

UNIVERSITIES AS THE SAVIOURS OF MANKIND OVER THE NEXT FOUR DECADES

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Abstract

Since Cardinal Newman articulated his 'Idea of a University' as a self-governing community of disinterested scholars in 1852, the role of the University in the world has gone through several evolutionary phases. Most recently, the role of the University as an engine of local economic growth has globally attracted much attention and funding. As the economies of the world gradually reign in public expenditure at the end of the greatest recession for 70 years, universities are going to be in line for retrenchment. There is a new rhetoric that may yet stay the hands of the budget cutters. The world is beset by a group of interacting Malthusian challenges - over-population, energy profligacy, resource depletion, unsustainable consumption, aging infrastructure, lack of resilience to future climates, financial chaos – to name a few. Where is the thought leadership for the new order of things, the local exemplars of the new order in the making, the action at a scale to create the new supply chains required by society, the formation of the new skills and skilled practitioners, etc, if not within the higher and further education system? The world needs to be in a different place in 2050: the challenges are enormous: we will not get there unless the Universities are out in front. Are we up to the challenge and can we take the wider population with us, having first acquired their trust in our commitment to lead?

Introduction

The role of universities down the ages has evolved, and I want in this paper to suggest the next step in that evolution. For much of their history, the two ancient universities in England were small. My own college, Trinity Hall in Cambridge, was founded by Bishop William Bateman in 1350, in his own words 'for the promotion of divine worship and of canon and civil science and direction of the commonwealth and especially of our church and diocese of Norwich'. The rationale behind this stated purpose may well be attributed to the Black Death of 1349, a disaster which, among other things, had resulted in a shortage of clergymen and lawyers (www.trinhall.cam.ac.uk). Note that 'science' was law in the 14th century! Bishop Bateman envisaged a community of 20 Fellows together with their pupils, but this number was not realised for over 600 years, and the Fellowship is not 60 strong today. Given that Fellows were ordained members of the Church of England until the late 19th century, it was clear that the 'Idea of a University' espoused by Cardinal Newman in 1852 as a self-governing community of disinterested scholars had a venerable antiquity associated with it.

It was just at the time of his writing that the first major change in universities occurred. In England, there was a steep rise in their number, with the back-bone of the so-called Russell Group today founded in the major metropolitan areas by philanthropists who had made their fortunes in the industrial revolution (Cadburys in Birmingham, Wills in Bristol, etc), and who sought the formation of administrators to keep the revolution going. In addition Prince Albert started the move to introduce into the UK the successes of the German higher education

system, namely the education and formation of applied scientists and engineers to promote the new technologically advanced industries of the time. This is the origin of Imperial College in London. By 1900 the number of UK academic staff (defined as those whose job description included an element of research in addition to that of teaching and scholarship) had increased probably 10-fold from 1800.

By 2000, there were 134,000 academics in the UK, and the second half of last century witnessed a great expansion. This began after 1945 when grateful nations acceded to the wishes of wartime scientists and engineers as they returned to their universities and continued their researches, this time with a peace dividend as the quid pro quo. By the 1960s, the rhetoric of universities as promoters of local economic growth was being established. Today, towns and cities such as Guildford, Reading, Exeter, Lancaster and others have a local university, which, together with its local infrastructure of science parks, research and consulting firms, and spin-outs, represents the largest local employer. We now live in a Knowledge Economy and the universities are the source of new capital in that economy: indeed that is the theme of our meeting.

There is now a considerable literature, both academic [1] and more popular [2-4] on the role of universities in the modern world. Many of the former deal with the way individual academics see themselves within a modern university with competing pressures to have impact in the current UK parlance: this is on top of being brilliant teachers and researchers, consummate at organising their own departments, sensitive and wise student counsellors and mentors, a force in their professional bodies, and entrepreneurs. The latter authors are more concerned with the macro level and ask whether the university is becoming the handmaiden to corporations, football leagues and other outside interests, or is under imminent threat of eclipse by some forms of on-line internet-mediated education. Put more positively, the university is seen as an agent of local national and international economic growth via its outputs of talented people aware of tomorrow's problems and of a range of new technological inventions and methods of working that can be exploited.

