The Fully-functioning university and its contribution to the advancement of knowledge

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The aim of this paper is to explore the implications of the concept of a 'fully-functioning university' for its contribution to the advancement of knowledge. The paper therefore starts by reviewing that concept and the tripartite mission on which it is based. The main question that the paper seeks to answer is, 'what kinds of research can best support the advancement of knowledge, the higher education of students and those beyond the walls of the university, respectively?' The paper also explores how universities can serve the advancement of knowledge, beyond 'research' i.e. in addition to research as that term is currently understood within universities. It concludes with some ideas for how a fully-functioning university can contribute to the advancement of knowledge in ways that also contribute to the advancement of students and the community and society more widely.

Keywords: Fully-functioning university, tripartite mission, research, knowledge, subject-centred research, student-centred research, service-centred research.

Introduction

This paper is about the contribution of a fully-functioning university to the advancement of knowledge. It reviews the concept of the fully-functioning university and explores different ways that knowledge can be advanced. The main aim of the paper is to explore the nature of a fully-functioning university's contribution to the advancement of knowledge.

The concept of a 'full-functioning university' is closely linked to the tripartite mission of the university, which includes (1) the higher education of its students, (2) the advancement of knowledge and (3) service to those beyond the walls of the university. The term 'fully-functioning university' was coined as a name for a university that values each of the parts of the tripartite mission in its own right and seeks to realise all three of them as fully as it can (Bourner, 2008). This paper seeks to identify the sort of contribution to the advancement of knowledge that would be pursued by such a university.

This is an important issue for many reasons. First, the leading role of the university in research is being challenged in these still early years of the 21st century. Second, what is meant by 'knowledge' is changing. Third, the role of the university in the dissemination of knowledge is under threat, especially from various forms of digital communication. These reasons are addressed below.

The role of the university in undertaking research is being challenged by amongst other things, 'think tanks' which could with justification be called 'research tanks', by research in organisations, business, public and not-for-profit and research institutes. There are an increasing range of institutions and groups outside of universities that undertake research (Bourner, Heath and Rospigliosi, 2014).

The meaning of the term 'knowledge' appears to be changing. There was a time, not long ago, when universities were uncontested authorities on what counted as legitimate knowledge, and it was knowledge of a propositional kind. It was what the philosopher Gilbert Ryle described as 'knowledge-that' to differentiate from 'knowledge-how' (Ryle, 1949). It was famously referred to by Gibbons et al, (1994) as 'mode 1' knowledge to differentiate it from 'mode 2' knowledge, practitioner-based knowledge often emerging from processes far removed from conventional research. Since that time, other forms of knowledge, including a 'mode 3 knowledge' have been proposed (- see, for example, Carayannis and Campbell, 2012) and have received varying degrees of recognition.

The traditional processes whereby new knowledge is disseminated in peer-reviewed academic

journals, and then in university courses and associated texts, is being challenged as more new knowledge is published on-line, often in forms that are not peer-reviewed, and disseminated in ways that do not involve university academics as gate-keepers performing a quality-control role. Wikipedia is a clear example (Lih, 2009).

The next section of this paper provides the context for this enquiry into the sort of contribution to the advancement of knowledge that would be made by a fully-functioning university. We then look at different kinds of research. In the following section we explore ways that a university can contribute to the advancement of knowledge other than by research per se. The main conclusions of the paper are that (1) resources devoted to research need not be at the expense of the higher education of students or social engagement, (2) the accumulation of knowledge aimed at increasing material wealth is encountering diminishing returns to human wellbeing in developed countries and (3) contributing to the advancement of knowledge implies a range of activities far wider than just research. There are many ways that the advancement of knowledge, broadly defined, can contribute to the higher education of students and the well-being of those beyond the walls of the university that lie outside the limited conception of the pursuit of knowledge inherited from the Humboldtian university of the 19th century.

Background

In 2008 one of the authors published a paper in this journal on the concept of a 'fully-functioning university' (Bourner, 2008). The term 'fully-functioning university' refers to a university that values each of the three parts of the tripartite mission in its own right and seeks to realise them as fully it can. This was the result of asking the question, 'What goals have endured across all the stages of the development of the western university?' The main conclusion was that the following three goals are evident in the whole of that development: (1) the higher education of students, (2) the advancement of knowledge and (3) service to those beyond the walls of the university. This is commonly known, especially in the USA, as the 'tripartite mission'. It turned out that the tripartite mission, which some believe to have originated in USA universities in the 20th century or the land-grant universities of the 19th century, actually has a solid pedigree going back to the Middle Ages.

It was also apparent that in each of the epochs that make up the history of the western university each of the three goals, in turn, has dominated the other two. These epochs are the medieval period, the Renaissance and early modern period and the modern period (Ridder-Symoens, 1992; Ridder-Symoens, 199; Ruegg, 2004). In each period, the university valued the dominant goal *directly* and the remaining two were valued insofar as they served that dominant goal and in each period the two subservient goals were reformed in ways that served the dominant goal. During the high years of the medieval period, as the Latin Church became increasingly powerful, the dominant goal of the university was service to Western Christendom through the Latin Church. During that time, the other two goals were expressed in ways that served that preeminent goal. In the early modern period, the higher education of students dominated and the other two goals were reformed to serve that goal. And in the modern era, the dominant goal of the western university became its contribution to the advancement of knowledge and the other two goals were reformed to serve that goal more fully (Bourner, 2008).

