Engineering Faculty Teams: A Proposed Process Model

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I. Introduction

The engineering faculty member is placed in an environment where he/she is encouraged to work as an individual, as a single entrepreneur in competition with other faculty members. Rewards are based on getting better teaching evaluations, or more research publications and money than other faculty members. This individual model is justified as one that motivates faculties and matches the natural individualistic tendencies of most engineering faculty members.[5]

In spite of the individual nature of the engineering faculty model, faculty members are often asked to work in committees to achieve some organizational objective. Faculty members typically meet, perform the task they have been given, and disperse. Skills needed to perform successfully as a team are assumed to be inherent.

With the introduction of Total Quality Management initiatives at many engineering institutions, the industry model of teamwork has been advocated by administrators[3], but rarely accepted and enacted by faculty.[7] Committees are encouraged to work more like "teams". The success of this team model in industry and academia has been mixed, with the TQM concept of teams negatively viewed in many organizations.[6]

Adams[1] addresses the potential impact and substantial issues of TQM team implementation with engineering faculty. Teams are expected to increase the administrative responsibility of faculty, redistribute power and authority among faculty, and revise the nature and philosophy of faculty workload. A survey instrument for evaluating team effectiveness is proposed by Adams.

This paper seeks to develop a basic model for engineering faculty teams. Specifically, academic processes are analyzed to determine the appropriate role of teams. Faculty attitudes towards teams and problems with teams are surveyed and reported. Finally, a modified team process model is proposed.

II. Academic Processes, Faculty Tasks and Role of Team Work

Academic departments in institutions of higher education have a core set of processes and tasks. One way to view these processes and tasks is by considering the following functional categories: (i) Student Recruitment, (ii) Educational Processes, (iii) Educational Resources, (iv)

Faculty/Department Development, and (v) Support Activities. We briefly discuss representative processes and tasks in each category and identify them as being either "team-oriented" or "individual" in nature. In this discussion, "teams" are implied to be some appropriate subset of the faculty members. Although some processes or tasks are identified as "individual", all might benefit from a team approach. Only tasks and processes that must necessarily be performed by teams are identified as such. Table 1 summarizes the above functions, the tasks and processes under each of them, and their team-orientation (team activities are italicized).

Table 1: Processes and Tasks in Academic Departments by Function

Student Recruitment	Educational Processes	Educational Resources	Faculty/ Department Development	Support Services
1. Graduate student recruitment *2. Undergraduate recruitment*	*3. Course development/ revision* *4. Course evaluation* *5. Curriculum development/ revision*	*6. Instructional computing/ lab equipment* *7. Instructional software* *8. Instructional laboratory use* *9. Textbook decisions*	*10. Accreditation preparation* *11. Continuing education* *12. New programs*	*13. Departmental databases* *14. Faculty recruitment* *15. Faculty evaluation* *16. Faculty/ staff reward plan* *17. Student financial support*
	18. Course teaching 19. Graduate research supervision	20. Library resources	21. Industry projects 22. Organizing professional conferences 23. Peer review of research publications 24. Professional society leadership 25. Research equipment 26. Research projects 27. Research publications 28. Research sponsorship 29. Textbook authoring	

The "Student Recruitment" function includes departmental processes for undergraduate and graduate recruitment. Graduate student recruitment requires application processing within the department while undergraduate student recruitment is usually centralized in the university. Both undergraduate and graduate recruitment share departmental tasks such as providing content for recruiting material, identifying potential regions/schools/disciplines for targeting recruitment efforts, and specifying admission requirements. These tasks must clearly be performed by a team.

The "Educational Processes" function involves the imparting of education and the guidance of student progression to a degree. Under this function, course development/revision and curriculum development/revision processes must be performed in a team mode to reflect the viewpoints of faculty members with different technical expertise. We define course evaluation as the assessment of the content and delivery of individual courses relative to the intention of the academic department. This assessment should take into account the role of the course in the overall curriculum. This consideration is not a traditional function in an academic department but is an important one in light of new accreditation standards. A team must accomplish such a process. The other two "Educational Processes", course teaching and graduate research supervision, are generally individual activities though some benefit may be realized from teamwork.

The "Educational Resources" function is related to non-personnel resources that an academic department acquires and maintains primarily for instructional purposes. Decisions regarding computing equipment, laboratory equipment, software, and textbooks for use in courses must be by teams. Individual faculty members normally make recommendations on library resources.