The millennial thinking over the last decade has been dominated by an inter-related set of Malthusian issues that start with the level of world population (including the aging demographic in some areas) and remaining poverty, and proceed through energy profligacy and resource depletion more generally, environmental degradation and loss of biodiversity, to aging infrastructure and a lack of resilience to future climates. To all these, one can add unregulated financial chaos. There is much hubris in even contemplating the reorganising of civilisation over a short timescale of just one half of a human lifespan to mitigate climate change above all the other issues. Continued evolution with an ever-increasing focus on the efficiency and care with which we use any and all resources is a much more appealing prospect. It is also one where engineering innovation can be driven at speed but not willed irrationally to meet totally unrealisable objectives given the resources available (c.f. the UK's Climate Change Committee). Malthus worried about a viable future for Great Britain with a population of less than 10 million, and could not foresee the industrial revolution or any one of a number of green revolutions. That should be a salutary reminder to those who offer unalloyed alarm about the future climate. It is hoped, Post-Copenhagen, that realism will infuse the public and policy debates and decisions about future climates and set them in a bigger context.

I want to develop the idea that higher education around the world is the only sector of a scale and scope, and having the resources, both human and economic, to tackle the basics and basis

of this set of millennial issues and to generate outcomes that could make a real difference to the world. Post World War Two the renewal of infrastructure was based on the necessity of reconstruction of what had been damaged and destroyed. We go back to the second half of the 19th century to the last time there was a major makeover and expansion of national infrastructure in Europe. As I have described above, at that time the academy in Europe was in no position to play substantial role in that exercise. If mankind is going to extricate itself successfully over the next few decades from the multiple Malthusian hooks on which it is impaled, then the university sector will have to embrace this challenge and to organise itself to deliver. In addition the civil society and governments will need to be overt in offering the challenge and supporting the work in universities, and industry, commerce and local governments must interface strongly so as to be able to implement new findings on the scale that would make a difference.

This is an enormous challenge, greater than any offered to the higher education sector in its history. It comes with great threats and great opportunities. If the higher education sector does not embrace the challenge wholeheartedly, then, in the face of the emerging challenges it will be progressively sidelined as an irrelevance by those who do take up the challenge. If the challenge is not taken up, societal conditions will degenerate and higher education will shrink to be a province of only those who can afford to pay. If the challenge is taken up successfully, then universities will see a rerun of life after World War Two, but on a bigger scale: they will be seen as saviours of mankind.

Retrofitting the Existing Building Stock: the societal role of Higher and Further Education

I have not yet got my head around the totality of the challenge I have just posed, but in this section and the next I will deal with one the aspects with which I am familiar, analysing the need to be much more efficient in the use of energy within buildings [6], and the role of higher and further education in the national and international efforts in this matter. I will then return to the central theme at draw bigger lessons.

The UK is typical internationally – 87% of the buildings here today will be present forming about 70% of the building stock in 2050. The energy used in buildings is about 35% of all energy used in the world, but in the UK it is higher: 45% of our energy consumption and our carbon emissions are associated with heating air and water in our buildings, and 27% of the total is from our 22.5M domestic buildings. We also have ~5M non-domestic buildings in retail outlets, offices, factories, hotels and hospitals etc. A major retrofit of our existing building stock for increased energy efficiency is an essential element of the future programme to meet the Malthusian challenge. If there are to be more violent storms, with associated horizontal rains, as a part of future climates, the exteriors of our buildings will need extra protection to prevent water ingress. When the problem is analysed further, again in the UK context, the role of the further and higher education sector becomes clear as I describe below. Note that the designers and occupants of new buildings are aware of these challenges and for them the exiting channels of innovation (within and beyond the further and higher education sectors) seem adequate for the coming decades. The big challenge is the existing stock.

