

**“Polytechnics” in Higher
Education Systems:
A Comparative Review
and Policy Implications
for Ontario**

report

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Contents

	Page
Introduction	2
Defining and Locating Polytechnics amidst Potential Modes of Higher Education Diversification Differentiation and Integration	5
- Defining Polytechnics	
- The Teichler Typology	
- Theories of Institutional Differentiation and Academic and Vocational Drift	
Comparative Polytechnic and Related Profiles: An Initial Sketch of Basic Developments	11
- The United Kingdom	
- Finland	
- United States	
- Australia	
- Canada (Alberta, British Columbia and New Brunswick)	
Selected Performance Issues in Comparative Context	28
- Performance Cluster 1: Access, Quality, and Accountability/Governance	
- Performance Cluster 2: Innovation, R&D and Human Capital	
- Performance Cluster 3: Student Pathways and Mobility	
Conclusions and Some Policy Implications for Ontario	45
References	52

Introduction

The purpose of this paper is first, to critically examine the experience of other selected countries with polytechnics and related sub-systems in higher education through a literature review of relevant developments in the U.S., UK, Australia, Finland, and Canada (in the provinces of British Columbia, Alberta and New Brunswick). Its second purpose is to examine the potential key policy options and implications for Ontario of this comparative experience with polytechnics.¹

The immediate impetus for this paper is the pressure to create in Ontario a new subset of polytechnics from among Ontario's existing Colleges of Applied Art and Technology (CAATs), but also the impetus comes from ongoing reviews of system design regarding higher education. The paper does not deal with these Ontario-specific aspects, but rather seeks to gain some insights from other jurisdictions and from that overview examine some potential policy issues for Ontario.

In one sense the scope of the paper is quite broad, precisely because it is comparative. But in a further sense it is quite limited in that space and time limits necessitate that the coverage be brief and illustrative in nature. Moreover, only three detailed clusters of polytechnic performance issues are examined as set out below.

The paper is not itself a systematic empirical head-to-head comparative account. Rather it draws on, summarizes, and comments on some published research of a quite diverse nature. The sources provide some systematic empirical analysis, but they also provide analyses of quite long periods of polytechnic and related higher education history. The literature can also often be quite diverse given the diverse higher education cultures of different countries and jurisdictions. My own overall experience as a university professor in Canada and the UK and some of my research experience on issues of innovation and research in higher education undoubtedly inform how I interpret the literature itself and my overall view of the potential policy implications for Ontario (Doern and Stoney 2008; Doern and Kinder 2007; Doern and Levesque, 2002).

The structure of the paper reflects the basic tasks at hand. The first section defines what a polytechnic is and locates it amidst the diverse range of higher education institutions and classification systems. This is a task that is not always straightforward or clear-cut (Skolnik, 2004, 1989; Orton 2003). The first section therefore necessarily sets out a way of understanding conceptually the modes of actual and potential higher education diversification, differentiation and integration. This analysis necessarily involves discussion of polytechnics as both a type of education and a type of institution (Skolnik 1989, 13-17). The Teichler typology is employed for this crucial scene-setting comparative analytical purpose (Teichler 2007; Teichler 2007a). Reference is also made to theories of institutional differentiation linked to concepts of academic drift and vocational drift (Morphew and Huisman 2002; Birnbaum, 1983). The comparative analysis then proceeds in two further steps.

The second section takes an initial quite broad summary look at overall developments in the five jurisdictions being examined, set, of course, in their own historical contexts. The third section then delves more deeply, albeit very briefly, into three selected clusters of performance issues: Cluster 1 (access, quality and accountability/governance); Cluster 2 (innovation, R&D, and human capital development; and Cluster 3 (student pathways and mobility). These are cast as performance "issues" rather than performance outcomes, largely because the sources involved do not always provide actual systematic comparative data across the five jurisdictions and also because "polytechnics" per se are a moving definitional target (see further discussion below and at the beginning of the third section).

¹ Thanks are owed to several members of the research staff of HEQCO and to one external referee for their very useful and constructive comments on an earlier draft of this paper. They have certainly helped make this a better paper. Any remaining gaps or inadequacies in the analysis are my responsibility alone.

Defining and Locating Polytechnics amidst Potential Modes of Higher Education Diversification and Integration

Defining Polytechnics

A first crucial task is to define polytechnics and to anchor the analysis in some kind of reasonable framework or typology that helps us deal with definitional complexity regarding “polytechnics” versus community colleges and vis-à-vis universities. Polytechnics can refer, as already noted, to either a type of education or a type of institution. For example Polytechnics Canada, a new national lobby group, says that “polytechnic education is career-focussed applied education that spans trades through advanced degrees, delivered in an environment where students receive hands-on training that enables them to more readily apply their skills” (Polytechnics Canada, 2007). Or, to quote the President of the British Columbia Institute of Technology (BCIT), “ a polytechnic goes to the heart of who we are: an institute of higher learning whose offerings include wide-ranging programs in technologies and trades, credentials up to and including master’s degrees, applied research, international activities, and partnerships with business” (BCIT 2007, 1).

As later sections of the paper show, the UK and Finland named their entire set of non-university institutions as polytechnics. Thus the notion of what a polytechnic is can take on several meanings. Institutions may be legally called a technology institute but their websites and reporting information refer to themselves as a polytechnic.

The paper cannot ignore the fact that there is considerable definitional stretch regarding polytechnics. However, in the context of possible policy options and implications for Ontario discussed later, the paper defines a polytechnic as **an institution of higher education, the majority of whose programs or degrees focus on education regarding applied technology**. In some jurisdictions these institutions are called institutes of technology.

As we will see, however, this does not solve all our analytical problems because, in practice, one could encourage and further develop **polytechnical education** as a smaller or particular element of the program or degree structure of all or most CAATs in Ontario. Such polytechnic educational elements for example could be justified and needed to meet local or regional needs in the areas being served by particular CAATs or similar colleges in the jurisdictions being surveyed.

The Teichler Typology

The definitional challenges mean that we need to visualize the actual and potential modes available for the diversification or differentiation of higher education systems and/or the real or nominal integration of such systems. Such a conceptual grounding can also help in the discussion of the five jurisdictions being explored and in highlighting the eventual policy implications that we later draw out for Ontario.

In this section, with the aid of Table 1, the paper uses and adapts the useful framework advanced by Ulrich Teichler (Teichler, 2007; 2007a). Teichler’s own analyses tend to focus on European higher education systems but the typology itself has a wider utility. As indicated in Table 1, the typology differentiates between formal versus informal modes and also vertical (or strata- centred) versus horizontal (based on profiles).

Table 1: Possible Modes of Diversifying or Integrating Higher Education

- Formal (visible binary categories) versus informal (e.g. reputation, labour market success)
- Vertical (strata) versus horizontal (profile);
 - Inter-institutional (e.g. types of higher education institutions versus Intra-institutional (e.g. level of programs and degrees, comprehensive higher education);
 - Formal Diversification: e.g.
 - 1) Types of HE institutions
 - 2) Types of study programs
 - 3) Grades
 - 4) Levels of Study programs and degrees
 - Informal: e.g.
 - 1) Reputation
 - 2) Profile

Source: Adapted from Teichler (2007, 1).

In the formal part of the typology, there are obviously efforts to set up quite visible institutional categories such as universities and community colleges or universities and polytechnics: in short, binary or dual institutional structures. As we will see, the UK formally established a polytechnic sector in the mid-1960s and then formally ended it in 1992, when the polytechnics institutions became universities. Finland in the early 1990s created a new overall polytechnic sector. Australia has had a binary system of universities and colleges of advanced education which was later combined into a unified system.

On the informal component of the typology, one can have a higher education system that is nominally one system but informally produces considerable differentiation in educational content and programs/degrees and via systems of reputational characteristics or recognized features of particular labour market success (e.g. technology institutes; performing arts institutes).

When one turns to the *vertical versus horizontal* dimensions of choice, still further possibilities emerge. Vertical strata can include different types of higher education or somewhat less visibly, simply different types of study programs, grade levels for entry and completion, and levels of study programs (e.g. 2-year programs) and degrees (academic versus applied or vocational). The horizontal dimension can include choices regarding comprehensive full service versus more focussed specialized institutions, inter-institutional cooperative or joint programs, and efforts to target a range of local industries or employers.

