

Address to the World Bank Conference
'Organizing Knowledge for Environmentally Sustainable Development'

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'Shifting Gears for the Applications of Knowledge'

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It is a great pleasure to be able to address this Conference and to do so in such distinguished company.

My topic is a straightforward one: the need to think again about how we generate knowledge, in the interests of a world in which that knowledge is desperately needed. I think I can set out the problem clearly enough: it is that we remain in the grip of an older paradigm about the creation of knowledge, a paradigm useful in its day but almost counter-productive now. It is hard to get out of its grip, because the paradigm seems the normal way of doing things, and our universities and the learned professions are to a considerable extent still based on it. I make some suggestions about what we should do to escape from the grip. I know that they will be resisted and opposed, because I have been here before. But the need is great, and I make the suggestions again. Let me start by outlining what I call the old paradigm, and explaining how it came to be dominant.

The Old Paradigm

The old paradigm is not very old, because it got its great start at the end of the second world war, when Vannevar Bush successfully advised President Harry S. Truman that he should establish a national science foundation so that science could flourish, and in consequence the US could win the peace just as it had won the war. Bush was clear about one central aspect of his proposal: scientists should be allowed to follow their own noses in determining what research should be done. Bush was a believer in what we now call the 'linear model' of knowledge: pure untrammelled research leads to discoveries about the nature of things which again lead in time to applications of the new knowledge that can be developed and commercialised and appear as new products or new processes. The causal arrow is a straight one, without feedback loops.

The notion that scientists should not only be allowed to follow their own noses but should be given public money to enable them to do so was understandably attractive to scientists. Since many of them worked in universities, access to research funds on what proved to be a large scale helped in the expansion of universities, and made the carrying out of research in some form an ordinary expectation of academic life. Since the NSF model was adopted by several other Western countries in whole or in part the consequence was a great increase in research activity throughout the Western world. This whole process was greatly assisted by other stimuli, the most important of them being sustained prosperity for nearly three decades after the war, together with a new interest in education, especially higher education, which sent steadily increasing proportions of the relevant age-

groups right through high school and on to university, where they were taught by increasing numbers of academics who were persuaded that they, too, should be engaged in research at the cutting edge and quickly expected to be given research grants to enable them to do so.

One outcome was a very great increase in the amount of what we call human knowledge, which is perhaps better defined as 'what academics think they know'. It is hard to measure this increase accurately. If it is measured simply as a function of the increase in the number of university students in the Western world, then there is probably thirty times as much knowledge now as there was at the end of the war. A more realistic increase, to take into account the generation of knowledge outside the university context, might be fifty times. There are now more than half a million different scholarly journals. Libraries that once aimed at comprehensiveness have given up the struggle; every library has to be selective. Advanced information technology has come just at the right time to enable us to select what it is that we want to know from among the mad abundance that is available, but of course this technology brings its own problems with it. These problems are for another address.

The great increase in knowledge has had two most powerful concomitants. The first is the continuing atomisation of knowledge and a consequent kind of elephantiasis in the old scholarly disciplines. Both Johann von Goethe and James Mill, in the early 19th century, have been credited as the last men who knew everything there was to be known. Today it is not possible, I should think, to know everything there is to be known in one major discipline. Everyone is a specialist, and generalists are held in some suspicion, if not outright scorn. Before the second world war it was possible to be a 'social scientist', expert in one field but knowledgeable across them all. One celebrated man of my country held chairs at different times in philosophy, political science, sociology and education, and published to advantage in them all; he was a first-class generalist. I cannot think of a counterpart today.

When I was a young academic, in the early 1960s, the divisions within my own discipline, political science, were broad ones, and you were expected to become knowledgeable in one but to have at least a passing knowledge of the names and issues in the others. That would be a herculean task in the late 1990s, and the specialities which academics profess now seem very narrow indeed in comparison. There is a good reason: it seems that an intellectual program works best when there are only a few hundred involved in it. Once the numbers become greater the group breaks in two or three as the issues acquire adjectives or other qualifiers. Knowledge has expanded not through big leaps of insight and the discovery of the general rules underlying adjoining broad fields of study (one of the dreams of the 1950s and 1960s) but mostly through little incremental additions to what has already been known. The boundaries between research areas have been fertile ground for new research, but that in turn has been followed by the erection of new boundaries, and the naming of new specialities. 'Review articles' aside, published research is for the most part restricted to the small, the narrow-gauge, the incremental. Few researchers are brave enough to generalise, and they always have to duck the sniping fire of the specialists.

