

# When Engineers Become Managers: Learning from Current Engineering Managers to Advance Engineering Management Education

Paul Ryan, B. Ed, MEM, P. Eng, CD

[paul.ryan@mi.mun.ca](mailto:paul.ryan@mi.mun.ca)

School of Ocean Technology

Marine Institute of Memorial University of Newfoundland

Dr. Leonard Lye, P.Eng, PhD, FCSCE, FEC

[llye@mun.ca](mailto:llye@mun.ca)

Faculty of Engineering and Applied Science, Memorial University of Newfoundland

Dr. Amy Hsiao, Ph.D., M.B.A., P.Eng

[amy.hsiao@mun.ca](mailto:amy.hsiao@mun.ca)

## Abstract

*This paper reports on the findings of a combined qualitative and quantitative research case study into engineering management (EM) practices in the offshore Oil and Gas industry in St. John's, Newfoundland. It was designed to examine the management challenges faced by EMs in this sector, how EMs are selected, how engineers respond to being made managers and to being expected to lead, and what training and development is needed to be an engineering manager. Specifically, the study investigated the relationship between each of twenty three (23) identified EM job activities on (i) difficulty, (ii) frequency of problem occurrence, (iii) benefit of training, and (iv) importance to job success. The data indicated that among the 26 EMs surveyed, problems occurred most often and caused the most difficulty in the activities considered most important to job success, specifically interpersonal communication, people management, leadership, motivating, finance and projects. The top training needs were identified as project management, effective speaking, motivating, leadership, decision making techniques, risk analysis, personal efficiency, and effective writing.*

## 1 Introduction

This case study arose from the fact that management is not a focus of most undergraduate engineering training programs [1], yet the Canadian Society for Engineering Management says that “almost half of all engineers enter a management position within ten years of graduation, and fully half of all registered professional engineers primarily utilize management skills rather than technical skills” [2]. The study was designed to investigate this phenomenon in terms of

the progression from engineer to manager, the selection of engineering managers (EMs), how engineers respond to being made managers and to being expected to lead, the management challenges faced by local EMs, and their development and training needs.

## 2 Overview

In this paper, an EM is defined as an engineer filling a management / team-lead role that combines the ability to apply engineering principles and the skill to organize and direct people, technology, resources, and projects [3]. The data gathering instruments used were an in-depth interview guide, a survey questionnaire, and an informed consent form. In-depth interviews were conducted with 10 EMs and surveys were received from 26 EMs, including those interviewed. Only aggregate and summarized data are used. Anonymous quotations are also shown in italics, but only where express permission has been obtained.

The study employed purposeful selection and judgement sampling to target those engineers that would contribute the most depth to the study data [4]. In-depth interviews were conducted with the 10 selected EMs to develop a narrative of their experience. The interviews were audio-recorded, with permission, and transcribed for analysis using voice recognition software. To help improve the narrative, the transcriptions were returned to interviewees to seek additional comment. Validation hermeneutics were used to portray the participant's accounts as accurately as possible and thematic and comparative analyses were used to interpret the qualitative data gathered from the in-depth interviews. The quantitative data from all surveys received was tabulated and analysed using descriptive statistics.

The interview was an exploratory, semi-structured conversation done face-to-face to ensure body language and other non-verbal nuances were not lost and to encourage a free flow of conversation and narrative development. It was designed around four major themes of exploration: the individual, the job, training, and personal experience. The typical interview took no longer than one hour to complete. Interview subjects were also requested to complete the survey to provide confirmation of interview comments. The survey was inspired by the study conducted by Barclay [5] and was designed to provide quantitative data for analysis along the same four major themes as the in-depth interview. A pilot study of the first three EMs confirmed that the survey and interview questions were suitable for the study.

### 3 Analysis of Results

The data that arose from the interviews and the surveys were both rich in depth and illuminating.