Implied in the "Faculty/Department Development" function is the enhancing of the credentials of individual faculty as well as the department. Accreditation preparation, and planning and proposing new programs are clearly team-oriented processes. While faculty can pursue continuing education or teach short courses independently, a team-orientation to this activity can be more effective in enhancing the credentials and image of an academic department. Creative professional endeavors such as completing industry projects, organizing professional conferences, peer review of research publications, professional society leadership, planning and acquiring research equipment, seeking sponsorships and completing research projects, and authoring technical papers and books are generally understood to be individual tasks.

The tasks and processes listed under "Support Activities" are primarily team activities. These activities typically include creating and maintaining departmental databases, faculty recruitment, and faculty evaluation, and faculty/staff reward plans. Some of these tasks require elaboration. Faculty evaluation refers to evaluation of faculty for re-appointment, promotion, tenure, and post-tenure decisions. University directives usually mandate these processes, yet faculty committees play a key role in these processes. The development of a faculty/staff reward plan must have participation of all faculty members, though the implementation will be done by the administrative head of the academic unit. Student financial support decisions are often made by individuals in the department such as the department chair, or individual faculty for their own research projects. However, team-based allocation of support might establish better standards and parity for academic and work performance of students.

As can be observed in Table 1, there is a long list of activities in academic departments that must be accomplished by teams. To excel in the accomplishment of these activities, academic departments must have the training and work climate that encourages teamwork without suppressing individual growth.

III. Factors Inhibiting Teamwork

In order to validate the above discussion, a survey was administered to the faculty in the College of Engineering at North Carolina A&T State University. The first question was: "Is team work among faculty important in the given set of activities?" The responses received are summarized in Figure 1. The activities are a subset of those from Section II with corresponding task number from Section II shown. All activities from Section II identified as team activities (1-17) received at least an 79% agreement from the faculty survey. Activities identified as individual (18-29) ranged from 40% to 95% agreement that teamwork was important. This result supports the earlier assertion that tasks that may be performed on an individual basis may benefit from a team approach.