There is a lot more that could be said about this process, notably the part played by learned journals, the institution of the PhD as the certification of the learned, which has fuelled much of the production of knowledge, and the way in which disciplinary knowledge has become 'territory' defended against other disciplines and the undisciplined alike. But that too must be left to another address.

The second major concomitant of the increase in knowledge has been the elevation of 'research', especially 'pure research', to its dominant place in the world of higher education, and the movement of universities to become suppliers of new knowledge rather than hosts of teaching and learning. The linear model gives the universities a special place in the generation of knowledge because it is the universities which particularly concentrate on pure research, which is thought to be the foundation of all knowledge. But, although most faculty are unaware of this movement, the 'research university' is quite a recent phenomenon in the nearly thousand-year history of institutions of higher education. Indeed, until our own century it would be easier to show that advances in knowledge came from outside the university than from within it.

The New Problem

Let us move from the old paradigm to the modern problem. We live in a world of 6 billion human beings who, if nothing changes, will number 12 billion by the middle of the coming century. We already put tremendous pressure on our planet through our sheer abundance as a species. Most of us now live in cities of one kind or another, and the urban proportion is rising steadily. The cities cover great areas, create huge demands for food and fresh water, require complex communications, transport, sewerage, education and civil order systems, and create dreadful environments in terms of water, air and soil pollution, not to mention in the potential for epidemic disease developed among undernourished urban populations through viral and respiratory pathogens.

The problem is ourselves. Whatever the solutions are, and I want to suggest some at the end of this address, they need to be general, or holistic. Just as a wise physician treats the patient, not the disease (which is a symptom of an underlying cause), so in building a sustainable world for human beings to thrive in and enjoy, we need to see our major policies as being at the level of the societies in which human beings live. That puts a different demand on knowledge, for, to make the point again, as presently constructed, human knowledge advances increment by tiny increment, and the guardians of the increments are specialists, who are often unable to link what they know to what other specialists know.

The linear model of knowledge-generation is not especially useful in such a situation. Pure understanding of what are highly dynamic contemporary social processes is a long way off, and the need for quick action has been clear for many years. We usually cannot wait for understanding of the pure kind. Is there an alternative? I think there is. It is a mistake to think that we must always search for new knowledge. We already know a great deal about our predicament, and it can make sense to employ first of all the knowledge we

already possess. I would like to give two examples, each of them at least passingly familiar.

The first is the growing discovery, throughout the 19th century, of the linked importance of clean water, sanitation, hygienic practices and fresh air in reducing mortality and morbidity in the urban populations of Europe and America. What we now regard as the ordinary municipal services or public utilities needed for any human settlement other than one of a tiny size grew out of that 19th century experience. In Western countries there has been at least a hundred years of acceptance of this need, to the point where it is probably true that our contemporary city populations cannot imagine that it was ever otherwise. But in the rapidly expanding cities of the developing world there is neither the understanding or the experience. What they need is not ever-more ingenious solutions to particular diseases that medical science can provide, but major preventative measures which deal with these diseases at the root, by avoiding them in the first place. In this case we already have the knowledge that is necessary: it is not dramatic, or new, or a breakthrough. It is old-fashioned, and it still works.

The second example is the link between smoking tobacco and the onset of lung cancer and other diseases like emphysema, a link which has been well known for two generations. Because people who smoke like to smoke, and find it hard to give up the practice even when they want to, and also because growing tobacco was a virtuous farming activity and making cigarettes was an industry which employed people, the move to discourage smoking was slow to occur, and governments (which obtained revenue through taxing tobacco products) engaged in it diffidently. What they finally did was to draw to people's attention that smoking was bad for you, to compel the manufacturers of tobacco products to print warnings on the packets, and so on. In time non-smokers and ex-smokers began to complain about the risk they ran of disease contracted through the smoking of other people, and smoking began to be discouraged or even banned in workplaces, public buildings, restaurants, aeroplanes and the like.