In Teichler's view the U.S. and Japan are the best examples of extreme vertical stratification, with countries like Germany and the Netherlands having the least stratification. In between these poles are countries such as the UK but also Sweden where there are a few excellent institutions somewhat distant from all the others in the system (Teichler 2007, 4). Arguably, Canada (and Ontario or other provinces within Canada) would be somewhere in the middle of the pack regarding degree of vertical differentiation.

Thus the actual emergence of the "non-university" sector (community colleges, polytechnics, colleges of advanced education, CAATs etc.) has taken different paths in different countries across the decades from the 1960s to the present. Overall growth has been significant, propelled by governments and societies seeking both economic growth and greater equality of opportunity and outcomes. Changes and choices in higher education systems have also been driven by policy choices related to globalization and regionalization (e.g. the EU) and through the use of policy instrument changes such as deregulation of fees, competitive funding, and league table rankings and performance benchmarking (Teichler 2007; 2007a).

Theories of Institutional Differentiation and Academic and Vocational Drift

Scholars of higher education have also addressed theoretically the underlying dynamics of institutional differentiation (Morphew and Huisman 2002; Birnbaum 1983; Huisman 1998; Rhoades 1990). At one level, institutional diversity within higher education systems is to be valued on its own terms, not only to meet different educational needs and to serve different types of students but also to foster a kind of laboratory of educational change and innovation.

However, research on institutional differentiation also shows that “colleges and universities are growing more alike over time as smaller, newer, less comprehensive institutions become more like their larger, older, more comprehensive peers” (Morphew and Huisman 2002, 491). There is thus an “academic drift” towards the structures and approaches of the top recognized universities. As Morphew and Huisman put it in terms of institutional theory, this “mimetic process is a function of increased professionalism and a single model of excellence that operates for all higher education institutions” (492).

Among systems of a binary institutional nature it has been recognized for some time that a certain amount of so-called “academic drift” is occurring as individual polytechnic institutions or subgroups of them seek to be more “university-like”. However, some universities can also experience “vocational drift” and become more “polytechnic-like” as they go after more business clientele or local student and study communities. Thus the causes of mimetic behaviour can also be due to these other kinds of factors as well.

Government higher education authorities are often caught in dilemmas in that they see the value of diversity and differentiation but they also need to control, if they can, the various kinds of “drift” that may be underway. Efforts by universities in both the university and non-university sectors to more explicitly compete through various “branding” strategies also become a factor. Such branding reflects actual underlying educational content being developed but also reflects the underlying entrepreneurial instincts of management teams in these institutions to meet demands in a complex and fast-changing higher education market (Ahola 2006; Codling and Meek 2006).

In later parts of the paper, aspects of the Teichler typology, of the dynamics of differentiation, and of the linked issue of polytechnics as institution versus polytechnics as education will necessarily re-enter the discussion. These conceptual issues arise in our initial profile of the five jurisdictions in the next section of the paper and they arise later in our discussion of implications and options for Ontario.

Comparative Polytechnic and Related Profiles: An Initial Sketch of Basic Developments

To advance our comparative understanding we now proceed with an initial sketch of basic developments in the five jurisdictions selected for comparison: the UK, Finland, the U.S., Australia, and Canada (BC, Alberta and New Brunswick). These five jurisdictions were selected to include systems with explicit polytechnic institutional sectors and those without. However, all of them offer various kinds of polytechnic education in their various colleges in the form of more particular applied technology programs or degrees. In addition, three of the countries are federations and two are more unitary states, features which can influence the issues to be explored. As noted earlier, we first lay out in broad basic developments in this section and then probe in the next section the three clusters of performance issues we have selected for a closer examination across the five jurisdictions. Table 2 provides a brief summary view of general polytechnic and related higher education development in the comparator jurisdictions.

The United Kingdom

The UK's experience with polytechnics is perhaps the starkest of the countries being surveyed. In the 1960s, the UK created a formal binary system when numerous colleges of art, commerce and other institutions became polytechnics. The polytechnics emerged out of more than 70 previous technical colleges. This new "public sector" system of polytechnics were cast by the then Labour Government as "comprehensive academic communities" catering to a wide range of students at all levels of higher education (Pratt 1992a, 34). The polytechnics would complement the "autonomous sector", the established university system, and thus form a formal binary system overall.

Table 2: General Polytechnic Development in the Five Comparator Jurisdictions

United Kingdom- Formal binary system established in 1965 when system of polytechnics was established to complement the autonomous university sector; System was abolished in 1992 when all polytechnics became universities. Polytechnic education is still a part of the program and degree mix of the now integrated university system overall.

Finland- Formal Polytechnic institutional sector established in early 1990s and still exists. Consortia of several colleges providing postsecondary education became the model for Finnish polytechnics. Cast as an equal but different second sector to complement universities in Finland.

United States- Complex multi-level four part system, with no explicit polytechnic institutional level per se. But numerous colleges of technology ranging from MIT and Caltech as global elite institutions to local small technology colleges are part of the U.S. system. Polytechnic education defined as applied technology in focus, is also a part of program or degree structure of other colleges. Highly competitive system in and among 50 states.

Australia- Does not have a system of polytechnics institutions per se but Australia did experience the establishment of a formal binary higher education system in the late 1960s centred around Colleges of Advanced Education (CAEs). Some of these were technology institutions in their main focus but most CAEs had some polytechnic education programs and degrees. This was followed in 1988 by a decision to reconstitute it into the Unified National System along with universities. Again, in the integrated system, there are universities with polytechnical education focus and content. Significant influence of federal-state government relations in higher education policy field.

Canada- Examples of three provinces, BC, Alberta and New Brunswick are discussed. As in Australia and US, there is no explicit system of polytechnic institutions. Key technology institutes in BC and Alberta describe themselves as "polytechnics" and are among 7 colleges in Canada that formed a national lobby group, Polytechnics Canada. Recent New Brunswick report advocates creation of some polytechnics institutions by merging some community colleges with regional campuses of two existing universities. Polytechnic education, however, is a part of the educational content of other community colleges in all three of these jurisdictions.

The polytechnics or public sector “was to be distinctive in governance in that the institutions were mainly run by local education authorities” (Pratt 1992a, 34).

In 1992 the Conservative Government of Prime Minister John Major ended the binary system by allowing all of the 34 then existing polytechnics to become universities (Pratt 1992, 3). A binary system was transformed to an integrated system in formal terms though, as will be seen later in this paper, with considerable defacto functional differentiation within the single system. The new integrated system was attributed to several causes and motivations ranging from John Major’s expressed desire for a classless system (since he himself did not have a university degree) to underlying pressures to make the entire higher education system more sensitive to the needs of industry and the economy.

For our analytical purposes, the UK example makes it more difficult in part to isolate the effects of the polytechnic institutions per se since we are now dealing with the cumulative effects of both 27 years under a binary system and a further 16 years under an integrated system. We return to these analytical challenges and limitations in the next section of the paper. At this stage, however, it is important to note the initial rationales in the mid-1960s for establishing a polytechnic system.

The rationale was four-fold in nature. The first was the need for greater vocational education and also for related greater variety, levels, and modes of delivery for courses. Universities were seen as being both unable and unwilling to make these changes. The second rationale was the “detrimental effect on morale and standards in the non-university sector of a ‘ladder’ system, if the public sector was repeatedly deprived of its ‘brightest ornaments through upgrading to university status” (Pratt 1992a, 33). The third and closely linked reason for establishing the polytechnic system was the need for a major part of the higher education system to be under greater social control so as to better meet social needs. Finally, but importantly, the Labour Government linked the need for greater vocational and professional focus to the need for Britain to be more competitive in an ever more competitive world. Overall, therefore, the policy need was for polytechnics that would be institutions of equal status with universities but functionally differentiated (Ahola 2006).

Some key characteristics of the polytechnics as they developed from the early 1970s to 1992 need to be noted:

- enrolments increased from 150,000 students in 1973 to over 450,000 in 1992; half were full-time students in 1973 compared to two-thirds in 1992;
- there was considerable diversity among polytechnics regarding enrolment size and proportions of full- and part-time students;
- polytechnics were more undergraduate institutions than universities;
- there was considerable difference among polytechnics in the proportion of mature students;
- polytechnics developed a vast number of degree courses in a relatively short period of time, nearly half of which were in science and technology;
- polytechnics pioneered modular structures, independent study and part-time courses at all levels;
- new funding mechanisms were established in 1988 the polytechnics were removed from the local authority sector (Pratt 1992, 3-5; Pratt 1992a, 34-35).

