An Organizational Approach to Leadership Development for Engineering and Construction Management Project Practitioners

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Abstract

Companies competing globally in the field of engineering and construction must continually demonstrate competency in the design and management functions associated with the delivery of complex capital projects. Such companies serve a broad and diverse industrial or commercial clientele and operate in an extraordinarily competitive and tight environment. The development of leadership skills as important core competency of engineering practitioners and project / construction management executives is an increasingly important objective for many globally competitive organizations within the capital project industry. This paper describes a proactive intervention approach to leadership development undertaken by a major engineering and construction firm. Through a post-intervention survey and workshop activities, this study determines the impact on sustained gain in leadership knowledge and skills as a result of the intervention. This study also identifies the characteristics of a leadership role model within the capital projects industry and its implementation barriers.

Keywords: leadership, engineering, construction, intervention, project management

1. Introduction

Admittedly, practicing project professionals are not frequently, or at least consistently, perceived as leaders (Russell and Stouffer 2003). A recent poll by the American Council of Engineering Companies revealed that a very few view consulting engineers as community leaders, while the majority perceive them as technical consultants (Toor and Ofori 2008b). Increasingly obvious to the profession is that a university education alone is not adequate for preparing practitioners for the important roles they will play in the design and delivery of infrastructures. A commitment to life-long learning, and in this case, leadership development is required (Chan et al. 2002).

Leadership skills serve to enhance and improve the effectiveness of an engineer's professional capability helping to extend beyond a traditional, and necessary, set of knowledge in mathematics and science (Christodoulou 2004).

This lack of focus on leadership is also translated to research efforts. Indeed, within the engineering construction industry, not much work in leadership development has been completed. Dulaimi and Langford (1999) argued that most studies on leadership in the construction industry concentrate on investigating the motivational factors and the personal characteristics of project managers. Importantly, several researchers have investigated the need for a learning culture that promotes leadership development and continuous improvement (Chinowsky et al. 2007; Lahteenmaki 2001; Pedler et al. 1991; Skipper and Bell 2008). A few studies initiated a focus on leadership development for construction project managers (Mustapha and Naoum, 1998; Odusami, 2002; Rowlinson et al., 1993; and Sumpunwetchakul, 2001, Walker and Newcombe, 2000). Toor and Ofori (2008a), in their recent review of empirical work on leadership in construction, show a mounting interest of the research community in leadership in the construction industry. This sentiment is reinforced with findings from Park's (2009) survey drawing on the expertise and experiences of different practitioners and academics in the industry, indicating leadership and team management ranked among the most important factors for project performance. All these research efforts highlight that effective leadership must be visible and effective during all phases of project execution. All project participants need to understand and align with strategically defined objectives and be encouraged as interrelated team members to execute engineering and construction functions in a coordinated, collaborative, and productive manner. Simply stated, perhaps the construction industry has been focused for too long on management, leaving out the aspect of leadership (Skipper and Bell 2006).

In recognition for the need of strong leadership, a leading global engineering firm that provides a wide breadth of engineering design, materials procurement, construction, and management services decided to proactively address leadership development within the organization. The target group for such development consisted of practitioner engineers serving both the design and the construction management functions. Both functions are critically associated with the delivery of large capital projects. As engineering project practitioners, the targeted group was viewed as a cornerstone for the effective execution of engineering work that is necessary to support the major industrial, infrastructure, and commercial projects undertaken by the organization. Within the organization, a practitioner engineer has the ultimate responsibility for the technical and administrative leadership of a multi-disciplinary professional group or team, as it was pointed out by previous research efforts (Ammeter and Dukerich 2002; Badger et.al. 2009; Katz 1991; Slattery and Sumner 2011; Sumer and Slattery 2010).

An internal assessment within the organization concluded that engineers historically developed leadership skills through maturity in the industry. Left unassisted, this development process requires years or even decades to properly prepare engineers for the leadership role that they need to undertake. The current business environment requiring expertise in cross functional project execution, together with the general "graying" of much of the engineering and construction management workforce, dictates a need for accelerated learning of effective leadership practices. After investigating the leadership literature, it was concluded that most of the published resource material focused on the behavioral aspects of leadership with much less attention paid to the concept of leadership development, particularly within the engineering and construction industry. Others (Toor and Ofari 2007; Toor and Ofari 2008a) have reached similar conclusions.