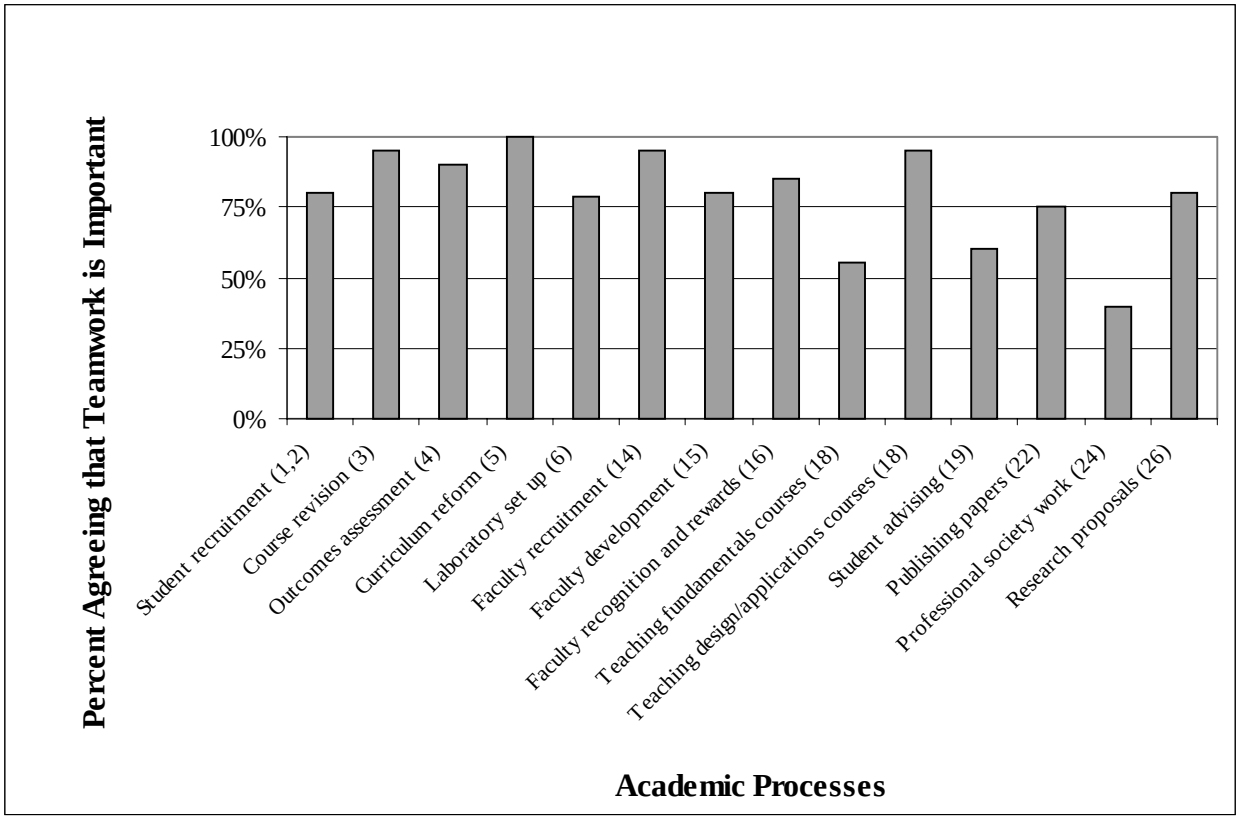

Figure 1: Importance of Teamwork

The survey also asked faculty to report how much time they spent in team-oriented activities. The results indicate that the majority of faculty members spend between 20 - 40% of their time in team activities (see Figure 2).

The survey also included a question intended to explore obstructions to team-based activities.

The specific question was "Which of the following reasons deters you from working more as a part of a faculty team effort?" Summary data is presented in Figure 3. The reasons given are listed below in order of predominance:

- Not having sufficient opportunities to work as part of a team
- Fear of not getting credit for individual contributions
- Lack of training on how to function as a team player
- Suspicion that other team members will try to get a free ride
- Faculty individuality prevents teamwork
- Poor planning and "last minute nature" of activities inhibits teamwork
- Lack of departmental strategy on forming, working in or evaluating teams
- Some faculty are "difficult to work with"

Although there is no widely accepted standard on the degree to which faculty are expected to be involved in teamwork, it was clear from the responses received that almost all the respondents felt that they would participate more in team activities if their work environment provided adequate encouragement and they had adequate training for teamwork.

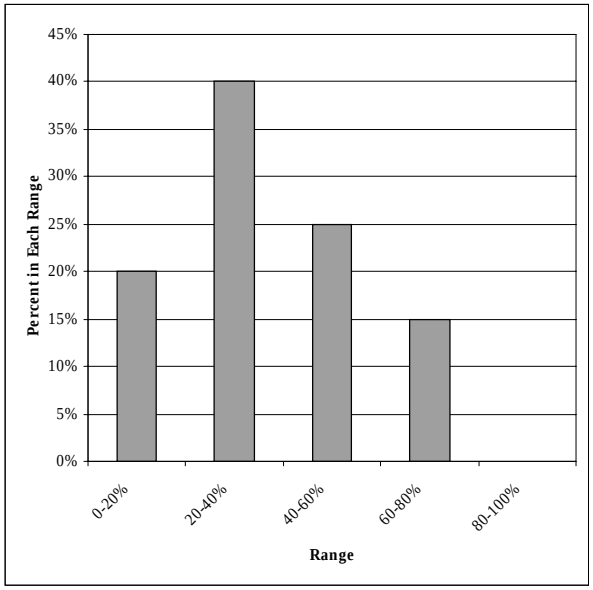

Figure 2: Proportion of Time in Teams

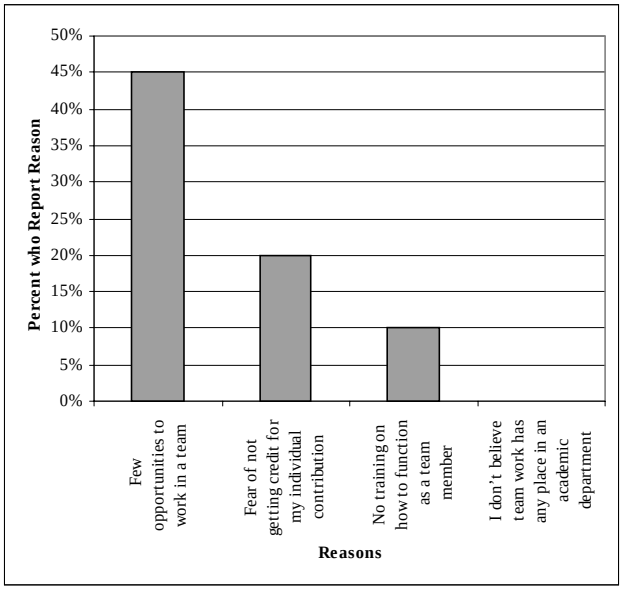

Figure 3: Deterrents to Teamwork

IV. Engineering Faculty Team Model

Prior to introducing the proposed faculty team process model, it is useful to consider the process model of traditional faculty teams (committees) and the industry TQM team model as frequently implemented. The process model of the traditional faculty team (F-team) is shown in Figure 4. Team work is the step where faculty members perform the organizational activity required of the

team. Team performance is usually not considered important and is rarely monitored.