Despite considerable controversy, and opposition from the university sector, the polytechnic system gained support and grew under subsequent Conservative governments.

Early concerns about the polytechnics centred around the charge that they might be subject to so-called “academic drift” as some tried to emulate the universities and thus potentially ignore their core functions. But by 1992, concerns also arose that so-called “vocational drift” was occurring on the part of universities as they sought to indirectly compete for students and to fill educational and program gaps and opportunities.

By the time the Major Conservative Government chose to end the polytechnic institutional experiment and allow all of them to become universities, the other underlying successful feature of the polytechnics was also well established. It was a more efficient system for educating large numbers of students and its growing relevance to industry and the economy now needed to be emulated in the higher education system as a

whole. Giving the polytechnics a further status boost by allowing them to become universities became a part of this logic of integration, just as becoming a polytechnic in the mid -1960s had done in the context of the earlier post-World War II system. We comment further on performance issues regarding the “former” polytechnic institutions in the post-1992 integrated UK system in our discussion in the third section of the paper. It must be stressed; however, that polytechnic education is still a key part of the new universities and is also an educational element of some of the older established universities.

Finland

Finland is a useful European example in that as a Nordic unitary state it established in 1992 the Finnish polytechnic “experiment” which was gradually entrenched as a fundamental reform to its higher education system (Lampinen 2001; OECD 2003; Valimaa 2007). As Lampinen notes, experimentation began in 1989 because of the growing view that

in the old system universities were isolated from other parts of the educational system and secondary education was a complex and highly dysfunctional system. As a result of the dysfunctionality, a great number of students after matriculating from upper secondary school did not find organic routes to continue their studies (Lampinen 2001, 311).

Influenced partly by the UK polytechnic development discussed above and by early European integration pressures, but mainly driven by domestic assessments of the need for change, the Finnish polytechnic system was established. In an initial 1990 White Paper, a key conclusion was that past Finnish educational reforms had been carried out as isolated changes which had produced a patchwork of anomalies. The White Paper’s proposals for comprehensive change met with a highly cautionary and conservative response. As a result, a later 1991 Parliamentary Act developed an experimental approach to be carried out between then and 1999. The statutory objectives of these changes and experiments were:

- to raise the standard of education;
- to react to changing needs for expertise and skills;
- to make vocational education more attractive;
- to improve the international compatibility of vocational education;
- to make vocational education more functional;
- to decentralize the administration of vocational education; and
- to reinforce the regional impact of vocational educational (Quoted in Lampinen 2001, 313).

Consortia of several colleges providing postsecondary education became the model for Finnish polytechnics. Seen as an equal but different second sector to complement universities in Finland, polytechnics were cast as “professional institutions providing high level non-academic professional training” (Lampinen 2001, 314). The reforms overall did not seek to merge institutions but rather to use various methods to increase the quality of education.

Thus the government initially gave permission for 22 experimental units comprised of 85 vocational institutions to operate as temporary polytechnics. These units were overwhelmingly multidisciplinary in their overall make-up. Later analyses showed however that the improvement of educational standards was the central mechanism of reform rather than the integration of institutes per se (Lampinen 2001; OECD 2003).

The initial experimental system was reported on and assessed but during the early to mid-1990s other developments occurred that spurred further reform. These included a deep economic depression in the early 1990s and the decision by Finland in 1994 to join the EU. As a result, in 1995 permanent legislation replaced the 1991 Act. It set out a more defined strategy for carrying out polytechnic reform. By 2000 most postsecondary vocational education was to take the form of polytechnic studies and thus, in addition, it was decided to close down vocational education at the intermediate (postsecondary) level (OECD 2003, 47).

Under the new law permanent licences for polytechnics would be let based on quality and performance criteria that included:

- the idea of action
- actuality and relevance of study programmes
- functionality of combinations of study fields
- major points of action
- size of the institution
- educational standards of teachers
- library and information services
- relationships to working life
- cooperation with universities and other institutes
- international cooperation
- regional educational and service functions
- evaluation system

The Finnish Higher Education Evaluation Council assessed the applications and made recommendations to the Ministry of Education. Originally, in 1996, nine polytechnics were granted permanent operating licenses and by 2001 this system had grown to 29 polytechnics “in all parts of the country and from both linguistic groups” (Lampinen 2001, 317). Thus, over a decade of experimentation and reform had resulted in a system where about 250 postsecondary vocational institutions had been restructured into 29 polytechnics (OECD 2003, 48).

The Finnish polytechnic system has been evaluated and studied by the above cited 2003 OECD report. We refer to this study in greater detail in the next section of this paper but it is of some importance to stress here that the OECD study is itself an example of a Finnish desire to ensure that its polytechnic system and its higher education system overall were assessed against international standards in a growing globalized economy and system of competition.

The United States

Without doubt the US has the most complex and diverse multi-level higher education system (McGuinness 2005; OECD 2006; Trow, 1999). It consists of over 4000 public and private colleges and universities offering choice that ranges from elite research universities to two-year technical and community colleges and four-year colleges. More specifically, the system includes:

- Comprehensive colleges and universities that provide undergraduate- and graduate-level education;
- Research universities that provide undergraduate and graduate-level education and support the granting of PhDs through their research mission;
- Community and junior colleges that offer associate degrees, baccalaureate-track courses, and vocational education and training (National Governor’s Association 2007).

The US system is a dynamic and competitive system, not only because of the mixture of public and private institutions but also because of the nimbleness of individual institutions, particularly the community colleges. In the context of this paper, it must be noted that the nomenclature of polytechnic institutions is not especially present in the US but institutions of technology are, ranging from MIT and Caltech at the apex right through to numerous local/regional technical and technological colleges serving local industries or trades. Moreover, polytechnic education is a part of the program structure of many other colleges seeking to serve particular areas or regions even if the larger mandate of such colleges is not applied technology-focussed.

In a very real sense the US has 50 systems of higher education tied to American federalism and its 50 states. But even the state systems are not necessarily fully structured. As McGuinness notes,

Studies show little correlation between one particular governance structure and the long term performance of postsecondary systems: there is not one ideal model of governance.

According to scholars who study postsecondary systems, the most significant determinants of a vibrant system are not particular governance but rather a clear, well-defined vision for postsecondary education intimately linked to the relationship between a state's public agenda and how the university system is perceived by the citizens of the state (McGuinness 2005, 133).

In recent years, concern about the US higher education system overall has centred on its quite low higher education graduation rates compared to other OECD countries and to its slippage in the percentage of adults from 25 to 34 who hold a university degree.

A recent study by the National Governors Association has noted both the strengths and weaknesses of the US system but in particular called for a new focus on three outputs it deemed "critical to innovation". These are:

- The development of problem-solving, creativity and other competences important to developing goods, services and processes.
 - Developing a well-qualified teacher core...(in math and sciences)
 - Creation of new knowledge through R&D and the diffusion and acceleration of new ideas into processes, products and services...
- (National Governors Association 2007, 3).

On the basis of this diagnosis, the National Governors Association advocates that state governors in the US develop a "postsecondary education compact" in each state. The compact would be negotiated with key stakeholders and would define long-term goals to meet the main agreed challenges. Institutions would be held accountable for meeting a set of performance standards in "exchange for a state's commitment to budget stability and a reduction in regulatory and bureaucratic burdens on the system" ((National Governors Association 2007, 6).

Australia

The Australian system is of comparative interest not only because Australia's higher education system is, like Canada's, a product of federalism but also because it does not have a system of polytechnic institutions per se. Nonetheless, Australia did experience the establishment of a formal binary higher education system in the late 1960s and early 1970s, followed in 1988 by a decision to reconstitute it into the Unified National System (Coding and Meek, 2006; OECD 2007; Williams, 1992).

In the 1960s, the Australian government established the Colleges of Advanced Education (CAEs) a set of new and merged previous institutions involved in technical and vocational education. This was done to create a genuine degree-granting alternative to the universities and also to clarify the role of universities by sharply reducing the number of students enrolled in universities who were taking one or two year sub-degree programs and also reducing the number of students enrolled in related sub-professional training programs such as nursing and some aspects of teaching (Williams 1992).

Federalism and differences of view between the Commonwealth and state governments also played a role. As Williams notes, "the universities were legally autonomous and received block grants for their first and higher degree students and for staff research, whereas the CAEs were controlled by State boards and given grants for approved vocational sub-degree and degree programmes" (Williams 1992, 6).