In 2013, we published in *Higher Education Review* an article which addressed the follow-up question, 'what sort of higher education is implied by the concept of a fully-functioning university?' In other words, what sort of higher education would be offered by a university that places direct value on the advancement of knowledge, the advancement of its students and the advancement of society? We concluded that it was one comprising a subject-centred part, a student-centred part and a society-centred part and we went on to explore what each of those parts might contain (Bourner, Heath and Rospigliosi, 2013).

The next stage of the 'fully-functioning university' enquiry is to ask, 'what does the concept of a fully-functioning university imply for its contribution to the advancement of knowledge?' We know from the first stage of this enquiry that the nature of the university's contribution to the advancement of knowledge has changed over time as the dominant part of the tripartite mission has changed from the medieval university, through the early modern university to the Humboldtian or modern university. We examined how the Western university has sought to advance knowledge across its history and concluded that it has taken different forms in different the different periods (Bourner, 2008). The rest of this background section contains a, necessarily brief, summary of those findings.

How did the medieval university contribute to the advancement of knowledge? In answering this question it is necessary to bear in mind that (1) it is possible to contribute to the advancement of knowledge in many ways including the dissemination, preservation, application and addition to knowledge and (2) the medieval university was part of the Latin Church and its superordinate goal was to serve that Church. What was most valued as knowledge in the medieval university, therefore, was that which supported the work and the purposes of the Latin Church. This included dissemination of knowledge of the Holy Bible which for many people in the Middle Ages (and later) contained the *literal* word of God (McGrath, 2001). It also included other scriptural texts from established sources such as Augustine of Hippo and other Church Fathers for which, from the 13th century, the standard text used in university education was the 4 volumes of the *Sentences* by Peter Lombard. And it included the 'practical arts' of the trivium (logic, rhetoric and written language) and the quadrivium (arithmetic, geometry, music, and astronomy). For a minority of students it might also include text-based knowledge of the main learned professions of law and medicine in the higher faculties that bore those names. Medieval universities disseminated knowledge mainly through their teaching (Bourner, Heath and Rospigliosi, 2013).

Medieval universities also added to the stock of knowledge through their interpretation of Christian scripture to meet the needs of changing times and the changing role of the Church and through the accumulation of such knowledge, mostly from Islamic countries, as was compatible with Christian scripture, particularly the works preserved from ancient Greece and Rome (Burnett, 1997). It was through these sources that Aristotle came to exert such a large influence on the most learned minds of the Middle Ages.

The purpose of the dissemination of knowledge through teaching in the medieval university was so that it could be applied, mostly by 'graduates' working as priests or in other capacities for the Latin Church (Bourner, 2008). The knowledge that was conveyed by the medieval university was seen as practical and applicable. The knowledge distilled from Islamic countries, and through them, from classical antiquity, was sought for its applicability to the purposes of the Catholic Church. The idea of 'the pursuit of knowledge for its own sake' would have made little sense within the medieval university or to the Church authorities. Indeed, the pursuit of earthly knowledge had been denounced by St Paul, the person who had most influence on the development of Christianity other than Jesus himself (Freeman, 2002). And the person who, in the Middle Ages, was the leading father of the Catholic Church, St Augustine of Hippo, had associated the acquisition of earthly knowledge with the sin of pride. Knowledge was acquired and disseminated in the medieval university, for the most part, because it was practical and applicable to the purposes of the Catholic Church (Bourner, 2008).

How did the early modern university contribute to the advancement of knowledge? The main clue to understanding the nature of the advancement of knowledge in the early modern period is to recognise the changed mission of the university in this period: it was to produce Godly gentlemen who could tell right from wrong morally, intellectually and socially (Curtis, 1959) and introduce them to 'the best that has been thought and said in the world' (Arnold, 1869). In order to realise this, it accumulated knowledge from ancient Greece and Rome, particularly in the fields of history, literature, oratory and philosophy (Turner, 2014). The Renaissance university thereby extended the range of what counted as knowledge. It valued new knowledge from different fields. The very term 'Renaissance man' conveys

the idea of breadth of knowledge.

Compared to the medieval university, where theology was the dominant subject, the so-called ‘queen of the sciences’, the university of the Renaissance placed greater emphasis on human experience in this earthly world (Grendler, 2004). It placed more value on humanity, on realism and on the experience of individuals (Mortimer, 2014).

Much has been made of the failure of the early modern university to play a major role in the scientific revolution and, in particular, the failure of the higher education it provided to incorporate the new empirical knowledge of the physical world (Ashby, 1966). This is to miss the main goal of the early modern university and to judge it by the aspirations of the modern university. The point of the early modern university was to produce Godly gentlemen who could tell right from wrong morally, intellectually and socially. That was its dominant mission and the sort of education needed to realise it did not require the inclusion of knowledge from the empirical sciences.

Many of those who did contribute significantly to the scientific revolution of the 17th century, however, had received a university education and that is evidence of the flexibility of that education which allowed space for students to develop a wider range of different interests. Thus, for example, Francis Bacon, who more than anyone articulated the new scientific project as the accumulation of new knowledge of the natural world, was educated at Cambridge university (Urbach, 1987). The Renaissance university underpinned the scientific revolution in another respect also, and that was in the value it placed on collecting. Many Renaissance scholars, such as Petrarch, accumulated manuscripts from monasteries across Europe. The Renaissance disposition to collect, preserve and accumulate is evidenced by the emergence of the ‘cabinet of curiosities’, the ‘room of wonders’, the building of galleries and the development of museums. The Renaissance turned the common human impulse for acquisition towards the accumulation of knowledge. It was this development which underpinned the great project of the scientific revolution i.e. the accumulation of knowledge.