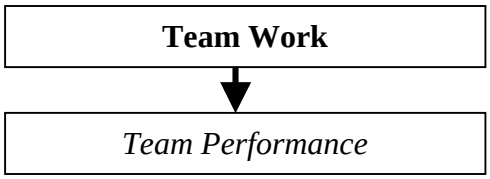

Figure 4: F-Team Model Process

Several comments about the F-team model are noteworthy.

1. Team success is not tied to individual success. In fact, participation in the team is often viewed as an activity in opposition to individual success.
2. Although the evaluation of the team should be based on the achievement of the objective, it is rarely actually analyzed by the team. There is no mechanism for feedback to the team.
3. Faculty members are assumed to possess the skills and motivation to perform effectively on the team.

Most attempts to change the faculty team model have been based on the team concepts developed in private industry (termed I-team) as part of the Total Quality Management movement. The advocacy for this team model is large and well-established. Yet, a backlash has occurred among many organizations that have unsuccessfully attempted to implement the I-team concept. This negative perception of teams may be based more on faulty and inappropriate attempts at implementing teams than in shortcomings in the team emphasis in TQM. Still, it is clear that this model is not universally successful. The typical I-team model (as frequently implemented) adds to the team process a "Team Building" step where the team performs exercises to promote trust and goodwill and constructs an environment where individual and team goals are consistent as well as a "Team Evaluation" step where the team effectiveness is measured and analyzed by the team. The basic flow of the I-team model is shown in Figure 5.

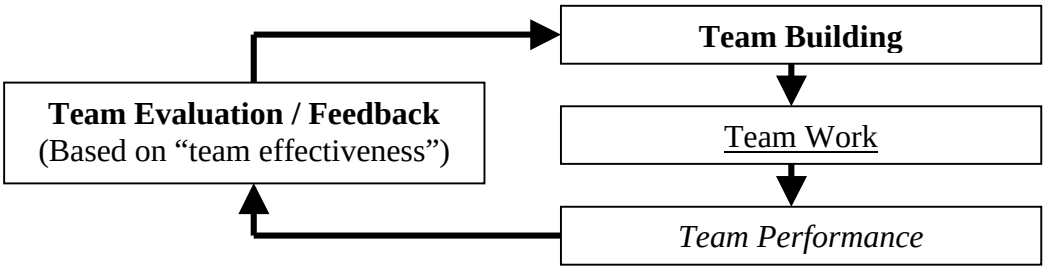

Figure 5: I-Team Model Process

Several comments can be made about the I-team Model:

1. Teams should be self-managed, with responsibility and corresponding authority.
2. Individuals tend to belong to a single team. The role of the individual in the organization is primarily determined by the role of the individual on the team.

3. The team building exercises are unrelated to the organizational purpose of the team. Positive team culture developed in the exercises does not clearly assist in achieving organizational purpose and may quickly dissolve under organizational pressure. The time and effort needed to build and maintain trust among team members is substantial, and can become a source of frustration among team members.[2]
4. Rewards tend to be focused only on team performance, with no recognition of individual effort. For some team members this is a disincentive.[4]
5. The team often becomes the end rather than the means. Team dynamics and effectiveness become the primary metric rather than achievement of the organizational objective.

The varied impact of teams in industry drove us to consider a team model where teamwork is universally considered critical to achieving organizational objectives, and where team members are assumed to have individualistic tendencies. This team model may be seen in athletic teams (A-teams). The approach to teams in athletics is significantly different than traditional faculty or TQM-driven industry teams. A step is added to develop team fundamental skills on an individual level prior to team building. The A-team model flow is shown in Figure 6.