One third of the UK housing stock was built in the 19th century (e.g. many of the rows of terraced houses) occupied originally by those who got a bag of coal a week, so that the efficiency of the thermal envelope was not a major issue for the builders. Had the buildings

been in Spain or Sweden, the extremes of temperature would have been factored in to the design at the start. Another third was built since the Second World War and this was an era of cheap energy, so again the thermal envelope was not an issue. Efforts to improve the thermal envelope started 40 years ago after the first oil crisis. The performance over the period 1990-2005 is instructive. During that time the carbon emissions from the domestic sector fell by 4% in spite of a 10% increase in the number of houses, a rise in the population by 4% and a steep rise in the amount of electricity use for IT and entertainment systems in homes. The House Condition Survey over that period shows that, taken as a basket of measures, the number of homes with (i) 60% of rooms by volume draught-proofed, (ii) 60% of windows by area double-glazed, (iii) cavity wall insulation installed where appropriate and (iv) 80mm or more of insulation in lofts rose from 35% to 65%. With the acceleration of these measures, it is likely that they will be saturated by 2015, with a further consequential fall in carbon emissions by 4%. This still leaves another 12% reduction to be found by 2020 and a further 50% beyond that to be found by 2050! Higher standards of existing insulation will be important, and so will new technologies (triple or vacuum glazing, external cladding, new water efficient measures, much more sophisticated controls, local forms of power generation etc). In addition changes in lifestyle and personal behaviour will be required to meet the 2050 targets of energy reduction.

Scale compounds the problem. If one imagines two major interventions per home, say one by 2030 and the second by 2050, we would do the best available at each turn. A simple sum indicates that we need to be dealing with in excess of 1M homes a year. This is about three times the number of homes per year that have a major intervention now for any reason, such as the installation of a conservatory, a building extension etc. New means of installation will be needed, or old ones resurrected (such as the 'four day package' for council homes in the 1960s, where over one week a new kitchen, bathroom, central heating and double glazing was installed in a home). The new installation will be a higher skilled job than is normally associated with building renovation.

There is no market in retrofitting: there are no yellow-pages with a list of competing providers of improved domestic energy efficiency. Such a market needs creating, and this in turn will not function unless there is a working supply chain. In the absence of systematic calls for superior products for thermal efficiency and water-tightness, there is no pressure for the research, development and production of new and improved materials, installation processes and smart control systems. In today's climate, research on cladding materials with improved thermal insulation and new methods of installation is quite unsexy and lacking in supply chain demand compared with (say) research on carbon capture and sequestration, although arguably they will be equally important to the nation in the long run. Holders of public research funds correctly expect ready-made supply chain demand for most of their disbursements, and the building materials industry will lose out. There are no lead players that can drag the market with them, as BT and Tesco can and do in their respective sectors.

Those who canvass door-to-door report a fall off in the level of trust by members of the public today. Someone offering to improve the thermal performance of my home is obviously out to make money for him/herself at my expense. Why should I trust them? Again, the sector is totally balkanised with no market leaders in instalment who offer worthwhile guarantees. My home is my primary personal and family asset, and TV programmes regular show episodes where frail and elderly people have been parted from significant sums of money by cowboys who leave the premises in a worse condition than they find it. Even if I want to do the job and am persuaded of the near and medium term benefits, as I count any investment

that takes more than 5 years to produce a handsome return as a poor deal, how do I finance the work? If I am a landlord, how do I recover my investment from my tenants other than through unpopular rent increases, even though they enjoy lower energy bills?

Finally, there are many calls on my time, and the siren voices that would usher in a new and lasting era of less consumption, less travel, less comfort and little pleasure do not appeal to me. I work hard to earn the ability to indulge myself, and the only alternative I foresee is sloth and despond.

So far I have identified technologies, skilled labour, market and the supply chain, trust, finance and behaviour among the major issues that divide the world of 2010 from the desired world of 2050 as far as domestic homes are concerned. Overlapping and different issues confront the non-domestic building sector, and the industrial sectors that are energy intensive. How can higher and further education play a role in bridging the divide? Suppose the public, channelled through central and local government, was to ask and to fund the higher and further education sector to meet the 2050 targets for the national energy efficiency and climate resilience of their own estates by 2035 to show the nation how to proceed.

There are at least twelve clear reasons why this would be a good idea if pursued properly and effectively.

(1) The university estate is a proxy for the whole built environment containing offices, heavy engineering laboratories (similar to heavy industry), public buildings such as libraries and lecture theatres, and domestic buildings in the form of student and staff residences.

(2) Universities contain a concentration of the world's brightest minds and intellectual leadership in all the areas of concern: materials, engineering, psychology, management, economics, etc.

