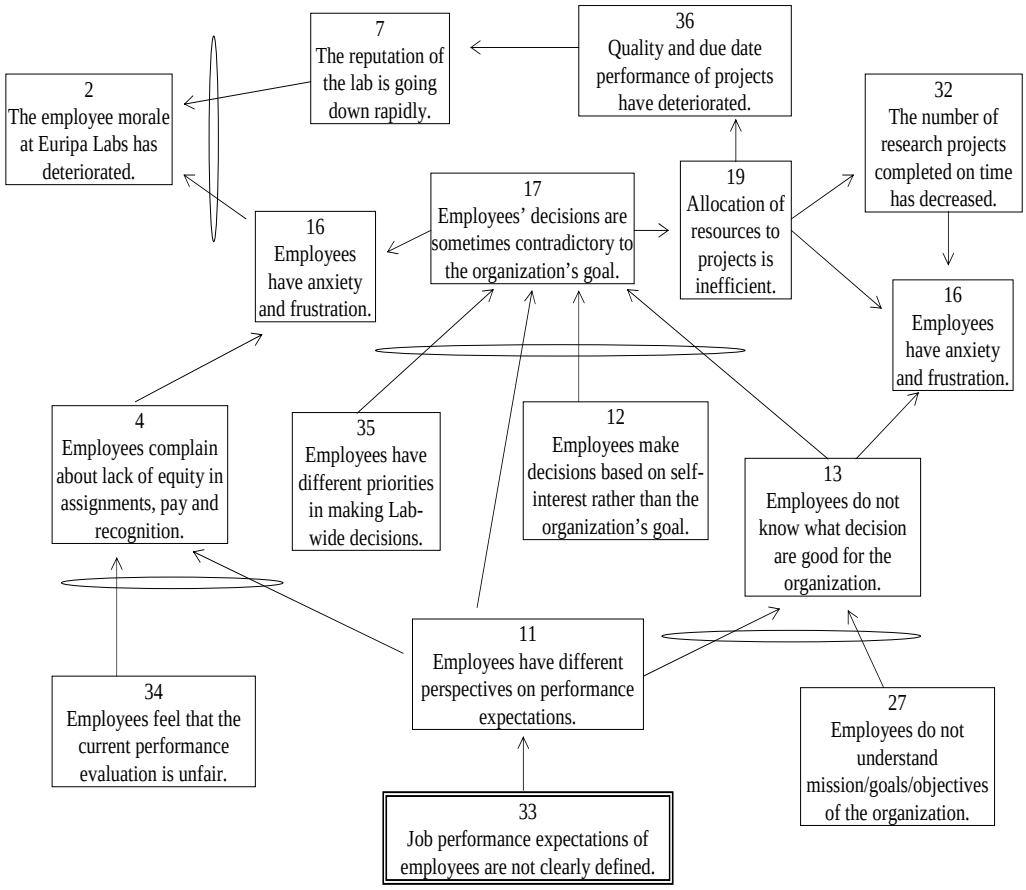
This restructuring eliminated the functional silos problem, and enabled researchers to communicate and collaborate easily across divisional lines to provide synergy to projects that had both government and commercial applications which required expertise in all or several of the disciplines of chemistry, computer sciences, physical and mathematical sciences. The Task Force also advised the use of Critical Chain multi-project application (Goldratt 1997; Newbold 1998) for this structure to work smoothly when staff scientists were working on several projects, to avoid conflicts over resource allocation and prevent staff from being forced to multi-task with the concomitant loss in productivity.

What to change to?—Mending the Performance Measurements Link

Another key issues identified in Current Reality Tree (CRT) was performance measurement, a complex, potentially political, anxiety-producing process (Senge et al. 1999). Figure 7 shows that the deterioration of employee morale was traced to unclear definition of performance expectations of employees.