By 1987, the 46 CAEs had 201,000 students in degree and the above noted sub-degree courses and had become the larger system compared to the 19 universities whose enrolments stood at 183,000 students. Coding and Meek conclude, however, that "by the mid-1980s, many of these colleges had developed to become so much like the universities that the binary system was doomed" (Coding and Meek 2006, 10).

In 1987 Australia established the unified national system (UNS) for higher education. The abolition of the binary system was part of the national government's policies to make postsecondary education a key element of its economic policy. To gain greater control and movement towards this policy preference, the Commonwealth Government invited universities and colleges to "apply for membership" in the UNS. The conditions for membership were:

- a minimum sustainable student load of at least 2000 equivalent full-time students;
- a willingness to negotiate with the Commonwealth Minister an educational profile which would define the role of the institution and the basis of funding; and
- an initial commitment by the institution to the Minister's views on internal management, credit transfer, staffing arrangements and a common academic year (Williams 1992, 7).

The colleges thus had considerable incentive in that under these terms they could become universities and, moreover, there was the promise of funding for research if they had more than 5000 equivalent full-time students.

The plan was to have a unified system but also one that would promote greater diversity. However, by the early years of the 21st century, Codling and Meek conclude that there has been considerable convergence in behaviour. These convergences are twofold, first that traditional universities have exhibited *vocational drift* by:

- adopting more applied missions;
- developing active partnerships with industry and new professions;
- offering more qualifications with overt vocational outcomes;
- generating more applied research funded by industry;
- becoming more enabling with their admission policies to encourage non-traditional learners.

Second, with regard to the former colleges as newer universities Codling and Meek argue that they have exhibited *academic drift* by:

- appointing more traditional university trained and experienced academic staff;
- adjusting their organizational cultures to be more academic;
- shifting enrolment patterns to include more school leavers;
- broadening their research focus and increasing its emphasis;
- adopting much of the symbolism and nomenclature of the traditional university (Codling and Meek 2006, 11).

This brief summary account of the Australian higher education system clearly has some parallels with the UK system previously discussed. Its CAEs were not called polytechnic institutions but many had a technology focus and most had polytechnic educational content in their program/degree structure even where their overall mandate was not technology-focussed. Its binary system eventually collapsed partly due to what Codling and Meek refer to as "status emulation" and partly due a kind of competitive spirit among universities in the integrated system that produced both of the above kinds of "drift", vocational and academic (Codling and Meek 2006, 12). Thus in the integrated system there are a few universities that have an overall technology focus and emphasis and most universities have some kind of polytechnic education content as was the case in the previous binary system.

Canada (BC, Alberta, New Brunswick)

This paper's brief discussion of Canadian developments regarding polytechnics does not deal with Ontario but rather samples some developments in British Columbia, Alberta and New Brunswick. However, first we note three overall features of Canada's higher education system. The first is that Canada has had in some sense a binary system in each province but the non-university part of that system has been more frequently referred to as the community college sector. Polytechnic institutions per se have never been the official

descriptor of this part of the higher education system. The second point to stress is that, as a Statistics Canada report concluded,

As the postsecondary world evolves, the grey zone between universities and colleges grows. The advent of transfer programs has created bridges and symbiotic relationships between the two...the classic typology of universities and colleges no longer captures the complexity of higher education (Orton 2003, 9).

Other scholars of higher education policy have also stressed the complexity of Canada's higher education system (Skolnik 2004; 1989). The Statistics Canada report went on to develop a new classification of higher education for its reporting purposes. It included six institutional types, some with constituent sub-types but not one referred to polytechnics.

Meanwhile, at the national level a lobby group, Polytechnics Canada, has recently been formed to advance the development of greater recognition of polytechnics in Canada and key polytechnic educational goals (Polytechnics Canada, 2007). The organization is composed at present of eight member institutions, including the Northern Alberta Institute of Technology (NAIT), the Southern Alberta Institute of Technology (SAIT), the BC Institute of Technology (BCIT) discussed further below, and five Ontario Colleges of Applied Arts and Technology (Conestoga Institute, George Brown College, Humber Institute, Seneca College, and Sheridan Institute). Its stated key priorities are to advance commercialization, academic mobility through a pan-Canadian accreditation system; and solve skills shortages (Polytechnics Canada 2007). Other publications stress its members' strong "applied research capacity" (Polytechnics Canada 2007a).

Alberta offers interesting examples of the more explicit emergence of polytechnics into the descriptive language of its higher education system. A recent Alberta Government framework paper on roles and mandates for Alberta's "advanced education" system developed a six sector model on institutional differentiation. The differentiation was based on "credentials offered, the type and intensity of research activity, as well as geographic focus" (Alberta 2007, 9) but "was not intended to convey a system of nomenclature for institutions" (Alberta 2007, 9). One of the six sectors is "polytechnical institutions".

Within the Alberta system are two key "technical institutes", the Northern Alberta Institute of Technology (NAIT) and the Southern Alberta Institute of Technology (SAIT). SAIT can trace its origins back to 1916 whereas NAIT emerged in the early 1960s (SAIT 2008; NAIT 2008). Both are now large dynamic technical institutes with strong links to Alberta industries, pan-provincial and regional/local.

Of interest for our purposes is the fact that the published provincial mandate statement for NAIT says that it is a polytechnic institute whereas no such designation is in the SAIT mandate statement (NAIT 2008a; SAIT 2008a). But the website home page of SAIT headlines SAIT as "SAIT Polytechnic" but that of NAIT makes no such reference (NAIT 2008b; SAIT 2008b). On the other hand both NAIT and SAIT are founding members of the previously mentioned national lobby group Polytechnics Canada. These peculiarities may or may not mean much. Both of these institutions are clearly technology institutes.

The **British Columbia** situation regarding polytechnics is arguably in one sense not much different than that of Alberta. There is no official polytechnic nomenclature used to describe institutions. However, the BC higher education system overall has had other changes that are different from Alberta. These were changes early this decade which allowed some comprehensive regional community colleges to become universities (Dennison, 2006; Dennison and Schuetze, 2004) and thus reinforce the point earlier about the many grey zones between the community college and university sectors.

The BC system does contain two technical institutes, the British Columbia Institute of Technology (BCIT) and the Nicola Valley Institute of Technology (NVIT) which is an Aboriginal postsecondary institution being created in 2007-2008. For our purposes, BCIT is clearly worth noting and again shows some of the same dynamics as noted regarding SAIT and NAIT in Alberta.

BCIT is officially named an institute of technology but its website and planning documents refer to it as a polytechnic, indeed as “Canada’s premier polytechnic institution” (BCIT 2007). Its service plan for the next two years begins with plans for advancing “BCIT’s Polytechnic Strategy” and refers immediately to the fact that it is a founding member of Polytechnics Canada (BCIT 2007a, 4). Its planning mandate stresses that it is and will be “a province-wide innovative organization, specializing in advanced technology training” (BCIT 2007a, 4).

As is the case with the Alberta examples above, BCIT is clearly the elite technology institution in the province and has used the polytechnic label to enhance its brand and also to position itself nationally and internationally as well in its provincial home base.

The recent Plant Report on postsecondary education in British Columbia (Campus 2020, 2007) is also noteworthy in several respects for this paper. First, it does not refer at all to either polytechnics or to BCIT. This may be because the report was not drafted as a detailed blueprint for British Columbia, but rather as a considered set of core principles to guide system development by 2020. It also stressed that British Columbia’s system of classifying its overall higher education system was different from that in many other provinces, in part because of the earlier reform focus on regional universities. Access to higher education overall is stressed in the report as access regionally, access where you lived. The report also stressed that a university system that was only or too marketplace focussed was too narrow. Higher education is both a social/human and economic undertaking (Campus 2020, 2007, pp 3-4, and p.9). The report also called for new governance and accountability systems that would promote overall system development and coordination to complement that of institutional autonomy. These would be anchored around a proposed Higher Education Presidents’ Council and a Higher Education Board (Campus 2020, 2007, pp 27-28). The report addresses the innovation agenda, stressing that the province’s “research intensive institutions must continue to be the key incubators of the innovation” needed (Campus 2020, 2007, p. 4). This recommendation referred mainly to universities (Campus 2020, 2007, pp. 74-81).

