The Politics of Accreditation: A Comparison of the Engineering Profession in Five Anglosphere Countries

by

Michael Klassen

A thesis submitted in conformity with the requirements for the degree of Master of Arts – Higher Education

Department of Leadership, Higher and Adult Education

Ontario Institute for Studies in Education
University of Toronto

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2018

Abstract

This study explores the politics shaping engineering accreditation in Canada, United States, United Kingdom, Australia and South Africa. Using pluralist political theory to analyze literature and relevant policy documents, this study shows important differences in the configuration of the engineering profession in different countries. These historical and organizational configurations shape the extent to which policy changes are centralized or decentralized, and influence the extent to which accreditation supports social closure for the profession. This ultimately shows the importance of analyzing local political factors that affect the implementation of international accreditation policies such as the Washington Accord. The findings lay the groundwork for future empirical studies to investigate the complex implementation dynamics in higher education institutions level in different national contexts, including the intermediary role of faculty networks and engineering education societies.
Acknowledgments

There is a certain degree of insanity in pushing to complete the full requirements of this degree in 15 months while overlapping with the start of the next one. In reaching the end of this journey, I would like to thank my co-conspirators in this plot who have helped me find my way through.

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<th>Definition</th>
<th>Country</th>
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<tbody>
<tr>
<td>AAEE</td>
<td>Australasian Association for Engineering Education</td>
<td>Australia</td>
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<tr>
<td>ABET</td>
<td>Accreditation Board of Engineering and Technology</td>
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<tr>
<td>ACEC</td>
<td>Association of Consulting Engineering Companies</td>
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<tr>
<td>ACED</td>
<td>Australian Council of Engineering Deans</td>
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<td>AHEP</td>
<td>Accreditation of Higher Education Programmes of Professional Engineers and</td>
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<td>APEGA</td>
<td>Geoscientists of Alberta</td>
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<td>American Society of Mechanical Engineers</td>
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<tr>
<td>ATSE</td>
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<td>Accreditation Unit</td>
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<tr>
<td>BEP</td>
<td>Built Environment Professions</td>
<td>South Africa</td>
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<td>Canadian Engineering Accreditation Board</td>
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<td>CEEA</td>
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</tr>
<tr>
<td>CEng</td>
<td>Chartered Engineer</td>
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<td>Council on Higher Education</td>
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<tr>
<td>IEA</td>
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<td>IEEE</td>
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<td>NCDEAS</td>
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<tr>
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<td>NCEES</td>
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<td>United States</td>
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<tr>
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<td>RAEng</td>
<td>Royal Academy of Engineering</td>
<td>United Kingdom</td>
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<td>RIBA</td>
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<td>RPEQ</td>
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<td>SAVI</td>
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<td>European Association for Engineering Education</td>
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<td>SPEE</td>
<td>Society for the Promotion of Engineering Education</td>
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<td>TLOs</td>
<td>threshold learning outcomes</td>
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<td>UK-SPEC</td>
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<tr>
<td>SPEC</td>
<td>Engineering Competence</td>
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<td>WA</td>
<td>Washington Accord</td>
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Chapter 1
Introduction

1.1 Professions and Higher Education

The professions occupy a central position within higher education, bridging links to industry, attracting public and private research funding, and contributing significantly to the status and prestige of elite universities in particular. Despite this fact, higher education research consistently overlooks the unique features of professional education, while research on the professions downplays the educational processes and contexts of universities. Professional degree programs are much more tightly coordinated and prescribed, with many fewer electives, than general arts and science degrees. Many include mandatory work-placements that are integrated into the curriculum. In the market logic applied to higher education in liberal market economies, professional programs also can charge much higher tuition fees, justified by the higher expected private returns to higher education obtained by graduates who eventually will secure much higher paying jobs.

As increasing numbers of students from a widening range of social class backgrounds gain access to professional education, questions of vocational outcomes and ‘job prospects’ have steadily increased (Marginson, 2007). In the context of government budget retrenchment and declining public funding for higher education, increasing focus has been placed on relevance, efficiency and value for money (Dill, 1999; Trow, 1993). Declining public trust has caused governments in liberal market economies to invest more in external quality assurance to more closely monitor and measure the ‘performance’ of their ‘investments’, encroaching on the institutional autonomy of institutions in the process (Stensaker & Harvey, 2010). Outcries that these trends represent an erosion of the “traditional” norms of higher education overlook the reality that for more than a century professional education has existed within higher education, with both a vocational emphasis on job preparation and more ‘invasive’ forms of external quality assurance led by professional bodies.
1.2 Quality Assurance of Professional Education

This thesis focuses on the institutional contexts and relationships between universities and professional bodies who are tasked with self-regulation of their professions. The mandate for self-regulation includes the responsibility for accreditation of university programs (Muller & Young, 2014b). Professional accreditation is a process of periodic external review and evaluation of the content, resources and outcomes of professional education that ensure graduates of accredited programmes have the requisite knowledge and skills to enter the profession (Harvey & Mason, 1995). Indeed, the abstract, theoretical knowledge that underpins professional judgments in particular contexts is derived from the disciplines, which have their home in universities (Abbott, 2002; Muller & Young, 2014a). This underlies part of the dilemma of professional education and its inward and outward facing knowledge: professional knowledge draws from the disciplines but applies that knowledge to practical challenges in the world outside of academia.

Professional accreditation can vary widely by sector and country, but broadly involves detailed prescriptions about the content of the curriculum, who is qualified to teach, and what standards for competence are considered adequate. Some professional bodies go as far to say they “own the syllabus” for courses in their area, leaving higher education institutions to figure out how to teach it (Harvey & Mason, 1995). Other accreditation regimes require robust mechanisms for evaluating learning outcomes that must be linked to curriculum decision making – this fundamentally changes the nature of the internal governance mechanisms in universities (Lennon & Frank, 2014). In both of these cases, professional bodies are getting involved in decisions that are traditionally thought to be wholly under the control of an autonomous professoriate, embedded in the notion of academic freedom (Harvey, 2004).

This tension has not gone unnoticed in the literature. In a broad survey of academics from different disciplines, some professional and some not, Harvey (2004) investigates the nuances of accreditation, pointing to the underlying power and politics at play, drawing rich examples from academics in various fields. The quote below, from a psychology professor, describes the interactions between professional societies and academic leaders:

The [Psychological] Society wanted to specify not only a curriculum but also the teaching time allocated to every element in it. The [academic department] heads argued
that university departments should maintain their autonomy and decide themselves what and how much they should teach. They believed the bureaucratic tail was seeking to wag the academic dog. But they lost the battle (Harvey, 2004, p. 215).

An example from architecture, a professional field, points directly to the hidden politics implicit in accreditation, even when academics themselves contribute to the process of assuring quality at one another’s institutions.

I have been involved in visiting boards myself on behalf of the RIBA [Royal Institute of British Architects] and Architects Registration Board and actually chaired one to [another university]. When I was chairman I suddenly became aware of how many hidden agendas were in existence and as we rejected the views of both the RIBA Education chairman and their full-time officer as to what we should say about the school (before the visit took place), I was not asked to chair a visit again (Harvey, 2004, p. 216).

Harvey’s article is a lone bright flower in an otherwise grey and barren landscape of accreditation literature, much of which is written by the actors involved in the process themselves, using structural functionalist arguments to justify both the importance and legitimacy of accreditation as well as its political neutrality (Patil & Gray, 2009). Jennifer Case (2014) highlights how these powerful professional bodies have used their power to shape engineering education: “the professional voices, most notably through the mechanism of accreditation, have managed to retain an emphasis on practice through the inclusion of design courses, particularly at the final year level” (Case, 2014, p. 149).

1.3 Engineering Accreditation: An Interesting Case

Among the professions that could be studied, engineering has several unique features which make it worth studying. First, rather than being a clearly defined field itself, engineering encompasses dozens of different sub-fields, with new branches such as biomedical engineering and nanotechnology emerging in recent years. This variety can lead to interesting internal differences in the application of accreditation criteria. In most Western liberal market economies, engineering is offered as an entry-level undergraduate degree, and the assumption is made that the majority of engineering graduates enter the workforce shortly after obtaining their degrees (Patil & Gray, 2009). Recent research in several of these countries indicates that engineering is
becoming a “sending” field (Prism Economics and Analysis, 2016; Wheelahan et al., 2015; Wheelahan & Moodie, 2017), meaning that more and more graduates are entering other fields either to work or for further education. This in turn raises questions about the suitability of a tightly controlled curriculum that might serve the needs of the profession but not the wider range of situations graduates are finding themselves in. As one Canadian study in the province of Ontario put it, having presented data on the small fraction of engineers who obtain their license or work in the field:

At least half of engineering graduates are likely to pursue career paths that will draw on their training in applied science but which do not involve performing engineering work as it is defined in the Professional Engineers Act. Most of these graduates will not complete and may not even enter the licensure stream. The question for universities is whether engineering schools are also providing these graduates with the preparation they need. (Prism Economics and Analysis, 2016, p. 23)

Another critical aspect of engineering is the rapid alignment of accreditation systems across countries in recent years. Engineering was one of the first professions to develop a strong mutual recognition agreement, The Washington Accord. Signed in 1989, the United States, Canada, the United Kingdom, Australia and New Zealand, the purpose of the Washington Accord is to increase engineering mobility by making it easier for engineers to have their engineering degrees recognized by registration bodies in other countries. The signatories to this agreement were “national engineering bodies that felt that, on the basis of mutual knowledge, they had sufficient confidence in each other’s accreditation criteria and procedures that each would be willing to accept the accreditation decisions of the other signatories” (Hanrahan, 2009, p. 54). This tied the accreditation policies and criteria of these countries together in a new way, despite differences in their contexts. The Washington Accord has grown in scope and power over the nearly 30 years since in its inception. What was once an informal gathering of peers has become formalized through an international organization in its own right, with an explicit constitution and selection criteria for new signatories. There is also now a system of periodic monitoring and evaluation to ensure all signatories adhere to the ‘international standard’ in engineering accreditation, defined by the members of the Accord. The geographic, cultural and economic range of members has also expanded from the original Anglophone nations to include a number of East and South
Asian countries, including China and India, as well as European countries such as Russia and Turkey.

So, while there may be some internal pressures to broaden engineering education in light of the divergent career pathways of graduates, many countries have signed up to maintain a common approach to accreditation, and by extension, engineering curricula. In the late 1990s, the United States made a fundamental change to its accreditation system, shifting focus from tight control of the number of courses in each subject area to a broader notion of programmatic learning outcomes or graduate attributes (Lennon & Frank, 2014; Matos, Riley, & Akera, 2017; Volkwein, Lattuca, Harper, & Domingo, 2007). As Case (2014) puts it,

> The shift to outcomes-based accreditation [in engineering] falls in line with much current popular thinking in higher education and in society in general, which asks questions about what graduates can ‘do’ rather than more traditional perspectives that center on what graduates ‘know’. This also matches the current demand from the cash strapped industrial sector that has started to demand that graduates can deliver value from their first day in the workplace (Case, 2014, p. 144).

The engineering profession’s focus on learning outcomes assessment has been critiqued from within based on “the bankruptcy of outcomes-based education as a change strategy” (Riley, 2012). On the other hand, experts in quality assurance in higher education have pointed to the US system of engineering graduate attributes as an exemplar in the implementation of cutting edge principles of quality assurance: “The new approach to subject accreditation by ABET [Accreditation Board for Engineering and Technology] (Volkwein, Lattuca, Harper, and Domingo, 2007) have provided a potentially valuable model for the design of more objective external quality assurance assessments for universities as well… An important component of these approaches… is the adoption of a rigorous, evaluation methodology conforming to social scientific standards of evidence” (Dill & Beerkens, 2013, p. 13). The authors see engineering (and other examples of professional) accreditation as placing more weight on validity and reliability than traditional approaches through standardized procedures and protocols. This is a troubling proposition, as it latches onto a particularly technocratic and positivist understanding of accreditation and quality assurance. Before accepting this, much work needs to be done to
question and problematize the perceived neutrality of engineering accreditation, in the US and elsewhere.

Building on these interesting and important features of engineering accreditation, I have chosen to study the politics surrounding changes to accreditation policy in different contexts. Importantly, the analysis focuses more specifically on decision-making about changes to policy, with less focus on the complexities of implementing that change at multiple levels of the educational systems. The latter is crucially important future work, that requires a strong analysis of the institutional and organizational contexts that shape accreditation policy, the focus of this thesis.

Because of the policy alignment across countries through the Washington Accord, I study the adoption of outcomes-based accreditation in several different countries. The purpose is to learn from differences in how higher education is organized and the unique configuration of the engineering profession in each context. The chosen countries are Canada, United States, United Kingdom, South Africa, and Australia. All five are English-speaking liberal market economies with ties to the former British empire – four countries being settler colonies, and the fifth being the imperial capital itself.

On paper, and from a rational technocratic view of policy making (Enserink, Koppenjan, & Mayer, 2013), the core features of the accreditation system should be substantially equivalent in all five countries based on their long-standing membership in the Washington Accord. However, as I will argue in this thesis, there are complex contextual features that shape the system in which accreditation is embedded. These differences do not go entirely unnoticed by the defenders of the rational view of accreditation, as shown in the quote below from Patil and Gray (2009):

One concern regarding the advancement of Engineering Education Quality Assurance worldwide is the lack of uniformity in Accreditation standards and practices. For example, within the Washington Accord signatories, each country has individual accreditation processes and variations in accreditation criteria as well as different documentation requirements and reporting processes. In addition, in countries without a national accreditation organization the major concern for an institution is to select an appropriate accreditation body. And, there are variations in the visiting process, report writing or documentation, and assessment in these countries (Patil & Gray, 2009, p. 20).
What is missing here is a more critical analysis of the power and vested interests of key actors in the engineering profession that might be shaping or underpinning the bureaucratic features such as criteria, report writing or documentation focused on by Patil and Gray. The fundamental reason for choosing a comparative approach to this study is an assumption that context matters, combined with the observation that there is no satisfactory existing analysis of the political dynamics underpinning accreditation across countries in the Washington Accord.

1.4 Research Questions

The overarching question driving this research study is: Who are the powerful actors shaping national engineering accreditation policy within key countries in the Washington Accord? Within this broad umbrella, there are three sub-questions which guide the data collection and analysis in this thesis:

1) Whose interests are reflected in engineering accreditation policy in countries in the Washington Accord?

2) How are accreditation bodies structured and governed and what role do they play in debates about accreditation policy?

3) How have other actors exerted influence on accreditation boards to make or resist changes to accreditation policy?

Implicit in these questions is an interest in how context shapes the policy, practice and politics of engineering accreditation in different countries. The questions are formulated so that they can be posed first of individual countries, and second in a cross-national comparative context, to understand key similarities and differences. The primary purpose of this research is to deepen the collective understanding of the politics of accreditation, and in the process to contribute to knowledge at the intersection of the sociology of professions, quality assurance in higher education, and engineering education specifically. A secondary purpose is to help actors involved in the accreditation process learn from each other’s experiences, and to understand their own reality better, thus leading to potential improvements in practice (Kandel, 1955).
1.5 Organization of the Thesis

Having introduced the core problem in Chapter 1, and the rationale for focusing on engineering accreditation, in Chapter 2 I develop my conceptual framework. This framework draws on literature on quality assurance in higher education to frame the political dimensions of quality, such as who defines quality and how is this enforced. It also incorporates the neo Weberian perspective on sociology of professions to show how much engineering legislation is based on an assumption or ideal of social closure. Finally, Chapter 2 elaborates an analytical framework drawing on pluralist political theory to unpack the different sources of power and interests of key interest groups involved in accreditation policy. Chapter 3 lays out the research design, from the interpretivist ontology to the pluralist political theory to the specific methodological steps taken to gather and assess relevant literature and policy documents. Chapter 4 is the longest section, focusing on describing the key features of each of the five countries in the study. Sub-sections include comparable information on all aspects of the engineering profession, with emphasis on the governance of accreditation and major changes in recent decades. Chapter 5 shifts to a comparative analysis, looking across all five countries to answer the research questions and to investigate how differences in context shape accreditation policy change, then returning to the role of the Washington Accord in shaping policy globally. Chapter 6 connects the analysis back to the relevant literatures, synthesizes major findings and lays out an ambitious research agenda for future studies to investigate the complex interactions involved in implementing accreditation policies.
Chapter 2
Conceptual and Analytical Framework

This chapter lays out the theoretical concepts that underpin the thesis. To set the groundwork, I review the history of professional accreditation, paying attention to the key terminology and assumptions that constitute engineering accreditation in particular. Next, I review two important but disjointed bodies of literature that situate accreditation in a theoretical place within the profession of engineering and the institution of the university. The first is the sociology of professions literature, which I use to connect to the broader process of social closure used to limit access to the profession. This links the exclusionary role of universities to the broader ‘professional project’ whereby professional bodies seek to obtain legitimacy and a legislative monopoly from the state. Second, I review the literature on quality assurance in higher education, which frames accreditation as another means to improve the quality of professional education. I give particular weight to the notion of the politics of quality assurance. What these bodies of literature lack are analytic tools to investigate interactions and differences in power among actors both inside universities and in professional bodies. To address this, I finally introduce pluralist political theory as the main framework for understanding the politics of interest group representation within accreditation bodies. I lay out the critical assumptions and limitations of this frame, while arguing for its relevance in my analysis which sits at the intersection of higher education and the professions.

2.1 Engineering Accreditation: History and Terminology

Lee Harvey defines accreditation as “the establishment or restatement of the status, legitimacy or appropriateness of an institution, programme or module of study” (Harvey, 2004, p. 208). In this sense, accreditation is a particular form of quality assurance, distinctive in its focus on minimum standards. Put another way, accreditation is defined as “institutionalized and systematically implemented evaluation schemes that end in a formal summary judgement that leads to formal approval processes regarding the respective institution, degree type and/or programme” (Schwarz & Westerheijden, 2004, p. 2). We see from this definition’s emphasis on formality and judgment that accreditation can have high stakes for the organizations involved.
In most countries, regional or national quality assurance agencies are responsible for institutional accreditation of colleges and universities, providing these institutions with a license to operate (Harvey, 2004). This is different than programme accreditation, which deems that graduates have professional competence to enter practise: “Usually graduation from an appropriately accredited academic programme is a preliminary step and full professional certification, and thus a licence to practice, follows only after some period of work experience” (Harvey, 2004, p. 208). Accreditation can also be state-sanctioned for certain professions, meaning that by law all programmes for a certain profession must be accredited. This is not always the case for engineering, where programme accreditation is typically voluntary on the part of institutions, even though in practice nearly all universities seek it.

Programme accreditation in engineering is conducted by teams of disciplinary experts (e.g. a group of senior mechanical engineering professors along with some active professional mechanical engineers) who will review the curriculum in detail, along with the qualifications of the instructors, and examples of student exams and projects. This is a labour-intensive process that happens once ever 3-6 years, depending on the country, and requires each department to first conduct an extensive “self-study” in a format prescribed the professional body, and later host a team of visiting experts for 2-3 days. Ultimately the visiting teams will report their findings back to the institution (privately) and to the overarching accreditation body which will make the final accreditation decision – granting full accreditation or requiring certain changes be made before doing so. It is very rare for programmes to be denied accreditation outright, and much more common for ‘provisional’ or ‘contingent’ accreditation to be given, pending major changes. In these cases, the time between visits is shortened – from five or six years down to three years – until the visiting teams have been satisfied.

Engineering is a self-regulating profession in most liberal market economies, and so professional regulatory bodies set their own national criteria for accrediting undergraduate programs that feed into their overall standards for competence for licensure. Regulatory bodies rely on accreditation to later license engineers when they meet their other requirements, such as supervised practice, and passing ethics exams and technical exams.

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1 These other requirements vary widely by country and are elaborated in Chapter 4.
Engineering accreditation first emerged both in the United States and in France in the 1930s. In their review of the history of engineering accreditation, Gray, Patil and Codner (2009) trace this history and the spread of the US model of engineering accreditation into Europe particularly in the last few decades, in parallel with the Bologna Process. They claim that at its core, “accreditation was a peer-review process based on professional authority gained through experience and, as such, the power was in the hands of professional educators (Gray 2002)” (Patil & Gray, 2009, p. 8). This glosses over a more fundamental tension in engineering education, explained by Case as the tension between the “shop culture” of working engineers and the “school culture” of engineering academics (Case, 2016). There are fundamental differences in the conceptions of engineering knowledge and expertise between these two groups.

Nonetheless, at a global level there is integration and alignment among engineering accreditation systems through the Washington Accord, explained by Hanrahan (2009):

The Washington Accord came about because six national engineering bodies felt that, on the basis of mutual knowledge, they had sufficient confidence in each other’s accreditation criteria and procedures that each would be willing to accept the accreditation decisions of the other signatories. Graduates of a programme accredited by one signatory would be recognised by the others (Hanrahan, 2009, p. 54).

The Washington Accord was first signed in 1989, by Canada, US, UK, Ireland, Australia and New Zealand. Since then, more than a dozen other countries have become signatories. There have also been crucial shifts in the focus of engineering education that have become codified in accreditation criteria. In the late 1980s, “the prevailing engineering education paradigm emphasized curriculum structure, content and the technical depth achieved” (Hanrahan, 2009, p. 55). This changed in the 1990s as educators came to believe that competencies and the ability to learn on the job, were just as important as the core engineering knowledge that had been the traditional focus. This was manifested in a focus on outcomes, rather than just inputs, in accreditation criteria. Some argue, as Case did in the quote in the Introduction to this thesis, that this shift is reflective of a greater influence from employers who want to hire ‘work-ready graduates’.