The outcome of this story, which is still of course continuing, has been a great reduction in the incidence of lung cancer and related disease on the part of those who stopped smoking. Of course smoking continues as a practice, and we have not yet discovered how to discourage young people from taking it up in the first place — it is still seen by some young people as glamorous and 'adult'. But the reduction in health-care costs that has occurred has been enormous. Once again, this advance has come not from a breakthrough in research but in systematic advocacy over a generation. It has worked partly because governments had the resolve to keep up the advocacy, despite the intense objection to it from pro-smoking interests, and because our populations are sufficiently well educated to be able to make up their minds for themselves. And that points to another of the great levers available to us in contemplating the world of the future: a well-educated population can do a great deal through understanding the dilemma it is in, and taking appropriate action to combat it. In both cases the role of government, broadly defined, has been obvious.

If I combine the lessons of these two examples I get the possibility of a strategy: use the knowledge we already have, and tell people what is

known. There may be a third element to the strategy: put as much effort into education as possible, because the better-educated people are, the more they can take responsibility for their own welfare and well-being. Perhaps there is even a fourth: ensure that governments or national agencies have the knowledge and the support to undertake the other three elements of the strategy. My own view is that these precepts provide all that is necessary for a well-intentioned government, and that international funding agencies like the World Bank need little more than the combination of these precepts *plus* a well-intentioned government.

This is so easy that it must be wrong. What seems worrying is that it runs counter to the prevailing orthodoxy that government intervention to produce outcomes in society is usually wrong, is always productive of unintended consequences, and is never as beneficial as letting the market solve the problem. It is probably because my own intellectual preparation has been in history and political science, rather than in economics, that I am not a great believer in the creative capacity of the market in transforming human society. But in any case much of what I have been describing as humanity's problem can be dealt with in economics under the rubric of 'market failure'. If that is allowed, let us move to the third section of this paper, which offers some suggestions about what might be done in the 'knowledge industry'.

Some Policy Suggestions

First I need to dispose of any suggestion that I want to get rid of 'pure research' and have all research 'targeted' or 'applied'. That is not my view: human curiosity is a powerful weapon in the advancement of knowledge, and Vannevar Bush was right to think that the intellectual curiosity of scientists themselves will probably get them further than following the mundane priorities of others. But there are other useful human qualities, and compassion and problem-solving are two more which can work very well in dealing with human predicaments, and producing useful outcomes for them. Medical research and defence provide dozens of examples.

What we need, and what we don't in fact have, is an easy linkage between governments and universities in the area of knowledge application. The reasons are familiar enough. Some are financial: Western governments are now chronically short of money, and unable or unwilling to raise more through increased taxation. Some are functions of scale: there is so much knowledge that is available, often so little agreement about what is relevant to a given problem. Some are cultural: government and academia have different senses of time, different meanings for the word 'deadline', and different imperatives. Some are territorial: universities see knowledge as their own product and want to surround it with rules of various kinds, while governments and funding agencies are uninterested in ownership and recognise that knowledge always has to be applied in a real and dirty world, not in an aseptic laboratory or a computer model. Some are epistemological: a lot of 'knowledge' is conjectural rather than factual, and governments are reluctant (outside the area of economics!) to rely too much on theories and possibilities; governments want certainty, and do not understand the university's need for extensive and continuing critique.

What is more, Western governments seem to have lost confidence in their capacity to achieve good outcomes through social and economic policy, and that makes them especially leery of pinning their faith on the outcomes of research in universities. Thirty years ago things were different, and there was a prevailing belief that, in principle at least, all human problems, whether social, economic or political, were solvable provided there was sufficient knowledge, money and political will. We do not think that way any longer, quite apart from the financial question. The more we know, the harder it all seems.

So to my suggestions. It is not much use directing them at universities, although I do so, because they have a strong sense of their own virtue, and are inclined to see the responsibility lying elsewhere. So I direct them at governments and international funding agencies, because they have, through their actions, some capacity to change thinking inside universities.