The Humboldtian university of the 19th century is the foundation of the modern research university. How did the Humboldtian university contribute to the advancement of knowledge? From the beginning, the goal of the Humboldtian university, its staff and its students, was the pursuit of knowledge itself (Humboldt, 1970). Knowledge is pursued so that it may be found so the success of the pursuit of knowledge can therefore be assessed by the extent of the discovery of new knowledge. In other words, the aim of the *pursuit* of knowledge is the *discovery* of knowledge and that meant research. The higher goal of the university became the accumulation of new knowledge and its dissemination and this led naturally to the development of the research university.

The modern university valued research as the intentional creation of new knowledge, it valued the dissemination of newly-minted knowledge and it valued scholarship as the critical interpretation of existing knowledge, particularly in the light of the latest contributions of new knowledge. The higher education of students in the Humboldtian university was to serve the pursuit of knowledge. In the modern university, this included the dissemination of recent additions to knowledge to the students of the university. It included the development of the students' critical faculties i.e. their ability to test ideas, assertions and evidence as the means by which claims to new knowledge could be evaluated. And it included the development of a questioning attitude as the by-product of well-honed critical faculties (Bourner et al, 2013).

The emphasis on research and scholarship within the modern university in the 1950s and 60s gave rise to the charge that universities were becoming 'ivory towers' divorced from the concerns of the rest of society (Robinson, 1968, Burgess, 1977). Arguably this was unfair to the modern university, as the advancement of knowledge was seen as a road to greater human material well-being. It sought to enlarge the pool of knowledge from which all could draw. This would lead to increased human mastery of the physical world promising the eventual eradication of famine, disease and poverty. And the development of the capacity to test ideas, assertions and evidence would help active citizens to

recognise those who would mislead through error or deceit.

The modern university sees research as the pre-eminent way of pursuing, and hence advancing, knowledge. Most universities currently see research as the primary vehicle for the advancement of knowledge. For this reason the next section addresses the question, what sort of research would be undertaken by a fully-functioning university?

Research in the fully-functioning university

For the purposes of this paper research is defined as *the intentional creation of shared new knowledge*. *Intentional* – because we recognise that knowledge can be discovered by happy accident, serendipity or as a by-product of some other process. *Creation* – is used in preference to the word 'discovery' because we want to include not only 'discovery' but also 'invention'. *Shared* – because new knowledge that is not shared does not add to the stock of knowledge available to the world. *New* – because 're-inventing the wheel' doesn't add to the stock of knowledge. *Knowledge* – because research goes beyond merely providing more data. Research is not the same as scholarship, which in this paper means, following Lewis Elton, the 'critical interpretation of existing knowledge' (Elton, 1992).

The 'fully-functioning university' values each of the parts of the tripartite mission in its own right and seeks to realise all three as fully as it can. The tripartite mission is often abbreviated to simply: research, teaching and service. This section of the paper addresses the question, 'what sort of research would be pursued by such a fully-functioning university?'

Our previous article on *The Fully-Functioning University and Its Higher Education* addressed the question, 'what sort of higher education would be offered by a university that places value on each part of the tripartite mission in its own right?' In that paper, we concluded that the sort of higher education offered by a fully-functioning university would be one that contained a subject-centred part, a student-centred part and a service-centred part. Each of the three categories pertains directly to one part of the tripartite mission respectively i.e. the advancement of knowledge (which in the academy is largely organised by subject discipline), the advancement of student education and the advancement of society (Bourner, Heath and Rospigliosi, 2013).

The same reasoning can now be extended to the research, which in the fully-functioning university would contain a subject-centred part, a student-centred part and a service-centred part. That, however, begs the question, do these theoretical categories have empirical significance i.e. 'can we populate these categories of this framework' or is one or more empty? In other words, can we give some non-trivial examples of subject-centred research, student-centred research and service-centred research respectively? To answer this question, we look at each in turn.

Subject-centred research This is research where the primary goal is to make a direct contribution to the advancement of knowledge within subject-disciplines. Over the last two hundred years, universities have become clear about the sort of research that best meets that goal. For example, it includes:

1. *Rigorous research* This is the sort of research that meets the criteria most frequently applied to research reports submitted for publication in peer-reviewed scholarly journals. These include methodological appropriateness to the aims of the research, critical assessment of the research findings and appropriateness of conclusions in the light of the literature in the field and in the light of the findings of the research itself.

2. *Basic research* This is fundamental research that is most likely to challenge assumptions within a subject discipline or open up new fields of enquiry. It is the kind of research that may produce a paradigm shift and it is particularly valuable when research within a particular

paradigm has encountered clearly diminishing returns.

3. *Open research* The advancement of knowledge implies the creation and growth of a pool of knowledge from which all can draw. This, in turn, implies research that produces findings that are shared and hence publically-owned rather than privately-owned. An increasing amount of research is funded by external sources and hence is contract-based with restricted access to the findings. A good example is research undertaken for the pharmaceutical companies which is intended to lead to patented innovations. This can result in research aimed at making a profit for its sponsors rather than contributing to the shared pool of knowledge. And this can divert resources away from socially beneficial research. For example, it has often been noted that no new antibiotic drugs have been discovered for several decades now and the most frequently given reason for this is the privatisation of research in this field (see, for example, Chicago Tribune 2013).