As a group, the countries in the Washington Accord undertook their own individual as well as joint studies to define “the globally relevant attributes which graduates from accredited
engineering programmes are expected to possess” (Hanrahan, 2009, p. 58). So far, we are mostly citing from the book *Engineering education quality assurance: A global perspective* (2009) which presents a useful historical overview of engineering accreditation. However, a crucial weakness of this source is its unproblematic articulation of the ‘consensus’ around outcomes-based education. Critical scholars point to the insidious ways that outcomes or competency-based education have the potential to undermine the knowledge foundations of a profession or vocation (Lasnigg, 2012; Wheelahan, 2009). Specific to engineering and the Washington Accord, others have called it out as a sign of educational imperialism on behalf of the United States which was the first to adopt outcomes-based education, and had much to gain from convincing other countries to follow (Akera, 2017; Matos et al., 2017). A deeper exploration of the events leading to the signing of the Washington Accord, and the widespread adoption of the US-model of outcomes based education are beyond the scope of this thesis, but deserve study in their own right.

The purpose of this section was to define accreditation and put it in a very brief historical context, however simplified. The most important takeaway is that the core logic and purpose of accreditation undertook a major shift in the 1990s and that the Washington Accord played an important role in accelerating the diffusion of that shift across countries. I now shift to exploring different theoretical and conceptual frames for understanding accreditation, to avoid the trap of assuming it is merely a rational decision-making mechanism explained by structural functionalism (Enserink et al., 2013).

### 2.2 Accreditation and Social Closure

Engineering is not unique in using accreditation as a mechanism to control higher education degree programs to meet the needs of professional bodies. As Harvey and Mason explain in their comprehensive review of more than 70 professional and regulatory bodies in England:

> Control has been based on the need to ensure that the new recruit is sufficiently well versed in the 'esoteric' knowledge required to carry out the professional role. It is control over the expert, esoteric knowledge, which perhaps affords the profession their power and privilege. The delegation of control of the profession to the professional body ensures that they have considerable power and autonomy. (Harvey & Mason, 1995, p. 16)
To explore this conceptual framing, we first step back to consider what it means to be a profession. The term ‘profession’ is highly contested and has been the subject of a vibrant scholarly debate over the past century (Abbott, 1988; Gorman & Sandefur, 2011; Muller & Young, 2014b). The search for a conclusive definition has frustrated and exhausted numerous sociologists, as professions have been analyzed from functionalist, interactionist, Marxist, Foucauldian and neo-Weberian perspectives. Functionalists led with a ‘trait’ approach that emphasized lists of positive characteristics such as expert knowledge, service to society and high status (Parsons, 1939), while interactionists later challenged and questioned the validity of these broad strokes assumptions through studies of professionals at the micro level (Becker, 1962). Marxists (Braverman, 1998), Foucauldians (Nettleton, 1992) and others used power lenses to question and challenge the control and authority vested in professionals due to their esoteric knowledge base and supposedly superior ethics. For this thesis, I take the neo-Weberian approach as my analytic entry point because of its flexibility and emphasis on macro politics (Saks, 2016).

The neo-Weberian approach builds on the early work of Max Weber who argued that “social groups engage in social closure in the course of furthering their social interests and they both attempt to exclude others from their group and to usurp the privileges of other groups” (Macdonald, 1995, p. 27). In the context of professions, this takes the specific form of “exclusionary social closure in the marketplace sanctioned by the state” (Saks, 2012, p.4). It is important to note that closure is broader than just the market, as (Macdonald, 1995) spells out clearly:

The occupation and its organization attempts to close access to the occupation, to its knowledge, to its education, training and credentials and to its markets in services and jobs; only ‘eligibles’ will be admitted. In so doing it may well exclude those of a particular race, gender or religion and thus play a part in the structured inequality of society (Macdonald, 1995, p. 29).

These critiques articulate a critical sociological perspective on why professions, engineering included, are sites of substantial inequity and marginalization. In this way, the neo-Weberian perspective focuses our attention at the meso and macro levels of analysis, away from the micro level of individual professionals:
Professionalization is a socio-political process, involving power and interests in the market at a macro level… Explanations of professionalization therefore are sought less in concrete knowledge and expertise and more in a profession’s tactics of competition and the prevailing socio-economic conditions (Saks 2012 p. 6).

While Saks argues for a largely political explanation of professionalism that downplays knowledge and expertise as part of credentialist ideology, other neo-Weberians integrate knowledge into the core of professional influence (Halliday, 1985). Halliday (1985) explains that the “knowledge mandate of a profession comprises its capacity to exert influence in virtue of the substance, form, transmission, efficacy, mobilization, objects and legitimacy of its cognitive core” (p. 422). This particular framing is built on Halliday’s analysis of six professions, including engineering, and he integrates Saks’ interest in politics of occupational monopoly with the central role of knowledge: “It [the knowledge mandate] is an epistemological warrant for public influence mediated by occupational and organizational politics” (p.422).

The ultimate sign of legitimacy for a profession is exclusionary social closure, when governments develop legislation that requires individuals to obtain a professional license to practice a specific type of work. In this way, the members of that profession are sheltered from competition in the labour market, with “entry to the profession usually gained through obtaining relevant higher education credentials” (Saks 2012 p.4).

This highlights the role of universities in selecting and developing new entrants to a given profession and equipping them with access to the underpinning knowledge base. It also helps us understand the purpose of accreditation from the perspective of the professional body. Returning to Harvey (2004), “professional accreditation is even more about control. It is about an external agency maintaining control of a subject area that links into professional employment, especially where to practice requires certification separate from academic qualification” (Harvey, 2004, p. 211)

There is a widespread assumption in Anglo-American contexts that accreditation exists to align the focuses of professional education in universities with the needs of professional bodies and ultimately employers, where professionals go to work. The neo Weberian perspective provides an underpinning assumption for legislation whereby the state delegates regulatory power to the professional body in return for a commitment to serving the public good and upholding high
standards of ethics. This assumes a very clear definition of the scope of practice being regulated, and proactive steps taken by the professional body to intervene and discipline their members if they malpractice or operate without a license. Interestingly, neither of these assumptions appear to hold well in the case of the engineering profession, which raises questions about what happens when the legislative protection over the scope of practice weakens? Do professional bodies cease to be relevant, and does accreditation truly become voluntary for universities? Harvey (2004) proposes that “sometimes, despite having no regulatory power, the professional body is so well established in the profession that is impossible to gain work in some areas without it” (p. 211).

This research contributes to answering these questions by exploring how professional bodies in different countries have protected or eroded the scope of engineering practice, and how the massification of engineering education has complicated the social contract between universities, professional bodies and the state. The other theoretical issue of concern from the sociology of professions is what happens to the foundational knowledge base of the profession as accreditation shifts to an outcomes-based model in many countries? That is a much bigger question that cannot be answered from a macro political analysis alone, and will require data collection at lower levels using theoretical frameworks from the sociology of education and the sociology of knowledge – a task for future studies.

Ultimately, the concept of social closure helps us see how accreditation can link engineering education with professional licensure and practice, giving weight to professional bodies in shaping the curriculum to meet their requirements. This view implies that autonomy and control is shifting away from engineering academics who lead departments, run programs and teach courses. This is in direct contrast to the assumptions of much of the quality assurance literature, which posits that faculty members retain control over shaping the implementation of curricula and by extension, ensuring or enhancing quality.

2.3 Accreditation and Quality

In contrast to framing accreditation in terms of contributing to social closure, the quality assurance literature looks at engineering education as a process largely controlled by faculty members embedded in universities, with accreditation as one of several ‘external’ requirements that must be met. This is linked to state and public demands for accountability for public
spending, a topic covered in depth in the literature on quality assurance in higher education (Stensaker & Harvey, 2010).

Massification of higher education globally has caused changes to the relationship between governments and higher education institutions. Scholars trace the growth in government expenditures on higher education and the expansion of private non-university sectors to increasing calls for accountability for public expenditures (Dill, 1999; Stensaker & Harvey, 2010). Calls for accountability have in turn spawned the growth of quality assurance and assessment organizations, processes and activities. Rhoades and Sporn (2002) trace connections between developments in the United States and Western Europe, as the ‘American model’ of quality assurance, developed much earlier because of the historical autonomy of institutions, was adopted and adapted by numerous European countries in the 1980s and 1990s. This American model is very similar to engineering accreditation processes in its focus on self-study, external review teams conducting site visits and ultimately providing a confidential report first to the program/institution, and after revision, to an external agency. Ultimately, the macro changes in the political and public policy landscape have led to more calls for accountability, and an overall decrease in the trust in higher education’s ability to reliably govern itself.

If we want to understand quality, we need to connect it with other concepts in broader theoretical frameworks. Clark (1997) was vocal on the fundamental forces changing higher education from within – disciplinary specialization, acceleration of knowledge growth, and fragmentation – which he argues keep universities bottom-heavy with the most authority in the basic units (programs and departments) because of their specialized knowledge. In citing Ewell, Clark questions the ability of any outside body to significantly influence the internal practices of basic units and claims “that quality happens, and is best assured, at the level where the work happens” (Ewell, 1992 cited by Clark, 1997, p. 97) – namely the basic academic unit. We can see in this view a stark contrast to the assumptions of the ‘social closure’ perspective which position faculty members as serving the needs of industry and the profession in which they are preparing future professionals.

Van Vught and Westerheijden (1994) identify five basic quality assurance mechanisms with broad similarity across contexts: independent agencies, self-assessment, peer review with visits, reporting results and links to decision-making and resources allocation. The majority of these
mechanisms are part of engineering accreditation. However, as research by Dill and Beerkens (2013) shows, different policy tools in different contexts can have drastically different degrees of effectiveness depending on how they are implemented. This speaks to the importance of the comparative nature of the thesis: the same criteria or processes may work very well in one context, and fail miserably in another because of organizational, cultural, historical and political factors.

There appears to be a deep-rooted disagreement among key scholars about the impact of external quality assurance in higher education. At the heart of this debate is a question: To what extent, and in what ways, do external quality assurance mechanisms affect teaching and curriculum development by faculty members in universities?

Clark and Dill take a stance that there is, or should be, very little actual effect. Burton Clark comes at this building on his years of fieldwork interviewing faculty members (Clark, 1987), and developing a powerful multi-level theory of higher education (Clark, 1983). He argues that there are so many levels of buffering, and so much authority at the level of basic units, that any externally driven or imposed system of quality improvement will not have any meaningful impact. David Dill comes at this as a quality expert, having supported a major research program investigating frameworks and tools for assuring academic quality. In a crude simplification, Dill finds that “academic programs designed by and whose standards are assured through the collective actions of knowledgeable faculty members” (Dill & Beerkens, 2013, p. 15) will be the most effective, thus supporting Clark’s view that universities are, and should continue to be, “self-guiding societies”. Dill (1995) elsewhere draws skillfully on an influential early quality thinker, Deming, to make a similar case: It is the coordination and integration among actual producers (faculty members themselves in the case of higher education) that leads to the majority of quality improvements, not external systems of quantification, measurement and control.

These theoretical arguments made by leading scholars in the field of higher education pose fundamental challenges to the logic underpinning engineering accreditation.

Skolnik (2010), Trow (1993) and other scholars tend to argue the opposite: Quality assurance has material effects on the work of academics, and much of this is negative. Trow (1993) argues that the rise of managerialism, using the case of England, has shifted the power from academics to administrators. Stensaker and Harvey (2010) provide critical analysis of how the rising focus on
accountability adds power to managers at the expense of academic workers. Skolnik (2010) also highlights the reality of many academics, who provide significant input into the black box of quality assurance, and then must sit and wait for the results to come out, which may have material impact on their work or even their jobs.

Finally, while numerous scholars have called for a better investigation at the meso and micro levels of analysis, Rhoades and Sporn (2002) state it most clearly:

Future research needs to explore in much greater detail the implementation of various quality assurance and strategic management practices. Formal legislation and policy are one thing. Actual practices ‘on the ground’, in academic departments and faculties, are quite another (Rhoades & Sporn, 2002, p. 384).

Professional programs are unique in that there are often national bodies that accredit them, distinct from the regional quality assurance agencies that accredit higher education institutions themselves. Dill repeatedly points to professional programs as being on the leading edge of quality assurance and improvement. Dill and Beerkens (2013) reviewed 14 different quality assurance mechanisms and point to teacher accreditation and engineering accreditation as standout examples, both from professions. We can thus see the significance of further research on the operationalization of engineering accreditation, as quality assurance scholars position it as a source of policy lending from which the broader higher education field will borrow.

From a theoretical perspective, there is important ground work to do in explaining the key actors that shape professional accreditation, including professional associations and bodies and the accreditation boards themselves. Looking at the governance of engineering education in Canada, the US and the UK, each accreditation agency is comprised differently, and is linked to different requirements for licensure: These nuances are documented in great detail in Chapter 4, adding substantially to the sparse literature on the topic.

Studying engineering accreditation provides an opportunity to look in greater detail at the specific mechanics of quality assurance implementation, because programs are the unit of analysis, rather than an entire institution. The other feature that makes this particular quality assurance mechanism interesting is the focus on curriculum and learning outcomes assessment. Because of the desired tight coupling with licensure processes, professional bodies are concerned
that graduates of accredited professional have demonstrated specific competencies. This differs from governmental quality assurance agencies which have less of a stake in the specific learning outcomes of all graduates of a higher education institution.

In the early 1990s, Harvey and Green (1993) highlighted how multiple, conflicting definitions of quality are used interchangeably in higher education. They note that each stakeholder has a different definition: quality as exceptional, quality as perfection, quality as fitness for purpose, quality as value for money, and quality as transformative. Skolnik (2010) picked up this line of thinking and framed quality in political terms as a competition for scarce resources in which different coalitions or factions use their own definitions to frame the debate and fight for power. Skolnik uses Ontario to map out the historical shifts between an academically-defined version of quality, which focuses on the resources required for ‘quality’, to a government-defined version, which focuses on ‘quality’ as demonstrated by learning outcomes. Skolnik warns that faculty are woefully underrepresented in the governance processes associated with quality assurance. Another voice on the politics of quality is Neave (1994), showed how massification of higher education in Europe was fundamentally changing the labour markets and occupational pathways for increasing numbers of graduates. He posited how the private sector sought to influence HEIs to have more consistency and conformity among graduates – to make for a more predictable supply of labour. This argument has particular relevance when looking at engineering accreditation where an explicit goal is often preparation for professional practice in a “closed” labour market (Saks, 2012). At the same time, professional accreditation shifts the power dynamics at a macro level by introducing another perspective altogether, that of professional regulatory bodies, rife with their own political interests and positioning:

Professional and regulatory bodies (PRBs) play three roles (Harvey & Mason, 1995). First, they are set up to safeguard the public interest. This is what gives them their legitimacy. However, professional bodies also represent the interest of the professional practitioners and here they act as a professional association or trade union (including legitimating restrictive practices), or as a learned society contributing to continuous professional development. Third, the professional or regulatory body represents its own self-interest: the organisations act to maintain their own privileged and powerful position as a controlling body. This is where control legitimated by public interest becomes confounded by control based on self-interest (Harvey, 2004, p. 212).
This overview by Harvey is powerful in its teasing apart of the different roles and dynamics between and within professional and regulatory bodies. As will be explored in Chapter 4, engineering professional bodies vary in whether they disaggregate or consolidate these different functions: learned society, interest group, trade union, and regulator.

While state quality assurance bodies are likely to frame quality as value for money or quality as learning outcomes (Skolnik, 2010), professional bodies are more likely to define quality as fitness for purpose. In this case, their stated purpose is an appropriate supply of highly qualified professionals who meet the regulatory requirements of the licensing body. This perspective is borne out in a survey of accounting professors in Australia and New Zealand which focused on faculty members’ experiences with and perspectives on quality assurance in accounting education (Watty, 2005). Watty found that “The attribute ranked 1 is designing a program to suit the requirements of the accounting profession” (Watty, 2005, p. 123). This was corroborated by responses to another question in the survey that focused on definitions of quality from Harvey and Green (1993): “respondents ranked fitness for purpose 1 (70%) and value for money 2 (63%), when asked how quality in accounting education is currently promoted in their schools/departments” (Watty, 2005, p. 123).

In summary, by positioning accreditation within the literature on quality assurance, we can see the broader range of definitions of quality and how different stakeholders will use a definition that further their interests. We also pay more attention to the ways that individual faculty members might use their professional authority to maintain influence over the curriculum and pedagogy. This links to questions of control and decision-making, to understand the extent to which faculty members retain their autonomy, or are forced to fit into a ‘system’ imposed from outside. As Harvey states so succinctly, “accreditation is a struggle for power and it is not a benign process” (Harvey, 2004, p. 221).

2.4 Pluralism as an Analytic Framework

We now shift to developing an explicit analytical framework for understanding how the politics of engineering accreditation unfold in different national systems. My overarching argument in this thesis is that pluralist theory explains how different national-level interest groups interact to shape decision-making about engineering accreditation policy.
Before diving into the specific political theory, it is important to explain why a political analysis is so important to understanding accreditation. Organizational scholars Bolman and Deal present a powerful simple way of understanding organizations through four distinct frames, or paradigms: structural, symbolic, political and human resources. I argue that much of the practice, policy and even research on engineering accreditation implicitly operates in the structural frame, making it particularly hard to critique. The structural frame is based on assumptions that

> Organizations exist to achieve established goals and objectives… suitable forms of coordination and control ensure that diverse efforts of individuals and units mesh… organizations work best when rationality prevails over personal agendas and extraneous pressures (Bolman & Deal, 2003, p. 47).

In this view of the world, problems come from structural issues, and they can be remedied through analysis and restructuring. In contrast, as I showed in the development of my conceptual framework earlier in this chapter, I believe accreditation is much better explained through the political frame which views organizations as arenas that host contests of different interests:

> Organizations are coalitions of assorted individuals and interest groups…[with] enduring differences in values, beliefs, information, interests, and perceptions of reality… Scarce resources and enduring differences put conflict at the center of day-to-day dynamics and make power the most important asset… [and so] Goals and decisions emerge from bargaining and negotiation among competing stakeholders jockeying for their own interests (Bolman & Deal, 2003, pp. 194–195).

The particular decisions I am interested in investigating relate to making changes to accreditation criteria and the broader legal and organizational frameworks that underpin the engineering profession in different countries. With these assumptions clarified, a particular political theory, pluralism, can now be explained as the basis for the analysis in this thesis.

Pluralism is based on the assumption that power is dispersed across different groups in society and not heavily concentrated in any one group (Dyck, 2004). This basic premise is problematic for thinking about the distribution of power in society as a whole, given widespread agreement on increasing inequality in liberal market economies (Marginson, 2016), both economically and
more widely. Nonetheless, pluralism still has significant utility for understanding the distribution of power and the dynamics of decision-making *within* an elite segment of society.

Within the engineering profession, we can explore the “assertion that power is distributed among a ‘plurality’ of power centers… which include political parties, interest groups, voters, associations” (Dobratz, Waldner, & Buzzell, 2015, p. 11). For engineering, these power centers are professional and regulatory bodies, their national associations, employers, learned societies, councils of deans of engineering and engineering faculty members themselves. As Ball and Peters explain, “decisions are seen as the outcome of bargaining between influential groups… [that] interact to produce an overall consensus, at the elite level and beyond” (Ball & Peters, 2005, p. 38). This view places emphasis on differences in power between groups, and the role of an elite sub-group that has more control over decision-making.

To adapt pluralism to the internal workings of the engineering profession, the notion of the state needs to be reinterpreted in our context. A core premise of the neo-Weberian approach to studying professions is the state-sanctioned monopoly on practice that is secured through a regulative bargain: the profession commits to self-regulate, adhere to a high standard of practice and ethics, and in turn the state agrees to give it exclusive right to practice, thus obtaining a virtual monopoly (Adams, 2010; Macdonald, 1995). What this means is that when licensing laws are enacted, the state has effectively delegated this power to the professional regulatory body. In other cases, where social closure (licensing laws) is weak or non-existent, professional bodies still have power derived from the size and strength of their underlying constituency. In this context, professional bodies are also referred to as ‘peak bodies’ signaling their ability to negotiate and influence as the top of a large ‘pyramid’ of members. In other countries, the legislative bargain is being reconsidered as the relevant government agencies consider changes to legislation and redrawing the boundaries of accountability for professional regulation.

Building on the assumption that some national engineering associations act as a proxy for the state, I consider how these organizations “act as a structure that retains legitimate power (authority) to guard the rules of the political [governance] process” (Ball & Peters, 2005, p. 11). A clear example of accreditation boards performing this “neutral” broker role is when the US Accreditation Board for Engineering and Technology (ABET) hosted several national-level roundtables with key stakeholders in the 1990s as part of revising its model, or when the
Canadian Engineering Accreditation Board (CEAB) hosted a Forum on Accreditation in 2016 in an attempt to build consensus on the purpose and vision for accreditation. The emphasis on different actors (such as the aforementioned power centers of accreditation bodies, professional bodies, councils of deans etc.) having input in decision-making about accreditation policy and criteria signals the intention to create space for a pluralism of different perspectives.

Using pluralist theory for this analysis is not foolproof. On the one hand, the elite decision makers in engineering at times will seek out and consider the perspectives of interest groups, and invest resources in the claims put forward by particularly vocal and powerful groups. On the other hand, in each country there is ultimately a discrete number of “elite” voting members on accreditation boards which have the final say in whether or not to make changes to accreditation policy. A major weakness of pluralism is that it fails to explain the absence of the voice of individual engineering faculty members, so important in the quality assurance literature. Faculty members in most countries lack mechanisms for organizing nationally despite being one of the most influential and impacted stakeholders in any policy change in this realm. Some might argue that deans represent the interests of their faculty members. However, in Canada at least, research shows how contracts and collective agreements align deans structurally with central administration and management more than faculty members (Boyko & Jones, 2010; Favero & Bray, 2010). Thus, faculty members are excluded from decision-making about national policy because they don’t have “equal access to political groups and associations” (Ball & Peters, 2005, p. 13) compared to other interest groups.