2. Objectives

A proactive intervention to address the subject of leadership development was directly undertaken by an Engineering Procurement Construction Management (EPCM) firm. This program was founded on the premise that leadership can be inspired and capability can be improved if proper awareness and motivation is present in the individual engineer and encouraged by the organization (Avolio and Luthans 2006; Kempter 2006; Luthans and Avolio 2003; Toor and Ofori 2008c).

A significant planning effort was undertaken to identify and establish the learning objectives as well as to begin the firm's development program. The process started with assembling a program oversight committee. The oversight committee consisted of representative managers from each of the functional areas within the organization. A high level executive served as the principal sponsor and fully participated in all the development discussions and deployment / evaluation activities.

The constitution of the oversight committee was deliberately broad, spanning multiple disciplines to capture breadth and depth regarding the project execution process within the organization. A list of high order learning objectives were identified, debated, and ultimately approved by the oversight committee. These objectives were to:

- recognize leadership traits and their application to engineering and construction;
- understand and implement current techniques advocated by the engineering profession for leadership development;
- address the distinctiveness of management and leadership with respect to the performance of engineering and/or project delivery professional services;
- embrace methods for creating positive organizational change;
- reaffirm the importance of ethics and integrity both personally and professionally; and
- emphasize the importance of a personal commitment to mentoring and to employee development process.

The overarching intent of the intervention was to promote a corporate environment where practitioner engineers would demonstrate effective leadership capability in the performance of their work, and would be able to work effectively with all participants in the project delivery process.

3. Intervention Themes

The oversight committee was charged with planning the details of the program development and execution as well as reviewing and approving all products and deliverables. The EPCM firm engaged an academic team to assist them in this process. The oversight committee, along with the academic team, also addressed suitable ways to measure the effectiveness of the program implementation. Ultimately, a robust training program was defined around major leadership themes. The themes were created and adopted by the oversight committee as presented below:

- **Definition of Leadership.** Introduced engineering practitioners to the different definitions of leadership within the engineering industry. Published materials were provided and discussed. Participants were asked to identify their own perspective or bias with commonly accepted themes or definitions. Differing views of leadership by some of the leading authors within and without the engineering industry were discussed. A corporately defined process for leadership development was introduced. Leadership was differentiated from management to define similarities and differences with respect to the practice of engineering in the various functions related to project delivery.

- **Communicating Vision.** Examined the subject of establishing objectives, vision, and strategic goals. Communication effectiveness was an important element of this discussion and techniques for persuasive communication were presented and discussed. A specially designed workshop was created for this session where teams were tasked to develop a persuasive argument either in favor of or against a prepared statement. Participants were reminded of the importance and relevance of leadership in the practice of engineering. All disciplines of engineering were engaged.

- **Integrity and Ethics.** Discussed the important aspect of integrity and ethics within the industry and the corporation particularly. An important discussion was facilitated with emphasis on both the personal and team responsibilities associated with engineering practice. Accountability and engineering licensure were also discussed. The core values and vision within the organization were communicated and reinforced with discussion and team activities.

- **Creating Positive Change**. Addressed the leader's role in responding to, or proactively creating, an environment of positive change. Personal initiative and accountability were again emphasized. The subject of high-performance teams was introduced. Problem solving tools and other proactive techniques associated with team leadership were introduced, discussed and experimentally practiced.

- **Mentoring and Staff Development.** Evaluated principles associated with people / employee development through the use of individual and team development, mentoring, and Maslow's hierarchy of needs. The organization's methodology for mentoring was presented in detail and discussed.Commitment to the process of employee development was emphasized at all levels of professional practice.

- **Self-Reflection.** Examined the attitude, behavior, skills and personal capability for each program participant. The goal was to define a path toward self-improvement and to develop personal discipline toward continuous improvement of leadership development and application of leadership principles at all levels of engineering practice.