Student-centred research This is research where the primary goal is to make a direct contribution to the advancement of university students and their HE. Here are three examples:

1. *Student-led research* It is increasingly common for undergraduate courses to include the requirement for students to plan and manage a small-scale research project (Healey et al, 2014). Undergraduate research is now commonplace in USA universities. In 2005 the US *Council of Undergraduate Research* and the *National Conference of Undergraduate Research* issued a joint statement referring to undergraduate research as the "pedagogy of the 21st century" (Walkington, 2015). This is supported by the growing number of undergraduate journals based in prestigious US universities aimed at publishing the results of undergraduate research, including, for example, the *Berkeley Undergraduate Journal*, the *Caltech Undergraduate Research Journal* and the *Columbia Undergraduate Science Journal*. In the UK, student-led research as part of the undergraduate curriculum has been championed by the *Higher Education Academy* (Healey et al, 2009 and 2014, Walkington, 2015).

2. *Research aimed at improving the practice of higher education* This research serves the advancement of students including their experience of higher education. For this reason, a fully-functioning university would place considerable value on research directed at improving the students' higher education.

3.*Inspiring research* Research that inspires, energises and enthuses lecturers can lead to classes that provide an exciting intellectual experience for students. It has been said that enthusiasm is 'caught not taught' so research that fires lecturers with enthusiasm for their subject can transmit this enthusiasm to their students. There is, however, an unresolved question about whether a high commitment to research distracts lecturers from teaching and draws away time and energy that could otherwise have been devoted to teaching and scholarship or whether it supports good teaching by providing lecturers with the thrill of intellectual discovery which they communicate to their students (Hattie and Marsh, 1996: 529; Hughes, 2005; Healey, et al, 2014). It is, no doubt, possible to find many examples of both.

Service-centred research. This is research where the primary goal is to contribute directly to those outside the walls of the university, including the local community. This is clearly related to 'impact' in HEFCE's use of that term. Examples include:

1. *Problem-focused research* The key distinction here is between research that is problem-centred rather than subject-centred. Problem-focused research is likely to be interdisciplinary or multi-disciplinary. It is likely to be seen as practical, useful and score highly on the 'impact' criterion (Denicolo, 2014). It is unlikely to be 'academic' in the pejorative sense of that word. It might well be 'mode 2' research rather than 'mode 1' (Gibbons et al, 1994). This is not the sort of research that is likely to receive an Ig Noble prize for improbable or low impact research

(Abrahams, 2004) or the sort of research that it likely to receive a 'Golden Fleece Award' for wasting public money (see, for example, Schimmrich, 2011). Problem-focused research is aimed at making a difference, and usually in the short-term rather than the long-term.

2. *Applied research* This is research that uses some part of the accumulated theories, knowledge, methods, and techniques, for a specific purpose. The rationale for its application is likely to be in terms of its contribution to well-being of the community, society or the world.

3. *Engaged research.* Research that supports university engagement with wider society, including the local community, is another example of service-centred research. This is the opposite of 'ivory tower' research. It is research that aims to produce findings that are as accessible as possible. It eschews academic and technical jargon to communicate as effectively as possible with a wider audience.

We have seen it is possible to find at least three non-trivial examples that fit within each of the categories, subject-centred research, student-centred research and service-centred research. This shows that the concept of a fully-functioning university generates a framework of research without empty categories. The framework therefore offers a potentially useful contribution to the discourse about research within a fully-functioning university.

Beyond Research

The tripartite mission of the university is to contribute to the advancement of knowledge, the higher education of students and the advancement of society more generally. This is sometimes abbreviated as research, teaching and social engagement. In this section, we explore the downside of the practice of abbreviating 'contribution to the advancement of knowledge' by 'research'. It would, incidentally, also be possible to challenge the abbreviation of 'the higher education of students' by 'teaching' and 'the advancement of society' by 'social engagement', but that would take the paper away from its focus, which is the potential contribution of universities to the advancement of knowledge.

'Research' is not synonymous with 'the advancement of knowledge'. Research is not even synonymous with the '*accumulation* of knowledge'. The pool of knowledge that we can draw upon, contains much that was not contributed by research as that term is normally understood within universities.

Moreover, the advancement of knowledge includes other elements in addition to the *accumulation* of knowledge per se, including enhanced ways of preserving/storing, communication/disseminating/accessing and applying knowledge. Developments in these other elements of the advancement of knowledge have contributed hugely to human wellbeing. It might be thought that these other activities are peripheral activities to research as the core contributor to the advancement of knowledge. However, it is easy to make the case that the greatest contribution to the advancement of knowledge in recent decades has been the development of the internet and, in particular, the World Wide Web. This is captured in the term 'Information Superhighway', and the 'knowledge lane' on that highway has already made a major contribution to the advancement of knowledge. It has connected up knowledge workers (including researchers) within similar fields enabling them to build on each other's work, it has connected up knowledge in different fields allowing for the cross-fertilisation of ideas across subjects and it has made all knowledge much more accessible to many more people, facilitating the application of new knowledge more swiftly and more widely. The significance of the web to the advancement of knowledge is captured in its goal as expressed by the founder of Wikipedia, Jimmy Wales, "to make the whole of human knowledge available to everyone" (Lih, 2009).

If the goal of the advancement of knowledge is to extend the pool of knowledge from which all can draw, then the 'Web' (and the internet more generally) has done more to contribute to the widening of that pool and enabled more people to freely draw from it than any other development since, and possibly also before, the printed book.

In the context of this paper, the most important thing to appreciate about the Web (and Internet) is that it was not the intended outcome of any specific research project or a programme of research. It was mainly the result of a series of practitioner innovations – most famously by Tim Berners-Lee (Naughton, 2000).