#### 3.1 Level of Education

In the local oil and gas industry, all EMs have at least a bachelor's degree in engineering and 25.9% have graduate degrees. That means that at least 74.1% of engineers in management positions did not receive any direct formal management training in their tertiary education. Indications are that most EMs get their management training and experience on the job, in the colloquial "trial by fire". One interview subject noted that *"I saw very early on that I wasn't going to get the help that I needed. I was sort of thrown to the wolves"*. Another noted that:

*"When I started here, it was sink or swim. Because I started as a project engineer, and on day one, it was no start up period. I think on my first day, I came in, all new, and they stuck me in a meeting with an irate project engineer on the client side, who had a project that was off the rails, and it was my job, it was my project, and I'd just gotten here. It was sink or swim. And that was my first day on the job. I came out shaking my head."*

Most interviewed EMs indicated that they had received a short in-house course in management or an external supervisory and management skills training program. Indications were that larger corporations had better developed in-house management training programs than smaller organizations. Several EM's lamented the lack of management training that they had received. One indicated that *"from a technical side I was there, but from a pure management side, I was very green. And I don't mind admitting that for one*

*second, I was very green"*. Others felt that they would have entered into management sooner and advanced faster had they received the necessary introductory training. Referring to an in-house leadership course, one EM noted that *"I think if I would have done something like that early on...it would have helped me significantly in progressing. I probably think that I would be further ahead in my career than I am now"*.

One way to expose more engineers to the management side of the business is to offer them the leadership skills training that they did not receive in their bachelor's degrees and to do so early enough in their careers to maximize its potential impact on them. Another potential way is to give engineers leadership skills training in their undergrad degrees through the establishment of an educational program along the lines of the Engineering Futures program offered by chapters of the Tau Beta Pi Engineering Honour Society [8].

#### 3.2 Corporate Expectation for Leadership

Analysis of the interviews revealed a clear corporate need for management and leadership that finds engineers rapidly placed into management and leadership positions for which they have not been formally trained. A few EMs did indicate an early desire to manage and lead. One felt that as a project engineer he was gently pushed towards management. Another referenced a move of desperation, saying that *"Someone said to me, well, do you want it? And I said I'd rather have it than have another idiot to work for."* The majority of EMs were reluctant, to varying degrees, to manage and lead, and some still question the decision to enter management.

Most of the EMs interviewed in this case study attribute their current role to personal hard work, a little bit of luck, and what can only be described as serendipity. The new and growing industry that is offshore oil and gas in St. John's has offered leadership and management positions to experienced and capable engineers when the departure of expatriate engineering managers, who got the industry going, left open positions to be filled in organizations. The industry also worked to build management positions around some engineers as the organization grew, concomitant with their progressive experience. As one EM stated *"My current role here...sort of evolved into that as well...there was not a defined role that existed that I applied for. The role kind of grew around me."*

Only one EM reported participating in an open job competition. All others reported being offered and appointed to their positions. As the industry matures in coming years, it will be interesting to see if this

trend continues. Will an expected increasing need for management and leadership result in more EM appointments or will these EM positions become solidified and more competitive in nature?

### 3.3 Leadership and Management Challenges

The survey data revealed that about 77% of EMs felt that they have quite a bit of control over their work objectives. This shows the high personal confidence EMs have and demonstrates the confidence and respect that the position holds with superiors. Encouraging too is the data showing that EMs use a mix of advanced planning and on the spot decisions when necessary. This suggests an experienced flexibility in management style is in use in the oil and gas industry in St. John's. Still, the data showing that unexpected problems occur 50% of the time speaks to the challenging pace of change that the oil and gas industry is experiencing, but it may also speak to a challenge in experience or education in EMs.

As shown in Figure 1, more than 73% of the EMs who participated in this study indicated that their job was mostly managerial, and a full 88.5% indicated it was at least 50% managerial.