FIGURE 7

Current Reality Tree – Performance Measurements Issue



This lack of clarity basically guaranteed a flawed measurement process and a cynical attitude towards performance evaluation (Wanous et al. 2000; Longenecker et al. 1988). At Euripa Labs, performance evaluation had been primarily done for groups, based on quantity and quality of research activities of the research team. Quantity of research activities referred to the number of research projects that a research team performed, while quality of research activities was measured considering customer satisfaction with projects performed, due-date

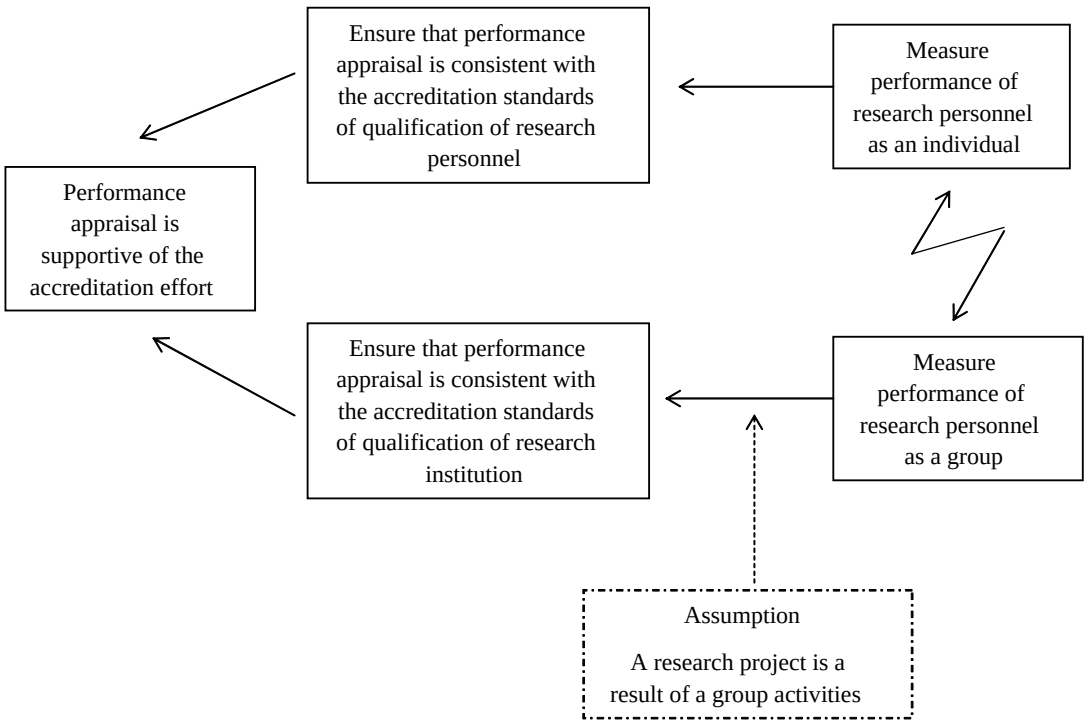
performance, cost and time deviations, etc. Performance evaluation of an individual researcher had secondarily been done based on his or her primary project leader's judgment on the researcher's contribution to the research project. As project leaders' judgments were believed to be too subjective, and as most researchers at some point in time worked for more than one project leader, most research personnel did not have clear understanding of performance expectations.

When Euripa Labs explored the AITRO accreditation standards, they found that the accreditation process guidelines stated that research personnel should have sufficient academic qualifications which required a combination of original academic credentials and subsequent research activities reflected by scholarly publications. Recently, Euripa Labs had decided to include the number of scholarly publications to the list of performance appraisal criteria.

The Task Force decided to develop new performance appraisal guidelines. It was noted that an individual's or a team's performance appraisal should be supportive of the accreditation effort. In order to be supportive of this effort, the performance appraisal must be consistent with the accreditation standards relating to the qualification of research personnel, as well as the accreditation standards relating to the qualification of research institution. Here arose the conflict. As shown in Figure 8, in order for the performance appraisal to be consistent with the accreditation standards of qualification of research personnel, research personnel's performance should be measured as an individual. On the other hand, in order for the performance appraisal to be consistent with the accreditation standards of qualification of research institution, research personnel's performance should be measured as a group.