(3) Students are there to be inspired today en route to positions of societal leadership tomorrow. Students are much more likely to tolerate experimental technologies in their accommodation (and might report on its effectiveness for a consideration on their rent) than homeowners making their primary asset available. The installers of tomorrow are likely to come from further education where they have had an up-to-date and sophisticated training. New and appropriate patterns of living learned at universities will become public norms over a period of two decades as today's students become leaders of public opinion.

(4) The aggregate scale of the university and further education estates (over 100 universities and 400 further education colleges in the UK) is sufficiently large to kick-start the retrofit market and to develop the supply chain. Sufficiency is not necessity, but necessity can be engendered by public choice as described below.

(5) Widespread dispersal of these institutions will allow them to give local exemplars, and certainly within 30 miles of any English home. The citizen will be able to see the newly retrofitted environment being made on their doorstep, and the errors being ironed out.

(6) The diversity of the sector means that several different approaches will be adopted and there will be an intra-sector competitive market to get their successes out the door.

(7) Knowledge exchange is an essential skill for modern academics working actively in the knowledge economy: by extension they are capable of fulfilling this role if universities are

societal beacons. Their current role of leaders in the knowledge economy is being greatly extended.

(8) Universities attract philanthropic funding, and a focus on solving the big, pressing and global problems will help maintain that funding stream in times of tight public finances.

(9) Through careful monitoring, both the Treasury for the public sector, and the private sector itself, will be able to key a close eye on the costs and the benefits of the work done within universities and further education colleges, and to plan the expansion to a national scale more effectively.

(10) Post-occupancy evaluation is a perennial challenge associated with assessing the value of interventions to buildings and capturing and disseminating the lessons so as to emulate past successes and to avoid past failures. The universities could handle the evaluation very effectively.

(11) The Malthusian issues behind this work are global, and the prospects for taking the lessons world-wide both for commercial benefit to the UK and the improvement of man's lot through aid are enormous.

(12) If the university sector grasps this challenge effectively their stance of taking the moral high ground in tackling global challenges is likely to harness more public trust than some other public or private agency charged with the same objectives. If major changes to the ordering of society become necessary, the university sector is globally connected and well placed to argue the case for change, particularly if the benefits are being seen to flow out of the universities into the private and public sectors.

What would it take?

Among the strongest critics of climate change alarmism are those who identify the Intergovernmental Panel on Climate Change as acting (subconsciously if not overtly) in the self-interest of the active participants, namely those engaged in climate science. If the Panel were to report back that the panic was over, the 20-fold increase in public monies spent on climate research in the US over the last 20 years would quickly be reversed. It is clear that if the world's 8000 universities and their associated further educational colleges were to take up the mission of saving the world by 'thinking globally and acting locally', there is some hope that the narrow self-interests of a few researchers and a few institutions might be submerged. As a part of the pact between society and higher education, this would be an essential element in the giving and receiving of trust. The local structures built in the context of the Knowledge Economy, coupled with the town-gown relations based on cultural or sporting events, are an essential foundation for the level of trust implied by the much larger set of issues being entrusted to the universities.

Many senior people in higher education would be opposed to what is being suggested on the grounds of mission creep. Universities were for teaching and scholarship in Newman's day, and should remain just that. Since then they have taken on the roles of research (willingly) and entrepreneurship (less willingly at first). Surely being entrusted with taking a lead in saving mankind is a step too far for which the sector is not prepared and it should not be prepared to engage at the required scale. The argument simply has to be won within the university sector. There is no other sector in existence capable of taking on the challenge in a

holistic manner, and there is not time to create an alternative sector. If the public side of the pact is clear and cohesive enough the argument will be won within the sector, with self-interest as the lowest common denominator. The promise may be a return to academic nirvana once the pressure is off, but that will be for future generations and they will have their own challenges. Even once the argument is won, the integration of this new role into the multi-tasking already characteristic of academic life will need careful consideration. Complex research projects now employ managers who are separate from the academic principal investigator (PI): it is they and not the PIs who hold together and oversee the complexity of the project and its interfaces with partners in and outside academia. The role of this research manager will grow, and for many aspects eclipse for practical purposes the role of the PI, which is thought leadership throughout the project. How the rewards for success in this mission are shared and appropriated and how the successes and failures of projects feed into promotions on academic and non-academic ladders within the university represent new challenges. None are show-stoppers, but the added complexity will not be without difficulties. The precise manner in which students in further education are trained in college, at the university or on-site is an extension of any form of accredited training today, but again not a show-stopper.