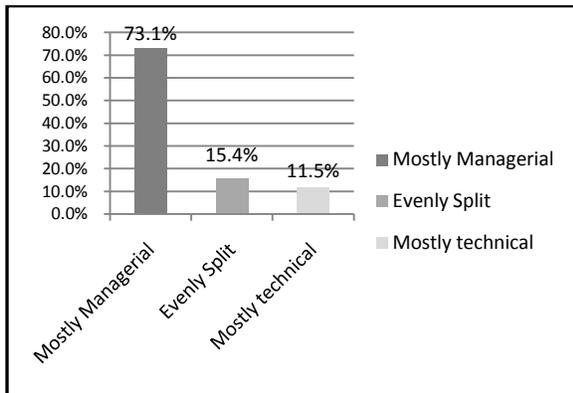


Figure 1. Managerial Split of Job Activities

Whether the position was desired or not, the EMs in St. John's had much to say about the difficulties and challenges they faced in performing tasks for which they were untrained in their bachelor degrees and often in their corporate life. This tangible concern resulted in one of the most pointed comments from the interviews when one EM said that *"I find myself asking myself sometimes, well, when there are issues on the table, how will that stand up in front of a judge"*. To be specific, in this case study, the activities considered most critical to job success were noted to cause the most frequent and severe problems. People management and projects was considered very

important or even critical to job success, and they often or always caused challenging or even severe problems. Leadership and interpersonal communications were considered very important or critical to job success. Problems in these areas rarely fail to occur and are not considered easy to solve. Motivating and finance activities were also considered very important or critical to job success. Problems here as well rarely fail to occur and are not considered easy to solve.

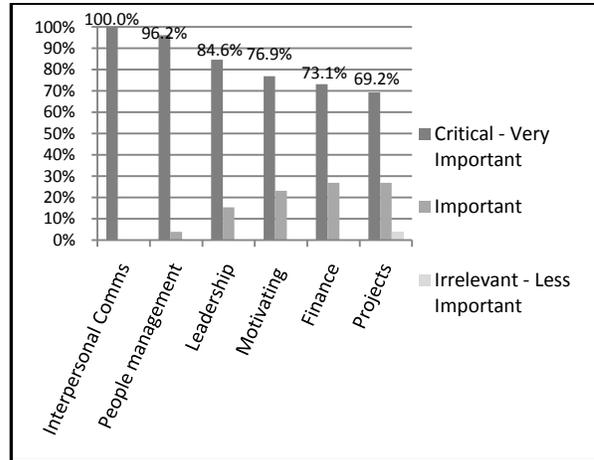


Figure 2. Activity vs. Importance to Job Success

Participants revealed that all these critical activities were mainly learned on the job by necessity. Unless suitably mentored, the expectation was simply to get on with the job and to learn as you go. As one EM said *"You picked it up as you go, out of necessity; I mean you just learned"*.

In the offshore oil and gas industry in St. John's, EMs might be expected to quickly take on a leadership role, such as in the management of subcontractors working on a common project. The task of leading and managing other people cannot be underestimated in its importance to the success of EMs and in the challenge that it presents. Selected interview quotes bear this out clearly: *"It comes back to your work ethic and your people skills. You can be a great manager of projects, but if you don't have people skills to get people working for you then you can go around in circles"*. *"I had one guy, his grandmother died about seven times. After the third grandmother you know something's going on"*.

### 3.4 Interpersonal Communications

This task was chosen as the most critical activity performed by EMs, selected by 100% of participants as an activity that was either important or essential to

their job success. When average people were asked in a survey to describe how engineers differed from non-scientific professionals, Danielson [9] tells us that the highest responses were that engineers were more introverted, individualistic, critical and analytical, but less emotional and social. These negative stereotypes are likely prevalent even today. Still, EMs “must learn how to deal with the idiosyncrasies of individual clients and personnel as conditions change in a dynamic environment” [10]. Selected interview quotes on this theme illustrate the importance of this issue and some of the challenges faced by EMs:

*“So it's more difficult, I think now, to manage people because there's no such thing as saying “well just go and do it. I'm telling you to do it, so do it”. There's a lot of cajoling, there's a lot of, not manipulation, because that gives the wrong impression, it's that you have to get people to think... for them to see what you're seeing and do one of two things: explain to you why you're wrong, or understand what you're saying and say, you know, you're right, we can do it. And that's the challenge.”*

When it comes to interpersonal communications, all work places can be viewed as learning environments, and one of the communication difficulties in any work environment is the difference in personal preferred learning styles [11]. Learning styles are “characteristic, cognitive, affective, and psychological behaviours that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment” [12]. A learning style mismatch between an EM and a team member, co-worker, or superior, can lead to miscommunication and frustration, but by “understanding how each person processes information, conflicts can be minimized, better decisions can be made more quickly, [and] performance should be more effective” [10].

