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**Innovation and Universities' Role in Commercializing Research Results:  
Second Thoughts about the Bayh-Dole Experiment**

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IN COMMERCIALIZING RESEARCH RESULTS:  
Second Thoughts about the Bayh-Dole Experiment**

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## **INNOVATION AND UNIVERSITIES' ROLE IN COMMERCIALIZING RESEARCH RESULTS: Second Thoughts about the Bayh-Dole Experiment**

### **Introduction**

To address the complex theme of the role of universities in research in newly emerging areas of science and engineering, and in the development and commercialization of faculty research findings as a basis for industrial renewal and economic growth is a challenge. To be assigned to attempt this in a brief conference presentation, truly poses a challenge of daunting proportions.

This audience, I am certain, already appreciates that the relationship between fundamental advances in scientific understanding and technological innovation is complicated and multivalent, and probabilistic; that it involves the incentives for discovery and invention, entrepreneurship and finance, the formation of managerial expertise and workforce skills, the diffusion of new processes and products, and a multiplicity of expectational effects and dynamic feedbacks that interconnect all of the foregoing processes. Were that not enough, the conference program organizers ask also that we explicitly consider the roles played by public institutions involved in training and research, particularly the universities; and that our understanding of the workings of the whole system be brought to bear upon a discussion of the goals and strategies for enhancing the European region's international economic competitiveness — specifically those announced in 2000 at the Meeting of EU Council of Ministers in Lisbon, and subsequently elaborated at the Barcelona Meeting in 2002.

Consequently, this presentation will be found to have offered at best only a partial response to the challenge. I intend to limit my focus to the nexus of issues raised by the Commission of the European Communities' *Communication* (of February 2003) on "the role of the universities in the Europe of knowledge".<sup>1</sup> That document assessed Europe's critical needs in the epoch of "knowledge-driven economic growth" and the means to meeting those needs. Beyond its specifics, I regard the general thrust of that text to be both influential and emblematic of the wider stream of thinking that has been shaping the policies of both EU agencies and the ministries of national governments on science, technology and innovation in recent years.

The EC's *Communication* identifies the university as the institution uniquely suited to meeting Europe's needs to become more effective in generating and exploiting science-based innovation, and it goes on to call for debate on the means by which the conditions prevailing among the region's universities can be changed — in order to better satisfy the requirements of the new societal role for which the Commission view those institutions to have been destined. Underlying that belief about Europe's path to a brighter economic future, as far as I can discern, is an arresting assessment of the present situation regarding the region's R&D capabilities — viz., that in the EU the leading institutions of higher education possess the potential to be more effective at generating commercially successful technological innovation than are the mass of business firms comprising the economy's private sector.

At the same time, along with other recent pronouncements by representatives of the governments of the member states, the Commission's *Communication* finds fault with the

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<sup>1</sup> European Commission, *Communication from the Commission: The role of the university in the Europe of knowledge*, COM(2003) 58 final. Brussels: Commission of the European Communities (5 February), 2003.

universities' researchers and administrators for failing to make the realization of their "innovation-potential" an institutional priority. From this it follows that what is needed is a program of institutional reform and reorientation that would release this supposed (latent) potential of the research universities, and thereby fulfill two of Europe's key requirements for achieving faster productivity growth and greater international competitiveness. One is to be able to pay for deepening of human capital formation via an expansion of public education and training at the tertiary level. The second is to substantially raise the share of EU gross domestic product invested in R&D by roughly half again, that is to say, from the current 2 percentage point level to the 3 percentage point level that was set by the Lisbon Meeting as a strategic "target" for the year 2010.<sup>2</sup>

I am persuaded that both university adaptations and other institutional innovation are both possible and desirable as steps towards reinvigorating the performance of the so-called European Research Area. Nonetheless, I shall try to convince you that the premises upon which the EC's proposed programs of university redirection and reform are grounded, and consequently the basic economic logic of this aspect of the innovation strategy for Europe, should be re-submitted for a more careful, indeed, more sceptical examination that they have generally been receiving. But, to firmly establish that my reservations are in no way rooted in hostility to institutional change, I want approach that argument a little indirectly – taking a few minutes to envisage with you the dawning of a new, innovative epoch in the development of higher education institutions for Europe. I can set out this vision in compressed and appropriately futuristic terms, rather than in the historical narrative style which is more expected of me, and which, in truth, is my more natural voice.