In sum, pluralism can help us analyze the bargaining tactics and political positioning of actors within a specific context such as the engineering profession in a given country. It can also begin to explain the meditative role of certain national associations. We will return to pluralist theory in Chapter 3 to explain the analytical strategy chosen for unpacking the interests and sources of power of different interest groups in the five countries in this study.
Chapter 3 Research Design: Methodology and Data Sources

This chapter lays out the logic and strategy of the research design, starting with how the research questions link with the choice of countries. It then moves on to the methodology that links data to research questions, data collection methods and the analytic strategy. Finally, I consider my positionality and reflexivity as researcher.

3.1 Choice of Countries

The goal of this thesis is to investigate the key differences that shape engineering education and accreditation in different Anglo-American countries that are signatories to the Washington Accord. The factors investigated, which are detailed in the research sub-questions, explore how accreditation is influenced by the broader structure and function of the engineering profession, and to a lesser extent, aspects of the higher education sector in the country in question. The five countries included in this analysis are Australia, Canada, United Kingdom, United States and South Africa.

The basic logic of the Washington Accord is that accredited programs are substantially equivalent to each other and that they produce consistent graduate attributes (outcomes). Its signatories, national organizations that provide accreditation to programs in higher education institutions (HEIs), might be expected to have many similarities in their structure, culture, and operations, so that ultimately their programmes and graduates would be ‘equivalent’. By choosing countries who are signatories to the Washington Accord, there is a reasonable expectation of comparability in the operations of the accreditation bodies.

Another dimension of similarity, or comparability, is the nature of professionalism, across countries. Broadly speaking, scholars of the sociology of professions point to two different

2 The Washington Accord and its history is explained in more detail in Chapter 2.1
models of professionalism: the “Anglo-American” model and the “Continental” model\(^3\). For the purpose of this thesis, I have focused on five countries that are more Anglo-American than they are Continental.

From a historical perspective, all five countries have complex relations with the British Empire, which is significant to the way that the engineering profession developed. Other historical works have traced the migratory impacts of British engineers in particular spreading ideas about engineering education throughout the world (Buchanan, 1986). The United Kingdom’s engineering professional institutions have the longest history, followed by the American professional societies (Buchanan, 1989; Layton, 1971). These professional bodies have their own complex set of relationships internal and external to the country in which they formed, and as will become clear, they also have a stake in engineering education and accreditation.

With these parameters and criteria in mind, it is important to explain why other countries have been omitted from analysis. The two main Anglo-American signatories that have been excluded are Ireland and New Zealand. Both were original signatories to the Washington Accord, and both have close linkages to their larger neighbor country – the United Kingdom and Australia respectively. The two main reasons for their exclusion are their size and similarity. Both have a small population (less than 5 million each) and small university sectors (less than 15 universities with accredited engineering degrees in each). In addition, both have evolved either from, or closely alongside, larger systems in the UK and Australia. As such, it was deemed that there would be limited additional insight from including them in the study.

With the set of countries established, we can now explain the methodology and design of the study.

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3.2 Methodology: Literature Review and Document Analysis

My understanding of methodology follows Creswell’s (2013) idea: Methodology is the logic and strategy of action that connect the choice of methods to collect and analyze data. Ultimately it must satisfy the knowledge claims of the chosen paradigm of the researcher.

I position the engineering profession as made up of competing interest groups who use the power available to them to pursue interests on behalf of their members (Dobratz et al., 2015). However, I assume there is more than a narrow economic notion of interest that will drive the strategies and tactics of different interest groups (Lowery & Gray, 2004).

The methodology for this thesis is a selective literature review and document analysis with a focus on breadth across different types of sources. Given the major gaps in the literature, I have looked for the most relevant sources in different forums to build up a comparative understanding of the five countries investigated. Revisiting the research questions introduced in Chapter 1, the overarching question driving this study is: “Who are the powerful actors shaping national engineering accreditation policy within key countries in the Washington Accord?” Given the challenge in answering this directly, the three sub-questions are more operational and linked to the data I have collected for the study.

Sub-question 1, “Whose interests are reflected in engineering accreditation policy in countries in the Washington Accord?” reflects the pluralist theoretical perspective. This question is answered through an analysis of the set of tables in Chapter 4 which draw on published literature, websites, policy documents and legislation for different actors in each country. The nature of the knowledge claims made here are far from certain, absolute or universal. I make tentative claims that must be tested further in future research including interviews with and observations of the actual actors in their context. What I do contribute through this analysis is a much stronger understanding of the differences between actors within a single country, and differences between countries in the distribution of power and influence across actors.

Sub-question 2, “How are accreditation bodies structured and governed and what role do they play in debates about accreditation policy?” follows from the data presented in response to sub-question 1, but gets more specific and technical with respect to accreditation bodies. In all cases this includes a close reading of legislation and constitutions of accreditation bodies (or their
organizational homes) to understand who makes decisions, how people are appointed or elected, and some of the internal organizational configurations such as the division of labour between policy making and policy implementation. There is extremely sparse published literature that takes an organizational view on the inner functioning of engineering accreditation bodies. One notable exception is the recent conference paper analyzing the organizational and historical features of the Accreditation Board on Engineering and Technology (ABET) in the United States (Matos et al., 2017). The second part of this sub-question – the role that accreditation bodies play in debates about policy – creates space for a conceptualization of these bodies as ‘arenas’ for political influence.

Sub-question 3, “How have other actors exerted influence on accreditation boards to make/resist changes to accreditation policy?” is the most challenging to answer adequately using solely documentary data sources. In this case, I have reached beyond scholarly literature to use internal publications (e.g. magazines published by professional bodies), formal letters written to government inquiries (e.g. in response to public consultation), and in a few cases national newspaper stories. Similar to sub-question 2, the most compelling published evidence of a clear historical analysis of how different actors shaped accreditation policy comes from the United States, notably a very recently published article by Atsushi Akera, a historian of science and technology studies (Akera, 2017). In some countries, such as Australia and South Africa, the nature of the political struggle takes place at an even higher level, relating to the governance and legitimacy of the actors that operate accreditation. This drifts slightly from the research question’s focus on “accreditation policy” but still contributes greatly to the understanding of the broader contextual dynamics shaping accreditation which are at the heart of this thesis.

3.3 Data Sources and Collection Methods

To expand on the broad methodological strategy articulated earlier, I will now give more specific details of the methods I used to search for relevant articles, and the sources I consulted to find relevant data. In my first pass, I used high-level, generic search strings to identify crucial works in the literature that have been highly cited. These terms included “accreditation”, “engineering education”, “quality assurance”, “Washington Accord”, and the names of the specific countries. As I developed my understanding of the key actors in each country, I got more specific in my searches, using the official names and acronyms of the relevant accreditation bodies such as
“Accreditation Board on Engineering and Technology”, (“ABET”), “Canadian Engineering Accreditation Board” (“CEAB”), “Engineering Council UK”, “Engineering Council of South Africa” (“ECSA”). I did the same with the keywords related to each country’s specific policy: for example, for Canada I searched “Accreditation Units” (AUs) and “Graduate Attributes” (GAs), while for the United States I searched for “EC2000”, and for the UK I searched for “UK-SPEC”.

There were two distinct sets of publications or journals that I consistently searched. The first group is higher education publications, both general and specific to quality assurance. The journals I searched in were Quality in Higher Education, Quality Assurance in Education, Assessment & Evaluation in Higher Education, Higher Education, Higher Education Policy and Management, Higher Education Policy, Research in Higher Education, and Higher Education Review. These tended to yield more conceptual and generalized studies that informed Chapters 1 and 2 of the thesis, with a few exceptions where engineering education studies were published in these journals (Volkwein et al., 2007). The second group of publications was engineering education journals and conference proceedings, which were fragmented and difficult to search, but yielded many more sources. The main journals I searched were Journal of Engineering Education, European Journal of Engineering Education, and Australian Journal of Engineering Education. Each of these journals is run by the relevant engineering education society or association, which publish a much larger number of conference papers (relative to journal articles) each year: the American Society for Engineering Education (ASEE), the European Society for Engineering Education (SEFI), the Australasian Association for Engineering Education, and the South African Society of Engineering Education (SASEE). Canada does not publish a journal, but does publish extensive conference proceedings from the Canadian Engineering Education Association (CEEA). The lack of an equivalent national association in the United Kingdom was troubling, and it wasn’t until late in the research process that I discovered the Engineering Professors Council (EPC) which ran its first small national conference for engineering education in 2017, with short proceedings.

Some of these proceedings are not searchable, and in these cases I downloaded the pdf files for an entire year’s proceedings and searched using many of the same keywords. On the whole, my goal was not to do a complete or comprehensive review of all the literature on engineering education, but rather to locate relevant sources that shed light on my research questions to
balance breadth and depth across the five countries. In this sense, the ability to look at the conference proceedings on a national or regional basis was quite helpful. It also revealed some very interesting patterns of who chose to publish or present which papers outside of their home country – potentially a tactic for developing more critical arguments, particularly about the politics of accreditation. For example, the paper titled *Do statutory and professional bodies in South Africa threaten academic freedom at universities: A perspective from the engineering profession* (de Jager & Emuze, 2014) was presented in Australia rather than South Africa.

What was striking about the review of the scholarly literature was the rarity of clear analyses of the organizational actors involved in accreditation and the engineering profession more broadly, let alone a critical or theoretically grounded study. This led me to search original documentary sources to gather information on the key actors in each country. For each country, I started with the accreditation body named in the Washington Accord, and systematically searched its website to download relevant accreditation policies, organizational histories, annual reports, and governance documents if they were available. Most countries had a long and detailed accreditation manual describing procedures for different stakeholders – these tend to be 100-300 pages in length, and so my review of these was abridged. I focused on finding information on the different actors involved in the process, their roles, and their relationship to one another.

Moving outwards from the accreditation body, I repeated a similar process for what I deemed to be the most influential organizational actors – usually the professional societies or regulatory bodies, the national council of deans, and any national umbrella associations (e.g. Engineers Canada and Engineers Australia). Given the immense proliferation of professional societies and institutions in the UK and US in particular, I did not review all societies. For the UK in particular, the most helpful and relevant sources were the government inquiries (Finniston, 1980; Hamilton, 2000; Uff, 2016) that took a system-wide view of the profession.

One area where my location and positionality as a Canadian was obvious was my ability to navigate and uncover hidden, but still publicly available, documents and details for Canada at a more granular level. This may be a feature of Engineers Canada’s transparency policies, but regardless, it meant that I had access to detailed information on political exchanges that were published on websites and even the details of internal board meetings and positions presented by different actors. I believe that in future studies, with appropriate relationship building and
contextual immersion, I can gain access to equivalent information for at least some of the other countries.

The table below gives an estimation of the number of sources of each type that I located and reviewed for the study:

**Table 1: Summary of Sources Consulted (by Country)**

<table>
<thead>
<tr>
<th></th>
<th>Canada</th>
<th>United States</th>
<th>United Kingdom</th>
<th>Australia</th>
<th>South Africa</th>
<th>Comparative/ Washington Accord</th>
</tr>
</thead>
<tbody>
<tr>
<td>Journal articles &amp; book</td>
<td>2</td>
<td>5</td>
<td>8</td>
<td>10</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>chapters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conference papers</td>
<td>10</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Policy documents</td>
<td>6</td>
<td>8</td>
<td>8</td>
<td>6</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Other sources</td>
<td>13</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>31</strong></td>
<td><strong>25</strong></td>
<td><strong>28</strong></td>
<td><strong>29</strong></td>
<td><strong>31</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

**3.4 Analysis Strategy**

The first stage in the analysis process was to establish comparable information for each of the countries in the study. This is laid out in Chapter 4, in narrative descriptions of the context and key features of each country’s engineering education and accreditation system. This information gathering exercise is built on the structure of the tables presented for each country which include comparable information about the licensing, regulation, accreditation, and education for engineers in each country. These tables, and the text descriptions, were developed in an iterative process between the data sources mentioned earlier and an evolving template of the minimum specifications required to answer the research questions.
The second stage of analysis involved interpreting the data to understand the sources of power, interests, and positioning of the key interest groups in relation to one another. This approach was taken, initially, for each country individually, presented also in Chapter 4. Finally, I used two analytical dimensions to frame the cross-country analysis: first, through the lens of the centralization of decision-making about accreditation policy, and second by considering the extent to which social closure was an important logic driving accreditation in the country.

3.5 Positionality and Reflexivity: Insider-Outsider Dynamics

I approach this research as both an insider and an outsider. I completed an undergraduate engineering degree in Canada, and participated in curriculum development and approval that adhered to the Canadian Engineering Accreditation Board’s strict requirements. This experience shaped my passion for studying organizational change in higher education, and was an initial window into the complex and ambiguous standing of accreditation as a gatekeeper for major curricular change in engineering. Currently, as a staff member in a leadership development institute within a large faculty of engineering, I see and hear things related to accreditation on an almost weekly basis. I also am a member of both the American Society for Engineering Education and the Canadian Engineering Education Association, presenting and publishing papers at their annual conferences. This gives me access to people, knowledge and internal cultural cues about accreditation implementation. I also have been an active member in a large-scale national professional project in Canada, the Engineering Change Lab, which has brought me into contact with many of the senior stakeholders in the profession in Canada such as deans, provincial regulators and members of the accreditation board. Accreditation has featured regularly as a key topic and the varying perspectives, views and assumptions have become clearer to me through participating in those meetings and conversations. These features position me as an insider in Canada, however I have had no direct experience as an administrator of accreditation processes at either the institutional or national level. I also have limited direct experience with members of any of the national organizations which I study and theorize about in this thesis.

It is thus important that I constantly challenge my (institution-centric) assumptions and that I am cautious about assumptions I am making about people, organizations and institutions which I
have had little contact with. Shifting from Canada, where I have studied and worked, to the other four countries in the study, it is important that I avoid the instinct to imprint a Canada-centric ‘model’ of how the profession is organized and how different actors view themselves and their role in accreditation. I have attempted to mitigate this by focusing on direct quotes and publicly available documents – policy, legislation, and position papers – to avoid making generalizations from one context to another.
Chapter 4 Description and Analysis of Five National Systems of Engineering Accreditation

This chapter describes the important features of the engineering profession that shape accreditation policy. It is organized around the five countries in the study: Canada, United States, United Kingdom, South Africa and Australia. Each country is a liberal market economy with a complex colonial history. In each country, engineering is a regulated profession, with a national accreditation body responsible for assuring the quality of engineering programs and maintaining the country’s signatory status in the Washington Accord.

Given the volume of information presented, steps have been taken to simplify the findings to set the stage for deeper analysis and comparison in the following chapter. In particular, a one-page table is used to summarize the core features of each country’s engineering education and accreditation system. In addition, a table with common formatting is used to analyze the interests and sources of power of each major actor in each country. This pluralist analysis answers the overarching research question for each country, and is followed by a direct comparison between that country’s system and Canada’s system.

4.1 Canada

Canada is a settler colonial nation state with a population of just over 36 million people (UN Statistics, 2016, p. 2) with one of the highest rates of post-secondary attainment in the world. Canada is a federation, and higher education has been delegated to the provincial and territorial governments, with no national ministry of higher education. Engineering became a regulated profession with social closure in many provinces in 1917 (Adams, 2010) and is regulated separately in each province and territory. Each province has its own regulatory body governed by its own legislation (some variation on a Professional Engineers Act), many of which protect not only the scope of engineering practice, but also the use of the title ‘engineer’ or ‘professional engineer’.

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4 57% of adults aged 25-64 with tertiary education according to OECD Education at a Glance 2017

5 Nunavut and the Northwest Territories share a common regulator; all other provinces and territories have their own.
Given the geographic size of the country and the distinct economic opportunities and challenges in each province, inter-provincial mobility has been an important focus for the provincial regulators. At a national level, these provincial regulatory bodies are represented by a national association, Engineers Canada. Engineers Canada sets policy for assessing foreign-trained engineers, accrediting university degree programs, while also advocating for policy change with the federal government.

Within higher education, engineering is a popular and growing 4-5-year undergraduate degree program which occurs mostly in universities, but also in polytechnics and community colleges in some provinces. Each of these institutions is governed provincially through the relevant provincial quality assurance framework, which tends to focus on accrediting institutions, rather than programs.

Canada has a modest number of national learned societies for some disciplines of engineering (civil and chemical engineering), while in other cases, there are Canadian branches of the American societies (Institute for Electrical and Electronics Engineering, American Society of Mechanical Engineers). Since the late 1800s there have been tensions between Canadian and American professional societies, and this cross-border competition was part of the impetus for engineers in Canada pushing for licensing laws in the first place, which led to the creation of the powerful provincial regulatory bodies (Millard, 1988).

Engineering faculty members are represented at the national level through two distinct bodies. The first is the National Council of Deans of Engineering and Applied Sciences (NCDEAS), which meets frequently, is a focal point for advocacy, and has been vocal and proactive in recent years, particularly on the topic of accreditation. The second body is the Canadian Engineering Education Association (CEEA), which emerged in 2010 from a previous network on engineering design education. CEEA has grown significantly in recent years, and offers a forum for sharing the scholarship of teaching and learning (Boyer, 1990) which includes a strong focus on how faculty members interpret and navigate accreditation.

The national accreditation body responsible for interpreting and implementing policy is the Canadian Engineering Accreditation Board (CEAB), a standing committee of Engineers Canada. The board is comprised of 15 nominated members: 6 from regulators; 6 members at large; 1 chair, 1 vice-chair, and 1 past chair. In nominating members, the board seeks “balance between
academic and non-academic… and representation from various disciplines” (MacQuarrie & Villeneuve, 2017). As of September 2017, the board is comprised of 4 former deans, 6 senior faculty members; and 6 industry representatives. The accreditation board’s explicit goals as recently articulated are (MacQuarrie & Villeneuve, 2017):

1. Engineering programs meet/exceed minimum standards for licensure;
2. Quality and relevance of engineering education continuously improves;
3. Board of Directors is provided with advice/recommendations on international matters regarding accreditation.

The accreditation board sees its role as interpreting and implementing policy, but not making decisions about any changes to policy. In this implementation role, the accreditation board makes an annual set of decisions about accreditation for a subset of engineering programs based on recommendations of volunteers who visited those programs in the given year. Visiting teams are comprised of experienced engineers who either work in academia or industry – while it is difficult to ascertain from official records, it appears that the majority of visiting team members are in fact academics. Engineers Canada has acknowledged the inconsistency created by having teams of volunteers leading accreditation visits, particularly given that visits occur once every six years, assuming that programs passed with no concerns in the previous round. CEAB is currently working to improve quality and increase consistency of visiting teams by investing in onboarding, training and support of accreditation visitors.

In total, CEAB has accredited 281 engineering programs at 41 higher education institutions. It has also been a member of the Washington Accord since its inception in 1989, and there is a belief within the accreditation board that its approach is unique, and its standards are the highest compared to other signatories: “What is unique about our system is that we do not require a final examination, but relevant engineering experience” (Culhane & Parent, 2016, p. 7).

Since 1965, a central feature of Canada’s engineering accreditation system has been its insistence that all students in a given engineering program complete a ‘minimum path’ of coursework in a set of core engineering subjects: engineering science, mathematics, engineering design, etc. Using a simple formula that converts hours in lecture, tutorial and laboratories into a consistent “Accreditation Unit” (AU), requirements translate into a minimum number of courses on particular subjects for each discipline of engineering. In practical terms, this approach limited the
flexibility for curriculum designers, and for individual students who would be able to choose only 2-6 elective courses out of ~40 total courses in their entire degree. The benefit of this system to provincial regulators has been a ‘guarantee’ that every graduate has demonstrated a baseline of technical knowledge. This translated into a registration and licensing system that bypassed the use of technical examinations, instead opting for an articulation of the engineering practice experience and a much shorter ethics and law exam. This is in stark contrast to the United States, where state licensing bodies require engineers to write 1-2 full days of examinations to obtain their license. The broader context is that before the Accreditation Board was established in 1965, each provincial regulator undertook its own decision-making on which programs it would accept as appropriate prerequisite for licensure.

Canada’s status as a signatory to the Washington Accord has led to significant changes in its accreditation system. As described below, the wider set of signatories explored and ultimately decided to change towards a set of outcomes-based graduate attributes in the early 2000s:

In 2001, it was proposed that the Washington Accord signatories work towards defining the consensus attributes of the Washington Accord Graduate. By the 2003 meeting an initial draft of a set of outcome statements that explored common ground between the outcomes already defined by many the signatories. (Hanrahan, 2008, p. 4)

This shift to include Graduate Attributes and a Continuous Improvement Process was announced around 2007, to give HEIs plenty of warning before the first set of accreditation visits under the new system would begin in 2015 (Lennon & Frank, 2014). Trepidation among faculty members and administrators can be seen in a suite of short practitioner papers presented and published at the Canadian Engineering Education Association’s annual conference in the years leading up to the new policy being enforced (Cloutier, Sellens, Hugo, Camarero, & Fortin, 2010; Frank et al., 2011; Harris, Steele, & Russell, 2011; Kaupp & Frank, 2017; McCahan & Romkey, 2012; Spracklin-Reid & Fisher, 2013). One journal article framed it as a “constitutional moment” for

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6 The total number of courses varies by university and by program – this is meant to be illustrative. In Quebec, where students have taken a different set of high school and CEGEP courses before entering, there are further constraints on the number of electives (Personal communication with Dean of engineering school in Quebec).
faculty members in a Center for Engineering and Society (Caron, Gopakumar, Dysart-Gale, & Harsh, 2014).