The **New Brunswick** situation regarding polytechnics has garnered national attention because of the September 2007 recommendations of the Commission on Postsecondary Education in New Brunswick (2007). The New Brunswick commission’s recommendations covered several aspects of postsecondary education in the province but, central to the strategy of increasing New Brunswick’s lower participation rates in higher education, advocated that three satellite campuses of the University of New Brunswick and the University of Moncton be merged with area community colleges to become polytechnic institutions.

The two-person commission likened polytechnics to US elite institutions such as MIT and Caltech but its critics in the Canadian Association of University Teachers (CAUT) argued, not surprisingly, that this comparison was a bit of a stretch and that, moreover, the commissioners were in fact down-grading the two area campuses of the two universities into polytechnics (Allain 2007).

Other criticisms centred on the view that the report had failed to address two key weaknesses in the New Brunswick system, underfunding compared to other provinces, and excessive control over the community colleges that had meant that colleges were extremely narrowly focussed on trades only (CAUT 2007, 1).

With respect to the early polytechnics debate in New Brunswick, two features are of importance in the larger context of this paper. The polytechnics were cast in terms of a more economically-focused higher education system. On the other hand, the debate easily regressed into the notion that polytechnic education was a step down and hence the new proposed institutions were not well received in some quarters in terms of inherent status and prestige.

In summary, this quite broad initial summary of the five jurisdictions reveals quite a varied pattern regarding polytechnics as a part of higher education systems. In the UK and Finland they emerge as a formal part of a binary system where polytechnic institutions were visibly and extensively created. In all five jurisdictions, there are certainly key aspects of polytechnic education either as the focal mandate for institutes of technology or as a part of the education program and degree structure of various types of colleges of advanced education, colleges of art and technology, community colleges or junior colleges.

These initial observations bear out the logic of the potential array of choices found in the Teichler typology discussed in the first section of the paper, choices between types of institution per se versus types of education. They also begin to reveal some of the dynamics of differentiation and academic and vocational drift revealed in theoretical literature on higher education noted briefly in the first section of the paper.

Selected Performance Issues in Comparative Context

With the above broad developments regarding polytechnics as context, we can now proceed to a somewhat more detailed comparative examination across the five countries/jurisdictions of selected performance issues. We comment, with the aid of Table 3 (see page 32) on the comparative experience under three performance clusters.

Cluster 1 encompasses the issues of access, quality, and accountability and governance. *Access* mainly refers to performance regarding a number of possible criteria, including the admission and education of larger numbers or proportions of: younger students; mature adults; women; students from low income families; language or ethnic populations; disabled persons, and persons from different regions of a country. *Quality* is a much more complex performance subject but in essence refers to the quality of teaching, instruction and related applied employment-related experiences provided and also learning services and technologies of delivery. *Accountability and governance* encompasses a mixture of direct reporting arrangements and information provision to relevant education and budgetary authorities and to clients/students and also, of course, formal structures such as boards of governors and budgetary approval mechanisms.

Cluster 2 includes performance issues such as innovation, research and development (R&D) and human capital development. These can also be seen as aspects of overall economic development but cast in recent years with a particular focus on key needs of the knowledge-based economy (Davenport 2002; Duderstadt 2005). *Innovation* refers to contributions to developing marketable and effective new products, processes, and institutional change (Doern and Stoney 2008; Conference Board of Canada, 2004). *R&D* encompasses for polytechnics mainly *applied* research and development tied closely to business product and process development but also to regional businesses linked to the polytechnic. Applied research regarding polytechnics is also closely tied to the training experience of its students linked directly to immediate employment. This kind of applied research is thus distinguished from applied research at universities and also from so-called basic research which is seen as being more the exclusive preserve of universities (Belanger et.al. 2005). *Human capital development* is a concept that treats education and human development as an economic and social asset analogous to technological, physical and financial capital. It involves the development and continuous lifelong renewal of an individual and a society's knowledge and skill base (Walters 2004). In higher education and S&T policy, it has historically been discussed more loosely simply as the overall development of highly qualified personnel (HQP) or the general human development of individuals through education.

Cluster 3 involves performance issues regarding the better development of student *pathways and mobility* among institutions and/or between sectors in a binary higher education system. These pathway issues can relate to both initial young adults in higher education and to later lifelong learning choices as younger students and mature adults seek to make and change their own educational backgrounds as their personal circumstances and aspirations change. This performance issue also turns on concerns about whether students are actively aided in the processes of navigating their way across the higher education system or are hindered in this process by bureaucratic barriers, intentional or unintentional.

In this section of the paper we necessarily have to cast these as performance issues rather than as proven performance outcomes across the five jurisdictions. This is because, as noted at the outset of this paper, the analysis is not itself a designed head-to-head comparison but instead draws and comments on diverse

comparative sources of literature where authors used diverse criteria or focussed only on selected issues of interest to them.

This more indirect “commentary” mode of analysis and interpretation employed is also needed because the paper is focussed ultimately on polytechnics. But, as we have already seen, this is often an elusive descriptor as between polytechnic institutions versus polytechnic educational programs/degrees and also diverse nomenclature in both categories. Moreover, in the case of the UK, a formal polytechnics sector operated for 27 years and then all polytechnics became universities. Polytechnic institutions no longer existed in the UK but polytechnic education certainly did in the form of applied technology programs and degrees in the integrated university system.

Last but not least, performance issues ultimately confront the conceptual dilemmas inherent in our discussion in the first section of the paper regarding the Teichler typology and its discussion of differentiation and integration in higher education achieved through formal change and nomenclature on the one hand, and informal change on the other hand, via changes in degrees offered, accreditation levels, etc.

To capture and comment on these complex performance issues and possible attribution of some outcomes to polytechnics, we now proceed with an illustrative discussion on a cluster by cluster basis across the five jurisdictions (see Table 3).

Performance Cluster 1: Access, Quality and Accountability/Governance

When one looks at the issue of **access** across the five jurisdictions, the patterns and evidence are fairly clear. There have been impressive increases or gains in access both in raw numbers and in percentages of the eligible populations. The polytechnic era in the UK and in Finland saw large increases in enrolment, as did Australia under its Colleges of Advanced Education (CAE) era. The more multi-layered U.S. system also saw great growth in the 1970s and 1980s although recent studies express concern about the much lower graduation rates of its higher education students compared to many other OECD countries (National Governors Association 2007, 2). Canada overall had significant increased access in its community colleges overall in roughly the same periods. The three technology institutes referred to earlier in BC and Alberta have had significant enrolment increases in the last decade or more.

Table 3: Selected Polytechnic and Related Performance Issues in Comparative Perspective Countries/Jurisdictions

Performance Cluster	UK	Finland	U.S.	Australia	Canada*
Cluster 1:					
Access	- polytechnics trebled enrolment	- significant increase in enrolment in 1990s; - no tuition fees	- very high access to diverse multi-level system; - concerns about lower graduation & completion rates compared to other OECD countries	- doubling of Colleges of Advanced Education (CAEs) enrolment from 1977 to 1987;	- doubling of overall community college enrolments in 1970s/1980s; - strong technology institute growth in Alberta and BC (BCIT, SAIT, NAIT)
Quality	- increase in standards & overall diversity of courses - some former polys after becoming universities did well in teaching league tables	- standards raised to qualify as poly, and since then as well; - increase in quality and diversity of programs and teaching innovation	- increased standards overall; - concerns about quality of teaching in maths and sciences	- increase in quality and diversity of programs and teaching innovation	- increase in quality and diversity of programs and teaching innovation

Performance Cluster	UK	Finland	U.S.	Australia	Canada*
Accountability and Governance	<ul style="list-style-type: none"> - local government-focused but numerous disputes; - later separate corporate structure - increased accountability links to business Clients 	<ul style="list-style-type: none"> - polys mainly municipal and private; - Board & Rector structure ; - agreements with Minister of Education with individual institutions; - evaluation council established; - more focus on business accountability 	<ul style="list-style-type: none"> - looser system of accountability to state governments - pressure for better coordination of missions among colleges; - more use of formal agreements between state and individual colleges; - calls for better data; - more focus on business accountability 	<ul style="list-style-type: none"> - divided governance between Commonwealth and state governments; - greater federal funding role than in Canadian educational federalism; - national protocols with individual institutions; - effort to enhance regional accountability - more focus on business accountability 	<ul style="list-style-type: none"> - focus on provincial accountability ; - Alberta's steps to increase mandate role review and control of program free lancing by individual institutes; - regional and community focus is strong; - formation of regional universities in BC out of some former community colleges; - New Brunswick controversy over making polys out of some university branch campuses