4. Intervention

The oversight committee followed a well-defined methodology to address the leadership development intervention within their organization, as Figure 1 illustrates. The committee first confirmed the organizational motivation for this initiative. Corporate alignment and executive level commitment for leadership development of their engineering practitioners were achieved. Secondly, the program objectives were formulated as "success criteria" items. Program development was completed by using a multi-disciplinary approach, engaging an academic team as well as drawing from the expertise of the oversight committee and other industry leaders that were consulted or referenced.

Figure 1. Leadership development process

Multiple options were evaluated with regard to the format of program delivery. Initially, an on-line version was considered in order to introduce the subject matter and principal concepts. Ultimately, in order to promote and emphasize an environment of participant interaction regarding the subject material, a dynamic face-to-face instruction setting was implemented. The instruction setting was purposely designed to have an interactive, participative facilitation, as opposed to a plain lecture format without significant interaction. Thus, comprehensive course materials were also created to provide appropriate reference resources for the program participants. These course materials included presentation material, case studies, background articles, reference documents, corporate strategy and program objective materials. A USB flash drive containing electronic documents of additional leadership tools and publications were handed to the participants. Multiple workshops were developed to provide case studies and/or discussion topics for the participants. Multiple "flip chart" methods to encourage both discussion and active participation were also integrated into the instruction method. Pilots or dry-runs were used to "pre-test" the delivery methods and make adjustments or refinements to both the content and the instruction. Each time the program was significantly modified, a new test or pilot delivery was conducted to ensure its effectiveness beyond the perspective of the oversight committee.

The deployment of the leadership development program was aggressively but carefully planned. Instructors were identified and selected for their proven facilitation and communication skills. Participants, often engaged in their first managerial position in addition to their favorable performance, were targeted by the organization to participate in the program.

4. Evaluation of the Intervention

Several levels of assessment or evaluation were conducted. The assessment was modeled after Mitchell's (1998) and captured the opinion of the participants in terms of program accomplishments, sustained (long-term) gain in knowledge and skills, and implementation of leadership in daily work practices. The first level captured the critique of the participants immediately after completing the program. The goal was to evaluate the participants' reaction to the course content and to capture their perception of how well the course objectives had been satisfied. The corporate oversight committee preferred simply worded yes/no type questions to allow respondents to briefly read each evaluation criteria and mark their level of understanding quickly and accurately. This survey was administered at the completion of the training module to ensure that all the material presented was still fresh and current in the participants' memories. The assessment provided important insights into the acceptability and applicability of the program from the perspective of the participants. All such products provided important feedback to instructors and the oversight committee enabling the leadership development program to continually monitor delivery effectiveness. Workshop products were particularly helpful in determining if engineer participants could successfully apply the leadership principals or objectives in case study scenarios.

In other cases, the workshop deliverables provided the oversight committee with team driven responses that enabled them to judge the effectiveness and/or comprehension of the intended corporate message regarding leadership implementation.

A second and third levels of evaluation was additionally conducted to assess the sustained gain in knowledge and skills two months after participating in the leadership development program and their implementation of leadership in daily work practices. Figure 2 illustrates an abridged sample self-assessment survey for to satisfy these two levels of assessment. Engineer practitioners were asked to rate their level of pre-training and post-training understanding on each topic using a scale from 1 to 5: 1 = Little, 2 = Some, 3 = Average, 4 = Much, and 5 = Proficient or Expert. Within each section, an assessment on its implementation level was also required in the same 5-point scale. A total of 37 responses were solicited, tabulated, and received. Engineering practitioners from mechanical, structural, instrumentation and controls, piping, process, and electrical engineers responded to the survey.

Self Assessment Survey

1 = Little
2 = Some
3 = Average
4 = Much
5 = Proficient or Expert

	Level of Understanding		
	Pre-Training	Post-Training	Level of Implementation
Leadership Applications			1 2 3 4 5 X
Understand leadership traits and how they apply to design teams.	1 2 3 4 5 X	1 2 3 4 5 X	
Understand barriers to effective leadership and how to overcome them.	1 2 3 4 5 X	1 2 3 4 5 X	
Understand the expectations of leaders and how to improve personal performance.	1 2 3 4 5 X	1 2 3 4 5 X	

Figure 2. Self-assessment survey -abridged

In terms of knowledge and skills, a common experience shared by many was that they (the participants) believed that had sufficient, or even superior, understanding of the subject matter until they participated in the leadership development program. Only after participating in the program they could really assess the level of understanding and implementation of the leadership principles. Indeed, survey results (see Table 1) indicate a clear distinction was evident between pre-and post-training perceptions among participants. The engineer practitioners participating in this evaluation acknowledged substantial improvement in their understanding and retention of the leadership related principals. A second observation that was of particular interest to the oversight committee was the reduction of variability of responses in post-training assessments. Such reduction indicates an alignment in the understanding and communication of leadership principles.