While faculty members pondered the curricular and pedagogical implications, the deans, as administrative leaders of engineering faculties, were more vocal in their opposition to the change. They used their national representative body, the National Council of Deans of Engineering and Applied Sciences (NCDEAS), to voice their concerns to Engineers Canada. The deans were concerned that the new system of outcomes-based accreditation would be in addition to the current inputs-based AU system, effectively doubling the workload for faculty and accreditation professionals. In 2016, NCDEAS published a public whitepaper that addressed Engineers Canada (and the accreditation board) directly. At the core of its argument, NCDEAS called Engineers Canada out for breaking an earlier promise that the workload of the new outcomes-based accreditation system:

**Workloads for program visitors and HEIs:** In 2008, Chantal Guay, former CEO of Engineers Canada, made the following commitment to NCDEAS. “Engineers Canada is committed to working with the NCDEAS during the transition to the new accreditation criteria, which is not intended to add more work, but to streamlining the accreditation process.” The workload to prepare for accreditation (both AUs and graduate outcomes) has been drastically increased beyond the workload required historically with the AU system (NCDEAS, 2016).

Later in the whitepaper, the deans propose a range of alternatives to the current AU-based system that would be easier to implement in universities, and less work for accreditation visiting teams (NCDEAS, 2016). They attempted to advance their interests of decreasing bureaucratic work through this proposal. The deans’ whitepaper clearly struck a nerve. A senior leader, Frank Collins, Assistant Dean and member of Engineers Canada’s Qualifications Board⁷, published a scathing response to the NCDEAS proposal, which included the following passage:

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⁷ The Qualifications Board operates in parallel to the Accreditation Board. The former deals with applicants whose engineering degrees are from foreign countries, whereas the latter focuses on accrediting engineering degrees from institutions inside Canada.
I think there are some fundamental misunderstandings of the DLC [Dean’s Leadership Committee], however, that have led to the suggestion that the Engineers Canada syllabi be used as the AB [Accreditation Board] baseline for educational credentials. The very suggestion that this be done, I feel, illustrates a common misconception of what the roles of universities and the AB are in this country. That is a strong statement – I understand. But with one foot in academia and one foot on the QB [Qualifications Board], I routinely see these misunderstandings. I will try to explain (Collins, 2016, p. 1).

Collins acknowledges the implication of his assertion: that the deans, as the most senior leaders of engineering faculties, do not understand the roles of key players in the sector, indicated through the naiveté of their proposals for change to the inputs-based accreditation system.

In parallel, and perhaps in anticipation of the growing conflict, Engineers Canada commissioned a consultant to study the issues at stake by surveying key players, reviewing other jurisdictions, and ultimately hosting a large multi-stakeholder forum for industry, administrators, regulators, faculty and even students. This forum took place in August 2016, and both the NCDEAS whitepaper and Collins’ response were part of a broader set of statements from influential interest groups published on a consultation website in the lead-up to this meeting.

The accreditation forum failed to bridge any gaps between perspectives of different actors. Shortly afterwards, at the September 2016 board meeting, the Accreditation Board voted on the recommendations of the NCDEAS, and rejected the primary proposal for a radical change to the accreditation system, opting instead to pursue further study of some of the more palatable options from the whitepaper. At that board meeting, George Comrie asserted an important nuanced dimension of why the deans were unsuccessful in their proposal, and why the Accreditation Forum hadn’t made much progress:

The over-arching purpose of accreditation is to support licensing decisions by Canada’s engineering regulators. While no one will dispute the desirability of maintaining the consistent high standard of Canadian engineering education, assisting engineering educators in their quality assurance efforts, and enabling their graduates to avoid having to repeat technical examinations in order to obtain licensure, these objectives are not the reasons the Canadian accreditation system was created, and are not sufficient to sustain it (Comrie, 2016).
This motion reasserts the priority of goals for accreditation in the eyes of regulators: first and foremost, it is about serving the needs of regulators to license professional engineers. The provincial regulators, represented at the national level through Engineers Canada, maintain control to shape accreditation policy so that it makes it easy to make licensing decisions about who gets to become an engineer in their jurisdiction. The lofty goals of quality assurance and maintaining a high standard of education, both emphasized in outcomes based accreditation, are not of interest to the provincial regulators in Canada.

Nonetheless, the Accreditation Board is still considering alternatives to the inputs-based unit AU curriculum assessment process. In a preliminary recommendation from the chair of the “AU Task Group” in May 2017, the group stated that:

A modified and less proscriptive AU system should be considered especially with respect to categorization. The NZ [New Zealand] credit system should be thoroughly reviewed as they have an outcomes based approach which appears to meet many of our concerns and they are a Washington Accord signatory (MacQuarrie & Villeneuve, 2017, p. 14).

This is an example of potential isomorphic mimicry, as Canada considers learning from and perhaps mimicking aspects of New Zealand’s system, particularly given its elevated status as a fellow Washington Accord signatory (DiMaggio & Powell, 1983).

Alongside the political positioning for fundamental changes in policy, led by the deans, a group of influential faculty members have taken on a project to support learning and sharing among engineering programs in Canada as they “make the transition to outcome-based programming, assessment, and accreditation”\(^8\). Interestingly, this project has been supported jointly by Engineers Canada and the NCDEAS, the two parties in apparent conflict over how the new accreditation system is being interpreted.

The Engineering Graduate Attributes Development (EGAD) group hosts a public website with guidance, research, examples, and members organize an annual workshop at the Canadian Engineering Education Association, in addition to presenting updates on progress in conference

\(^8\) [http://egad.engineering.queensu.ca/](http://egad.engineering.queensu.ca/) accessed September 17, 2017
papers at the same venue (Frank and Kaupp, 2011, 2014, 2016). The latest update of the project shows important changes taking place in faculties of engineering across the country, notably (Kaupp & Frank, 2017):

- A shift from administrator (Associate Dean) led accreditation to individual faculty members and committees (p.3)

- Creation of new specialized positions (full and part-time) to handle accreditation and assessment. (p.3)

- A declining fraction of administrators who see accreditation as “An Exercise that has to be Completed; Something That Has to be Done” (p.3)

- Increasing role for employers in the process (p.6)

This highlights the difference between formal policy making in official forums, and the ongoing implementation realities and inter-university collaboration among faculty members that drives decisions in practice. While it is useful to have a national snapshot based on an internal survey of this niche community, further research is required to substantiate, probe and interpret these changes to organizational structure and culture.

Table 2 below summarizes the description of the Canadian system presented in this section, using a common set of categories that are later applied to the other four countries in the thesis.
Table 2: Engineering education system in Canada

<table>
<thead>
<tr>
<th><strong>Engineering profession:</strong></th>
<th></th>
</tr>
</thead>
</table>
| Legislation:               | • Exclusive right to practice for licensed engineers (degree + 4 years of supervised practice)  
• Delegated power to regulatory bodies (self-regulated profession). |
| Reg. bodies                | • 12 Provincial licensing bodies represented by Engineers Canada |
| Licensure rates            | ~30% nationally |

| **Engineering’s place in higher education sector:** |  |
| Where is it taught?       | Universities, Polytechnics, Colleges |
| Nature of degrees         | Direct-entry, first degree (bachelor’s degree), 4-5 years |
| Engineering disciplinary bodies. | • 7 discipline specific societies (vs. 60+ in the US)  
• Association of Consulting Engineers of Canada (ACEC).  
• Canadian Engineering Education Association (CEEA) an important community with growing annual conference and published conference papers. |

| **Accreditation body:** |  |
| Name/design              | • Canadian Engineering Accreditation Board (CEAB); a standing committee of Engineers Canada  
• Focused on programs meeting minimum standards for licensure; secondary goal of improving quality/relevance of education |
| Composition of membership| • 15 nominated members; 6 from regulators; 6 members at large; chair, vice-chair, past chair. |
| Decision-making,          | • Engineers Canada makes decisions on any changes to policy/criteria  
• Accreditation Board’s makes “accreditation decisions” each year in the June meeting of the CEAB based on volunteer recommendations. |
| Policies/criteria         | • All of the accreditation visits are done by volunteers (inconsistent)  
• Minimum-path (1450 accreditation units)  
• 12 Graduate Attributes  
• Continuous Improvement Process |
Washington Accord history.

- Original member (1989).

<table>
<thead>
<tr>
<th># of accredited programs.</th>
<th>43 HEIs, 281 accredited engineering programs (2017).</th>
</tr>
</thead>
</table>

Major changes in last decade:

- Addition of outcomes-based accreditation, via Graduate Attributes and Continuous Improvement Process
- Opposed vocally by faculty and deans, who want to see the old system renewed to keep workload manageable.

Table 3 below shows the pluralist analysis for engineering in Canada. For ease of analysis, the provincial regulatory bodies are grouped together, despite the fact that there are twelve distinct organizations with their own local politics and interests. Each actor has quite different interests, and their power is useful at different stages in the policy making process.
Table 3: Pluralist analysis of key interest groups in Canada

<table>
<thead>
<tr>
<th>Actor / Interest group</th>
<th>Interests / Perspectives</th>
<th>Sources of Power</th>
<th>Stage in policy process where power is most effective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Provincial Regulatory Bodies</strong> (e.g. PEO, APEGA)</td>
<td>Ease of licensing; Caliber of engineers; public safety</td>
<td>Decision-making on Engineers Canada board; Policies for licensure</td>
<td>Policy Change with strong role in resisting change</td>
</tr>
<tr>
<td><strong>Accreditation Board</strong> (committee of Engineers Canada)</td>
<td>Keep the peace; Mutual recognition with other W.A. members</td>
<td>Shaping how criteria are interpreted; Visiting teams training and composition; Annual accreditation decisions</td>
<td>Change and Implementation</td>
</tr>
<tr>
<td><strong>Industry/employers</strong></td>
<td>Work-ready graduates; generic skills &gt; technical</td>
<td>Limited direct input; indirect via hiring decisions</td>
<td>None – informally might shape Change</td>
</tr>
<tr>
<td><strong>Deans</strong> (via NCDEAS)</td>
<td>Minimize administrative burden; Maintain accreditation status</td>
<td>Seat on EC board; Large influence on local interpretation; Decision to request accreditation (or not)</td>
<td>Change/ Implementation – with the most direct control over Implementation.</td>
</tr>
<tr>
<td><strong>Faculty members</strong></td>
<td>Flexibility/autonomy in what is taught &amp; how</td>
<td>Discretion for how to implement/interpret</td>
<td>None – informally on Implementation</td>
</tr>
</tbody>
</table>

The two major groups in opposition are the deans and the provincial regulatory bodies. Each has different interests, with an emphasis on protecting their organizations from undue bureaucratic overhaul, and each holds significant authority over a major component of the engineering
licensure pipeline. Each group has seats on the accreditation board, although the regulators have considerably more seats. What is interesting is that there is limited overt conflict between the two groups. Instead, the accreditation board becomes the political arena for them to exert their influence. It is important to recognize that in Canada, the accreditation board is technically a committee of Engineers Canada. I have positioned the accreditation board as “keeping the peace” between other actors in the profession, and particularly among the provincial regulators who are the basis for Engineers Canada’s existence. On the other hand, the design of the Washington Accord is that the signatory body in each country is the accreditation board, which means that the CEAB actually gained some influence by signing the accord. However, this influence is highly circumscribed, and is reduced to influencing the other stakeholders in Canada to supporting outcomes-based accreditation in order to get the mobility benefits of being an accord signatory. It appears that the CEAB has been successful in adding the new outcomes-based system, but unsuccessful in shifting, reducing or removing the old inputs-based system.

The two interest groups that have the least power over accreditation policy are faculty members and employers. Both have a crucial role to play in engineering, but neither is well organized into an interest group that has an effective voice in the accreditation process. Others have argued, in general terms, that employers’ interests are reflected in professional regulatory bodies in engineering (Case, 2016) while emerging theories from the sociology of professions take the stance that organizational (employer) and professional control are two distinct forms of authority (Noordegraaf, 2007).

The main source of power employers exert is through hiring engineering graduates and supporting or constraining their pathway to obtaining licensure. Increasingly, employers in Canada have come to see engineers as valuable employees based on their flexible skillset and work ethic, independent of their professional designation. This is eroding the membership base (and therefore revenue) of the provincial regulators as the fraction of engineers getting licenses vs. getting degrees continues to decline, particularly in Ontario (Prism Economics and Analysis, 2016). One initiative that seeks to include employer perspectives on accreditation is the Canadian Engineering Education Challenge, a rogue group of deans, engineers and consultants who are developing a national survey of employers to test the extent to which graduates are demonstrating the graduate attributes. This initiative has emerged under the auspices of the
Engineering Change Lab in Canada, and has received funding from a critical mass of deans who are all members of NCDEAS.

Individual faculty members in engineering have the least explicit power of all interest groups described in this analysis, at least when it comes to directly effecting accreditation policy. The closest approximation of an interest group would be the Canadian Engineering Education Association (CEEA), a small learned society with ~300 members that hosts an annual conference for faculty interested in research on engineering education. To date, the CEEA has had a limited advocacy role, however its conference has created a vibrant ecosystem of accreditation ‘champions’ who organize processes and teach courses in their local universities. In a sense, engineering professors and staff are ‘getting on with it’, learning how to manage the current policy regime of inputs-based and outcomes-based in parallel. This is manifested in the Engineering Graduate Attributes Development (EGAD) project mentioned previously.

The most influential actors in Canada’s system are the provincial regulatory bodies, with their dual roles as membership organization for engineers and licensing bodies. These building blocks of power combine with their decision-making power in the national association, Engineers Canada, and its accreditation board, to act as a strong force for retaining the status quo. This is an example of how power is not equally distributed: “Interests link with institutional factors… [to show] how organizational rules and structures protect the policy preferences of particular interests from opponents attempting to alter or replace those policies” (McDonnell, 2009, p. 62).

From this perspective, the provincial regulators would have accepted the addition of outcomes-based accreditation introduced by Engineers Canada via the Washington Accord because it had no effect on their licensing procedures, and if anything, contributed to more internationally trained engineers obtaining their license. The deans, on the other hand, bore the brunt of this increased workload and were vocal in calling out Engineers Canada for falsely promising that the process would be streamlined. In a plea to reduce the workload, the deans targeted the old tried and tested inputs system, which the regulators have come to rely on, and this was summarily defeated because of the structural power held by the regulators.
4.2 United States

The United States is a settler colony nation with a population of over 320 million people (UN Statistics, 2016, p. 3), and the largest and most diverse higher education sector in the world. Higher education is highly decentralized, and coordinated largely by the market mechanism of exchange (Clark, 1983). The history of institutional autonomy for universities led the United States to develop a complex configuration of regional accreditation agencies, and that ‘model’ for external institutional quality assurance has since diffused throughout the world (Rhoades & Sporn, 2002). As state governments have become involved in financing public higher education, demands for accountability have grown as well.

Engineering developed as a profession in the United States in the early 1800s through the institutions of professional engineering societies, such as the American Society for Civil Engineers and the American Society for Mechanical Engineers (Layton, 1971). Notably, there is a major division between the knowledge, status and representational functions of these societies and the legal regulation of engineering practice, the latter being the mandate of state licensing bodies. These regulatory agencies are actually extensions of the state government, such as the Massachusetts Board of Registration of Professional Engineers and Professional Land Surveyors, which is contained within the Office of Consumer Affairs and Business Registration for Massachusetts. This has led to a very narrow scope of practice of engineering that is actually protected through social closure, as “registration normally provides exemptions for [engineers working in] industry or the government” (Prados, Peterson, & Lattuca, 2005). In addition, engineers must be separately licensed in each state they seek to practice in, and registration boards require that engineers write an 8+ hour examination in addition to discipline specific tests of their knowledge. These factors have led to a declining proportion of engineering graduates who ever register as a Professional Engineer (P.E.). Currently, the National Society for the Promotion of Engineering estimates this proportion is less than 20%, which is supported by licensing statistics from the National Council of Examiners for Engineering and Surveying (NCEES, 2017).  

According to the NCEES report, there were ~170,000 new licensed engineers in the 10-year period from 2006 to 2016 (17,000 per year), compared to an estimated ~105,000 new engineering degree graduates each year. As a fraction, this is ~16% of graduates who obtain their license to practice. This also doesn’t
Engineering is taught in a range of higher education institutions in the United States, with the majority of accredited engineering degrees being offered by universities. Fitting with the American cultural norms of student choice and electives, engineering can be offered as a major that is selected or indicated part-way through a course of study, rather than as a standalone professional degree that students enter into directly at the point of application/admission. This has enabled researchers to investigate pathways both “into” and out of engineering as a major (Sheppard et al., 2004; Stevens, O’Connor, Garrison, Jocuns, & Amos, 2008).

The engineering profession in the US is characterized by a complex landscape of influential engineering learned societies, 60-70 in number, which exert influence through their prestigious fellows and members, their conferences, and their journals. An entire association has been created, the American Association of Engineering Societies (AAES), simply to coordinate between the different groups. There is a long history of infighting and political positioning between the different disciplines of engineering, documented masterfully in Layton’s “The Revolt of the Engineers” (Layton, 1971). Important differences in the early stages were the relative focus on professional ethics and responsibility vs. corporate interests, which were reflected in membership criteria and investment in knowledge production and dissemination. A cross-cutting association, the American Society for Engineering Education\(^\text{10}\), looks at issues of engineering education across all disciplines, with its own set of more than 40 internal divisions. The ASEE’s predecessor organization, the Society for the Promotion of Engineering (SPEE) was formed in 1893 and in the early 20\(^\text{th}\) century was a central actor in shaping the engineering curriculum through several high profile reports (Akera, 2017). When the decision was made to introduce national level accreditation, the organization that was created for that purpose, the Engineers’ Council for Professional Development (ECPD) took the central role in administering an engineering accreditation system. Down the line, SPEE changed its name to become the ASEE, and now hosts the largest conference on engineering conference globally, and publishes the Journal of Engineering Education, the most prestigious journal in the field.

\(^{10}\) ASEE was formerly the National Society for the Promotion of Engineering Education (NSPEE).

account for those who become licensed in multiple states (each state would count as 1 in NCEES statistics).
Engineering accreditation in the United States is overseen by a large and powerful association, the Accreditation Board of Engineering and Technology (ABET)\(^\text{11}\), which is a coalition of 35 professional and technical society members. ABET’s mandate extends beyond engineering into computer science and other applied and natural sciences, and also includes accreditation of graduate degrees, lower-level diplomas and qualifications. ABET is governed by a Board of Directors, comprised of elected individuals, officers and directors from the ABET Member Societies. The board’s “primary responsibilities are to set policies and procedures, establish the annual budget and approve accreditation criteria” (ABET, 2015a). An important point to note is that the board was recently restructured:

From a single large board to a smaller, limited-membership Board with a clear emphasis on fiduciary responsibility over ABET, and three separate boards of delegates through which representation from member organizations (including ASEE) occurs… [This] has become an important factor in ABET’s decision-making process. While there may have been issues such as those of fiscal responsibility and oversight that prompted ABET to make these changes-- and other non-profit organizations have enacted similar changes-- the change enables ABET to act more autonomously, both through the governing board’s isolation, as well as the shielding that it provides for decisions up and down the organizational hierarchy (Matos et al., 2017, p. 7).

ABET’s central activity is the accreditation of engineering degree programs, which is managed by the Engineering Accreditation Commission (EAC), responsible for the administration of accreditation. EAC is large enough to support a professional staff of 7 full-time people, including a Chief Accreditation Officer. The EAC is also comprised of a representational mix of member societies, with 19 officers and 81 members representing more than 20 organizations. While the board maintains the decision-making control for changes to accreditation criteria, policies and procedures, the EAC is limited to “formulat[ing] and recommend[ing] policies and procedures on accreditation to ABET leadership. Particular emphasis is placed on process improvement and process uniformity across commissions” (ABET, 2015b).

\(^{11}\) ABET was formerly the Engineers’ Council for Professional Development (ECPD).
Following the American model of quality assurance, namely self-study reports by institutions, and external review visits by teams of volunteer peer experts, ABET accreditation visits are led by volunteers. The organization reports on the demographics of its volunteers which are quite revealing: 81% are age 50 or older; 84% are male; 77% are white; and 67% are academic, compared to 18% practitioners and 9% industry (ABET, 2015a). The criteria for becoming a program evaluator which drive these demographics are (a) possession of appropriate degree; (b) membership in an ABET member society; (c) interest in improving education; and (d) completion of an extensive training process. The central importance of professional societies is clear in who is allowed to be an accreditation evaluator: evaluators must participate in engineering professional societies to further their career in engineering education.

In total, the EAC accredits 2,400 programs at 500 institutions each year, making it the largest engineering accreditation agency in the world. Not surprisingly, ABET is one of the founding signatories of the Washington Accord.

The most significant change to engineering accreditation in the United States in recent decades was the introduction of the EC2000 criteria in 2002, which shifted the focus to student learning outcomes. The adoption of EC2000 was the result of a decade long process started in 1994, including three major workshops that represented “all facets of the engineering community – university presidents, deans, faculty, and administrators; industry leaders; private practitioners; professional and technical society liaisons and executive directors; ABET leaders…” (ABET, 2004, p. 3). Given the size and scope of ABET’s activities, this change rippled through thousands of engineering programs, and accordingly, ABET commissioned a high-profile evaluation of the impacts of the change, led by a group of higher education researchers from Penn State University. Findings from the evaluation were published in higher education and engineering education journals, and they showed quantitative changes in the assessment practices of ~200 programs across ~40 institutions. These findings were trumpeted by ABET as signs of the success of the major changes to accreditation criteria (Prados et al., 2005; Volkwein et al., 2007).

As the new ABET learning outcomes became implemented across the country (colloquially referred to as ABET “a to k” referring to the alphanumeric numbering of the core learning outcomes), critical researchers and practitioners within the engineering education community
raised questions about the logic of the change. In one particularly scathing critique, Donna Riley, now Head of the School of Engineering Education at Purdue University, called out “the bankruptcy of outcomes-based education as a change strategy” in the title of a published ASEE conference paper (Riley, 2012). This connects to a larger critique of the trend towards learning outcomes as the dominant assessment and quality assurance mechanism in higher education (Lasnigg, 2012) and the narrow instrumental conceptions of competency-based training in vocational education (Wheelahan, 2009). Other studies have investigated the subtle way in which ABET accreditation shapes the logic of all curricular decision-making in the United States, even in brand-new programs or brand-new institutions (Seron & Silbey, 2009) which are seeking to break out of old norms and patterns.