## **An innovative epoch in the European university system**

### ***Institutional creativity envisaged***

Communities of scholars and students from distant parts of the continent have assembled collectively to form centers of learning of unprecedented size, and by adapting pre-existing organizational forms to create novel governance structures, have given rise to numerous new and *more efficient* nodes for knowledge-creation and knowledge dissemination. The resulting radically new institutional model lends itself readily for imitation, and soon is being replicated widely throughout the entire region of Western Europe, and eventually far beyond. Moreover, the academic life carried on within these new organizations is *infused with much infectious dedication, which makes possible the highest intellectual standards*, especially in those institutions that succeed in their struggles to free themselves from the repressive constraints imposed by various regulatory authorities. A movement is underway, with the active encouragement and the sanctions granted by a pan-European authority, to bring into being *an international university system... a European-wide academic commonwealth which would transcend race and provincialism in the collective pursuit and dissemination of learning.*

The profound departure from previous traditions and formal arrangements in higher education just depicted has been conceived during a period of intense and eclectic intellectual activity, featuring efforts to synthesize old and new systems of thought. This has required mastering and further developing what for many of the participants is a powerful but unaccustomed set of analytical tools. The resulting new analytical mode finds many transdisciplinary applications, and has *advanced with such meteoric pace that it is displacing the established, classical norms of education.* It is destined to achieve intellectual dominance as *the centerpiece of the*

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<sup>2</sup> The persisting weak macroeconomic performance of the major industrial countries, particular those with substantial manufacturing sectors and R&D-intensive industries recently has forced a more realistic public "revision" of the R&D investment target for the EU private sector of 2 percent of GDP, and consequently a deferral of the date at which the total (public and private) R&D target investment rate would be attained.

*university curriculum*, thus marking a radical transition in pedagogy: from an educational system founded on a passive attachment to an inherited culture, to one in which an investigative and questioning approach to all sources of knowledge is in the ascendant.

These dramatic alterations in the cognitive and institutional structures of higher education in Europe are nonetheless firmly *rooted in utilitarian soil*. They are responses to the need to harness the expanding intellectual forces of the era to the increasingly demanding knowledge requirements of the surrounding society and economy. While pursuit of advanced inquiry by an intellectual elite -- as a contribution to fundamental understanding of an ordered universe and the place of human-kind within it -- is held to be one of the universities' perennial functions, these institutions also are seen *as service agencies catering for a hierarchy of social needs*.

The surrounding societies, with which these organizations soon develop increasingly strong symbiotic relationships, *have at their disposal only limited finances for the purposes of higher education. Returns of a concrete nature are expected...from investment in university concerns. Scarce resources are not made available for the subsistence of ivory towers*. Instead, the society of this era expects its universities *to be vocational institutions responding to vocational needs*. Reciprocally, new arrangements are introduced by other institutions to facilitate the provision of finance for the continuing education of certain cadres of specialized workers who engage in knowledge-intensive service activities that the community at large deems to be particularly important. Thus, by mobilizing and rationally deploying Europe's intellectual and pedagogical resources on a hitherto unprecedented scale, the new system manages -- despite the constraints of its situation -- to *meet the professional expectations of a broad spectrum of contemporary society*; and its constituent institutions are judged to have achieved this *without becoming the monopolistic agencies of any one privileged section of the community*.

It sounds quite good, does it not? Indeed, it really was good. As many in this audience already must have surmised, the inspiration for the foregoing recitation has not come from my reading of the recent European Commission "Communication" on the future role of the universities. Rather, the preceding evocation of the emergence of a vibrant, innovating and socially responsive university system reflects the assessment by modern historians of the rise the Europe's medieval universities in the epoch stretching from the 12<sup>th</sup> to the 15<sup>th</sup> century -- an epoch which saw the founding of the venerable institutions of Bologna and Padua, Paris and Montpellier, Oxford and Cambridge, Prague and many others. Indeed, I constructed my text by piecing together direct quotations and close paraphrasings of the works of Professor A. B. Cobban, a leading British historian of the origins and early development of the remarkably successful medieval institutional innovations.<sup>3</sup>

### ***The "vision" deciphered***

I make no apologies for the benign deception entailed my relating modern historians' views of salient developments in the early medieval university scene, masked in the language of our contemporary discussions of university research and training policies in Europe. "The medieval university" has been receiving an unwarranted amount of bad press in recent times, in Britain, most notably in the public utterances of the Labour Government's former Minister of Education and Skills, Charles Clarke (who presently heads the Home Office). In the spring of 2003, shortly after the circulation of the EC's *Communication*, Mr. Clarke urged Britain's universities to think more about how they benefit the economy and opined that "a medieval concept of a community of scholars seeking truth is not in itself a justification for the state to

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<sup>3</sup> The portions of the text in the preceding section at appear in italics are direct quotations drawn from A.B. Cobban, *Europe's Medieval Universities*, Oxford: Oxford University Press, 1988. Ch.1, which provides citations to numerous sources -- including recent historical studies by other others.

put money into that. We might do it at, say, a level of one hundredth of what we do now and have *one university of medieval seekers after truth...as an adornment to our society.*<sup>4</sup> Thus, there is some value simply in reminding ourselves from time to time, and reminding the makers of public policy, too, that to propose that the university community should serve the “utilitarian” needs of society hardly is a modern idea. The medieval roots of this remarkable institutional form, as Professor Cobban says, were firmly planted “in utilitarian soil.” Greater awareness of that fact would be useful, especially in drawing attention to the difference between the principle of “service” – about which there can be no real debate -- and the question of how best the modern university can serve the societies on which it ultimately must rely for its support.