Table 1. Survey responses

Knowledge and skills	Sustained gain									
	Pre-Training					Post-Training				
	Little	Some	Average	Much	Proficient or Expert	Little	Some	Average	Much	Proficient or Expert
Understanding of leadership traits and how they apply to design teams.	11%	26%	42%	13%	5%	0%	3%	21%	50%	24%
Understanding of barriers to effective leadership and how to overcome them.	13%	45%	21%	16%	3%	0%	3%	29%	50%	16%
Understanding of the expectations of leaders and how to improve personal performance.	5%	37%	39%	13%	3%	0%	5%	13%	53%	26%
Understanding of the characteristics of an effective team.	8%	30%	43%	16%	3%	0%	3%	11%	57%	30%
Understanding of team member and team leader roles and responsibilities.	5%	22%	57%	14%	3%	0%	0%	11%	59%	30%
Understanding of the importance of differing personality types.	11%	30%	32%	14%	14%	0%	3%	16%	43%	38%
Understanding of the ways to manage team conflict.	16%	41%	30%	11%	3%	0%	3%	27%	46%	24%
Understanding of tools and techniques to maintain team alignment.	49%	30%	14%	8%	0%	0%	3%	30%	43%	24%
Understanding of the SDE's role in employee development through mentoring.	5%	35%	30%	14%	16%	0%	0%	5%	49%	46%
Understanding of the roles, responsibilities, and benefits of the mentor and the mentee.	5%	22%	32%	24%	16%	0%	0%	8%	54%	38%

Finally, an effort to determine comprehension, retention and implementation was considered key measures of delivery effectiveness. The program required post-training action planning by participants and follow-up activities to reinforce retention to corporately defined leadership objectives. Thus, participants were also asked to rate the level of implementation in their everyday work environment. The scatter diagrams and percentage summaries lead to the conclusion that the program effectively increased the application of leadership practices by project participants. Indeed, as Figure 3 presents, the level of implementation of leadership practices significantly augmented after the intervention.