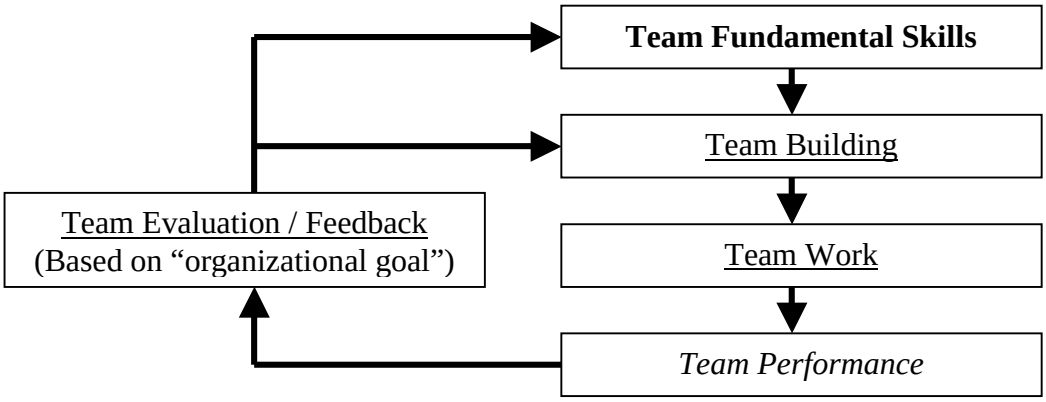

Figure 6: A-Team Model Process

Several comments can be made about the A-team model:
1. An emphasis is placed on individual fundamental skills before entering the team process. Having the individual skills allows one to more fluently participate on several teams at one time.
2. Team building is still composed of exercises to practice together and creation of a reward system encouraging team success. The difference in the A-team model is that team building is directly related to organizational objective success.
3. Though team success in meeting organizational objectives is the primary metric, there exist ways of measuring and rewarding individual contribution. The encouragement of individual contribution is directly and positively correlated with team success.
4. Team performance is evaluated based on organizational objectives, with feedback driving individual skills and teambuilding development.

When this model is applied to engineering faculty members, the details of each step must be modified. The development of "Team Fundamental Skills" consists of teaching visioning, facilitation, conflict resolution, consensus building, and goal-setting. Faculty members often believe these skills are trivial and that they possess no deficiency in the application of these skills. We believe that individual team members must possess an explicit knowledge of these skills in order to use them within a team environment.

The "Team Building" step is the most difficult. The issues raised in Section III are addressed here. The first step provides the tools for teamwork; this step provides the motivation. Teams must be valued by the faculty and administration in order for this step to be successful. This step must be the natural result of explicit strategy implemented at the department (and potentially college) level. The faculty must agree on the process and importance of teams, as well as methods to determine and reward individual members. Teams must be given objectives that are clear and consistent with departmental vision and mission. Individuals must be able to recognize the mutual interdependence of team and individual success. Specifically, team performance must play a clear and appropriate role in individual promotion, tenure, and post-tenure review, award and recognition programs, and compensation. The role of teamwork in these reward processes should grow from the common subjective measure of collegiality to a more objective outcome-based measure. Appropriate attempts to build trust, honesty, and openness among faculty members would be a part of this step. Because faculty members would continue to work individually as well as with multiple teams, team-building exercises to build trust and agreement are limited to those which directly influence the desired organizational outcomes.

The "Team Work" step is defined by the organizational task or process as defined in Section II and its associated organizational objectives. "Team Work" is performed using common team skills (step one) within the team environment (step two). This step is the only one that currently exists in the traditional F-team model.

The "Team Evaluation" step is consistent for each team and must quickly evaluate team performance. The evaluation process must determine opportunities for improvement in terms of skills, team process and most importantly, organizational objectives. Future team skills, processes and work are influenced by this evaluation. Finally, team results should be made visible for all faculty members in a timely manner.

V. Implementation

Implementation of this team model requires that team processes be used routinely for appropriate tasks. Team processes, in contrast to individual tasks, require coordination and availability of team members. Implementation of a team system will expose poor planning hidden by an individualistic focus and demand departmental operation in a more proactive, strategic mode. Once achieved, processes and tasks will be driven by deliberate plans. Thus, the team model will both enable and require thorough departmental planning.

As a result of this strategic planning emphasis, teams are formed only when needed to meet some specific organizational objective(s). Team composition is a function of skill level, expertise, experience, and team workload. Team leadership would be distributed and not based solely on seniority. The team would establish objectives and explicit performance measures consistent with the desired organizational outcome. Performance measures should gauge the success in achieving the outcome, not the level of activity of the team. These objectives and measures would be reviewed, adjusted (if necessary) and approved by the departmental faculty. Upon completion or at appropriate review intervals, team performance would be evaluated according to the performance metric. Finally, individual evaluation is a function of individual contribution as determined by other team members and overall team success. Overall team performance for an individual is a function of the individual's team performance levels on each team and the individual's team workload. Overall team performance for an individual serves as an input to faculty evaluation processes.

VI. Summary

This paper has considered the appropriate use of teams of engineering faculty within an academic department. Surveyed as well as published evidence shows that engineering faculty teams have a role in performing many academic processes. Yet the nature of engineering faculty members and the individual focus of the academic culture provide some challenges to team success. Traditional academic committees as well as common industry team structures do not address the potential power of teams in an academic environment. A new faculty team process model is proposed that includes individual team skill development, establishment of a departmental team culture, and explicit evaluation and feedback of team performance. The next step is to implement the model within our department to determine its impact on achieving desired departmental outcomes.

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