In fact, it would be easy to make the case that greatest contributions to the advancement, or even the accumulation of human knowledge, over the last millennium have involved no research at all, and certainly not in the sense in which that term is normally understood within universities. For example, a case can be made for the assertion that none of the dozen most significant contributors to the advancement of knowledge over the last thousand years were the result of any research project or programme of research. Here, for instance, is one plausible list:

1. Recovery of knowledge from ancient Greece and Rome in the Renaissances of the 12th and 15th centuries
2. Sea-based voyages which leading to the connecting up, of the world
3. Development of the printed book
4. Invention/refinement of spectacles
5. Growth in literacy
6. Improvements in transport that released people from the isolation of the village and the countryside more generally
7. Invention of the microscope
8. Invention of the telescope
9. Invention of artificial light, including gas-lamps and electric light.
10. Building of public lending libraries
11. Invention of broadcasting
12. Development and internet and the Web.

The argument so far can be summarised in the contention that research is not the spring which is the source of the pool of accumulated knowledge but one just one tributary into the accumulation of knowledge and that the accumulation of knowledge, in turn, is but one part of the advancement of knowledge. This is illustrated in the following figure:

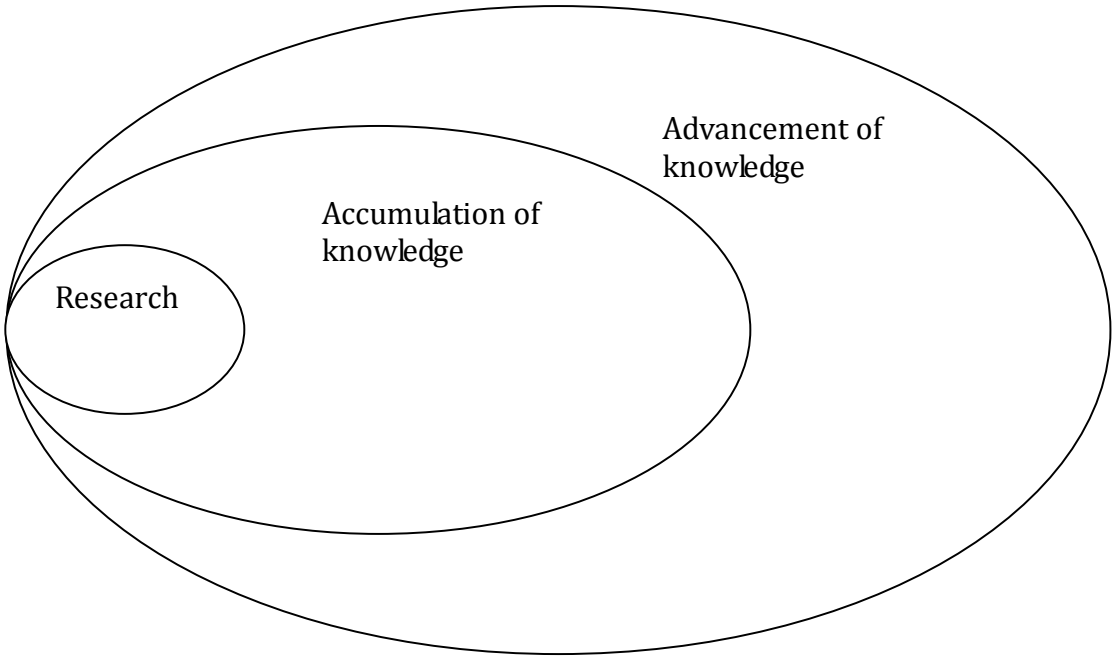

Figure 1: Research as part of the accumulation of knowledge, which is part of the advancement of knowledge

Arguably, therefore, research, the intended creation of shared new knowledge, has contributed a relatively small share of the stock of accumulated human knowledge. To test this proposition it is only necessary to sample randomly the pages of a good encyclopaedia (even the peer-reviewed *Encyclopædia Britannica* with contributions from over 100 Nobel Prize winners) with the question: 'Is this piece of knowledge the result of a research project?' This sampling process will reveal that the portion of our current stock of knowledge that is research-based is still surprisingly small … so far. This conclusion raises the question, how else can a university contribute to the advancement of knowledge in addition to research? There are many ways, including, for example the following:

1. *Demystifying and popularising knowledge.* This advances knowledge by making it more accessible to a wider proportion of the population. In this context, it is interesting to observe the growing practice of the appointment to chairs in 'the public understanding of science' (such as Richard Dawkins at Oxford University) and more recently in other subjects too including, for example, a chair in the public understanding of psychology at Hertfordshire University. It is also interesting to observe the emergence of evidence-based self-help books (mostly written by university professors of psychology or neuroscience) as a new phenomenon in a field hitherto dominated by books based on anecdote, personal experience and dubious authority. Such new activities that make the knowledge published in the academic journals accessible to a wider audience contribute significantly to the advancement of knowledge.

2. *Developing research as a transferable skill amongst all university students.* Research as a transferable skill is of growing importance as the pace of accumulation of knowledge is accelerating and as an increasing percentage of graduates find employment in positions that will involve at least some elements of the accumulation of knowledge (Bourner et al, 2014). Research projects undertaken by students help to prepare them for life after graduation, including the sort of jobs in which most university graduates are employed, and certainly the sort of jobs to which they aspire as graduates. A recent study of changes in the pattern of graduate employment of graduates over 4 decades identified the need for a new kind of vocationalism based on skills that are traditionally associated with research (Bourner, Greener and Rospigliosi, 2011). The fully-functioning university would offer a higher education that develops the capacity of students to plan and manage their own research and their own learning more generally.