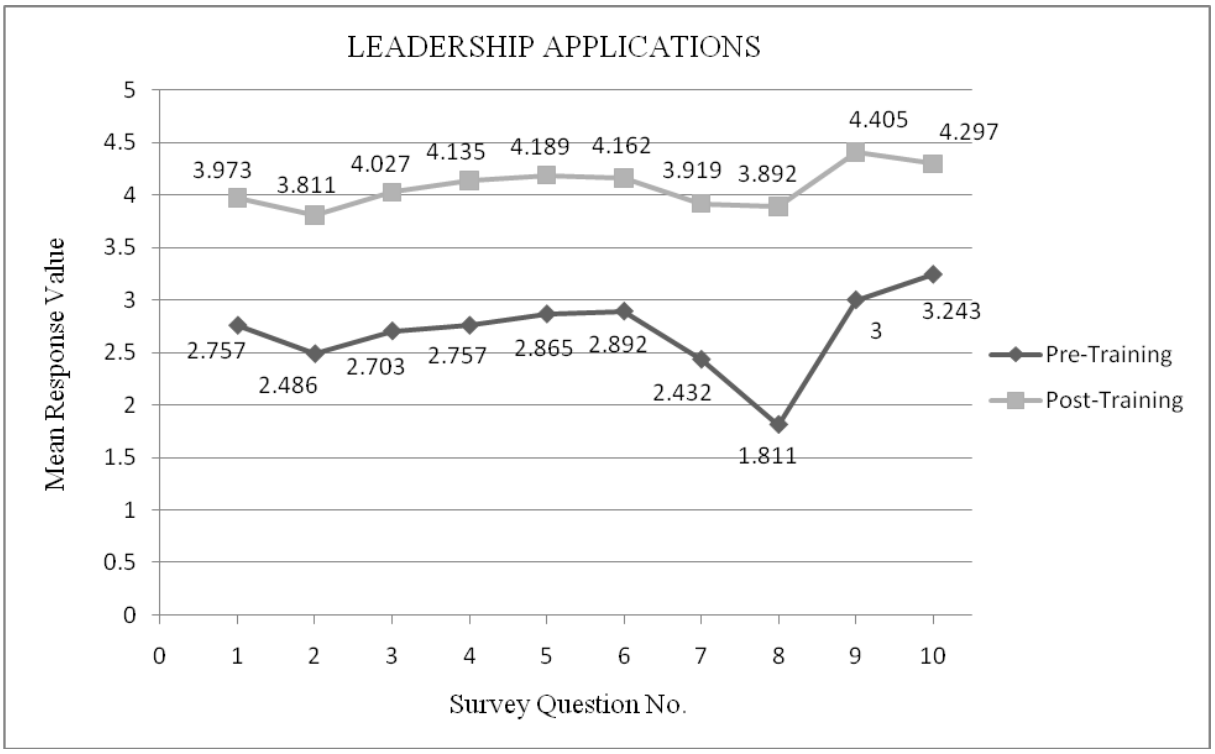

Figure 3. Implementation of leadership

5. Sustained Implementation of Leadership Principals

Corporate executives expected leadership skills to be applied to effectively lead multi-disciplinary teams. Thus, an additional effort (beyond those of the program) was necessary to enable a long-term, sustained project-focused team alignment process that resulted in shared goals, created an awareness of interdependence, and developed trust, commitment, shared vision, accountability, and alignment among team members. To enable this transformation within the organization, each individual was asked to develop a personal leadership development strategy. Such strategies were discussed and approved by supervisors and included the definition of both formal and informal activities to enhance the development of improved leadership behaviors. Each individuals was asked 1) to reflect on how she/he was to interact with subordinates, peers, and supervisors and 2) to address the effectiveness of their communication and their employee mentor role performance. Viewed as a form of "self-reflection", an individual was to formulate a short term and long term list of activities aimed at enhancing their overall progress toward effective leadership. Individuals identified their most distinctive skills or talenst and acknowledgead those for improvement. In the long run, the corporate positive and reinforcing environment with respect to leadership development activities has been observed to result in a culture of continuous improvement, work efficiency, team alignment, and life-long learning.

6. Leadership Model Characteristics and Leadership Implementation Barriers

The facilitation of discussion with engineering practitioners to identify the leadership traits deemed most important by the group of participants has been proactively sought by the organization since the conclusion of the leadership program. Conducted as a team activity, the participants have been asked to identify traits of particular importance for an effective leadership role. Figure 4 summarizes these main leadership characteristics. As shown in the figure, effective communication skills is the most important characteristic for a leadership role. Indeed, effective communications has identified as one of the top five most important traits in every response sought. Planning, proactivity, ability to make decisions, and the ability to build collaborative relationships are also considered fundamental for an effective leadership role.