Starting in 2009, ABET has undertaken a process to consider revisions to Criterion 3 (Program Outcomes) as part of a harmonization effort across its broader portfolio of accreditation beyond engineering degrees. A Task Force was created, and a small-scale consultation of key stakeholders – students, faculty, industry, professional and technical societies – was undertaken, along with surveys of ABET evaluators in the 2010-2011 cycle. At its core, the main complaints were that certain learning outcomes were hard to measure, and so the proposed changes to Criterion 3 include aggregation of outcomes to a smaller set that, according to ABET, will be easier to measure.

The changes have been met with a wide range of responses from key stakeholders. The most vocal and active resistance has come from influential leaders within the American Society for Engineering Education, including Riley. Riley was invited to give a distinguished lecture at the 2016 ASEE conference, and on the basis of the title of her presentation, was removed from the program, allegedly at the influence of ABET executive leadership. Ultimately, she was reinstated, and after her lecture “Mind the Gap - What the ABET Crisis Can Teach Us About Connecting Research and Practice”, ABET presidents and past-presidents vocally challenged her and defended their consultation process publicly.

Riley and colleagues followed up their direct political activism in 2016 with a carefully constructed analysis of organizational and historical dimensions of ABET, which help to explain some of the contradictions and complexities of the politics of accreditation change in the United States (Matos et al., 2017).
For its part, ABET’s website lists its public rationale\textsuperscript{12} for changing criterion 3. In the citation of relevant references that justify the change, the first is the ABET-sponsored evaluation of the EC2000 change, and the next two are reports from the two leading professional societies, the American Society for Civil Engineers (ASCE), and the American Society for Mechanical Engineering (ASME). These references signal the importance of the wider professional society power base and their roles as key stakeholders in the organization’s governance.

In sum, accreditation remains a hotbed political issue in the United States, and any changes to the criteria and process are debated intensely. This is despite the major disconnect between engineering education, professional bodies and licensing, the latter remaining the domain of state governments, and declining in relevance among graduates. Professional societies are central and powerful actors, and the ultimate outcomes of the current revision process are likely to be determined by the stance, and political positioning, of the key societies such as ASCE, ASME and IEEE.

\footnotesize{\textsuperscript{12} http://www.abet.org/accreditation/accreditation-criteria/accreditation-alerts/rationale-for-revising-criteria-3/}
### Table 4: Engineering education system in the United States

<table>
<thead>
<tr>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engineering profession:</strong></td>
</tr>
</tbody>
</table>
| Legislation: | • Weak social closure - exclusive practice for stamping drawings only  
• No legislation around the use of the title engineer. |
| Regulatory bodies | • 50 state registration boards which require separate licenses based on extensive exams; fall within consumer protection departments |
| Licensure rates | <20% nationally |
| **Engineering’s place in higher education sector:** | |
| Where is it taught? | Universities, Polytechnics, Colleges |
| Nature of degrees | First degree (bachelor’s) or Major that can be selected within degree. |
| Engineering disciplinary bodies | • 60+ influential professional and technical societies  
• American Society for Engineering Education hosts largest engineering education conference in the world. |
| Deans council | • Engineering Deans Council of the ASEE has 350 members and hosts several conferences per year.  
• Involved in earlier pushes for change (Green Report) |
| **Accreditation body:** | |
| Name/design | • Engineering Accreditation Commission (EAC), a commission of the Accreditation Board of Engineering and Technology (ABET) |
| Composition of membership | • EAC has 19 officers, 81 members representing 20+ societies; includes 7 professional staff to coordinate activities |
| Decision-making, | • ABET makes decisions on any changes to accreditation criteria  
• EAC makes recommendations to ABET; focuses on conformity across commissions (beyond just engineering). |
| Policies/criteria | • All of the accreditation visits are done by volunteers (inconsistent)  
• Criterion 3: Program Outcomes  
• Criterion 5: Curriculum |
| Washington Accord history. | • Original member (1989).
• Arguably the most influential member - driving

| # of accredited programs. | • 500+ HEIs, 2400+ accredited engineering programs.

• Currently proposing revisions to Criterion 3 (Program Outcomes) and both the change, and the consultation process, are being resisted by influential leaders within ASEE.

We can immediately see the increased complexity of the situation in the United States relative to Canada. Much of this comes from the century long evolutionary history of institutional configuration (Akera, 2017; Matos et al., 2017). The unambiguous fact is the central role that the Accreditation Body of Engineering and Technology (ABET) plays in shaping accreditation in the United States. However, much like Engineers Canada, ABET is a representative coalition, meaning its governance and decision-making is explicitly shaped by various other organizations. The most powerful are the engineering professional societies, such as the American Society of Civil Engineers (ASCE), the American Society of Mechanical Engineers (ASME) and the Institute of Electrical and Electronics Engineers (IEEE). A particularly important society when it comes to accreditation is the American Society for Engineering Education (ASEE), which historically had a strong and important role in shaping the nature and focus of accreditation, as a recognized expert authority on curriculum and pedagogy.

ABET was under significant pressure from nearly all actors to change accreditation in the 1980s and 1990s, and with funding from the National Science Foundation (NSF), a series of important workshops were hosted in the 1990s. These workshops facilitated input from industry via Industry Advisory Councils, which led to the major shift from inputs-based accreditation to outcomes-based accreditation, enshrined in the “EC2000” criteria. These criteria garnered worldwide attention, and in 2004, ABET commissioned a group of respected higher education scholars to conduct a national evaluation of the impact of the new criteria, with an emphasis on curricular changes and faculty culture that indicated the criteria had had modest impacts on practice inside institutions (Prados et al., 2005; Volkwein et al., 2007).
Table 5: Pluralist analysis of key interest groups in the United States

<table>
<thead>
<tr>
<th>Interests / Perspectives</th>
<th>Sources of Power</th>
<th>Stage in policy process where power is most effective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accreditation Board of Engineering and Technology (ABET)</strong> (specifically the Engineering Accreditation Commission, EAC)</td>
<td>• Keep the peace; • Generate revenue; • Mutual recognition with other W.A. members; • Consistency of accreditation; • Ease of evaluation;</td>
<td>• Gatekeeper role in relation to legislation; • Direct decision-making over criteria change; • Shaping how criteria are interpreted, Visiting teams training and composition; • Annual accreditation decisions;</td>
</tr>
<tr>
<td><strong>Professional Engineering Societies</strong> (e.g. ASCE, ASME, IEEE)</td>
<td>• Advancing knowledge; • Promoting discipline; • Membership fees/dues</td>
<td>• Seats on the ABET Board of Delegates and the Engineering Accreditation Commission</td>
</tr>
<tr>
<td><strong>American Society for Engineering Education</strong></td>
<td>• Improving quality, equity, and protecting and general education; • Rigour and fairness of accreditation process itself.</td>
<td>• Seat on board of ABET and EAC. • Historically more control over accreditation as “authority for pedagogy and curriculum”. This diminished with creation of ABET.</td>
</tr>
<tr>
<td><strong>National Council of Examiners for Engineering and Surveying</strong></td>
<td>• Protecting public; • Conducting licensing exams fairly;</td>
<td>• Seat on board of ABET and EAC.</td>
</tr>
</tbody>
</table>

*Note: each society helps accredit programs in its discipline*
The current political battle for revisions to accreditation criteria has a very different genesis story than the externally driven change that precipitated EC2000. As Atsushi Akera masterfully documents in his recent article on the history of US engineering accreditation:

> The learning outcomes were made the object of an internal review carried out by a task force two levels down, [and] the focus shifted from professional interests toward operational issues having to do with things such as consistent evaluation outcomes, the capacity of ABET’s volunteer program evaluators, and what the members of this task force honestly felt were realistic expectations that could be placed upon the programs undergoing evaluation (Akera, 2017, p. 1840).

This internal review of accreditation initiated by the Engineering Accreditation Commission has coincided with a restructuring of ABET, raising concerns about decisions happening behind closed doors without the same level of legitimate consultation (Matos et al., 2017). Here we can observe cracks in the pluralist model underpinning ABET’s delegate structure, as internal power has shifted towards the bureaucrats who are more concerned with the ease of evaluation and consistency of accreditation than the broader professional implications of changing the content or pedagogy of engineering education.
The most vocal critics of the current revision process have also been the authors of some of the cited research. They have used the voice of the ASEE in ABET to articulate their concerns, but it appears that the impact on decision-making is limited. The ASEE itself has a much stronger presence, reputation and role in the engineering education relative to CEEA in Canada.

Again, in contrast to Canada, the registration and licensing bodies in the United States are practically invisible in discussions of accreditation. Their national body, the National Council of Examiners for Engineering and Surveyors, has one seat on the Board of Delegates, but it is clear from the statement by the incoming President of that organization that licensure is in a very weak position:

We must not take for granted that engineering and surveying licensure will always be here to protect the public. There is a general lack of understanding of the value of licensure in our educational institutions, in political circles, and in the business world (Tami, 2017, p. 4).

It is unclear, in the absence of a more detailed empirical study, how the professional societies that comprise the ABET voting majority use their power to influence decisions about accreditation policy. The engineering deans in the US also are in a weak position, having an interest group mechanism through the ASEE, but not taking very active stances on accreditation policy in the public arena in this current round of revisions.

The most important feature of the United States context is the central role of the accreditation body, which is a large and powerful organization itself. It is still caught up in representational politics, although in this case the core tension is between engineering educators (via ASEE) and the internal bureaucracy of ABET. Another important dimension of ABET is its global reach and ambition, as the organization has recently focused on global expansion, offering ABET accreditation of programs in many countries around the world, bringing in much-needed revenue for the non-profit and finance-conscious organization. It has been suggested that beyond this “neocolonial” project (Matos et al., 2017), the United States has also used its size and power to shape the direction of the Washington Accord and its home organization, the International Engineering Alliance (IEA). There is little in the way of recorded evidence of this dynamic, but it is an assumption that deserves testing through empirical examination. To sum up the American
case, we return to the words of historian Akera who urges us to understand the nuance and complexity in the current situation with ABET:

This account should also make it clear that governance is not just about which organization is in control, but the political and bureaucratic processes, both codified and improvised, that are built into the organizations that give different constituents a voice in shaping engineering education (Akera, 2017, p. 1841).

This speaks to the importance of layering organizational (bureaucratic) lenses onto the pluralist theoretical approach in our analysis in the future.

4.3 South Africa

South Africa is a settler colony with a complex political history, unique among the countries in this study in that the indigenous (black) peoples are a majority (80%) of the overall population of over 55 million people (UN Statistics, 2016, p. 2). Due to the oppressive colonial regime of apartheid, higher education has only been made accessible to black populations since 1991. Despite the end of legal apartheid in 1994, its social, economic and educational manifestations remain very real today (CHE, 2016).

Higher education is governed by the Ministry of Higher Education and Training, with research, guidance and quality assurance provided by the Council on Higher Education. The system has undergone significant changes in recent decades with institutional mergers, expansion of access, and a doubling of the number of students in a decade or less (CHE, 2016). With growth has come a focus on accountability and quality assurance – and this has led the Council on Higher Education to enter into a unique partnership with the engineering accreditation body (Akoojee & Nkomo, 2007).

Engineering in South Africa has its roots in the mining sector, as major deposits of gold and diamonds were discovered in the late 19th century and continue to be a major driver of the national economy. The overall philosophy and structure of engineering education reflects the British colonial influence, and yet the profession only became regulated by legislation in 1968 when the Professional Engineers’ Act was passed and a statutory body was created, now the
Engineering Council of South Africa (ECSA) (Kloot, Case, & Marshall, 2009). The first accreditation visit didn’t occur until 14 years later, because the initial wording of the accreditation functions of ECSA “was viewed with suspicion by some universities as being a possible encroachment on their autonomy” (Kruger, 2016, p. 16). Over time, trust was built through national conversation with deans and members of ECSA’s Engineering Accreditation Committee.

Engineering education in South Africa has expanded along with other fields of study, with particularly fast growth in non-degree credentials such as the National Diploma of Technology. The core engineering degree, typically a 4-year Bachelor of Science in Engineering (BSc, Eng), is offered by the more elite universities. One curricular innovation that has gained significant attention in South Africa and internationally is the foundation programme, initially an ‘extra’ year designed to support the transition of students with less preparation for engineering, often coming from poorer, lower quality schools that catered to black South Africans (Kloot et al., 2009). This has since evolved into a five-year integrated holistic curriculum that supports access and equity while leading to an accredited degree with its promise of access to powerful theoretical knowledge.

South Africa has developed its own set of national professional learned societies, such as the South African Institute for Civil Engineers (SAICE), and the equivalent bodies for mechanical (SAIMechE), electrical (SAIEE), and chemical engineering (SAIChE). While some institutes have links to their parent institutes in the United Kingdom, none have an independent statutory basis comparable to their UK counterparts. Historically, the ECSA has delegated responsibility to the associations for vetting and approving applicants for licensure given their disciplinary expertise. In terms of coordination across associations, Case (2006) notes that “Previously there was a body that collectively represented the members of the various institutions, termed the Engineering Association of South Africa (EASA), but this no longer exists, and its successor the South African Engineering Association (SAVI) appears to be defunct or at least non-functional” (Case, 2006, p. 3). This fragmentation may be a result of internal competition or simply a lack of incentive to work together. That being said, recent coordinated action and response to government decisions across more than a dozen of the voluntary engineering associations indicate that some informal coordination is still occurring, even if the formal channels for supporting it have gone dormant.
The Engineering Council of South Africa (ECSA) is responsible for registering engineering professionals at three levels: engineers, engineering technologists, and engineering technicians. In carrying out this role, the ECSA implements the accreditation system and is the signatory body to the Washington Accord, which it joined in 1999 as part of the second wave of signatories along with Hong Kong and other East Asian nations. The membership of the 30-person ECSA council is heavily weighted towards practicing professional engineers, with 20 members in this category, meant to represent the range of disciplines. Other categories include 6 who work for the government (these can overlap with the practicing engineers), and 10 members of the public nominated through an open process of public participation.

ECSA’s accreditation system is built around five criteria: (1) Credits, Knowledge Profile and Coherent Design; (2) Assessment of Exit-level Outcomes; (3) Quality of Teaching and Learning; (4) Resourcing and Sustainability; and (5) Response to Previously Identified Deficiencies and Concerns, Capacity for Improvement and Programme Review. The first and second represent the “old” and “new” paradigms of accreditation, the former a count of credit hours spent on particular knowledge areas, the latter a set of graduate attributes or learning outcomes. The inclusion of an explicit criterion on “Quality of Teaching and Learning” is quite unique and worth further investigation to unpack its meaning and implications for practice.

The ECSA currently has awarded accreditation to over 100 programs from 16 universities. Very little information is available on the inner workings of the accreditation process relative to other countries in the study. In a 2006 review of the overall engineering profession, Jennifer Case makes explicit mention of the lack of research on many facets of engineering education in the country:

In sourcing relevant information to back up the arguments presented in this paper, there was found to be a relative dearth of literature available in the public domain. The most substantial review of engineering and engineering education in South Africa is to be found in the ECSA/EASA 1995 submission to the National Commission on Higher Education, which, although written ten years ago, is still an informative overview (ECSA & EASA, 1995)... Much of the engineering education research conducted in South Africa focuses on particular programme contexts and there is also little systemic analysis (Case, 2006, p. 5).
South Africa made the switch to an outcomes-based accreditation process at almost the exact same time that it joined the Washington Accord. As the ECSA explains on its website:

The accreditation process for BEng-type programmes was extensively revised in the late 1990s and outcomes based criteria were introduced in 2000. As a result of a recent review, ECSA has adopted common accreditation criteria, policy and processes based on the BEng-type process for all types of programmes. While each type of programme will have appropriate standards, that is statement of outcomes to be achieved at exit level and curriculum structural requirements, criteria such as the quality of teaching and learning will have a common form for all types of programmes (ECSA website, Accreditation Page).

Case’s (2006) review notes the relative enthusiasm of the ECSA’s adoption of this new form of accreditation, and links it to the body’s joining of the Washington Accord. While there is only sparse literature exploring the political dynamics around this time, a few conference papers, particularly those presented outside the South African context, hint at undercurrents of dissent. One paper, presented in Australia was titled “Do Statutory and Professional Bodies in South Africa Threaten Academic Freedom at Universities: a Perspective from the Engineering Profession” (de Jager & Emuze, 2014). Unfortunately, the study’s quantitative survey methodology failed to provide rich answers to the powerful question in the title. Another paper, focused on the implementation of a radically new model of education in an engineering department, pointed to how engineering academics would skillfully use ECSA accreditation requirements as an argument to resist change:

The engineering academics claimed the sanctity and authority of the Engineering Council of South Africa (ECSA), as the agency likely to scuttle any attempts to move into the innovative engineering education model… Now one could argue, with some legitimacy, that ECSA was simply “used” to protect disciplinary turf. But it remains clear, in fact, that ECSA’s acceptance of this model was likely to constitute a major battle given the conservative tradition this institution seeks to protect (Jansen, 2002, p. 515).

The major changes currently underway in South Africa’s engineering education and accreditation system are the ongoing review of the Engineering Professions Act, and the recent controversy around reappointments to the ECSA council.
In 2000, the South African government, through its Department of Public Works, moved to consolidate and expand its role in overseeing professions in the built environment: engineering, architecture, construction, project management, etc. While engineering had been self-regulated since 1968, many of these other occupations/professions would be self-regulated for the first time. Parallel legislation was drafted for six professions, and six professional bodies (ECSA being the one for engineering) were created, with an overarching Council of the Built Environment created to coordinate across the six Built Environment Professional Councils.

By 2014, the government declared that the scheme wasn’t working, listing a number of challenges in a proposal to overhaul the policy and further centralize control. Not surprisingly, members of the engineering profession reacted strongly to this move. In a jointly written 15-page response coordinated by the South African Institute for Civil Engineers (SAICE), the voluntary engineering associations (not ECSA), challenged the government for overstepping its bounds and losing sight of the purposes of professional self-regulation. An illustrative statement showing the tone of the joint response is below:

The ‘draft BEP [Built Environment Professions] Policy, 2014’ reflects a view that the BEPCs [Built Environment Professions Councils] can be the agents of the DPW [Department of Public Works] and can force Government policy on the professions through the BEPCs… A thrust of the proposals in the draft BEP Policy, 2014 that is worrying is that the DPW seems to see the BEPCs as implementation arms of government for functions that other parties should do but are not. The BEPCs are not implementing agents nor are they intended to be such (SAIEE, SAIIE, SAICE, & COET, 2014)

In 2016, the Minister of Public Works, Thulas Nxesi, followed through on some of the suggestions from his ministry’s own 2014 draft policy paper and ignored the recommended nominations of the outgoing ECSA council, placing more government members on the council to the shock of the engineering community. This led to a March 2017 court motion put forward by a group of 14 voluntary associations, with the SAICE again taking the helm and making public comment on where the government had gone wrong and why court action was necessary:

The council has been complaining that we’re anti-transformation. If you want to take the voluntary associations out of the registration process and do the testing yourself, then the
implication is that you want to change the testing process to deal with your 
transformation imperative… Certainly the inference is that they wish to drop the 
standards to achieve their transformation imperatives… ECSA wants to do the testing. 
They don’t want the associations involved, they want to disband them (Barron, 2017, p. 
2).