FIGURE 8

Evaporating Cloud – Performance Measurement Issue



Measuring performance as an individual is in conflict with measuring performance as a group. One of the assumptions of the statement: 'In order to have performance appraisal be consistent with the accreditation standards of qualification of research institution, performance should be measured for the group' is that a research project is a result of a group's activities which can only be evaluated as a group, not individually. How can we invalidate this statement? The primary injection is the development of an appraisal method which relates the evaluation of the performance of an individual researcher to the performance of a research project.

In developing its new guidelines, the Task Force mandated that the performance appraisal of the individual researcher would be based on quantity and quality of his/her research activities. Quantity of research activities referred to the number of research projects that a researcher got involved in, as well as the number of activities performed for the completion of the project. Quality of individual research activities within the team would be measured by the percentage of activities completed on time, the percentage of activities reworked and any other criteria an individual team would develop at the start of each project. Upon completion of the project, each team member would evaluate him or herself and every other team member based on these criteria, and individual contributions would be measured by an averaging of these evaluations. This system would alleviate fear of management subjectivity, would put control of evaluation into the hands of team members, and would make individual members accountable to the team (Senge et al. 1999).

It is too soon to say what the final outcome will be regarding the AITRO (Association of Industrial and Technological Research Organizations) accreditation, but our informants report a greater optimism and renewed energy to work towards the upcoming accreditation (within the year). Regarding organizational productivity and morale, reports from Euripa Lab are also positive. Our informants report that the new structure, while confusing at first, is easier to understand. Job responsibilities and reporting relationships are clearer, which makes performance appraisal easier and more meaningful. The contracting process is more efficient, and deadlines are being met. Harold Cumming has announced that he will step down at the conclusion of the accreditation review, and a search committee has begun setting guidelines for the search for Harold's replacement. Through the TOC TP process, lab employees have become more collaborative, and more sophisticated about organizational issues, and are addressing the Director's search in a highly structured manner using TOC tools.

CONCLUSION

This paper demonstrates how the Theory of Constraints (TOC) tools were used in identifying core problems of leadership, organizational structure, and performance appraisal; and developing solutions that addressed the core problems. Without the CRT developed by the team and without the EC diagram, it would have been difficult to convince President Thompson to modify the management team. Without careful analysis using tools of TOC TP, it would have been more complicated to enlist the support of the four division leaders of Euripa Labs to restructure into two divisions, the Commercial Contracts division and the Government Contract division (see Figure 6). And finally, developing new performance appraisal guidelines would have been likely to create high resistance. Although appraisals are meant to be logical and objective, they are often manipulated by managers for both benign and selfish reasons (Longenecker et al. 1989). The politics of performance appraisal are tricky

at best, but TOC tools enabled Euripa employees to understand the reasons for balancing individual and team evaluations, and to support the change. This case illustrates the value of TOC tools for analyzing and resolving dysfunctional managerial situations. Not only do they provide a framework for understanding organizational dysfunction, they also enable change agents to consider cause and effect, the common phenomenon of solving one problem but creating another through a poorly considered solution, the areas of resistance to problem solutions and the increase in buy-in that the use of these tools can engender, as well as the development of appropriate action planning steps that result in increased involvement, trust, positive optimism and efficient change (Wanous et al. 2000). With the establishment of more efficient leadership, the restructuring of the organization and the institution of objective performance standards, Euripa Lab was on its way to earning the AITRO accreditation, as well as becoming a more rewarding place to work, a place in which the employees could place trust and take pride. Furthermore, as new problems emerged, the organizational capacity to identify and resolve them was strengthened.

The TOC tools have typically been used in dealing with physical constraints. The application of this framework with Euripa Labs leads us to the conclusion that the TOC tools provide promise as a strategy for management teams grappling with difficult organization programs and working towards resolution of a wide variety of issues, including managerial and interpersonal organizational dynamics. We suggest future applications of the principles of TOC to organizational analysis, and to introducing TOC vocabulary to the discipline of organizational behavior.

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