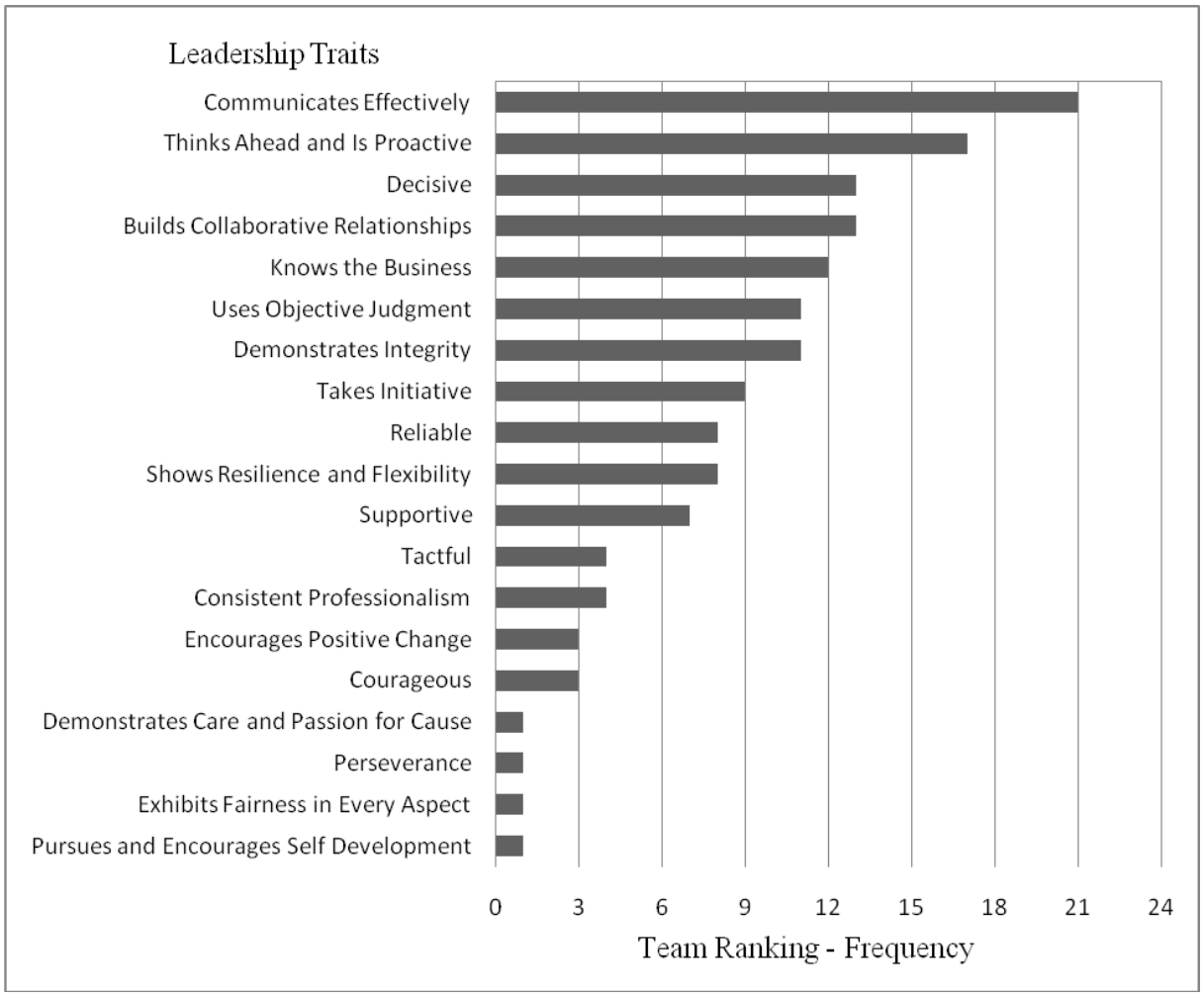

Figure 4. Leadership characteristics

The organization was also interested in the perceptions of their engineer practitioners with respect to the barriers that impede the effective implementation of leadership. Team activities where participants were asked to priority rank the barriers within the organization were facilitated. Such ranked barriers are summarized in Figure 5. Betrayal of trust and micro management are the highest standing barriers to leadership success. Arrogance, lack of team-building skills, and lack of ethics and values are also significant barriers to the leadership role. It should be noted that these barriers were not indicated as present in the work environment of the engineers, but those that the engineer practitioners felt most susceptible to.