3. *Elevating the esteem in which knowledge is held.* There are many ways of doing this, from recognising the contribution of the accumulation of knowledge to human wellbeing, to celebrating significant additions to the stock of knowledge. Academics have an opportunity to elevate respect for knowledge as part of the higher education they offer. Arguably, this would be better realised by focusing on the contribution of the advancement of knowledge to the wellbeing of humankind than focusing on the pursuit of knowledge for its own sake.

4. *Integrating and synthesizing of knowledge.* As the stock of knowledge rises, it is only possible to stay up-to-date with the leading edge in a field by reducing the breadth of the field - that is, by specialisation. This raises the danger of increasing fragmentation within the map of knowledge, creating gaps between academic disciplines. This, in turn, risks the emergence of a need to rediscover solutions that have been solved in other disciplines. It is no longer realistic to expect anyone to be familiar with the leading edge of many different subjects. 'Polymaths', people with an acquaintance with the leading edge of a wide range of subjects, are a dying breed, if not already extinct. What does seem possible, however, is to envisage a tribe of boundary-spanning individuals within academia who are reasonably up-to-date with the leading edge of two or possibly three different fields of study and can act as channels of communication for the ideas being developed in those different fields.

5. *Knowledge transfer between producers and potential users of knowledge.* As well as transfer of knowledge between academic disciplines, knowledge can also be advanced by

facilitating the transfer of knowledge between those who generate knowledge and those who need to use it. Knowledge Transfer Partnerships (KTPs) (Hewitt-Dundass, 2012) are well-known examples of one way of connecting the users of knowledge with those who are producing it. A less obvious example is the Community and University Partnership Project (CUPP), of the university of Brighton, which acts as a broker between community-based organisations and the university and, in particular, researchers within the university who are able to direct their research efforts towards problems identified by community organisations (Hart et al, 2007). These two examples, illustrate the scope for the development of knowledge brokerage within universities as a way of advancing the cause of knowledge.

6. *Identifying domains of applicability of knowledge.* Universities have focused on the generation of knowledge in the form of research. Knowledge can also be advanced by discovering new domains in which knowledge can be used. The development of evidence-based self-help books referred to above is a recent example. In recent decades also, science has moved beyond increasing knowledge of the natural world and is making increasing inroads into the world of subjective experience (Popper's 'world two', Popper, 1978) and as it does so, the scope for new domains of application grows wider. It has been said that 'when science has solved all the problems of life, all the problems of living will remain'. To which an observer of the incursion of science into 'world 2' in recent decades could reasonably respond, 'not any more'.

7. *Interpreting new knowledge.* Until the scientific revolution or the 17th century, the accumulation of knowledge was piecemeal, uncoordinated and largely unrecognised. It was the scientific revolution that elevated the accumulation of knowledge to a systematic activity. It was justified in terms of social purpose: the aim of science was to contribute to the enlargement of the pool of knowledge from which all may draw and the reason for so doing was to increase human well-being by gaining more control of the natural world (Bacon, 2001, 1605). Science offered a new method (Bacon's Novum Organon) for realising the primary goal of humanism inherited from the Renaissance (Urbach, 1987). In order to achieve that goal, the discovery of new knowledge is not enough. It is necessary also to make sense of the new knowledge in terms of its contribution to the existing stock of knowledge and also in terms of its contribution to human well-being. In other words, the interpretation of new knowledge contributes to the advancement of knowledge towards its higher goal, the improving of the human condition. The interpretation of knowledge can take various forms from traditional scholarship to working through the practical implications of new knowledge.

8. *Liaising with other groups with an interest in the advancement of knowledge.* These include, for example, professional bodies, research institutes, think tanks and government agencies. It includes, for example, activities that are face-to-face (such as conferences), print-based (such as special issues of academic and professional journals) and on-line (such as those responsible for various forms of digital repositories of knowledge and its dissemination). As the accumulation of knowledge proceeds, taking ever-more diverse forms, there is an important role in connecting up the different strands to facilitate contact and communication.

9. *Organising knowledge.* Most of the producers of new knowledge are focused on specific fields within academic subjects. Few are interested in taking a meta-level position with respect to new knowledge. Universities, with their commitment to the advancement of knowledge per se, are well-placed to adopt an overview perspective. There are opportunities for universities to make a further contribution to the advancement of knowledge by enhancing understanding of the accumulation of knowledge itself. Karl Popper wrote about 'world 3', comprising 'products of the human mind', and universities are in a position to take on special responsibility for the development of world 3 (Popper, 1978). This would, however, involve universities going significantly beyond their usual role in the advancement of knowledge, subject-centred research.

10. *Critiquing and evaluating knowledge.* Within the academy, the incentives favour publication of reports of research contributing new knowledge. The incentives to test such knowledge advanced by others are much weaker. The evidence supporting claims to new knowledge that pass peer review are not usually tested thereafter unless they conflict with the claims to new knowledge of another researcher in the field. Consequently, there is relatively little testing of the evidence used to support the conclusions of research. According to Popper "Science can be said to be largely the result of criticism – of the critical examination and selection of conjectures, of thought contents."(Popper, 1978, page 160.). Universities can enhance their contribution to the advancement of knowledge by placing more emphasis on testing the evidence for putative new knowledge.