There will be important internal changes within universities if such a grand plan were to eventuate in order that the deliverables are to be delivered. I have repeatedly used the adjective 'effective' above. Universities usually undertake projects on a 'best effort' basis with no ultimate liability for any consequences of noble failure. The focus will shift decisively towards deliverable solutions for the next few decades, away from longer term and theoretical constructs. The links between industry and academia in the knowledge economy have given rise to the offices of technology transfer to facilitate the process of knowledge exchange. The perceived global urgency of the actions implied in the retrofitting agenda will require an interface infrastructure capable of very rapid knowledge transfer, and to handle the blurring of the interfaces between research and development within the university and manufacture and installation outside in the community. The scale and international reach of the overall project and the handling of the rationalisation in the market place as some solutions are perceived more successful than others will need the interface between the inside and outside of universities to be wider and more open even than now.

It is important to note that many of the details of this large picture are already the topics of active research within the universities. Without exception, the efforts are very fragmented in nature, and small in scope: they are not considered and carried out in the context of the scale on which the solutions need to be rolled out nationally and globally. There are the foundations of action on which to build. The rise of integrated multi-disciplinary research in the great universities is already well advanced in some problem areas, with some universities doing better than others. When academics realise that the end-users want well-rounded and holistic solutions to deep problems, the older offering of great depth but no breadth of thought is known to be redundant. It is important to remember that on the long timescale, it is the very deep thoughts that justify the place of the great university in the world. Cambridge appealed to Erasmus, Newton, Darwin, Rutherford, and Crick and Watson during its 800th celebrations last year. This aspect of university life will need to be preserved through the next few decades. The work proposed here will involve new materials, control systems, power engineering, installation techniques, economic models, management patterns and aspects of personal behaviour all integrated so as to produce a society that is more energy efficient, resilient to future climates and sustainable in future consumption. Some universities favour the formation of dedicated internal institutes as the means of governance. Other models may

be needed is the projects start to come centre stage, involving the central administration through its estates and building managements services, in the planning of projects and their day-to-day operation. The governance systems of the ancient universities are woefully inadequate here, but most of the 19th and 20th century universities do have governance systems that can cope. Campus universities have an advantage having neighbours at the periphery, but the potential gains for universities embedded in town and city centres are even greater, as early and painstaking planning may result in accelerated uptake in the community. To the extent that street-by-street solutions emerge as being more effective, less costly and involving less disruption, the delivery of a retrofitted built environment that involves the university and the city working together is likely to reach the local contribution to global targets sooner. How to handle the individual property owner in a delivery at community level is another topic for university enquiry.

Are the universities up for it? The challenge has not been put to the universities in the stark terms I have suggested above. The stridency of the claims made by climate alarmists are backfiring at the moment, and correctly so, but as the UN millennium goals seem not to be met, there is a case for rebranding the complete set of Malthusian global problems as a multi-part challenge for the higher and further education sector. If the private sector and central and local government can come together and unite around these issues, the universities already have and can acquire enough leaders to rise to the challenge. To those on the political right who regard social action as anathema, the fact that the challenge is in the hands of 8000 independent universities should moderate instinctive rejection. Academic commons is a place where the solutions could be devised, scoped, and demonstrated for all, with the real markets being developed in the areas surrounding the universities. Those on the political left would be instinctively attracted to this way forward for humanity. If the proper debate is held, I think that universities would be up for this mission provided the resources appropriate to the task were available.