Performance Cluster	UK	Finland	U.S.	Australia	Canada*
Cluster 2:					
Innovation	<ul style="list-style-type: none"> - new poly degrees were half in S&T areas; - considerable in teaching methods and course delivery; - innovation discourse and practice strong since mid-1990s both on former polys now functioning as universities and on integrated university system overall 	<ul style="list-style-type: none"> - increase reference to innovation but not in precisely defined way; - setting up of joint “virtual polytechnic” involving some current ones; 	<ul style="list-style-type: none"> - central theme of National Governors Association compact on higher education; - express reference to universities being excessively regulated by federal and state governments; - earlier federal and state policies on innovation, including strong federal patent policy and commercialization ethos; - numerous entrepreneurial universities 	<ul style="list-style-type: none"> -key focus in past few years; - national research priorities regarding universities in unified higher education system. 	<ul style="list-style-type: none"> - strong federal and provincial innovation policy discourse; - 2007 federal S&T strategy has explicit commercialization focus for federal granting bodies re: universities; - innovation ethos stressed by briefs from Association of Community Colleges of Canada and also by new lobby group, Polytechnics Canada

Performance Cluster	UK	Finland	U.S.	Australia	Canada*
R&D	<ul style="list-style-type: none"> - Greater stated focus on applied R&D; - logical links with historical origins of many polys when they were previously technology institutes; - part of the dual dynamic of both “academic drift” of the polys and former polys and “vocational drift” of the universities; 	<ul style="list-style-type: none"> - Key new focus when polys formed in early 1990s; - Formal R&D strategies enunciated for higher education overall; - greater pressure and competition for research grants; 	<ul style="list-style-type: none"> - concern over need for greater R&D focus and funding; - advocacy of need for “entrepreneurial R&D” 	<ul style="list-style-type: none"> - greater explicit focus in discourse and practice amidst highly competitive united system of advanced higher education 	<ul style="list-style-type: none"> - explicit policy focus for some institutions in recent Alberta 2007 report on roles and mandates; - strong emphasis in above noted Association of Community College and Polytechnics Canada reports and statements; - some community colleges successful in obtaining CFI research infrastructure grants;

Performance Cluster	UK	Finland	U.S.	Australia	Canada*
Human Capital	<ul style="list-style-type: none"> - not an explicit discourse used; -greater reference to highly qualified personnel and to skill needs and shortages 	<ul style="list-style-type: none"> - same as UK with policy focus on broader human development through higher education; - focused concern about improving teacher skills 	<ul style="list-style-type: none"> -strong support as goal but more specific concerns about better qualityskill in overall teaching and in math and science Skills 	<ul style="list-style-type: none"> - again, human capital discourse not pronounced; - focus on skills and filling gaps in skills and on equity issues; 	<ul style="list-style-type: none"> - not an explicit discourse; greater reference to highly qualified personnel and to skill needs and shortages; - strong Alberta focus (BC as well) on skill shortages for a booming economy. - New Brunswick concern to upgrade from earlier apprenticeship skills focus;

Performance Cluster	UK	Finland	U.S.	Australia	Canada*
Cluster 3:					
Student Pathways & Mobility	<ul style="list-style-type: none"> - Improved through development of polytechnics; - But continuing concern over “ladders” of opportunity and movement between sectors; part of legacy of class politics and discourse in UK; - key reason why polys allowed to become universities but still concerns about two-tier system existing informally and by reputation; 	<ul style="list-style-type: none"> - arguably the key reason for establishing the polytechnic system; - significant improvement in pathway guidance and support in last decade; - but still strong tendency for children of blue collar workers to attend polys and children of the middle class to attend universities; - targets set to increase international links and experience for students in integrated EU context 	<ul style="list-style-type: none"> - highly complex multi-level system provides great choice but also concerns about transfers between institutions and types/levels of institution; 	<ul style="list-style-type: none"> - improved initially by CAEs system and later by current united system of advanced higher education; - greater focus on improving international links and in attracting Foreign students; 	<ul style="list-style-type: none"> - greater concerns in several provinces examined for improving mobility and movement between systems and among institutions through better credit recognition and information; - BC and Alberta studies and policy concern about taking specific steps to remove barriers. - Polytechnics Canada’s aim to promote national accreditation system

All five jurisdictions also saw significant improvements in educational access for women, older mature students, persons from lower income families, and persons with disabilities. There are nonetheless remaining concerns about the degree and speed of progress on these various important key access criteria. Australia has set equity targets for its overall system (OECD 2007, 44-52) and there are still concerns about working class access in the UK and Finland (Tysome 2007; OECD 2003; OECD 2006). Regional access issues have also been a part of debates in Canada in each of the three provinces examined (Campus 2020, Alberta 2007; Commission on Postsecondary Education in New Brunswick 2007).

With respect to issues of **quality** as a performance issue, the patterns, evidence and criteria are bound to be more complex. In all jurisdictions, there have been overall improvements in standards. In the UK and Finland, these were partly achieved through the requirements initially adopted to become polytechnics but also through the development of much more diverse courses and teaching and delivery approaches. The fact that there were larger classes because of increased enrolments without the commensurate increase in resources meant that some aspects of increased access were seen as reductions in quality due to the change in

teacher-pupil ratio. However, the polytechnics or rough equivalents were always partly seen and sold as vehicles for more efficient higher education. In the UK, after polytechnics became universities, some of them immediately did quite well in league table scores on teaching quality compared to the older well-established universities (Smithers 2004). And of course all of the polytechnics or technology institutes were able to argue quite convincingly that their close links to business and employers, generally, sectorally, and regionally was a significant quality advantage in terms of the learning and employment relevance of their courses and degrees.

Accountability and governance as a performance issue raise more complex questions about performance and democratic political control and/or autonomy. Accountability can refer to traditional notions of the accountability of polytechnics and close equivalents “up” to governments and education authorities. However, in modern public management, accountability can encompass “accountabilities”, in short, multiple reporting and other relations “down and out” to clients, stakeholders and students and also across among institutions engaged in joint partnered work (Flinders 2001). The notion of governance as, in effect, a system of “mutual accountability” also increasingly involves not only the governance of the institutions through “boards” but also newer forms of governance agreements (and contracts) with some key stakeholders, particularly business, but also communities and local government.

In all jurisdictions, for polytechnics and for higher education generally, there has been a much more entrenched use of quality assurance measures and processes to compare and rank institutions and to approve new degrees and programs. The availability of the Internet has also greatly increased the ability of individual institutions to be more transparent vis-à-vis their varied stakeholders including local/regional communities as a whole.

Accountability and governance also crucially involves complex relations with governments in different kinds of political systems and cultures and potential changes in their funding systems. As we have already seen, our sample of jurisdictions includes polytechnics and related institutes functioning within unitary states versus federations. The UK and Finland are examples of the former albeit with newer forms of devolved government. The U.S., Australia and Canada are the examples of federations.

In all jurisdictions there have been major efforts to enhance the accountability relations (often tied to co-funding) with business regarding educational content and relevance. In the UK and Finland, polytechnic governance was tied to local government mainly but also, in Finland, to private providers of polytechnic education. In the UK, the local government tie-in led to frequent disputes and eventually resulted in the polytechnics being incorporated as separate entities removed from local government. In Finland, the governance of polytechnics and of the higher education system overall has also centred on the use of negotiated performance agreements with the Minister of Education and on the establishment of a national evaluation council.

In the U.S. the pattern has been a somewhat looser accountability to U.S. state governments and considerable autonomy for the many diverse types and levels of college in each state (Kogan 2002; McGuinness 2005). The study noted above by the National Governors Association pressed strongly for better coordination of missions among colleges and also called for agreements on performance between state governments and individual colleges and a need for an improved data system on higher education (National Governors Association 2007, 6-7).

Australia’s governance issues, as it moved from a binary to a unified single system have included a greater role for the federal government than has occurred in Canada, particularly regarding funding. But it has also involved recent governance concerns about accountability to regions and, as in other countries, about “national protocols” with individual institutions.

Alberta’s recent report earlier (Alberta 2007) also showed a concern by a Canadian provincial government about having more detailed mandate and performance agreements with individual institutions. It called for greater political control over an individual institution’s ability to free-lance its way into new program areas without better consideration being given to the whole system, its financing, and its relevance to the economy

in particular (Alberta 2007). The Plant Report in British Columbia also called for new institutions of accountability to deal with system-wide coordination among institutions (Campus 2020, 2007).