11. *Advancing Local Knowledge.* Universities exist within a global context, a national context and a local context. The accumulation of knowledge is itself a global enterprise with international journals publishing research results that are available to people across the world. National policies impact on universities with, for example, substantial university funding depending on the decisions of national governments. Universities also exist in the context of local communities where, for example, local planning provisions apply, students find accommodation and spend most of their daily lives. Universities in the UK are much less loved by their local communities than are universities in the USA (Watson, 2007). One way of addressing this would be for universities in the UK to direct more of their concern for the advancement of knowledge towards the local community. There is an opportunity for universities to do much more in terms of the preservation, discovery, communication and application of knowledge of their local communities. It would be possible, for example, for universities to develop themselves into 'knowledge hubs' for their local community. They are particularly well-placed to do this in terms of their expertise, facilities and access. And that would address at least two the three parts of the tripartite mission: the advancement of knowledge and the advancement of the community.

We earlier drew attention to the emergence of undergraduate research and journals, particularly in the USA, which publish the fruits of undergraduate research and have looked at this growing phenomenon elsewhere (Bourner, Heath and Rospigliosi, 2014). The *Council on Undergraduate Research* in the USA offers a wide range of resources to support undergraduate research. Undergraduate research aimed at advancing local knowledge would add in the third part of the tripartite mission. The scope for such research is underlined by the 'recent' (2012) establishment of Penn State University's journal, *Undergraduate Journal of Service Learning & Community-Based Research*. Such journals illustrate the potential for the advancement of local knowledge to contribute to all three parts of the tripartite mission including the advancement of knowledge, the higher education of students and service to the local community.

There are isolated and piece-meal instances of universities in the UK contributing to the advancement of local knowledge including, for example, universities that make their libraries available to the local community. To our knowledge, however, no university has yet developed a *strategy* for the advancement of knowledge about its local community.

12. *Developing a love a knowledge and the disposition to learn amongst university students.* Graduates with an inclination to learn will be more disposed to draw from the stock of knowledge.

Discussion

This section discusses some assumptions or issues that have emerged in the paper so far. These include (1) the categorization of the stages of the development of the western university used in the

paper, (2) the issue of who decides what counts as legitimate knowledge and (3) change in the way that the goals of the pursuit of knowledge are realised.

Stages of development of the university

This paper has worked within a 'stages' framework of the development of the western university: medieval, early modern (commencing with the Renaissance) and 'modern'. This classification is not one we have developed to support the conclusions we draw in this article, but rather it is the consensus model of the main developmental stages of the western university. This was, for example, the categorization used by the Standing Conference of Rectors, Presidents and Vice-Chancellors of the European Universities, now European University Association (EUA) for their monumental *History of the European University in Europe (*Ridder-Symoens, 1992; Ridder-Symoens, 1996; Ruegg, 2004). In fact, it is difficult to find any other stadial model of the development of the Western University in the literature that has acquired any currency amongst historians of the university.

Role of universities in the legitimisation of knowledge

In the High Middle Ages in Europe, the Latin Church was the dominant force. By the 13th century, the Latin Church exercised unprecedented degrees of political, spiritual, personal and moral power and it also exercised intellectual authority and power. The Church contained most of the literate people and Latin, its own language, was the medium of intellectual discourse. Moreover, the Church was the source and interpreter of the highest knowledge of all, the word of God.

Later, the power of the Latin Church declined and its authority dissipated. Much of its political power and authority moved towards the emergent nation states, its spiritual authority declined as the Bible as the recognised word of God, became increasingly available in printed form and in vernacular languages. Personal and moral authority moved towards individual conscience and intellectual authority moved towards the universities.

Increasingly, universities acquired authority on what counted as recognised knowledge; the history of the university is also the history of what 'counts' as knowledge. The Renaissance and early modern university widened the boundaries of recognised knowledge to include the classical and humanistic forms and sources of knowledge, including knowledge about what it means to live a good life. This led the elevation of the position of secular knowledge relative to spiritual knowledge which had been dominant in the High Middle Ages in the heyday of the Latin Church in Europe. The humanities, including history and literature, became recognised as legitimate fields of knowledge when they were admitted into the early modern university (Turner, 2014). The development of the 'modern' university in the 19th century, extended the boundaries further to include knowledge of the natural world from empirical sources, and, in particular, science and then its applications in fields such as engineering. This was soon followed by the social sciences. Knowledge of new technologies (such as computers) and new professions (such as accounting) followed. By the end of the end of the 20th century 'mode 2' knowledge and practitioner-based knowledge, often based on reflective learning, was recognised even at the highest, doctoral, level in the new professional doctorates developed at that time in the UK (Bourner, Bowden and Laing, 2001).

We are currently witnessing a democratisation of knowledge as new knowledge emerges from new sources such as undergraduate students and new forms, such as practical knowledge available on-line via, for example, YouTube videos and wikiHow.

Universities can contribute further to the advancement of knowledge by continuing to extend the domain of legitimate knowledge by recognising new kinds of knowledge from different sources, including fields of 'knowledge how' as well as 'knowledge that'. If universities wish to retain their leadership and authority in what counts as legitimate knowledge then they need to take a more active role and strategic role, in the legitimisation of knowledge.

Changing values

One of the consequences of the scientific revolution was 'the accumulation of knowledge of the natural world' project as a collective endeavour. And, as we have seen, the rationale for this accumulation was to benefit humankind. How could science best benefit humankind? In 17th century, Europe, as well as the rest of the world, was subject to periodic famines and plagues (Clark, 2007). The average lifespan in England was only 37 years in the 18th century (Mortimer, 2014). By the end of the 18th century, 85 per cent of the world's population still lived in extreme poverty, caught in the Malthusian trap (Chandy et al, 2015). Humankind's greatest need was to reduce extreme poverty including famine and disease. Greater control over the natural world promised to do that and the accumulation of knowledge of the natural world was the way to gain that control. As Bacon had emphasised, 'knowledge is power' including the power to reduce extreme poverty and famine.