It is yet to be seen how this turbulent policy environment will influence accreditation and 
engineering education, but the fundamental questions and challenges to professional authority 
and self-governance are likely to have major implications. This area is ripe for further empirical 
work to understand how different actors are using their power to influence change. It would 
appear that the state is attempting to reassert its control over the professions, and by extension, 
aspects of higher education.
Table 6: Engineering education system in South Africa

<table>
<thead>
<tr>
<th>South Africa</th>
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</thead>
<tbody>
<tr>
<td><strong>Engineering profession:</strong></td>
</tr>
<tr>
<td>Legislation:</td>
</tr>
<tr>
<td>Regulatory bodies</td>
</tr>
</tbody>
</table>
| Licensure rates | • Limited data available. Approximately ~200 new licenses/year.  
• Role of learned societies in final examination for licensure is currently under threat by government’s transformation agenda. |
| **Engineering’s place in higher education sector:** |
| Where is it taught? | • Universities (12) – typically more elite institutions |
| Nature of degrees | • Four-year Bachelor of Science in Engineering (BSc, BEng) with some five-year holistic ‘foundation programmes’ to support equity & inclusion |
| Engineering disciplinary bodies. | • 15-20 national professional institutes. South African Institute for Civil Engineering (SAICE) appears to be the most vocal/active.  
• South African Society for Engineering Education is newer society, hosts biennial conference and publishes short proceedings. |
| Deans council | • Not located. |
| **Accreditation body:** |
| Name/design | • Engineering Council of South Africa (ECSA) has 30 members: 20 must be practicing engineering (range of disciplines), 6 from government, and 10 members of public nominated through open process |
| Composition of membership | • Limited public information about Engineering Programme Accreditation Committee (EPAC).  
• Purpose: Assures stakeholders that programmes provide the educational foundation for roles in profession; and that the teaching, learning and assessment processes are effective. |
| Decision-making, | • ECSA makes decisions on any changes to accreditation criteria  
• Accreditation group (internal to ECSA) oversees process. |
| Policies/criteria | • All of the accreditation visits are done by volunteers (inconsistent)  
• Five criteria: (1) credits, knowledge profile, coherent design; (2) exit-level outcomes; (3) quality of teaching and learning; (4) resourcing and academic freedom; (5) response to previous reviews |
<p>| Washington Accord history. | • Joined in 1999. |</p>
<table>
<thead>
<tr>
<th># of accredited programs.</th>
<th>16 universities, roughly 100 programs</th>
</tr>
</thead>
</table>
| Major changes in last decade: | Engineering Professions Act currently under review (since 2015)  
|  | Government overriding decisions about appointments to ECSA. |
Table 7: Pluralist analysis of key interest groups in South Africa

<table>
<thead>
<tr>
<th>Actor / Interest group</th>
<th>Interests / Perspectives</th>
<th>Sources of Power</th>
<th>Stage in policy process where power is most effective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engineering Council of South Africa, (ECSA)</strong></td>
<td>• Ease of licensing; • Caliber of engineers; • Public safety;</td>
<td>• Decision-making on accreditation; • Registering licensed engineers;</td>
<td>• Change with strong role in resisting change</td>
</tr>
<tr>
<td><strong>Professional engineering societies (e.g. SAICE, SAIChemE)</strong></td>
<td>• Graduates are of high quality and able to pass licensing tests; • Maintaining standards of engineering and public trust;</td>
<td>• Some individuals have seats on ECSA board; • Involvement in licensing process;</td>
<td>• Implementation (providing experts for visiting teams)</td>
</tr>
<tr>
<td><strong>Department of Public Works &amp; Council of Built Environment</strong></td>
<td>• Regulating professions in the built environment; • Protecting public;</td>
<td>• Legal authority over built professions; • Ministerial control over ECSA board composition;</td>
<td>• Indirect influence on Change by changing the composition of ECSA’s board.</td>
</tr>
<tr>
<td><strong>Industry/employer s</strong></td>
<td>• Work-ready graduates;</td>
<td>• Limited direct input; indirect via hiring decisions</td>
<td>• None – informally might shape Change</td>
</tr>
<tr>
<td><strong>South African Society for Engineering Education (SASEE)</strong></td>
<td>• Quality and equity in engineering education; • Research on eng. education; • Collaborate with other bodies;</td>
<td>• Very little power;</td>
<td>• Implementation -&gt; shaping faculty interpretation of accreditation criteria.</td>
</tr>
<tr>
<td><strong>Faculty members</strong></td>
<td>• Flexibility/autonomy in what is taught &amp; how;</td>
<td>• Discretion for how to implement &amp; interpret.</td>
<td>• None – informally on Implementation</td>
</tr>
</tbody>
</table>
The Engineering Council of South Africa is the central actor in both engineering education and the broader profession. It defines, owns and operates the core processes of accreditation, which are laid out in exacting detail in a set of well-organized governance documents, represented in the diagram below:

Figure 1: Documents in the ECSA Accreditation System (ECSA, 2014, p. 1)

South Africa has responded directly and explicitly to the requirements of being a Washington Accord signatory, which it joined in 1999, ten years after initial formation, and 8 years after the end of apartheid in South Africa. ECSA is distinct from the other signatory bodies in that it is not explicitly a representative body, although it is run by a board of nominated members, intended to represent the industrial and academic communities in engineering. It is similar to Engineers Australia in the consolidation of crucial functions (registration and accreditation), and therefore its power relative to the other actors such as professional societies. Interestingly, ECSA has maintained a ‘dual’ system of accreditation that includes both complex quantitative metrics for counting course credit in different key subject areas, as well as an explicit set of learning outcomes (Graduate Attributes) that are benchmarked directly to the Washington Accord standards. This situation is what the deans in Canada, an original W.A. signatory, have been resisting so vehemently, on the grounds of the “double” workload it creates. We thus gain a window into some of the contradictions and international power dynamics between nations, as
arguably Canada’s wealth, power and positioning as ‘original’ signatory give it extra leeway in its slow adoption of graduate attributes, compared to South Africa who joined a decade later than Canada, but adopted the policy in full force almost a decade before Canada.

The other distinctive feature of South Africa’s configuration is the direct, activist role played by the central government, via the Department of Public Works, by actively looking to change the rules of the game for numerous professions, including engineering. Ultimately, professional bodies have been delegated their power to self-regulate by the state, and this can be taken away. That being said, the strategy being employed by the Minister has been questioned on its legal basis, which has led to a court case against the government. The fascinating dimension of that case is that it has been put together by a coalition of professional engineering societies (and other actors), led by the South African Institute for Civil Engineers and its vocal CEO. So, at the same time as we see the state attempting to re-exert its authority over the professions, we see pluralist-inspired organization of aligned interests challenging this perceived intrusion on the autonomy associated with self-regulation. Of particular importance is the coalition’s tactics of emphasizing that government allocation of seats on ECSA’s board was in the interest of the (government)’s transformation agenda, which is explicitly positioned as counter to the public (safety) interest of high standards that is assumed to be the professional societies’ raison d’etre.

Given the sparse public information and published literature on the implications of this shifting landscape for accreditation, new empirical work will be required to understand what this means for higher education institutions in South Africa and the engineering programs they offer. It clearly is an instructive case that can bear lessons for all of the countries included in this study, should they choose to afford South Africa the attention it deserves as a peer Washington Accord signatory.

4.4 Australia

Australia has a population of approximately 24 million people (UN Statistics, 2016, p. 7). The federal government maintains control of much of the higher education policy in the country, while some decision-making and funding is devolved to the regional state governments. Australia has been particularly aggressive in the adoption of neoliberal reforms that have sought to create and shape markets in higher education as the main mechanism of coordination (Olssen* & Peters, 2005). In addition, the country has adopted a National Qualifications Framework
which has had more influence on vocational education than universities (Wheelahan, 2011). In line with other industrialized liberal market economies, higher education has expanded rapidly since the 1980s, and at the same time, intense stratification has taken place, with the elite “Group of 8” universities holding onto their prestige as the original elite institutions in the country.

The engineering profession in Australia is framed by a Royal Charter, signed in 1938 and amended as recently as 2015, that establishes Engineers Australia, the main body overseeing the profession. Engineers Australia offers both an entry-level PEng qualification (for engineering graduates) as well as the full license, Chartered Professional Engineer (CEng), designation. In a particularly confusing division of labour, another entity, the National Engineering Registration Board (NERB) actually operates the official ‘register’ of licensed engineers in Australia. Engineers can be chartered, or registered or both – but it is only in the state of Queensland, where there is legislation (The Professional Engineers Act, 2002) requiring engineers must be registered to practice engineering.

In parallel, Professionals Australia (PA) offers the Registered Professional Engineering (RPEng) certificate. PA grew out of the trade union Association of Professional Engineers, Scientists and Managers Australia (APESMA) that slowly added other professionals to its ranks. Its positioning to offer a parallel credential to the CEng lies in its foothold in Queensland. Here, it is the assessment body for Registered Professional Engineers of Queensland, a situation that came about because of a particularly vocal professor at the University of Queensland in the 1930s (Boyce, 2003) who convinced the state government to pass its own Professional Engineers Act and set up its own regulatory body, much like the provinces in Canada. The RPEng credential offered by Professionals Australia, however, is being marketed to engineers across the country, and Professional Australia is explicit in its intent to compete with the CEng on the basis of price: “Professionals Australia believes there should be a statutory framework to support registration which is obtainable and fairly priced for working professional engineers, supporting their careers while protecting the public.”

13 (Website FAQ link: https://www.professionalengineers.org.au/rpeng/faqs/#148764883313-3cf52be9-cba6)
Engineering education is offered largely in the form of four-year direct-entry Bachelor of Engineering (BEng) degrees taught in universities. As soon as graduates have obtained their degree, they may immediately commence supervised practice with a PEng qualification from Engineers Australia – this is distinct from other jurisdictions where new graduates are designated as “Engineers in Training” under supervision for 4-5 years before they become a licensed professional engineer.

There are approximately 30 professional engineering societies in Australia, many of which are legally incorporated under the umbrella of Engineers Australia and governed by Royal Charter. This hierarchical structure differs markedly from the autonomous, independent professional societies visible in the other Anglosphere countries in this study. In addition to the traditional disciplinary societies, the Australasian Association of Engineering Education (AAEE) is also included under this category, an important regional organization that runs a journal on engineering education, and hosts annual conferences.

A crucial interest group in the Australian engineering education context is the Australian Council of Engineering Deans (ACED), an incorporated organization which represents the deans of universities and colleges which offer accredited engineering programs. The ACED makes “submissions to government inquires, and undertak[es] projects aimed at improving the quality of engineering courses and research” (ACED Website, accessed September 22, 2017). The council is extremely organized and vocal in national policy discussions, submitting 4-6 position papers, formal letters, and whitepapers to different commissions and ministries each year. The council’s focus on improving quality is very pertinent to accreditation. The deans are also well aligned with Engineers Australia, and there is a Joint Consultative Committee of ACED and Engineers Australia that meets several times per year.

Accreditation of engineering degrees is led by Engineers Australia and its Accreditation Board. The board has only six members: Vice President of EA, and five other members (2 with experience in large organizations, and 1 with experience in academia). The board itself approves guidelines and operational procedures, which are implemented by volunteer teams, called accreditation panels, comprised of approximately two-thirds ACED member institutions, and one-third industry. University programs being accredited develop a self-study report to rate themselves against criteria, including mapping course learning outcomes to program learning
outcomes. There is a preliminary teleconference with the accreditation panel, and then a 3-day evaluation visit. In total, Engineers Australia accredits over 330 programs in 38 institutions.

Engineers Australia’s accreditation criteria focus on three broad areas: (1) the operating environment; (2) academic programs; and (3) quality systems. Each is split into component parts with specific performance indicators for each sub-item. The competence standards for a “Stage 1” professional engineer (a university graduate ready to be admitted to practice) are broken into knowledge and skill base; engineering application ability and professional and personal attributes. Of particular note is the level of detail, and the number of indicators and outcomes included in these accreditation criteria. Authors of a comparative study looking at a subset of engineering accreditation competencies in Australia, China, Sweden and United States commented on how Australia stood out for having so many indicators and outcomes prescribed in such detail (Kabo et al., 2012).

The last major review of accreditation was in 1995-1996, led by Engineers Australia, the Dean’s Council and the Academy of Technological Sciences and Engineering (ATSE), and resulted in a commitment to outcomes-based education. This was in alignment with the choice by ABET in the United States to make a similar change in a similar timeframe, and both were inaugural members of the Washington Accord. More recently, in 2011 a major revision of the core framework, the Stage 1 Competency Standards, in “a collaborative and consultative effort” (Australia Council of Engineering Deans, 2016).

The most striking feature of the accreditation system in Australia is the apparent unconditional support for it among national stakeholders, particularly when compared to Canada. In a public letter to the government, the ACED wrote the following:

> The benefits of program accreditation, as outlined above, are well recognized by ACED members. The current processes operated by EA and other accreditation bodies are a cost-effective way of assuring and benchmarking threshold entry level program outcomes for a complex profession. ACED and its members do not consider accreditation to be “a burden”, financial or administrative (Australia Council of Engineering Deans, 2016).

While official interest groups such as the dean’s council remain steadfast in their support of outcomes-based accreditation, there are a few conference papers and journal articles that hint at
some dissatisfaction among engineering faculty members. In the introduction to a 2013 conference paper laying out in detail one school of engineering’s experience with accreditation, Carew and colleagues articulated beautifully the dilemma facing faculty:

Preparing for Engineers Australia (EA) accreditation offers engineering schools and faculties a choice: present the current curriculum in the best possible light, or use preparation for accreditation as a catalyst for curriculum change? The former, simply mapping what is currently on offer, is usually a lower risk, lower effort option and one which may appeal in a change-weary, budget-constrained, research-focused faculty (and sector). In most Australian schools and faculties, engineering programs are not ordered and deliberately structured entities. This is because an engineering curriculum grows like a climbing plant, and often vigorously resists efforts at pruning or redirecting. The current era in Australian engineering education is one of threshold learning outcomes (TLOs), Tertiary Education Quality Standards Agency (TEQSA) audits and an apparent desire by EA for explicit program objectives and related, deliberate curriculum structure. In this new era, it appears that engineering curricula should be engineered! (Carew, Doe, Hadgraft, Symes, & Henderson, 2013, p. 2).

It is difficult to determine if the exclamation at the end of the statement is genuine or feigned enthusiasm for the new accreditation regimes. In any case, the authors articulate in simple terms one of the core tensions in outcomes-based accreditation: whether and how to subject an organic curriculum to a rational, bureaucratized system that shifts power to the system designers and “bureaucrats”, and away from the academic “professionals” at the heart of the teaching and learning process. This tension shows up in a broad summary of the main argument:

Engineering curriculum is not entirely unwieldy, but it is impractical and inefficient to attempt rigid control over all aspects of curriculum. The mechanisms presented here offer curriculum managers the option of identifying those parts of curriculum structure which might best be maintained and managed centrally and those parts of the curriculum which are best left to the devices and creativity of unit coordinators (Carew et al., 2013, p. 1).

There are more obvious signs of political struggle at higher levels of the engineering profession. As previously mentioned, Engineers Australia and Professionals Australia offer parallel credentials aiming at similar goals, despite the absence of consistent national legislation to
require licensure across the country. In 2016, things become more heated between the two organizations in light of labour market data and immigration policy surrounding engineering work. At the time, engineers were on a skilled occupations list that facilitated much easier migration for people with an engineering qualification. In a high-profile article for the Sydney Morning Herald (January 1, 2017), both organizations went on record to criticize the other. Professionals Australia’s CEO was quoted saying “If the labour market reality is there is no shortage of skilled engineers it is logical that you would take them off the skilled occupations list… Engineering job vacancies are at an all-time low, yet, in 2015/16, record numbers of skilled engineers migrated to Australia” (Patty, 2017). He took the attack directly to Engineers Australia, challenging the organization for earning revenue ($8.8 million in 2015-2016) for conducting migration skills assessments: “We hope that role [conducting migration assessments], which now represents 18% of their revenue, isn’t affecting their advocacy on behalf of the profession… there is undoubtedly a conflict here and we say the government should recognize that conflict when it is listening to advice” (Patty, 2017). In this statement, Professionals Australia seeks to undermine the credibility and legitimacy of Engineers Australia, the statutory body in the country, by questioning their financial interests.

Stephen Durkin, the CEO of Engineers Australia, responded by putting the issue in a broader perspective: “Engineering has a highly cyclical employment market, and long-term migration is a method of moderating this boom/bust cycle. As Engineers Australia provides this [migration skills assessment] service at cost, we don’t face any of the vested interest that a union might in any move to artificially constrain the labour market” (Patty, 2017). The article goes on to paraphrase Durkin saying “Professionals Australia, as a union, had an interest in forcing a skills shortage to reduce supply, drive up costs and artificially inflate wages” (Patty, 2017). It is interesting to see how seriously Engineers Australia took the criticism, and the decision to respond in-kind by undermining the credibility of their competitor organization, emphasizing their own vested interests as a “union”. This has potent meaning in the present neoliberal environment, where unionism has declined rapidly in many liberal market economies, including Australia, where the only sector with a growing or stable unionized share of the economy is professionals (Bowden, 2017). There is also some irony in critiquing the strategy of “artificially” constraining a labour market to inflate wages, as this is the core tenet of social closure which underpins the logic of professionalism, at least in neo-Weberian terms (Saks, 2016).
In sum, Australia’s engineering education system shows close integration between the main national professional association, the dean’s council, and the professional societies, with an apparent harmony among those different constituencies. However, the existence of a parallel competitor professional body, Professionals Australia, which is aggressively challenging the dominant authority of the Charted Engineer designation and its bestowing organization, Engineers Australia, is leading to overt political conflict in the public sphere.
Table 8: Engineering education system in Australia

<table>
<thead>
<tr>
<th>Engineering profession:</th>
<th></th>
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<tbody>
<tr>
<td>Legislation:</td>
<td></td>
</tr>
<tr>
<td>• Degree graduates can enter practice immediately as a PEng; can apply for a full CEng license after 4-5 years of practice.</td>
<td></td>
</tr>
<tr>
<td>• Parallel qualification, RPEng, offered by Professionals Australia</td>
<td></td>
</tr>
<tr>
<td>Regulatory bodies</td>
<td></td>
</tr>
<tr>
<td>• Engineers Australia is national statutory body except for Queensland where Professionals Australia registers engineers</td>
<td></td>
</tr>
<tr>
<td>Licensure rates</td>
<td>Unclear % nationally</td>
</tr>
</tbody>
</table>

| Engineering’s place in higher education sector: |  |
| Where taught? | Universities, other Higher Education Institutions  |
| Nature of degrees | Direct-entry, 4-year first degree (Bachelors of Engineering)  |
| | Some direct-entry master’s degree programs now being accredited.  |
| Engineering disciplinary bodies. |  |
| • 30 discipline specific societies, all of which fall under Engineers Australia – more hierarchical.  |
| • Australasian Association of Engineering Education publishes journal, hosts conferences, and serves wider region beyond Australia.  |
| Deans council |  |
| • Australian Council of Engineering Deans (ACED) very active and vocal in contributing to policy discussions; close integration with Engineers Australia through joint committees; very aligned on accreditation.  |

<p>| Accreditation body: |  |
| Name/design | Accreditation Board of Engineers Australia  |
| Composition of membership |  |
| • Very small: only 6 members appointed by Council of Engineers Australia: chair, 2 employers (large organizations), 1 senior academic  |
| Decision-making, |  |
| • Makes recommendations for policy change to Engineers Australia  |
| • Oversees implementation, appoints (volunteer) accreditation panels  |
| • Receives accreditation reports and makes decisions on what programs should be granted accreditation with what conditions.  |
| Policies/criteria |  |
| • All of the accreditation visits are done by volunteers (inconsistent)  |
| • Stage 1 Competency Framework: 16 competencies  |
| • Recommended content split across knowledge domains  |
| • Continuous Improvement Process  |
| Washington Accord history. |  |
| • Original member (1989).  |
| • EA claims to have influenced the GA standards of the accord.  |</p>
<table>
<thead>
<tr>
<th># of accredited programs.</th>
<th>• 38 HEIs, 331 accredited engineering programs (2015).</th>
</tr>
</thead>
</table>
| Major changes in last decade: | • Changed to outcomes-based in 1996 (20 years ago)  
• Major changes to qualifications framework and national quality assurance (beyond engineering) have required significant integration and alignment(mapping) work.  
• Major revision to Stage 1 Competency Standards in 2011. |

Australia’s engineering education system is dominated by the centralized and powerful professional peak body, Engineers Australia. Legally the Institute of Engineers Australia, created by Royal Charter, the organization sets the overall standards for engineering qualifications and also operates the accreditation system. As two influential deans articulate: “The prime mediator between the engineering faculties and engineering employment is the program accreditation system operated by Engineers Australia (EA), and its Stage 1 Competency standard (EA, 2014)” (Male & King, 2014, p. 8).

There is very little visible dissent or political battle over the accreditation criteria or implementation process itself, which may be due to how deeply it is buried within the organizational structure of Engineers Australia. The accreditation board is a standing committee of the board, and is only mentioned once in the footnotes of the 120 pages of general regulations for Engineers Australia, and not included in the Royal Charter that underpins the organization.
Table 9: Pluralist analysis of key interest groups in Australia

<table>
<thead>
<tr>
<th>Actor / Interest group</th>
<th>Interests / Perspectives</th>
<th>Sources of Power</th>
<th>Stage in policy process where power is most effective</th>
</tr>
</thead>
</table>
| **Engineers Australia (EA)** (includes accreditation board) | - Register and certify engineers (CEng);  
- Align accreditation with other national QA processes;  
- Keep the peace;  
- Mutual recognition; | - Power to change accreditation criteria;  
- Shaping how criteria are interpreted;  
- Visiting teams training and composition;  
- Annual accreditation decisions; | - Change/Implementation |
| **Professionals Australia** | - Increase membership;  
- Secure best “economic deal” for engineers;  
- Challenge EA’s monopoly on licensing;  
- Prioritize Australians over immigrants; | - No direct influence on accreditation except for in Queensland State | - N/A – except to undermine public trust in Engineers Australia |
| **Australian Council of Engineering Deans** | - Improve quality and reputation of Australian engineering education; | - Direct access to Engineers Australia;  
- Very active in national policy;  
- Individual deans shape local interpretation;  
- Government funding for research projects and reports; | - Change/Implementation – with the most direct control over Implementation. |
| **Engineering technical societies** | - Furthering knowledge base and distinct features of each discipline; | - Weak – considered ‘part’ of Engineers Australia within a hierarchical structure  
- Australasian Association of Engineering Education creates forum for faculty to share exp.; | - Unclear |
| **Industry/employers** | - Work-ready graduates;  
- Generic skills > technical | - Limited direct input;  
- Indirect via hiring decisions;  
- Consulted widely by ACED in 2012-2014 on WIL. | - None – informally might shape Change |
In comparing Engineers Australia with Engineers Canada, its counterpart Washington Accord signatory in Canada, the crucial difference is that Engineers Australia is a stand-alone organization created by national legislation (Royal Charter) and therefore has significantly more autonomy as a single unified organization. In contrast, Engineers Canada is a membership association of provincial regulatory bodies, who themselves have power delegated to them by provincial governments in the form of Professional Engineering Acts. However, in terms of social closure, a license to practice is required in all Canadian provinces, whereas membership in the professional body as a condition of practice is only required in Queensland in Australia. Another crucial contrast with Canada is that the Australian Council of Engineering Deans (ACED), like the disciplinary colleges, is organized underneath the banner of Engineers Australia. ACED has been a strong advocate and public supporter of outcomes-based accreditation, in direct contrast to the Canadian NCDEAS which has publicly criticized Engineers Canada and questioned the value of the ‘dual’ system of inputs and outcomes based accreditation.

Given its apparent monopoly on engineering certification, accreditation and beyond, perhaps it is not surprising that the main challenger to Engineers Australia is a ‘competitor’ industry trade union, Professionals Australia, which seeks to offer a parallel, alternative qualification to the CEng. Building on the detailed description of this conflict from Chapter 4, the new dimension to foreground here is the focal point of the political battle: migration. The Washington Accord was explicitly designed to “assist the mobility of professional engineers”14.