- We need to recognise that in dealing with large human populations the policy prescriptions must be simple, easy to explain and based on past successes. Developing such policies will require among other things the use of historically knowledgeable generalists — which good historians often are.
- We need to recognise also that we already know a lot, and be prepared to distil that knowledge in a form that allows it to be transferred to new situations. Things that work in one country may not work in another, for straightforward reasons of history, culture or level of technology. Knowing when and when not to try to transfer policy successes will require among other things the use of generalists who find it easy to compare and are actually good at doing so.
- Balancing the long term with the short term is the hardest part of policymaking. But when in doubt, governments and funding agencies should prefer the long term. The long-term goal is a sustainable world, and the aim should be to empower populations to make good decisions for themselves, not to have to rely on others to make them.
- That pushes us to remember that the best short-term policies should also have excellent long-term outcomes. Equipping shanty-town dwellers with decent housing, running water, electricity and sewerage will not only improve their material conditions; it will give them a stake in the preservation of the society they live in. Educating their children will enable their generation to take the next great step forward. Making them a real part of the body politic can only take place when these earlier conditions have been met.

These first few suggestions are not at all radical; indeed, they are almost banal. But they point to a mis-match between what governments and funding agencies are involved in and the world of the university. Because these suggestions do not require or depend on much new research. Rather, they require a relatively rare kind of knowledge person — the wide-ranging generalist with a good sense of history and an interest in comparison. The growth in new knowledge is almost unmanageable. Somehow or other we need to develop many more people who are capable of interpreting research

findings in one field and linking them to those in other fields so that their joint use is possible.

That does not mean that I think we should flood the world with historians. Most of them are specialists too. What it does mean is that in seeking to use the knowledge that universities have developed in the last half-century we need to start with making clear what outcome are we are seeking, and then attract people who find interesting the challenge of applying existing knowledge to that problem to produce a given outcome. Sometimes they will say, after examining what is already known, that further research is needed. If that is the response, then those who are commissioning the research need to make sure that it is directed to the outcome. Academics love research for its own sake: it is an intellectual game against nature, and they sometimes have to be dragged from it to undertake the work that is needed.

I finish with three quite pointed suggestions about the funding of research on the part of governments and international funding agencies.

- **encourage applications** Resist the cry that understanding must come first — there are many people engaged in that activity already. What is more, we don't ordinarily devote ourselves to complete understanding before we do things: life is short, and tasks are many, and it can be enough to know that automobiles, aeroplanes and computers work (not to mention public health initiatives) without our knowing exactly why. Understanding can come afterwards, as it did for Pasteur.
- **encourage outcome-oriented social science** Attract the best practitioners to work not on models and theories but on the real world, in all its difficulty and noise. The natural sciences are not the best model for the social sciences, for the world of the social sciences is not the laboratory but humanity itself. And if part of the problem lies in the domain of the natural sciences (as it does, for example, in the field of the environment) make sure that the work involves the social sciences, because the final point of all such work is human society itself.
- **encourage cross-disciplinary work** The 'disciplines' of the university world are divisions of academic history and convenience, and they get in the way of real-world analysis. They cannot be ignored, because the 'knowledge' that we have is largely organised within disciplinary boundaries. So make sure that projects are based on cross-disciplinary teams which comprise knowledgeable specialists — people who have a base in one discipline but a wide-ranging interest in knowledge generally.

Once again, these suggestions are hardly revolutionary. They imply a shift in perspective for universities from the generation of knowledge for its own sake to the generation of knowledge in the interests of humankind. It is not at all difficult to justify the shift. What is the advancement of human knowledge for, if it is not to serve humanity? And we need that knowledge, now. The problems facing us are large and daunting, and the speed of change is very great. Surely that ought to be enough.

In fact, I don't think it is, and that is why I have made the suggestions to those who actually provide money to support the generation of knowledge.

Because academics and universities, like virtually all actors in our society, are quite responsive to financial incentives!

REFERENCES

It is impossible to document a paper like this, since it arises from the experience and thought of a working life as much as from anything else. But since I have mentioned Vannevar Bush, and not everyone will understand the reference, the place to go is

United States Office of Scientific Research & Development (1945), *Science – the Endless Frontier*, report by the Director, Vannevar Bush, July 1945. Reprinted 1 (Washington, US Government Printing Office, 1945, National Science Foundation, 1980).

My own writing in this field began with 'How Research Came to Dominate Higher Education and What Ought to be Done About it', *Oxford Review of Education*, Vol. 17, No. 3, 1991, pp 235-247.

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