By the 21st century, the human population in most countries had sprung the Malthusian trap (Deacon, 2013; Rist et al, forthcoming 2016). Moreover, the number of countries that have escaped the Malthusian trap continues to rise decade by decade thanks, at least in part, to the contribution of the accumulation of knowledge (Mokyr, 2002). By 2015 the proportion of the world's population living in extreme poverty was down to less than 10% (Chandy, et al., 2015). The 'accumulation of knowledge of the natural world' project has been remarkably successful in contributing to the 'great escape' (Deacon, 2013).

The world of the 21st century is therefore very different from the world in the 18th century with different needs and hence different values. Globally, the number of people who die from obesity annually is now more than three times the number who die from starvation (Ng, 2014). Moreover, the former is rising rapidly and the latter is falling fast. The two leading causes of death in the world now are heart attacks and strokes (WHO, 2014) and obesity is also a contributory factor to both. Mental ill-health is growing at a remarkable rate in developed countries. Mental disorders, particularly anxiety and depression, and substance abuse were the leading causes of non-fatal illness worldwide in 2010 (Whiteford, et al, 2010). It would appear that, globally, problems associated with affluence are gradually replacing problems associated with extreme poverty.

In so-called developed (economically) countries acquiring more material stuff is making a diminishing contribution to experienced wellbeing. Over 40 years ago Richard Easterlin observed the absence of a statistically significant relationship across developed countries between real income and measured satisfaction with life (Easterlin 1974). Since that time, the so-called 'Easterlin paradox' has been confirmed by the failure of the richest countries to record a significant increase in average happiness despite a doubling or trebling of average real income (Proto and Rustichini, 2013). At best, rising real income per head makes a diminishing marginal contribution to human wellbeing (Deacon, 2013). Diminishing marginal utility of real income has been confirmed empirically and measured using modern methods of assessing changes in human wellbeing (Layard, Mayraz and Nickell, 2008). In the words of the charity, *Action for Happiness*:

> *For fifty years we've aimed relentlessly at higher incomes. But despite being much wealthier, we're no happier than we were five decades ago. At the same time we've seen an increase in wider social issues, including a worrying rise in anxiety and depression in young people. It's time for a positive change in what we mean by progress.*

In recent decades, it has become clearer that increasing consumption of material goods by humankind has unintended consequences in terms of its global impact. The case for the indiscriminate accumulation of knowledge to increase material consumption is weakening as each decade passes. In the 21st century there is more need for greater knowledge about how to live with lower environmental impact. And, as the contribution to human well-being made by additional consumption declines, there is a need for greater knowledge of how else to increase human well-being. There is a growing need for

more knowledge of factors that contribute most to human well-being. We have explored some implications of this for 'happiness research' and its role in the curriculum of university education elsewhere (Bourner and Rospigliosi, 2014).

Conclusions

The fully-functioning university is a university that values each part of the tripartite mission in its own right and contributes as fully as it can to the advancement of knowledge, the advancement of its students and the advancement of the community and society more widely. In this paper we have focused on its contribution to the advancement of knowledge. The main question addressed has been, 'how can a university contribute to the advancement of knowledge in ways that also help to realise the other two parts of the tripartite mission?'

The main conclusions are:

1. Research in universities need not be at the expense of the higher education of students or social engagement. Indeed, it is easy to find ways in which research can support these other two parts of the tripartite mission. The 'higher education of students' part can be supported by, for example, student-led research, by research into the practice of higher education and by research that inspires university lecturers and fires them with enthusiasm. The 'social engagement' part of the tripartite mission can be supported by, for example, problem-centred research, applied research and research that engages the university with wider society, including the local community.

2. Research is only one way that a university can contribute to the accumulation of knowledge and the accumulation of knowledge is only one way that a university can contribute to the advancement of knowledge. Many of the other ways can support the higher education of students and social engagement. For example, developing research as a transferable skill amongst university students supports the advancement of students and contributing to the advancement of local knowledge by establishing local knowledge hubs would contribute to the community in which a university is located.

3. There is a limit to the social value of the accumulation of knowledge aimed at enhancing the material wealth of humankind. In developed countries the contribution to further material wealth to the total wellbeing of their inhabitants is rapidly diminishing and some have argued that it has already reached zero (Easterlin, 1974). This is not true, however, of the accumulation of knowledge aimed at contributing directly to human wellbeing. This implies that the value of knowledge in different fields can change over time and as a result of human development. And this implies, in turn, that it is not a settled issue but one that needs to be periodically questioned and examined.

There are many practical implications of these conclusions. First the notion that there is a simple trade-off between resources devoted to research and teaching or social engagement is simplistic in the light of the first conclusion above. In particular, it is possible to find forms of research that support one or both or even all three parts of the tripartite mission. Projects that make a larger contribution to realising all parts of the tripartite mission deserve preferential treatment within the fully-functioning university. Second, universities seeking to contribute to the advancement of knowledge could profitably look beyond research, conventionally defined. By so doing, they are likely to be able to find ways that also support one or both of the other two parts of the tripartite mission. Simply taking the time to use the language of 'advancement of knowledge' rather than the shorter 'research' would help to provide a broader perspective. Third, the value attached to new knowledge in different fields is likely to change in the forthcoming decades with increased relative value attached to new knowledge aimed at supporting enhanced human wellbeing directly rather than through the indirect medium of

increasing material consumption. Universities that recognise the consequences of this for the changing value of different kinds of knowledge are most likely to flourish in the 21st century.

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