EMs are thus advised to realize that not everyone thinks or processes information the way they do, that an individual's preferred learning style will dominate in a high pressure situation, and that this style may not match their own. EMs need to be conscious of the communication conflict that can result when their learning style causes them to quickly decide to solve the wrong problem using the obvious “single right answer”, to discounting the input of others, or to refuse to consider alternatives. Similarity can also produce conflict when two design engineers produce separate single correct solutions. Ultimately, the key to improved communications is for an EM to understand their personal preferred learning style and the strengths and weaknesses of the styles of those they work with, to avoid extremes in any one style, and to blend styles to greatest effect [10].

### **3.5 The Need for and Benefit of Training**

The fact that, other than in a few sub speciality areas, all potential training areas were indicated by the participants to be at least somewhat if not highly beneficial suggests a strong respect and desire for continued education among the participant EMs. It also suggests that they are not receiving much of the soft skills training that they require, whether because the company they work for has not or does not provide it, or because they have not sought out such training outside the company. In his book *Stuff You Don't Learn in Engineering School: Skills for the Real World*, Carl Selinger [13] asserts that:

*“I strongly believe that what you don't know will hurt you, or hold you back... Take, for example, public speaking. Many young engineers feel that they don't have to learn how to speak in front of groups. This is flat-out wrong. Any young engineers who feel that they can succeed in their careers without adequate speaking, writing, and people skills have to adjust their thinking.”*

EMs, both personally, and for their staff, must realize that choosing to engage in adult education itself can be a reactionary response to the removal of a barrier to participation. If certain situational barriers like child care, transport or funding are eliminated, adult learners may react with immediate participation in formal, non-formal, or informal learning. Choosing not to engage in adult education is also a reactionary response from many adults whose disposition leads them to recall an unpleasant time under the evaluation of a teacher, or who feel personally inadequate due to the length of separation from schooling, or who do not see a need for lifelong learning because they already have a job [16].

Accompanying the concept of lifelong learning is the need for EMs to adopt a tendency toward self directed learning. This tendency is not always present in all adult learners and they routinely erect barriers that are actually within their power to eliminate. Those with an internal locus of control will know that situational and dispositional barrier ownership rests with the individual [14] and a self directed adult learner would recognize this and take steps to be proactive in learning rather than reacting when a barrier somehow falls.

### **3.6 Advice for Future Engineering Managers**

This case study discovered some significant wisdom from interview participants that is presented here as an opportunity to provide future engineering managers with the benefit of their advice. The foremost advice

to would-be EMs is that you are your own career manager, so have a plan for the long term. One participant, in commenting on early career plans, put it this way:

*“So I was trying to figure out how to make my next move, and you know, it seemed to me at the time, as a young engineer, that I could go the MBA route or I could go out the door, but if I didn't make a change, in all likelihood, I was going to be the intermediate mechanical engineer until the senior mechanical engineer either died or retired.”*

EMs and engineers in general can benefit from the knowledge that work breaks from the industry do not mean the end of a career in the oil and gas industry, so never despair if you think you have made the wrong choice. Despite industry breaks of several years, some EMs indicated cold recruiting calls that got them back into the industry, or voluntary re-entry after one, three or seven years that was warmly welcomed.

Another piece of advice from EM's in practice is to get additional training as early in your career as possible. This should include the leadership skills you will need to work effectively with people and specific other training that is required on the job, such as project management.