My own experiences to date in canvassing the ideas of this section indicate that some vice-chancellors and other academic leaders do appreciate the retrofit challenge but are not convinced that the public support is there yet, nor the resources on the scale needed. The complexity of today's university and the downturn in world economic fortunes are both sufficient to keep them preoccupied with continuity of operation. With retrenchment on the horizon, today is not the time for bold initiatives from within the sector. The challenge has not been put to the vice-chancellors collectively by the Government acting for the public. The Government in turn has more urgent economic factors to consider, and the scale of investments in energy efficiency and climate resilience will be totemic. The case has not been built by the academic sector to take on their behalf into the public realm of debate. It would take a three-year campaign to get to a point where the challenge might be taken up. If there were to be a coincidence of storms to take out Bangladesh, London, New York and Tokyo, or repetitions across the globe of brown-outs in the electricity supplies, there might be the public will to act on scale, but by then it will be urgent delivery the next day, rather than the long-term evolution that will preoccupy the debate. In the final section I want to develop a plan of action that would incorporate the retrofitting of the built environment into the altogether bigger project – saving mankind!

At the local level [7], I have used data from the Cambridge City Council website and from various reports by consulting engineers to determine that £550M spent on all Cambridge buildings (£220M getting all homes to the Government's Warm Front standard) and £230M on non-domestic buildings getting them to level C in energy efficiency) would reduce the

carbon footprint by 25% by 2020, using off-the-shelf technology. If Cambridge (city, university and business) was to achieve this reduction and the sources of electricity were to meet their 80% CO₂ reduction, the national targets for 2050 would be reached. I have estimated an 8% return on investment, and I could see major pension funds providing the finance provided we could engineer the appropriate repayments, probably at 12%, i.e. at net cost to the community. Imagine Cambridge acting as an exemplar! These actions would not of itself kick-start the retrofit market or reinvigorate the supply chain. The progress of this work could be a beacon for the sector.

Universities as Saviours of Mankind

The previous sections dealt in greater detail with one important problem – how to retrofit our building infrastructure so that in future we use less energy and have buildings that can withstand the extremes of future climate without discomforting the occupants. We still have the other half of energy consumption (in transport and industry), and the consumption of resources more generally, to consider along with a growing and aging population, persisting poverty, and environmental degradation. These add further complexity and wider ethical issues, and bring an even wider group of academics into play (e.g. those in the life-sciences and in medicine). There appears not to be a qualitative level of greater complication if the millennium challenges are treated together: the scale is rather larger. I want to consider in this closing section what we might want to do in the coming decade so that by 2020 we are on a more satisfactory trajectory towards a better world than this last lost decade where climate change had an undue influence in the public debate, not making much progress in its own arena and blocking progress in others. In the UK, the climate change targets for 2020 cannot possibly be achieved in practical engineering terms without major brown-outs of electricity: no-one with a decade or more of practical engineering management in industry would contradict this once a few simple facts were put in front of them, such as the need to replace 30% of our entire infrastructure in 15 years, something never attempted, let alone achieved, in the developed world. China might do so without needing to consider the niceties of local opinion and with vast financial resources. In spite of this the EU and UK Governments are flying in the face of engineering realities in upping the 2020 targets during 2010. This section will focus on what is practical going forward, with appropriate incentives, rather than setting unachievable targets without willing action on a scale of a general mobilisation that would otherwise be essential.

The big picture is very large. We should proceed initially by attempting to put the solution to the Malthusian issues into a prospectus to the world-wide academia such as is associated with a major sale in business, containing the aims and objectives, the why, how and when, together with an estimate of the costs and cash flows, and the business case, manpower requirements and the activities of the counterparties. The very preparation of such a prospectus would itself be a work of great discipline and valuable in itself. It would involve creating the vision of how global academia might rise for some of their time above narrow national interests in pursuit of noble ends through devising practical means. In the process, it would start to place bounds on what might reasonably be expected. Too much of the public debate is about willing the ends without any consideration of the practical (in many cases engineering) means. An attempt to look at the budgets would be a great advance on the most macro- of macroeconomics, and engender some realism into what might be accomplished on various scenarios from a modest involvement through a full-steam-ahead basis to a global academic mobilisation. From the high-level global description one could cascade down to national and local levels to discern where the investments of academic effort would be best

placed. It is already the case for example in Canada that 5% of the national R&D spending is devoted to solving problems identified in the developing world. This idea could be extended.