Engineers Australia is both the W.A. signatory, and the self-proclaimed “trusted voice of the profession” that has undertaken labour migration studies for the Australian government which signaled that more skilled engineers were needed to deal with fluctuations in labour demand. The

challenge and critique leveled by Professionals Australia clearly serves its own interests in positioning it as a viable challenger to the dominance of Engineers Australia. However, PA focuses narrowly on the economic exchange, and ignores the link between Washington Accord signatory status and the policy rationale for engineering migration. It highlights an interesting angle for future study: to what extent are engineering graduates actually exercising the mobility afforded by the accord, and which countries are sending vs. receiving? In other words, what is the ‘balance of trade’ of graduates and how is that being understood politically in each nation state? It is telling that despite this rational technocratic rationale for the accord in the first place, an overwhelming majority of published material on the Washington Accord or by its host organization, the IEA, focused on the mechanics of accreditation recognition and very little on policy outcomes – engineer mobility.

In sum, Australia’s situation is characterized by a powerful, overarching organization that has organized the other usual suspects in the profession underneath it in a hierarchical structure. At least from available material, this provides one explanation for why there has not been more public political positioning from within the profession, and why the only visible critique is coming from outside Engineers Australia from its small, fledgling competitor. The other remarkable feature of Australia’s system is the focused, articulate and influential role of the dean’s council, which appears to be working in concert with the national body for the profession, rather than against it, in the case of Canada. The deans’ ability to mobilize research funding and to organize and deliver on sector wide consultative projects, indicates that the group holds an important form of soft power within the Engineers Australia fiefdom.

4.5 United Kingdom

The United Kingdom, comprised of England, Scotland, Wales and Northern Ireland, has a population of just over 65 million people (UN Statistics, 2016, p. 7), and a checkered and complex history as headquarters to the former British Empire. This history is reflected in the fragmented nature of the engineering profession, which dates back to the late 18th century making it the oldest in this study. Engineering has its roots in a vocational, trade-based occupation that has slowly come to occupy space in higher education institutions, yet remains tarnished as a lower status profession particularly in comparison to law and medicine.
The UK engineering profession evolved through the creation, growth and proliferation of professional engineering institutions (PEIs), or professional bodies, such as the Institute for Civil Engineers (ICE). Many of these were established in law by a Royal Charter, considered the gold standard in regulation and professional status for an occupation. While these Royal Charters protect the title of professional (Chartered) engineer, there is no requirement for individuals undertaking engineering work in the UK to be registered, except in the nuclear sector.

Due to their historical legacy, the PEIs remain powerful and autonomous in the UK context. There are currently 25 PEIs, ranging from a few dozen members up to 60,000. The largest three, representing civil, mechanical and chemical engineering, make up 70% of the population of registered engineers. Many operate globally, in an imperial fashion, registering members in former colonies, and even accrediting courses in universities in other countries. The Institute for Chemical Engineers (IChemE) alone accredits engineering courses in 13 different countries. PEIs play different roles, including acting as qualifying bodies, learned societies, promoters of the profession, and advisers to the government. The net effect of such complexity and interdependence is that, as Sir John Uff puts it in his scathing independent review of the engineering profession in the UK, “The current structure of UK engineering presents an almost impossible landscape for the outside world to navigate effectively” (Uff, 2016, p. 15). One of the intended contributions of this section is to map that territory for easier navigation.

The UK government has been trying, for more than 50 years, to bring coherence and coordination to this “almost impossible” landscape. In 1965, the first council of engineering institutions, later renamed the Engineering Council UK, was created to try and coordinate, however it had no mandate to act on behalf of the profession. Later, its promotional activities were unbundled and placed under the responsibility of another organization, EngineeringUK. The Engineering Council does, however, have a regulatory mandate:

The Engineering Council is the regulator for the engineering profession and exercises an overseeing function both in relation to standards and professional registration. In regard to standards, prescribed levels of competence and commitment are required to be met… set out in UK-SPEC [UK Standard for Professional Engineering Competence], which has been drawn up in collaboration with the whole profession. As regards registration, the 35 PEIs are each licensed by the Engineering Council to conduct interviews to assess
professional competence and to award appropriate registration. The institutions collect a “registration fee” from each registered member that is used to fund the activities of both the Engineering Council and EngineeringUK (Uff, 2016, p. 37).

A third overarching national body, the Royal Academy of Engineering (RAEng), also plays a major role raising the profile of the profession, although it is funded by central government rather than the PEIs. RAEng operates with a close link but no explicit formal relationship with the PEIs. Again, Uff sums up the state of affairs well, stating that there is a “systemic failure in the governance construct of the profession and the leadership responsibilities of the Royal Academy, the Engineering Council and EngineeringUK demonstrably overlapping” (p. 15).

One of the tangible crises facing the profession is the low and declining proportion of engineering graduates who register and become members of PEIs, let alone obtain their Chartered Engineer license. A rough estimate shows that of all eligible engineering graduates (4-6 million), only 15% are members of PEIs, and only 5% are actually Chartered Engineers. This varies significantly by sector, with civil and structural engineering having the highest licensure rates, followed by mechanical engineering and finally, electrical and electronics at the lowest end of the spectrum. Both engineers themselves and their employers find the registration and licensure process complicated, burdensome and irrelevant – especially because of the diversity and independence of the PEIs.

The fragmentation of the landscape is not for lack of trying. There have been no less than 4 major commissions and independent reviews of the profession calling for reorganization and amalgamation of PEIs, none of which have led to any noticeable change (Finniston, 1980; Hamilton, 2000; Perkins, 2013; Profession, 1993). The most recent, cited frequently in this section, is a review by Sir John Uff which was commissioned, ironically, by the three largest PEIs in the country, ICE, IMechE and IET, and was released publicly in 2016. The central recommendation of the Uff report was the creation of a joint body that would ultimately lead to a merger of all PEIs. In the report, Uff himself skeptically acknowledges that this would be the fourth time this exact recommendation has been made, dating back to the famous Finniston Inquiry in 1980.

To obtain a professional license as a Chartered Engineer, one must have an accredited degree (masters or bachelors) as well as evidence of work experience professional development, and
ultimately one must go through a professional review including an individual written application and a professional interview. Engineering degrees in the UK differ in their high proportion of Master’s degrees and combined Bachelor’s-Master’s degrees (often 3 years + 1-2 years). Degrees are mostly taught in universities or university technical colleges, although successive policies introduced between 2009-2014 have supported “higher” degree apprenticeships which can be offered in further education colleges (Hordern, 2015). The full impact of this on engineering degree education has yet to be seen. Degree apprenticeships may become a more prominent form of engineering education because they offer a viable alternative to the recently hiked tuition fees: apprentices are paid to complete their coursework, as opposed to paying to be a university student.

The main national organization that brings together engineering educators is the Engineering Professors’ Council (EPC), which has evolved from a council of department heads formed in the 1970s that eventually broadened its focus to include all faculty members. It remains quite a small organization, and recently held its first major conference, “New Approaches to Engineering in Higher Education” in partnership with IET. The small set of short papers published in the proceedings indicate similar themes to other national engineering education conferences, with more calls for reform and fewer empirical investigations. Many UK engineering academics also engage in the European Association for Engineering Education (SEFI) which is home to the European Dean’s Council.

When it comes to assuring the quality of engineering degrees, the overarching agency in charge is the Engineering Council UK, which has a mandate to regulate the profession, holds the national register for engineers, and is the Washington Accord signatory body. The council’s governance structure is based on weighted groups that allow for proportional voice for licensing institutions to enable “self-regulation” of the profession. In practice, there are 22 trustees nominated by the 35 PEIs and EngineeringUK.

Accreditation policy falls under the remit of the Registration Standards Committee of the Engineering Council. As stated on its website, “The Engineering Council sets the overall requirements for the Accreditation of Higher Education Programmes (AHEP) in engineering, in
line with the UK Standard for Professional Engineering Competence (UK-SPEC)\(^\text{15}\). AHEP is a high-level framework developed in 2004 that outlines the purpose and process of accreditation, with some generic guidance on important competencies that should cut across all disciplines of engineering. The Engineering Council claims that these standards have been developed through a consultative process that included input from both academics and employers. In contrast to Canada, documentation of these consultations has been difficult to locate.

Because of the decentralized and autonomous stance of the PEIs in the UK and their direct alignment with the fields of engineering studied in university, the Engineering Council delegates the actual implementation of accreditation along these lines:

Degree accreditation is undertaken by sector specific professional engineering institutions under license from the Engineering Council. These institutions interpret the standards as appropriate for their own sector of the profession and use them when deciding whether degree programmes meet the requirements to be awarded ‘Engineering Council accredited degree’ status (Engineering Council, 2014).

Once again, the decentralization has the potential to lead to chaos in implementation, as the system design requires that a university with 10 engineering programmes to be accredited 10 times in parallel by 10 different PEIs. In an attempt to rectify this, yet another organization was created, the Independent Engineering Accreditation Board (EAB). The EAB tries to encourage consistent accreditation processes, and coordinates visits where 3 or more PEIs agree to accredit degree programs in the same visit. This has led to the creation of detailed documentation by EAB to help prepare for site visits, documenting learning outcomes, and other implementation details.

What is striking about the literature on engineering education in the United Kingdom is how much the focus remains on the activities and politics of the professional engineering institutions, and how little investigation there is of the impact of accreditation on higher engineering education itself. One short paper from the recent Engineering Professors’ Council conference

raises familiar questions about the problems of accreditation, and it points to the power of professional bodies in dictating accreditation requirements.

Engineering faculties often prioritize the requirements of professional bodies over and above other demands. There are numerous reasons for this but the key driver is, without a doubt, professional accreditation. Yet the research briefly referred to in this discussion paper reveals that many young people are totally unprepared for the rigours of a career in engineering when they enter university. Few understand what professional bodies are and, worse still, many have little or no idea what engineering actually is. Until professional bodies, industry and education begin to work together to promote engineering and the role of the engineer in society, little will change (Clark & Andrews, 2017, p. 56).

Papers from UK engineering educators remain a minority in the European engineering education conferences, and even more so in the American context. A few papers have begun to explore differences between the UK system and Australia or the United States, but their analysis has been atheoretical and focused on surface level differences such as frequency of assessments within courses. For example, Hylton and Otoupal-Hylton (2016) document the experience of a UK engineering professor who teaches in the US for two semesters, and focuses on the number of assignments and examinations in a typical course, citing detailed examples. The paper makes only passing reference to accreditation.

Overall, the United Kingdom is home to one of the most fragmented and fractured landscapes of the engineering profession. This situation has its roots in a particular historical context of second half of the 19th century, when British engineering was at the height of its power, and new disciplinary institutes were allowed to proliferate through Royal Charters (Buchanan, 1985). The structure of professional engineering institutes leads to what must be an incredibly tedious and frustrating process of accreditation. Overlaid on top of this is the increasing pressure at a system level from the Quality Assurance Agency, and the introduction of the high-stakes and intrusive Teaching Effectiveness Framework, which has drawn significant worldwide attention (Canning, 2017; Filippakou & Tapper, 2007, 2008; Salter & Tapper, 2000). From the countries studied in this thesis, the United Kingdom had the least visible scholarly literature on engineering accreditation. Perhaps this is a reflection of the sector-wide and highly invasive quality assurance
frameworks that draw the attention of educational researchers, combined with the nascence of engineering education research as a distinct field in its own right. This is not to say that there is any lack of interesting and complex phenomena to study – quite the contrary. There are major opportunities for research to develop nuanced and multi-level understanding of accreditation dynamics in the UK context, which can make a substantial contribution to the sparse national literature on the topic.
Table 10: Engineering education system in the United Kingdom

<table>
<thead>
<tr>
<th>Engineering profession:</th>
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| Legislation:            | • Royal charters for Engineering Council and professional engineering institutions (PEIs).  
                          | • Title of engineer is protected, but no exclusive right to practice.  
                          | • Degree graduates register with PEI of choice, and later go through professional review to obtain their Chartered Engineer (CEng) license. |
| Regulatory bodies       | • Engineering Council is overall regulatory body  
                          | • 35 different PEIs each regulate practice in their own domain. |
| Licensure rates         | ~5% nationally |

<table>
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<tr>
<th>Engineering’s place in higher education sector:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Where is it taught?</td>
<td>Universities &amp; university technical colleges.</td>
</tr>
</tbody>
</table>
| Nature of degrees                           | • 3+1-year combined Bachelor’s and Master’s of engineering degrees.  
                          | • New degree apprenticeships may change the field significantly.  |
| Engineering disciplinary bodies.            | • 35 professional engineering institutes double as regulatory bodies and learned societies. Very autonomous and independent.  
                          | • Royal Academy of Engineering is separate but key organization  
                          | • EngineeringUK is responsible for promoting the profession.  |
| Deans council                               | • None. Some UK deans are part of European Dean’s Council.  |

<table>
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<tr>
<th>Accreditation body:</th>
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</table>
| Name/design         | • Registration Standards Committee of Engineering Council sets overarching policy, but implementation is done by PEIs.  
                          | • Engineering Accreditation Board (EAB) helps coordinate joint visits by 3 or more PEIs to decrease administrative burden of parallel work. |
| Composition of membership | • Varies widely depending on PEI. |
| Decision-making,    | • Engineering Council makes decisions about UK-SPEC framework  
                          | • PEIs themselves make decisions about accrediting programmes. |
| Policies/criteria   | • UK-SPEC is the competency framework for obtaining CEng.  
                          | • Accreditation of Higher Education Programmes (AHEP) takes UK-SPEC and interprets in the context of higher engineering education. |
| Washington Accord history | • Original member (1989).  
                          | • Engineering Council is the ‘single body’ representing UK engineering. |
| # of accredited programs. | • Unclear. Engineering Council: 4,000 courses (?)  
• EAB coordinates 8 visits per year, 80-100 programs per year. |
| Major changes in last decade: | • UK-SPEC underwent minor revisions in 2014  
• Uff report in 2016 recommended major organizational changes to PEIs |

There is some irony in following the centralized system of Australia with an analysis of the chaotic “system” in the United Kingdom (UK), particularly given the direct influence of British policy on Australia’s legal and political systems. Even Engineers Australia itself was set-up by a Royal Charter.

The dominant actors in the UK are the professional engineering institutes, which hold the power to register and license engineers, and are delegated full responsibility for program accreditation. The challenge lies in the large number and wide variation in size and effectiveness of these PEIs, reinforced by the independence grounded in individual Royal Charters. The Engineering Council, which is the Washington Accord signatory and the organization tasked with trying to integrate and coordinate at a national level, suffers from a lack of control over the core processes: registration and accreditation. In this way, the Engineering Council has a very similar mandate to Engineers Australia, but lacks the authority and control to act on it. It tries to play a mediating role between different representational groups, as does ABET in the United States, but the actual accreditation decision-making is undertaken by the professional bodies themselves.

A notable innovation in the UK landscape is the refreshed strategy and vision of the Engineering Professors’ Council, which has staked out its claim as the body that integrates and represents all engineering academics in the country. This is an evolution from its history as a representative group for department heads (which have important roles in accreditation given the segmentation along disciplinary lines). The EPC has started to make inroads in policy discussions, explicitly invited into an important consultation on learning outcomes in engineering, and receiving support from IET to host conferences on innovation and best practice in engineering education. However, it still suffers from a lack of formal power and authority, and an apparent distance from decision-making, such as the access to power enjoyed by the ACED in Australia.
<table>
<thead>
<tr>
<th>Actor / Interest group</th>
<th>Interests / Perspectives</th>
<th>Sources of Power</th>
<th>Stage in policy process where power is most effective</th>
</tr>
</thead>
</table>
| **Professional Engineering Institutes** (professional societies e.g. IChemE, ICE, IMechE) | • Protect and increase membership;  
• Organizational survival;  
• Learned society – promote knowledge & advance practice; | • Royal charter, membership dues and control of accreditation implementation; | • Change (resist);  
• Implementation (strong monopoly) |
| Engineering Council UK (regulatory standards committee) | • Keep the peace;  
• Develop some consistency and harmonization across PEIs | • Has its own royal charter;  
• Oversees accreditation and sets general framework; | • Change; but only at generic levels |
| Engineering Accreditation Board | • Improve efficiency and decrease workload; | • Very little;  
• Some coordinating authority over PEIs;  
• Some input into guidelines; | • Informally during Implementation only. |
| Industry/employers | • Work-ready graduates; | N/A | N/A |
| Engineering Professors Council (professors and department heads) | • Voice for professors;  
• Increase profile & influence of professors;  
• Best practices exchange;  
• Influencing accreditation processes; | • No formal power;  
• Included in Assessment of Learning Outcomes in Engineering (ALOE) working group (2006-2009);  
• Informal relationships with IET, IMechE and RAEng. | • Implementation (program/course level). |
| Deans | • Minimize administrative burden;  
• Maintain accreditation status | • No (visible) formal association/organization | • Implementation (interpretation) but perhaps less power than department heads? |
Canada and the United Kingdom are very dissimilar in many respects. While each have decentralized registration and licensing, they have done so along different lines. Canada has constitutionally delegated power to the provinces, who have developed their own parallel legislation and thus provincial regulators register engineers across all disciplines. The UK has delegated power to the specific disciplines, via Royal Charters that underpin the professional engineering institutions who register engineers across the entire geography of the country, but without a strong legal basis (i.e. weak occupational closure). Both countries are similar in having a representative association at the national level setting high-level accreditation policy. However, in Canada, the CEAB has significantly more control over its processes, and importantly, it maintains control over the selection and training of accreditation visiting teams, and makes its own final decisions on the basis of recommendations. On the other hand, in the UK, the Engineering Council sets the high-level framework (UK-SPEC) but then leaves to the professional bodies the discipline-specific customization along with all of the logistics of visit preparation, execution and final accreditation decision-making. Some of the coordinating function implicit in CEAB in Canada exists in a separate organization altogether in the UK, the Engineering Accreditation Board. The most fruitful comparative learning might take place, by comparing in more detail the positioning and mandate of the UK’s Engineering Professor’s Council, in comparison with the Canadian Engineering Education Association. The EPC has roots in a representative body for department heads but is forging forward into the scholarship of teaching and learning in the UK, whereas the CEEA has started with teaching and learning and now is seeking more of an advocacy role, at least to influence funding for engineering education research in Canada.

The UK is an example of extreme decentralization, and the disciplinary lines along which this occurred has led to fragmentation, in-fighting and an overall weakening of the engineering profession. All attempts to rectify this, by suggesting organizational mergers and amalgamations, have failed to lead to change. John Uff’s analysis points to Royal Charters as the cause. This legal mechanism underpinning the professional bodies is particularly difficult to change in the face of incentives for the organizations to persist, however skewed those incentives might be.
Chapter 5 Cross-Country Comparison

In the previous chapter, I documented the key elements of the engineering profession and educational system in each of the five countries in this study and explicitly applied a pluralist framework to analyze the interests, sources of power and key actions of different interest groups involved in engineering accreditation in each country. In the analysis that followed each table, attention was given to the governance of the accreditation board itself, to see how different interest groups vied for influence in the formal decision-making over changes to accreditation policy.

The chapter builds on this in a more explicit cross-country comparison, looking across all five countries for similarities in differences in who are the most influential actors, the centralization of accreditation policy decision-making, and the strength of social closure.

First, we consider the most influential actors shaping accreditation policy in each country, while factoring in the extent of centralization/decentralization and how that shapes the distribution of power in the profession. Second, we investigate the strength of social closure and its imprint on accreditation logic, paying attention to the division of labour between organizations responsible for accreditation and those who undertake licensing. Finally, we return to the Washington Accord as the policy driver that simultaneously brings the countries in this study together, raising important questions about the extent to which alignment can be achieved given such different governance regimes in different signatory countries.

5.1 Most Powerful Actors and Distribution of Power

In Canada, the most powerful actors are the provincial regulatory bodies, which make up the board of Engineers Canada, a national association. They exert their power through their majority voting power on Engineers Canada’s board, and in recent years they have resisted proposals to make changes to the historical inputs-based accreditation system they are accustomed to. Because of this dynamic, the Canadian Engineering Accreditation Board (CEAB) becomes a political arena, but it is not an equal playing field. In this sense, it is not a ‘pure’ pluralist contest, but rather one where there is entrenched power reflected in decision-making over policy changes.

In Australia and South Africa, the national association (peak body) itself is the most powerful actor shaping accreditation policy. These are closest to the ideal type of social closure, as there is
a centralized decision maker with significant authority over the other actors, and the self-regulatory mandate to make decisions about changes to its accreditation policies. In both cases, the accreditation board is a smaller, less distinct entity that is part of the bureaucracy of the organization, Engineers Australia and Engineering Council of South Africa respectively. An important similarity is the speed and consensus with which outcomes-based accreditation was adopted – in South Africa’s case it came with signatory status in the Washington Accord as a requirement for membership; while in Australia the change happened on a very similar timeframe to the United States. Clearly having a single, strong voice for the profession makes it easier to adopt wholesale policy change. What is also interesting is that there was no obviously visible opposition to the change from stakeholder groups representing the engineering professoriate. In fact, the Australian Council of Engineering Deans has on multiple occasions been publicly supportive of the outcomes-based accreditation regime. Interestingly, in both countries the authority and autonomy of the peak body is under pressure, but from different challengers. In Australia, a competitor professional body, Professionals Australia, is challenging Engineers Australia’s “monopoly” – this is possible because of historical oddities in the legislation of engineering that meant one state, Queensland, had a different set of requirements that enabled the creation of a parallel body. In South Africa, the national government itself is threatening to undermine the autonomy of the profession through both legislative changes to the Professional Engineering Act, as well as directly intervening in the composition of the board for ECSA.