As with your career, you are in charge of your work life balance. As a leader in your role in engineering management, leadership starts with you, and a successful work life balance is an example for those who follow you. The following rare comment notwithstanding, *“I'm happy where I am in my career right now, and I'm happy with the amount of work that I have to put into it”*, it is known that most EMs work diligently, for long hours, and it can be a struggle to balance work and life. As one EM noted:

*“The workday is frantic, and the reality is in today's workplace between phones and these things, blueberries I call them, you can't escape work. So I force myself to have a work life balance. I have a cabin that's out of cell phone coverage and I make 14 trips a year.”*

Serving EMs will advise you to get fit and stay fit. Find a routine early in your career that helps you relieve the stress of the job and follow it with vigour.

Another critical skill in which you will most likely not receive any training but in which you will be expected to perform is public speaking. Ability in this skill can enhance any career. You can try to avoid it, but you cannot deny it. Those EMs with plenty of practice indicated little problem with this task:

*“Something you had to do. It's probably something that, I don't know what the training is now in engineering, but it's probably something that engineering training could probably benefit from”.*

*“Funny enough, when I went to Toastmasters...about half the class were engineers, and engineers of my age at the time, who were just getting up in levels”.* You are recommended to be proactive and get yourself any training you can get in this area. Join the local chapter of Toastmasters [15] or volunteer for low profile speaking sessions that will increase your comfort level. Remember that courage is not the absence of fear; it is mastery of it.

## **4. Recommendations**

Recommendations for academia, the offshore oil and gas industry, and for serving EMs, flow from the analysis of the data in this case study.

### **4.1 Academia**

The first recommendation is to introduce engineers to management and leadership concepts and skills at the early stages of their careers. While they are still in university struggling to attain the technical grounding that is assumed in all engineering graduates, leadership skills training will have the greatest career impact. It is known that bachelor programs have little to no space for such additional programming. It is therefore recommended that Engineering Faculties take up the task of establishing a local Tau Beta Pi (2001) chapter [8] or equivalent Engineering Futures program, to provide leadership skills training for undergraduate engineering students on evenings and weekends.

It is recommended that universities consider establishing a “New Engineering Manager” short course, along the lines of the one offered by the UK Institute of Mechanical Engineers [16] that would quickly get new EMs up to speed on the non-technical skills that they will need to be as successful as possible in their new roles.

It is recommended that the concepts of lifelong learning and self-directed learning become mantras for engineering faculty as they engage with engineering students.

### **4.2 Offshore Oil and Gas Industry**

Companies with a clear need for engineering management and leadership are recommended to provide paths for the professional development of their engineers and to be proactive in ensuring that their engineers get the management and leadership training that they need to be effective in their roles. For example, Memorial University of Newfoundland works with local engineering or technology-based

industries to provide a practical and relevant Master of Engineering Management program. Human Resources departments can work with universities to establish courses or programs to address EM.

### 4.3 Current Engineering Managers

Current EMs are recommended to understand their preferred learning style, the conflicts that can result from learning styles mismatch, the strengths and weaknesses of each style, and how to blend styles for optimal effect. EMs are recommended to take action to understand each generation in the work place, including their preferred leadership style and the assets that each generation bring to the work place. They are recommended, where possible, to influence and embrace the benefits of flexible HR policies that appeal to Generation X and to Millennials.

## 5 Conclusion

The results of this study show that engineering management in the oil and gas industry in St. John's is still an evolving field, and that those who fill EM roles face numerous and diverse challenges, not the least of which is formally defining their role beyond doing what needs to be done.

Young engineers are challenged by the corporate need for engineering leadership and management and the rapid expectation to lead often without receiving the benefit of training in management skills or leadership. This expectation to lead is most successful when coupled with suitable leadership skills training for EMs to help them avoid the conundrum that has activities considered most critical to their job success causing the most frequent and severe problems.

There are three distinct generations in the work place today. Interpersonal communications skills will be ever more critical as these different mind sets come together to try to move the industry forward.

With all this in mind, it is expected that the role of engineering manager in the future will continue to be both challenging and rewarding for any engineer with a penchant to lead and manage, whether that penchant be voluntary or coerced.

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