Performance Cluster 2: Innovation, R&D, Human Capital

Innovation as a performance issue and aspiration is clearly a growing feature in all five jurisdictions. However, as a policy concept that emerged in the 1990s into higher education and related industrial and micro economic policy discourse, it is subject to many diverse meanings. In the context of the knowledge-based economy, it had more rigorous meanings tied to the invention and development of new first-to-market products and processes (Conference Board of Canada 2004). However, it is also easily cast by various government departments and higher education institutions as a more general contribution to “change” or “continuous improvement”.

In the UK, as noted, the polytechnic experiment was seen as highly innovative in part because it led to a vast increase in science and technology-oriented courses and to innovation in teaching (Pratt, 1992, 1992a) Once the UK polytechnics became universities they also took up the innovation mantra and, along with many of the older universities, established innovation centres/labs. Studies of the Finish polytechnic system certainly point to innovation as a performance goal but not in a very precisely defined way (OECD 2003, 125). Innovation goals tied to the Internet were also a part of plans to establish a joint “virtual polytechnic” involving several current polytechnics.

In the U.S., a more precise innovation agenda was the central feature of the National Governors Association study and campaign for a new compact for higher education as a whole. The same study also linked some of its innovation themes to the issue of excessive federal and state regulation of the diverse U.S. college system (National Governor’s Association 2007). There are of course other broader developments in the U.S. where, to a greater extent than in the other comparator countries, many universities have sought to transform themselves into entrepreneurial universities and have been encouraged and required to do so by federal and state laws, including federal patent laws (Doern and Stoney 2008; Slaughter and Rhoades 2004; McGuinness, 2005).

In Australia and Canada, innovation agendas for universities and technology institutes are certainly increasingly present. In Australia, this has extended to national research priorities being developed, with universities playing a pivotal role. In Canada, the 2007 federal S&T strategy paper was much more explicit about commercialization goals for federal research funding of universities (Canada, 2007). Similarly, recent briefs by the Association of Community Colleges stress the economic and innovation roles of its member colleges (Association of Community Colleges 2006; 2007). These briefs also stress that applied research in these colleges means research and development tied closely to business product and process development but also to regional businesses linked to the college. Such applied research is also closely tied to the training experience of its students linked directly to immediate employment. As noted earlier, this is also the central theme of the early statements of Polytechnics Canada (2007; 2007a). Similar innovation discourse and performance also feature highly in the Alberta advanced education mandate report (Alberta 2007) and in the reports and website material of the three provincial technology institutes surveyed, BCIT, SAIT and NAIT in a previous section of this paper.

Research and Development (R&D) as a performance issue and goal has, not surprisingly, also increased markedly under the broader rubric of innovation policy. Applied R&D has been especially emphasized as both polytechnic systems and individual technology institutes sought to improve standards and make themselves ever more relevant to business sectors and business clusters in local communities. They were also seeking to differentiate themselves from universities. Governments were also encouraging this more explicit applied R&D role as a way to put pressure on universities themselves to innovate and to be more commercially relevant.

In the UK polytechnic period, applied R&D increased almost immediately for the simple reason that many of them already had historic mandates in technical fields and hence their rebirth as polytechnics doing applied

R&D was a small incremental step. Since then the former polytechnics, performing as functioning universities, have expanded their funding from research granting agencies, and universities overall are also doing much more applied R&D, either via grants or via partnered funding with business. In the UK and other countries, these dual trends are among the reasons why analysts, as we have seen above, refer to both “academic drift” by polytechnics and “vocational drift” by universities as the dynamics of mutual emulation take hold (Ahola 2006; Codling and Meek 2006; Williams 1992;).

The Finnish polytechnic system emerged later than that of the UK and thus R&D was an explicit focus from the outset. R&D strategies have been built in as a matter of national policy and with some proven improvements/results (OECD 2003, 119-120).

In the U.S. the studies noted earlier have shown a continuing increase in applied R&D in community and technical colleges but have urged a greater focus on so-called (and largely undefined) “entrepreneurial R&D”. Similarly applied R&D has grown in the former CAEs that later became a part of the Australian unified system of higher education (OECD 2007). With regard to Canada, and the three provincial examples surveyed, applied R&D is also a growing policy feature. Recent studies have shown that some of the technical and community colleges have also been successful in obtaining research infrastructure grants from the Canada Foundation for Innovation (CFI) (Association of Canadian Community Colleges 2006; 2007). When the CFI was set up in 1997, it was not envisioned that such colleges would be covered by CFI funding. In a larger sense, all of the applied R&D aspirations of polytechnics and technical institutes are likely to create a much greater set of demands on the already overstretched grant funding regime in all five of the jurisdictions being sampled.

Human capital is the final performance issue in this cluster of issues. It is not common in any of the jurisdictions to use the discourse of “human capital” very often or very precisely (Walters 2004). Such human assets in a modern economy and society are of course seen as crucially and increasingly important but in the sources reviewed for this study, these were much more likely to be cast in terms of highly qualified personnel, skills development and skill shortages, and the broad-based development of human beings through advanced education.

In the UK polytechnic experience, key improvements in skill developments and needs were central and significant improvements did occur. In both the UK and Finland, steps were also taken to improve the qualifications of teaching staff in the polytechnics, and in both countries the state of colleges devoted to “teacher education” became a separate focussed issue and teacher shortages emerged as skill sets for teachers changed. Similar concerns have been present in the U.S. particularly regarding teaching in math and the sciences. In the Canadian examples examined, Alberta has given special attention to serious gaps in skills and qualified people as its economy boomed in the last decade of energy and related oil sands development but also in other areas of a booming economy (Alberta 2007).

Performance Cluster 3: Student Pathways and Mobility

The final performance cluster concerns the issues of student pathways through the higher education system and the overall mobility of movement and aspirations as circumstances change for individuals as they proceed through life. Indeed, in recent years it has involved goals related to life-long learning and also to expanded international educational experiences for students beyond national boundaries. Partly this is an important policy issue but it is also often seen as an administrative issue tied to the provision of information to students about choices and options and about recognition of credits among institutions and between sectors in a binary system.

In both the UK and Finish cases, pathway issues and the need to construct “ladders” of access and opportunity within and between sectors was a central political rationale for the formation of the polytechnics sector. In the UK it was also a rationale for later allowing the polytechnics to become universities. In both these country examples, there has been significant improvement in information that facilitates pathway movement for the benefit of individuals. Nonetheless, concerns remain in the UK about an informal two-tier

system. And of course there are finite limits in the Finish system as to the extent to which course and degree credits are recognized between the two sectors of its binary system. Recent Finish policy has also set targets for polytechnics and universities to increase international links and experience for students in an integrated EU context.

The U.S. higher education system in its multi-level complexity does provide a great range of choice about pathways and course and degree recognition. Indeed, it is often argued explicitly that the inherent competitiveness of the U.S. system, where diverse colleges actively seek out students, produces pathway advantages for students. None the less, the U.S. system is far from perfect and concerns still arise over this important performance issue.

The Australian experience under its current unified system of advanced higher education has also improved system information regarding student pathways. And far more than the Canadian case, they have actively sought to increase international links both for their own students studying elsewhere and in attracting foreign students to study in Australia, and eventually to stay.

The Canadian situation exhibits similar concerns in all three provinces surveyed about this pathway and mobility issue, in particular through better credit recognition and information. Alberta policy reports (e.g. Alberta 2007) and British Columbia analyses both suggest the need for greater focus on this issue and for better data on these mobility and transfer patterns ((Campus 2020, 2007; British Columbia Council on Admissions and Transfer, 2008; 2005; 2004)

While there are clearly some similar trends in aspiration and achievement across the sample jurisdictions regarding these three clusters of performance issues, national differences still arise. Moreover, as stressed from the outset, we are attempting to summarize and illustrate issues regarding polytechnics as institutions and polytechnics as education. Thus, to say the least, we have somewhat of “moving target” subject across the five or more decades of experience and evolution involved in the five jurisdictions.

Finally, it needs to be said that the separate performance issues within the three clusters and among them are not perfectly watertight. There are boundary links and overlaps among them. For example, there are links between the pathways issue and human capital issue. Similarly, there are links between innovation and R&D and accountability issues regarding business.