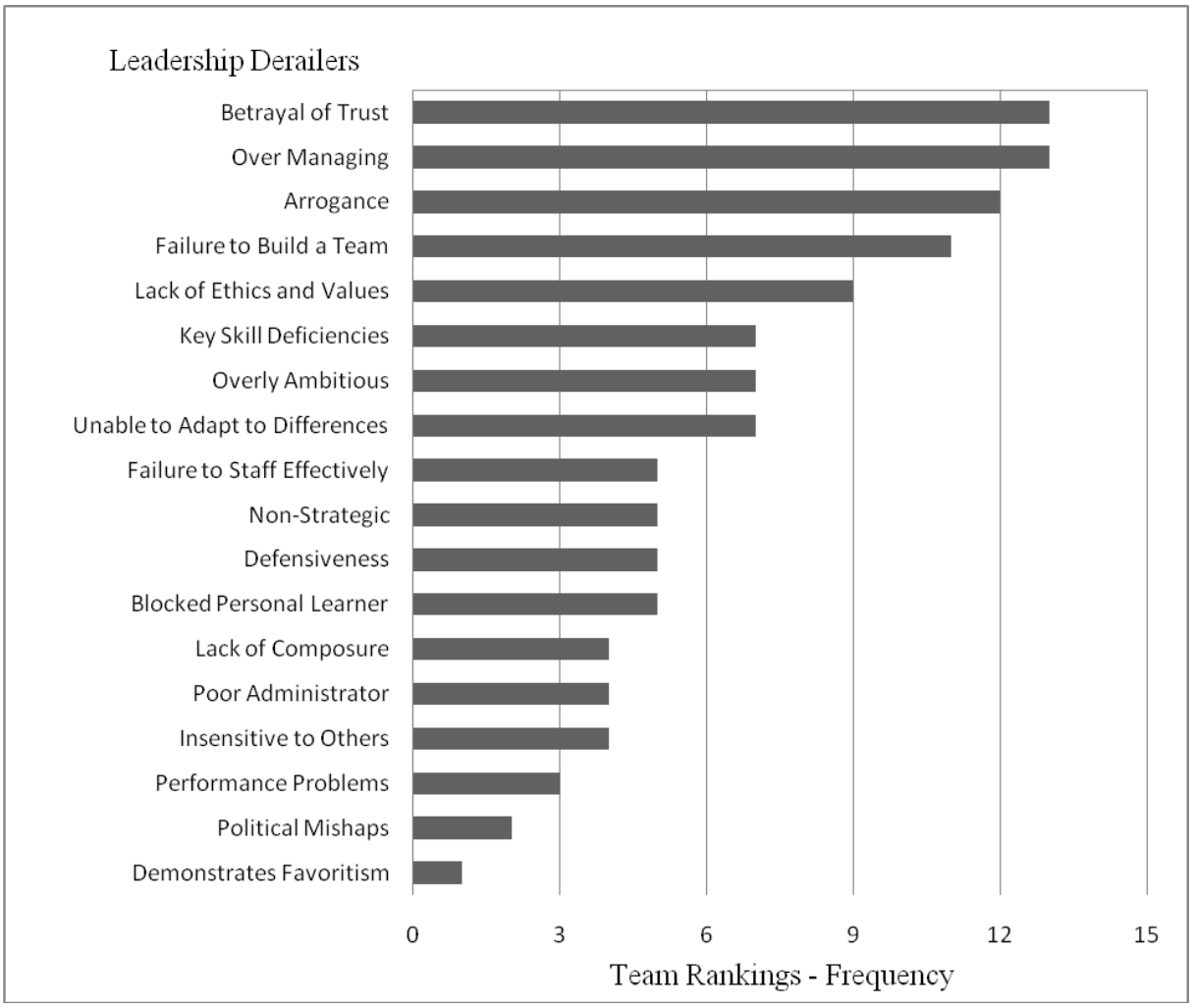

Figure 5. Leadership implementation barriers

7. Conclusions

This study contributes to the body of knowledge in three aspects: sustained gain in knowledge and skills, trending of organizational interventions, and characterization of leadership characteristics and barriers. First, this study proves that well-crafted organizational interventions can result in the sustained gain in leadership knowledge and skills for an improved project delivery process. The results indicate a significant increment in leadership knowledge and skills among engineer participants. Such increment in knowledge and the intervention delivery approach also resulted in a stronger communication of leadership practices among the participating engineers. Second, this study also proves that the effect of organizational interventions can be measured and trended over time. Survey tools capture the pre- and post-intervention assessment of the participants well after the intervention in order to assess its sustained effects. Similar survey efforts can be used to trend the variation of such effects over time. Finally, the most prominent both barriers and characteristics for a leadership role within the delivery of capital facility processes were identified. While most of the previous literature has concentrated on the characteristics for leadership within the capital projects industry, this study also highlights the importance of barriers such associated with trust, ethics, management, personal attitudes, and management skills.

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