What would be the appropriate agency for oversight and ownership of the project? The UN is already very heavily engaged at the next level down, and also heavily engaged in real politick. The Inter-Academy Council might be a better body, aligned to the interests and well versed in what the academy can offer. However it is too aligned with the producer push side of the equation, and a better owner still would be representative the end users. The World Trade Organisation might be one party. Indeed it might be a new body made up of representatives of all these world bodies as they each have something to contribute and something of an expectation of outcomes.

Given all the good will, it is likely that a project as envisaged could gain legitimacy and even start to make a difference in less than 5 years. It is important to ask would have to be going on, on the ground, in 2015 to think that this challenge was being taken up by the international academy and in a manner that was likely to be able to deliver on a global scale? In the narrow context of the built environment we might expect to see underway major international collaborative programmes that are aiming to (i) improve the energy efficiency of high-rise apartment blocks, (ii) systematically replace shanty towns with affordable intermediate quality but energy efficient buildings, (iii) improve cityscapes, (iv) re-engineer commercial buildings for a dramatic reduction of energy consumption and (v) alter lifestyles without compromising perceived quality-of-life choices. The same might be paralleled in the context of surface and air transport, extending wherever possible the notion that bits rather than atoms are transported. A microcosm of what I have in mind is a continuation of the spirit of the Cambridge-MIT Institute's 'Silent Aircraft Initiative', well documented elsewhere [8], especially in respect of building communities of all relevant parties (airlines, airports, regulators, aircraft manufacturers, central and local government, ...) around the one of the major challenges of the sector (in this case removing 97% of the sound from a landing aircraft) to integrate the new knowledge in a way that discoveries are accelerated into applications. The next green revolution for both the developed and developing world could be started with international collaborations of academic, industry and government laboratories engaged on the subject. In all this it is essential that the eventual end users are actively involved in scoping the projects at the outset, engaged with their progress throughout and gearing up to exploit the work. It was possible to overcome all the perceived problems, e.g. rights to the intellectual property, which might have been an obstacle. For practical purposes, one very important feature of the CMI world was that the core funding came from one source, the UK Treasury, and this meant that the petty bureaucracies of multiple funding agencies were averted. This last for example still bedevils collaborations across the Atlantic. A community around the topic of an aging society will include many academic disciplines, and the agencies and providers of social services (both public and private) as well as charitable foundations. There is much to be gained if international best practice is established within and international community with shared goals.

All the above is outcomes focussed, and this is deliberate. The role of academia is to deliver the ideas and prototypes for the new world order. Deep academic reflection and analysis is a proper part of the exercise, but not enough on its own. In the modern jargon of research management, delivering the deliverables is the essence of the project.

In recent years we have seen the way that climate change science has become advocacy, and that should be a lesson to us all of how not to proceed. Governments have been taking advice

based on forward model simulations but without being given a robust reality check of an engineering critique: that has been a recipe for disaster. One cannot be a critic of the establishment view of climate alarmism or a sceptic in the proper scientific sense without being labelled as a denier. When proposals are made to and adopted by governments which violate some of the basic tenets of good engineering practice one should anticipate a backlash, and not only from those with a vested interest in the status quo. Those with respect for the integrity do scientific discourse and engineering realities are correct to be outraged.

But ...

Is this all a pipe dream, or could it evolve into the zeitgeist of the academic establishment worldwide, aided, abetted or even driven by the young? Even if the latter, is it too idealistic to get traction in the harder-nosed sections of the world, e.g. corporations and national bodies, or other places where narrow interests and egos get in the way? One must strive for local actions that might be integrated into an international project. At least the former will contribute to solving the world's big challenges, although not with the same effectiveness of reach in the absence of the latter.

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- [7] M J Kelly 'A Cambridge Retrofit', unpublished
- [8] The project is described <http://silentaircraft.org/>. The Cambridge-MIT Final Report is on <http://www.cmi.cam.ac.uk>, and the two-year-on follow-up review is on http://www.technopolis-group.com/cms.cgi/site/group/uk_group/uk_project_sheets/902_CMI.htm.

I do hope for comments below this essay (just add one by clicking at the "Comment" button after you have done your login.)

More important yet, I hope that others will present their own ideas how universities can contribute to the solution of problems in our world in separate reports! M J Kelly, August 25, 2010