The United Kingdom and United States feature the strongest professional learned societies which dominate and complicate the landscape in those countries. In the UK, professional institutions have direct responsibility for conducting accreditation and interpreting national guidelines set out by the Engineering Council UK. This creates significant complexity and inconsistency across the different disciplines of engineering, and a monumental logistical challenge for universities seeking to be accredited for programs in a wide range of disciplines. In the United States, the dominant actor is the accreditation board itself, ABET, which has recently gone through an organizational restructuring that concentrates power internally and gives it more ability to act as an autonomous organization rather than a representative association of member societies which was its founding purpose. Where the American professional societies retain significant power is in the allocation of voting seats on the board of delegates for ABET, although this power is being
challenged by the new, smaller, corporate board overseeing the organization. An emerging interest group within ABET is the professional evaluators who form the bureaucratic core of the organization and are perceived to be driving the latest round of changes to accreditation criteria – to the chagrin of some vocal stakeholders in the engineering education community. The UK and US represent variations on the other extreme ideal type, that of a highly decentralized and fragmented profession with a diverse range of stakeholders involved in accreditation policy making – the UK being the more institutionally complex of the two in this regard.

Looking at the five countries together, what do we learn about the nature of the most powerful actors shaping accreditation policy? In all cases, there is a body (board, committee or standalone organization) tasked with making decisions about change. The power of pluralist analysis is to illuminate which interests are represented on those decision-making bodies. They vary widely in size, from a half dozen in Australia to more than fifty in the United States. They also differ in the distribution of seats or votes to different constituent groups. Canada emphasizes provincial regulators; South Africa emphasizes practicing engineers from government and the private sector; US and the UK emphasize professional societies. Because the accreditation boards or bodies themselves are serving as a platform for bringing together a range of interests, they can be seen playing a mediating or peacekeeping role, such as the Canadian Engineering Accreditation Board balancing perspectives of the deans and the provincial regulators. On the other hand, as the nature of accreditation itself becomes more complicated and bureaucratized, some accreditation boards, such as ABET, are consolidating their power and prioritizing efficiency and streamlined process over their historical role as brokers of professional interest groups. In this situation, accreditation can be seen to take on a life of its own, justifying its own existence and drifting from its historical role mediating between universities and professional bodies. Following this line of thinking, we shift our attention to the fundamental policy basis for accreditation in the first place, social closure.

5.2 Social Closure

There is an important pattern unfolding across all five countries: enrolment in undergraduate engineering degree programs has increased dramatically in recent decades in all countries, and there has not been a corresponding increase in the number of engineers who are obtaining their
professional license. This doesn’t appear to be a prominent focus of the literature on the topic, and represents a looming existential crisis for the profession globally. While gathering comparable statistics was beyond the scope of this thesis, there remains an important contribution to the scholarly literature and to the profession itself to compile and aggregate historical trends on enrolments, licenses, and changes in the ratio of those who graduate with engineering degrees to those who actually become licensed professional engineers as per the logic of accreditation and social closure. What was apparent in the analysis was how differences in the strength of legislation and the division of labour across organizations in the profession affected the extent to which licensing was even a priority in different countries.

In Canada, where provincial regulatory bodies were the most influential actor, the link between accreditation and licensure is the strongest. This was precisely the stated rationale presented by representatives of the regulatory bodies in the high stakes board meeting that blocked the proposal to change inputs-based accreditation. However, even in Canada licensure rates are declining, particularly in the most populous province of Ontario (Prism Economics and Analysis, 2016).

The United States is the extreme opposite, where the state registration boards responsible for examining, registering and licensing engineers have next to no voice in accreditation policy decision-making. While these examiners and registration boards have banded together in a national association, they don’t hold back in acknowledging the reality that licensure is under threat in all states. Despite this decoupling between accreditation and licensure in the US, there is no sign of programs or universities choosing to abandon accreditation either: the downside risk is too high, and the important legitimacy afforded by being ABET-accredited is too valuable. This reinforces the point that accreditation can be a powerful force in its own right, regardless of social closure, and its quality assurance role becomes foregrounded.

The United Kingdom has arguably the lowest rates of licensure\textsuperscript{16}, and this can be attributed to two main factors: The first is the strength of legislation: other than in the nuclear sector, the

\textsuperscript{16} In the 2016 Uff Report, he estimates the overall licensure rate to be less than 5% of engineering degree graduates who obtain their CEng license/registration.
Royal Charters which underpin the professional societies do not equate to exclusive rights to practice, leaving it optional to employers and to engineers themselves whether or not they choose to become certified. The second reason is that registration is handled independently by the major professional engineering institutions, each with different processes, timelines, requirements and fees. This forces engineering graduates to choose their disciplinary affiliation, which is difficult given the uncertainty and poor match between discipline of study and work in liberal market economies in general, and in the UK in particular (Dixon, 2015; Wheelahan & Moodie, 2017).

What is interesting, however, is the closer linkage between accreditation and licensing in the UK than the US, as the same disciplinary bodies (PEIs such as the Institute for Civil Engineers) are responsible for both accreditation and registration for their particular discipline of engineering. The contradictions of functional (disciplinary) alignment between closure and accreditation on one hand, with practical decoupling as fewer graduates become licensed on the other, point to the importance of moving beyond the rational-technocratic assumptions of linear policy logics in understanding the complexities of accreditation policy making and breaking.

South Africa and Australia display similarities as licensing and accreditation functions occur within the respective national associations. Where they differ from Canada is in the forces for change. South Africa, which is younger in its overall approach to regulating professions, is questioning the relevance, role and autonomy of professional bodies across multiple professions within the domain of the ‘built environment’. This government policy stance has the effect of lumping engineering in with other occupations like architecture, land surveying and construction. In their vocal resistance to the potential loss of autonomy, professional engineering societies have invoked their most powerful rhetorical tool in the professional project, the threat to public safety which is associated with bureaucrats and lawmakers attempting to directly regulate a profession such as engineering. These conflicts foreground the importance of social closure in perhaps a more explicit way than anywhere else in the study, as these battles took place many decades (if not centuries) earlier in the other countries such as Canada, US and the UK (Buchanan, 1989; Layton, 1971; Millard, 1988).

Australia is unique in its approach to engineering qualifications – university graduates are immediately granted an entry-level qualification, which eventually gets upgraded to a full professional qualification, although there is no explicit national legislation that makes that
qualification a necessity for practice. This makes tracking and comparison confusing, as seemingly all graduates would be entitled to the entry-level title regardless of what occupation they enter into. It also foregrounds the salience of the ‘alternative’ qualification offered by Professionals Australia which tactically targets the higher fees charged by Engineers Australia. This jurisdical conflict, while ostensibly about power and control of the profession, risks devolving into a petty popularity contest or worse, a price war questioning who can offer the lowest membership fees. Nonetheless, Engineers Australia shows similarities to ABET in promoting accreditation as a powerful control mechanism with its own logic and rationale, independent of its link with licensure.

The overall finding is that social closure is not nearly as clear cut in engineering as it is in other professions such as medicine and law. It is stronger in countries like Canada and South Africa than in the United Kingdom or the United States, but across the board it appears to be under threat from both employers choosing to hire engineers without licenses, and governments seeking to reduce regulation and red tape. Even though its practical functional effects may be weak, the logic and rhetoric of social closure is adopted widely by engineering professional bodies, and in some cases enshrined in law. Similarly, the assumptions of social closure, namely that all, or a majority, of students pursuing engineering degrees will go on to practice engineering in their careers, are deeply embedded in accreditation policies and criteria. This presents a policy challenge and an analytical one. The next section takes up the analytical question of why and how outcomes-based accreditation has been so quickly spread to so many countries around the world, through the Washington Accord.

5.3 Institutional Isomorphism and the Washington Accord

The pluralist analysis of the most powerful actors shaping accreditation policy revealed a gradual convergence among the five countries, whereby a single national professional body has significant influence over accreditation policy. While these organizations differ in their legal status, structure and relationships with professional disciplinary societies, they share interests in improving accreditation processes, keeping the peace among national stakeholders, and maintaining their status as a Washington Accord Signatory. In order to fully explain why this is happening, we need to move beyond a purely political analysis.
One theoretical explanation for the seeming incoherence in the professional logic of social closure being selectively applied to accreditation lies in institutional isomorphism (DiMaggio & Powell, 1983). A close study of the history of engineering professionalization in different countries highlights the influence that the ‘high status’ professions of medicine and law had on engineering professional organizers (Buchanan, 1985, 1989; Layton, 1971; Millard, 1988; Noble, 1979). In the first place, engineering’s attempt to obtain social closure (with varying degrees of success) can be framed an act of mimetic isomorphism whereby engineers sought to replicate elements of law and medicine’s successes in obtaining a monopoly on their field of practice.

Extending our timeframe back into the early 20th century, we can explain the development of accreditation systems (which came after licensure schemes were devised) as responsive to pressures for accountability and again mimicry of other professions. Shifting to the last quarter century, the Washington Accord can be seen as a form of normative isomorphism, as several accreditation bodies sought to align their practices, norms and values globally to present a united front and thus increase the legitimacy of the profession, while achieving some practical trade and migration benefits through increased mobility. What this study shows is that, as of 2017, accreditation’s promise as a mechanism for delivering engineering graduates to a protected professional labour market has waned. In other words, accreditation as a part of the social closure mechanism has become a rationalized myth (Meyer & Rowan, 1977). Actors involved in accreditation will still argue its rational stated purposes from a structural perspective as a strong justification for its existence. This is particularly important for justifying the evolution of accreditation in the past 15+ years from an inputs-based accounting exercise to a more involved ‘continuous improvement’ system attempting to link data on student outcomes to changes to curriculum and teaching at an institutional level. This change has been led by the United States and Australia, who both undertook major reviews of their accreditation systems in the 1990s. Just as these began to be implemented in full force in the early 2000s, nearly identical definitions and conceptualizations of ‘graduate attributes’ were adopted by all countries in the Washington Accord, thus spreading the policy rapidly through the signatories. Two dimensions of the Accord help to explain the increasing power of national professional associations in several countries: first, it is a requirement of the accord that only one single country be the signatory. Second, the complexity of outcomes-based accreditation requires centralized expertise and the management capacity to support a broader and more complex bureaucracy.
The five countries in this study were chosen specifically because they are signatories to the Washington Accord, and yet in the preceding pages I have challenged assumptions of their institutional similarity at a system or landscape level. There is clearly convergence on the criteria and logic of the accreditation system itself. However, the policy changes towards outcomes-based accreditation are being transplanted into fundamentally different institutional contexts and thus we should expect wide variations in how they are implemented and their impacts (if any) on the actual teaching and learning at the core of engineering education. This study provides a strong foundation for approaching a comparative study of the implementation dynamics of accreditation in the countries considered.

Another important perspective on the Washington Accord is a geopolitical perspective on its relevance to national interests in the global knowledge society. As of the completion of this thesis, 19 countries are signatories to the Accord – notably including Japan, China, India and Russia as well as a number of other South Asian nation states. In this respect, the auspicious timing of the accord being signed in 1989, two years before the fall of the Soviet Union, sheds light on the fact that Russia was a much later signatory (2012). Russia was thus required to submit to the requirements agreed upon decades earlier by the core Anglosphere original signatories, dominated by the United States. The more recent inclusion of China and India, with the two largest populations in the world, also points to the powerful coercive isomorphic forces exerted by the Washington Accord and its home organization, the International Engineering Alliance. New signatories go through a particularly invasive ‘initiation’ process and all signatories are monitored every 3-6 years to ensure they maintain their comparability. As a site of powerful, elite group of actors in engineering globally, there would be significant value in a closer analysis of the specific individuals and interests that shaped the initial accord, as well as the buy-in for shifting the accord’s standards to outcomes-based following the lead of the United States. That analysis, while valuable, is well outside the scope of this thesis.
Chapter 6 Discussion and Conclusions

In this final chapter, I take stock of the core findings with reference to the research questions and highlight the significance of the findings – both theoretically and practically. I acknowledge the limitations of the methodological approach taken, and lay out next steps for a future research agenda on engineering accreditation in a cross-national comparative context.

6.1 Summary of Findings and their Significance

1) Political theory and the sociology of professions sharpen our understanding of professional education in higher education institutions. A key objective of this research is to bring together disparate bodies of literature to enhance the theoretical understanding of the dynamics underpinning changes to professional education in higher education. I have shown how a modified pluralist analysis of the interests and power of different national interest groups can explain important differences in the politics of accreditation across countries that espouse to operate in ‘comparable’ policy regimes. Pluralism is helpful in unpacking conflicts and resistance to changes, such as Canada’s delayed adoption of outcomes-based accreditation. This analysis is enriched by access to key statements, comments and whitepapers by the different actors involved. Pluralism is less useful for interpreting irrational reasons behind actors’ decisions and strategies.

The focus on power and interests in pluralism aligns well with key concepts from the sociology of professions and a broader political economic view of higher education to begin to explain dynamics inside organizations. On the other hand, clearly there are limits to the neo-Weberian approach to analysis of professions, which downplays the agency of university actors in shaping professionalism. Future theoretical work can help address this limitation by returning the favour – bringing theoretical concepts from higher education to build a more dynamic neo-Weberian theory of professions that reflects the powerful and heightened role of higher education institutions in defining and shaping professional knowledge, qualifications and identities.

2) The key institutions of the engineering profession vary widely in terms of centralization and division of labour, influencing the extent to which social closure is achieved. Although organizational theory was not a central theoretical focus of the study, the concentration of decision-making for accreditation policy varied widely by country, as did the delegation of
responsibility of registering and licensing engineers. The overall trend in the shift to outcomes-based accreditation is a concentration of decision-making power in a small inner core of national professional bodies. This involves a loss of power by the professional disciplinary societies, particularly in the United States and United Kingdom, where they have historically been the strongest. The UK is the only country to delegate the full accreditation process to a multitude of parallel disciplinary societies, and yet the Engineering Council UK, a new organization and the Washington Accord signatory, is gaining power of the professional institutes by setting the overarching competency framework for engineering, which feeds into the accreditation process. At the same time, registration and licensing also remains decentralized, which offers one explanation for the extremely low rates of both in the country. This example illuminates a fundamental tension between decentralized professional disciplinary societies and centralized national associations or bodies. Across countries, power seems to be shifting from the former to the latter, which is reinforced by the Washington Accord’s emphasis on a single organization being a signatory.

This centralization has major implications for the extent to which social closure is foregrounded as a purpose of the profession at large, and accreditation in particular. Previous work has tended to focus more tightly on accreditation boards themselves, while this research has shown the additional complexity and explanatory power gained by widening the scope of analysis to include a broader set of actors. An organizational dynamic that is the visible in the ongoing revisions to ABET’s criteria in the United States is the increasing bureaucratization and professionalization of accreditation and evaluation itself, consistent with centralization. The significance of this pattern should not be underestimated. It speaks to the staying power and professional authority of bureaucratic actors in any policy system, something that Burton Clark (1986) identified as highly influential to national higher education systems in his seminal work on integration and coordination. Similar dynamics are beginning to emerge in other countries, such as Australia and South Africa, given the increased technical complexity of accrediting programs that aspire to be outcomes-based and driven by continuous improvement processes. Future empirical research is needed to understand this less visible work occurring below the political radar, which will shape the future of accreditation governance. Another implication of social closure’s weakening role is that we need to consider a wider range of theoretical
perspectives from the sociology of professions to explain differences in politics of the engineering profession in different contexts.

3) **The Washington Accord is a powerful force for isomorphism.** The policy’s focus on ‘comparability’ masks significant variation in the political, cultural and organizational arrangements of the profession in different signatory countries. This finding has important theoretical and practical implications. Theoretically, it opens the door to new conceptual frameworks for studying accreditation that draw from institutional theories and other symbolic frames within organization theory, thus helping researchers move beyond structural functionalist understandings of why and how accreditation is important. Scholars of comparative education have developed useful models and perspectives for studying policy borrowing and lending that also can be used to understand the Washington Accord’s role in spreading outcomes-based accreditation as a ‘travelling’ policy. Practically, it raises questions about the inner workings of the accord and its home organization, the International Engineering Alliance (IEA): How do influential leaders within the organization view its purpose and function? Who gets to lead the inter-country monitoring visits, and how is power reflected in those exchanges? As a wider range of countries with even more divergent societal, cultural and political contexts come to join the Washington Accord, how will the members steering its direction handle these tensions and contradictions? There are many fruitful lines of research that can investigate these questions through frames of internationalization, geopolitics and global political economy.

6.2 Limitations and Future Research Agenda

The main theoretical limitations lie in my choice of pluralism as the main political theory to analyze interest groups and political dynamics in engineering accreditation. While pluralism was developed to consider the full spectrum of political issues and decisions associated with democratic governance of an entire country, it is applied here to a specific dimension of a specific policy issue. The majority of citizens have no knowledge of, nor interest in, the inner governance of the engineering profession, so it begs the question of whether the power struggle over accreditation is similar enough to policy making or state governance more broadly. The best answer lies in historical works that trace the power struggles to establish and assert the engineering profession at large, in Canada (Millard, 1988), the United States (Layton, 1971; Noble, 1979), the United Kingdom (Buchanan, 1985, 1989) and South Africa (Kruger, 2016). In
these histories, even though political analysis is not explicitly applied, a range of different groups form and disband to represent the interests of their members, and engineers vie for power to govern the profession and make decisions on behalf of their wider membership. While accreditation has been largely ignored in these histories, the few examples that do exist highlight similar political struggles over accreditation itself, such as in the United States (Aker, 2017) and South Africa (Kruger, 2016). These overall conditions fit well with what has been labelled ‘neopluralist’ approaches (Lowery & Gray, 2004), which can be applied to single policy issues, and consider the full cycle of how interest groups form, how they enter the ‘population’ of other groups, how they attempt to influence policy, and what policy outcomes arise from that attempted influence.

Power is not equally distributed in society, nor in engineering itself, but pluralism was the best available tool to include the interests of actors from both inside higher education and from the broader profession in this study. The way I have framed the interest groups assumes a relative homogeneity of interests of the key individuals who constitute those groups and organizations. This could be countered with a much more granular analysis of the interests of the actual elected officials and board members of the professional societies, regulatory bodies and accreditation boards. This was out of scope for this thesis. However, such an analysis would be useful and revealing – it could borrow from some of the sophisticated network analyses being employed by Sheila Slaughter and colleagues starting with their work on academic capitalism (Slaughter & Rhoades, 2004) but extending to networks of university trustees (Pusser, Slaughter, & Thomas, 2006). Such an analysis can move beyond a polarized and oversimplified distinction between the interests of academics and working professional engineers – as in many cases there are academics who are leading professional societies, regulatory bodies and even accreditation boards.

Building on the findings and limitations, I close by sketching a future research agenda for professional accreditation in cross-national context. This signals the incredibly rich opportunity landscape for theoretically informed, methodologically appropriate research that can significantly alter the way scholars and practitioners understand professional education in an international context. In turn, this can empower people from individual faculty members to the chairs of accreditation visiting teams to realize their (bounded) agency in redirecting the
enormous time investments of accreditation to higher purposes, such as increasing student capabilities and reinvigorating the original ethical basis of the profession.

**“Triangulate the politics”**

The work started here can be expanded greatly by interviews with key stakeholders involved in accreditation policy making processes. This would be easier for retrospectively interpreting past decisions, but it could also be fruitful for understanding current political dynamics related to accreditation criteria revision processes or legislative changes to engineering. A further step would be to observe the deliberations of accreditation boards during their annual review meetings to understand the key issues, topics, assumptions and frames underpinning the operations of the current systems.

**“On the ground realities”**

One of the most crucial areas for future research is to shift from analyzing policy adoption to studying policy implementation. Particularly given the proposition that changes to accreditation are following an isomorphic process, we might expect to see major differences between stated goals and actual organizational and individual behaviours. By studying how universities and programs within them respond to outcomes-based accreditation regimes, we can learn about the functioning of the under-structure of higher education, and foreground individual faculty members’ agency.

**“Zooming in a few layers”**

More research is needed to frame and conceptualize the organizational structures and cultures in which accreditation is implemented. This includes a more fine-grained understanding of academic governance in different national contexts – how are decisions about minor and major curriculum changes made in a department? What local politics are at play in the senates, faculty councils, and various committees that deliberate on the details? This work can bring important concepts from organizational sociology to bear – and there are ample theoretical frameworks already adapted to higher education that can enable these analyses to contribute back to the higher education literature.
“Bringing faculty back”

With a stronger conceptual framework for internal governance, we can also look more closely at the values, identities and mindsets of individual faculty members involved in professional education. This analysis can elaborate on the vertical and horizontal fragmentation of academic work (Jones, 2013) in the context of engineering education. This is the micro level of analysis at which notions of academic freedom are enacted and challenged. This approach can also foreground the agency of faculty members in their local contexts to resist or circumvent oppressive monitoring regimes on the basis of their disciplinary expertise and professional autonomy. Lastly, this level of analysis enables us to pay attention to the emergence of new categories of academic workers, particularly the professional bureaucrats of accreditation which are emerging – both in national accreditation boards as designers of the process, but also in individual departments and faculties of engineering, as the local coordinators and drivers of the data collection and continuous improvement processes. This picks up on a long tradition of researching changes to the nature of academic work, and in particular can benefit from the work of Gary Rhoades on managed and managerial professionals in higher education (Rhoades, 1998).

“Connective tissue”

Following the line of inquiry from Rhoades on managerial professionals to his later work on interstitial organizations, a final dimension of a future research agenda is cross-scale dynamics and the social learning that occurs through engineering education associations, conferences and journals. These organizations and their activities are typically downplayed in higher education research, and taken for granted by practitioners who participate in them. I am uniquely positioned to treat these organizations as important sites of learning, resistance and policy borrowing and lending. In this thesis, I treated the conference papers published in these forums as both data and literature. In future work, I want to investigate their contributions to connecting national level accreditation policy debates to institutional level implementation and learning processes.
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