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Changing importances of professional practice competencies over an engineering career

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ABSTRACT

The profession depends on its practitioners developing management and leadership skills to achieve good client outcomes and robust, reliable products or services, delivered by profitable, ethically run engineering businesses. The difficulty is determining what those skills are, and where in the career they are needed. The New Zealand population of professional engineers was surveyed to rate the importance of a list of management and leadership topics. Results show the relative importance of various topics and how their importance is perceived differently with years of experience. The results also help differentiate the roles of teaching institutions and ongoing in-career professional development.

1. Introduction

It is expected that engineers will use engineering management and leadership tools more extensively as their career progresses, and some become specialised management engineers (IPENZ, 2015). Their careers start by taking responsibility for the management of their own personal work and the professionalism thereof, to become independent practitioners. With time they typically take responsibility for managing the work of others in projects and organisations, to become technology or team leaders. Some may stop there, but many other engineers subsequently take responsibilities for managing whole business units or organisations, leading staff, and perhaps eventually for governance and setting strategic direction. Consequently there is a need for engineers to develop an evolving set of professional skills as their career develops. But what exactly are those skills and when are they needed? This question is also relevant to the need for life-long learning and enduring professional development (IEM, 2009).

This is addressed by analysing a large survey-data set to determine the relative importance of management and leadership topics for engineers at different stages in their careers. The particular area of focus for this research was the New Zealand (NZ) engineering profession. In the present context we do not make a firm differentiation between 'management' and 'leadership', but instead simply use the term 'engineering management' to refer to the general set of skills required for organisational success. This was done as there is no consensus in the literature, in either the business or engineering literature, on the boundary between 'management' and 'leadership', so any distinction is necessarily subjective. Furthermore, the topic is generally known within the engineering profession as 'engineering management' and tacitly assumed to include some leadership components, which is another reason to stay with the existing terminology.

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2. Background

2.1. Research question

The engineering profession is highly dependent on its practitioners developing the necessary management skills to achieve good client outcomes and robust, reliable products or services, delivered by motivated staff in profitable, ethically run engineering businesses. The difficulty is determining what those skills are, when they are needed, and developing the appropriate competencies in graduates and practitioners. The question addressed here is the longitudinal one: *what are the various management and leadership capabilities [topics] used in professional engineering practice, where in the engineer's career does the need arise for each?* This is an important question because of the implications for teaching and professional development. This question is somewhat related to that asked by Giegold, 'what is the most effective way for an engineering manager to improve his or her leadership skills?' (Giegold, 1981). If it were known how the need arose longitudinally over time, educators, employers, and professional bodies could present the material at an appropriate time and contextualise it accordingly. This could also help differentiate the roles of teaching institutions and ongoing professional development (PD) in-career. Thus some topics might best be taught as part of an undergraduate training, and others as part of a PD programme after graduation: at present that distinction is unknown.

2.2. Relevant literature

That engineers need to know some management and leadership is beyond doubt. The ambiguity is in what exactly they need to know, and where in their career. The first question is what soft-skills engineers need to know. There is some consensus on the composition of that body of knowledge, though it lacks specificity to be really useful. The engineering accords (IEM, 2009) provide guidance, though not at the level of detail for curriculum design (Banik, 2008).

2.3. Management and leadership

The notion of 'management' and 'leadership' is generally understood in the management literature to be somewhat overlapped (Simonet and Tett, 2013). The modern concept of 'leadership' is inextricably linked to strategising, and the two are co-dependent: if there was no strategy to develop then the need for a leader would be diminished. Consequently, organisational change is also usually perceived as a systematic and top-down process (Balogun and Hailey, 2004; Burnes, 2005) of decision-making and deployment, at least from the 'leadership' perspective. The general opinion is that strategy formation is a systematic process and that it is necessarily performed by a leader. The 'directed' approach to strategy development, which is the historical perspective, sees change as the deliberate alignment of the organisation to strategy decided by the leaders direction (Kaplan and Norton, 1992). Thus the directed approach asserts that strategy should be a deliberately planned response to fit ('align') the organisation to the external environment (Johnson and Scholes, 2002; NIST, 2013), and that change is the deployment of this strategy. That perspective emphasises a top-down process, and elevates the role of leadership by an upper echelon in decision making (Cannella, 2001). Within the management literature it is sometimes called a 'planned' approach (Burnes, 2005, p. 74). Some even call it a 'designed' approach (Johnson and Scholes, 2002, p. 39), which refers to the deliberate and methodical nature of the process (Graetz et al., 2006, p. 10). So one way that management and leadership are differentiated is to state that leadership involves the identification of external alignment needs and opportunities for the organisation, the formation of a vision of the future state of the organisation, the development of a set of strategic actions to achieve that desirable future state, and the internal change management actions that are necessary to develop the underpinning organisational capacity. In contrast the role of managers is to attend to the operational processes concerning the means by which the organisation achieves its purpose or mission, and this involves supervising the allocation of resources (people, consumables, assets, finances). Consequently leadership and management require different skills.

Another perspective, which overlaps somewhat with the previous, is that leadership is primarily about motivating others to change their behaviour to achieve a better outcome, whereas management is about the supervision of resources. From this view anyone can be a leader, and the attribute exists throughout an organisation. The primary leader is then the chief executive officer. These theories assign primary causation for organisation success to the skills and personality of the leader, hence styles of leadership are important (Dulewicz and Higgs, 2005). Theories include charismatic leadership (Conger and Kanungo, 1987, 1994, 1997; Conger et al., 2000), vision, transformational leadership (Robbins et al., 2001, p. 421), servant leadership (Chewning, 2000; Crippen, 2005; Fisher, 2004; Giampetro-Meyer et al., 1998; Greenleaf, 2002) and strategic leadership (Johnson and Scholes, 2002), among other theories. In these theories leadership is an affective (emotional) process that is directed towards achieving specific behaviours in others, not so much by force of authority as by changing motivation. This too links into change management, as in the previous visioning perspective of leadership, and indeed these various theories are complementary.

These different constructs for leadership and management are found in the psychology-management fields, and the engineering literature itself does not generally go to these levels of detail. By examination of what other people consider to be 'engineering management' (as shown below) it is apparent that (a) a wide variety of leadership and management topics are considered to be included, and (b) there is a large amount of variability in what each source considers to be