Conclusions and Some Policy Implications for Ontario

The purpose of this paper has been to critically examine the experience of other selected countries with polytechnics and related sub-systems in higher education through a literature review of relevant developments in the U.S., UK, Australia, Finland, and Canada (in the provinces of British Columbia, Alberta and New Brunswick). It has been stressed from the outset that the paper is not itself a systematic empirical head-to-head comparative account. Rather the analysis has drawn on, cited, summarized and commented on some published research of a quite diverse nature. These sources have provided some systematic empirical analysis, but they also provide analyses of quite broad periods of polytechnic institutions and polytechnic education history examined in the context of the different higher education cultures of five different countries and jurisdictions. We have necessarily stressed that polytechnics can be either an institution or an area of education (programs, degrees) and hence provide a kind of moving target, analytically speaking.

As emphasized from the outset, the paper has not been able to ignore the fact that there is considerable definitional stretch regarding polytechnics. However, in the context of the conclusions below regarding possible implications for Ontario the paper employs the working definition set out in first section of the paper. A polytechnic is defined as an institution of higher education the majority of whose programs or degrees focus on education regarding applied technology. As we will see, however, in the discussion of policy options this

does not logically solve all our analytical problems because in practice one could encourage and further develop polytechnic **education** as a small or selective program element of the program or degree structure of all or most CAATs in Ontario without calling the institution a polytechnic. This kind of educational content would again have an applied technology focus but it would not be the main part of its mandate for higher education.

We now offer overall conclusions and link these to the second overall purpose of the paper which is to draw out some initial policy implications for Ontario. The policy implications must be considered as tentative because, as stressed from the outset, the paper contains no Ontario-specific information. Further Ontario-focussed research is needed to draw out more complete and definitive policy implications for Ontario. Each of the main sections of the paper bring with them some overall policy choices and ranges of policy coverage.

We began with the Teichler typology because it usefully and crucially differentiates between formal versus informal modes of higher education and also vertical (or strata- centred) versus horizontal elements (based on profiles). At its core, the Teichler typology implies the simple reality that Ontario choices can range from quite formal restructuring of polytechnic institutions to much more informal changes in polytechnic degrees and education content and delivery. These kinds of choice and evolution were also linked in the first section of the paper to theories of differentiation in the higher education literature and their discussion of diverse kinds of both academic and vocational drift. These overall conceptual issues also arose in our initial profile of the five jurisdictions in the second section of the paper.

These conceptual issues, in combination with the paper's overall comparative historical account of the five jurisdictions, suggest that Ontario could consider the following overall range of policy options regarding polytechnics:

- 1) take steps to convert the entire CAATs sector into a polytechnic institutional sector (as in the UK and Finland) accompanied by some systemic effort to improve and enhance their quality;
- 2) take steps to encourage and "incentivise" a smaller subset of existing CAATS to "bid" to become formally designated/named polytechnic institutions, the majority of whose programs relate to applied technology;
- 3) maintain the status quo allowing all existing CAATs to individually offer polytechnic education as a smaller of particular element in their program or structure partly to meet regional or local needs.
- 4) take steps to develop joint university-CAAT programs that would deliver high quality polytechnic education;

The rationale for each of these four options would of course have to be developed more fully by taking into account more Ontario-specific analytical factors. For example, the present paper has not been able, due to limits of space and scope, to answer the question of whether there is some type of polytechnic education in other jurisdictions that is not presently offered in Ontario.² Nonetheless, some further concluding points about the four options are worth noting.

Option 1 seems highly unlikely to be chosen, because, at first glance, Ontario's situation does not seem to be close to the political-economic dynamics that propelled the taking of this option in the UK and Finland. Moreover, under this option the definition of a polytechnic institution would not meet the more focused test suggested in the paper's applied technology-focussed definition.

² The external peer reviewer raised this important and valid question and pointed out that if the answer is yes, then one must still ask whether such education is needed in Ontario. If the answer is no, then the current CAATs in Ontario are meeting key educational needs, although other issues governance and branding may still be involved and require possible change.

Option 2 has a potentially more logical fit but it also has financial implications that require further analysis. It also implies that overall provincial higher education policy would want to support this notion of partial structural differentiation within the CAATs system overall.

Option 3 represents a clear logical option if polytechnical education in program terms was seen as usefully offered in many or most CAATs, in part perhaps on the grounds of regional/local access and also on the grounds of some new programs serving as laboratories of program experimentation and learning.

Option 4 regarding university-CAATs cooperation in polytechnic program development is an obvious logical possibility. The paper has not explored this in the context of our very broad look at five jurisdictions, but some cooperation in other jurisdictions already occurs. Moreover, the discussion of differentiation theory and of academic drift and vocational drift in the UK and Finish cases suggests the potential for such an option at a practical level. Clearly, however, we have also seen examples of inter-sectoral resistance on the grounds of concerns about prestige by universities and also possible loss of traditional focus by community colleges such as in the CAATs system.

The third section of the paper logically supplies an initial set of more particular policy goals and issues regarding performance. Our account has treated these as issues rather than as proven policy outcomes in each jurisdiction sampled. The issues are by no means new for Ontario, but the relative emphasis among them and how they might be conceptualized would be practical policy and resource allocation concerns no matter which of the above four overall options were selected.

For example, the Cluster 2 set of performance issues- innovation, R&D, and human capital- may loom larger if polytechnics were especially defined as suggested in this paper as those focussing on applied technology mandates. The comparative analysis suggests that of this trio of issues, innovation and human capital in particular, may be partially entering the “discourse” of performance issues but without much precision as to what they actually involve and how they might be assessed in real terms as key ways to assess progress in the knowledge-based economy. The applied R&D issue in this cluster is probably on firmer ground than the other two in terms of analytical and mandate performance logic, but it too raises the very real policy and resource allocation issues regarding who will fund such likely increased applied R&D activity-- federal granting bodies, provincial funding mechanisms, or private firms, possibly tied to new tax breaks or refundable tax credits.

Cluster 1 issues regarding access, quality, and accountability and governance will also continue to be important but may show up in new or changed forms as different groups of students and communities press their claims on any pro-offered new polytechnic institutional subsector such as suggested under Option 2 above. Access may take on different hues of emphasis such as those tied to life-long learning and older citizens in an aging population. Regional access may loom large and thus suggest that Option 3 regarding polytechnic education makes the most sense. The access of newly arrived large numbers of immigrants from very diverse communities may also loom larger in policy terms.

A key issue of quality will also raise policy issues regarding expanded mandates for provincial quality assurance agencies and possible increases in the publication of more explicit league tables that rank institutions in performance terms. Governance and related accountability issues may see education ministries seeking more specific negotiated and published agreements between the minister as funder and agent of the taxpayer and *individual* institutions. There is also likely to be more pressure as in British Columbia and Alberta for new institutions of accountability to ensure better coordination across the higher education system overall or among CAATs.

Cluster 3 concerns regarding the issue of student pathways and mobility are in some ways the “softest” of the performance issues discussed. All jurisdictions surveyed see it as an important policy goal but the issues of credit recognition, and the movement of students through, around or over barriers to mobility are also often seen as administrative problems. It is possible that policy options such as a higher education ombudsman may come into play along with the more sophisticated use of internet information on these system-wide pathway and mobility issues. There will also be inherent limits to how far this goal can be achieved in that

there are bound to be limits and outright opposition in some quarters if it becomes too easy to shift from one sector to another and thus arguments emerge about the relative academic quality of programs and sectors.

It is thus apparent that there may be both synergies and clashes as the four suggested options are matched against the clusters of performance issues or criteria. In a word, the choices are complex. To firm up these policy options, issues, synergies and clashes for Ontario regarding polytechnics per se, further research is needed that more explicitly takes them into account. In addition, the following factors and elements need to be explored in any further more Ontario-specific study: existing provincial policy and accountability regimes for CAATs; the likely medium-term future needs of the Ontario economy for higher technology-focussed skills in the global knowledge-based economy; the more precise aspirations, capacities and plans of those particular CAATs that may be seeking formal recognition as polytechnic institutions; the implications for the remaining CAATs that continue to provide polytechnic education but are not designated polytechnic institutions; and the precise performance criteria and accountability and governance mechanisms needed, including those explored in this paper. Analysis of the Ontario context also needs to take explicit account of observed tendencies for institutional differentiation and for both academic and vocational drift to occur and whether there are ways to limit it, or simply recognize that it is highly likely to happen as the dynamics of emulation, differentiation and branding occur.

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