Nevertheless, for the benefit of those who wish to complete their decoding of my “vision,” I should quickly identify the most salient among the historical details to which I was alluding, before coming back to the future vision of the university’s role in “the Europe of knowledge’ – as the European Commission would have it.

The medieval idea of the *studium generale* was indeed a major institutional innovation. That was the term by which the medieval universities were first described, distinguishing them from *studium particulare* --institutions offering instruction in the arts by local scholars for local students. Although thought to require endorsement of the Pope or the Holy Roman Emperor, the status of *studium generale* was of a customary rather than legal nature until the late 13<sup>th</sup> and 14<sup>th</sup> centuries, when Italian jurists devised the term *studium generale ex consuetudine*, and applied it to long established centers such as Paris, Bologna, Montpellier, Padua, Oxford, and Cambridge.

By adapting pre-existing organizational forms -- notably, corporate guild organization-- the masters and students created novel governance structures for a rapidly increasing number of these new and *more efficient nodes* – or as we economists would say, agglomerations or ‘clusters’ that generated economies of scale and scope for knowledge-creation and knowledge dissemination. Only by accident did the Latin term *universitas* --*which in common usage denoted several types of corporate bodies, e.g., craft guilds or municipal councils* -- come to be specifically associated with university institutions. Before the 15<sup>th</sup> century *universitas* referred to guilds of students (as in the case of Bologna) or of the masters (in case of Paris), -- that is to the personnel of the university rather than the university structure as a whole.

The ‘New Logic’ of Aristotle, rediscovered and made available in Latin (c. 1150 – 1250) emerged as the characteristic analytical mode associated with these novel institutions of learning, *advancing with such meteoric pace that it soon displaced established classical norms of education and found many transdisciplinary applications.* Logic, or dialectic, was the indispensable instrument for deep penetration of all branches of learning – including theology, law, medicine, the natural sciences and grammar; it soon achieved intellectual dominance as *the centerpiece of the new university curriculum, the quintessence of all that was forward-looking and creative.* Logic’s rise thus marked *a radical transition in pedagogy: from an educational system founded on a passive attachment to an inherited culture* (namely that associated with studies of classical literature), to one that was committed to an investigative and *questioning approach to all sources of knowledge.*

These alterations in the cognitive and institutional structures of higher education in Europe were *rooted in utilitarian soil;* their respective societies expected its universities *to be vocational institutions responding to vocational needs.* The *studium generale* featured a regime offering graduate training – in at least one of the “superior faculties” of law (canon or civil or both),

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<sup>4</sup> *The Guardian*, May 10 2003, p.3, reports these statements as taken from a transcript, released by the Department of Education and Skills, of the Minister’s remarks made earlier in that week at a gathering at University College, Worcester. The emphasis in the quoted statement has been added.

theology, and medicine. Training in logic and the art of disputation was the prescribed general preparation for most professional activities. Allied to knowledge of the relevant procedures, dialectical training could be applied successfully over a wide range of intricate administrative, litigious, educational, and diplomatic affairs.

Reciprocally, new arrangements were introduced by other institutions (namely, the Church) in order to *facilitate the provision of finance for the continuing education of certain cadres in specialized knowledge-intensive service activities* whose work was held to be socially important. The specific financing arrangements to which I thus referred were those permitting beneficed members of the clergy to receive the incomes of their benefices whilst absent from their parish and attending university as students or teachers.

By the 13<sup>th</sup> century a movement was underway with the encouragement and sanction of pan-European authorities (namely, that of the Pope and the Holy Roman Emperor) which was aimed at forming *an international university system...a European-wide academic commonwealth which would transcend race and provincialism in the collective pursuit and dissemination of learning*. This advanced the theoretical notion of the *ius ubique docendi* – the legal right of a graduate of one university to teach in another without undergoing examination. By the 14<sup>th</sup> century possession of this right by holders of a master's degree from the institution in question was a cardinal legal hallmark of the status of *studium generale* – and so normally was included in the institution's founding charters. In practice, however, university particularism (and job-protection for the masters) tended to prevail against the supranational (and leveling) implications of the *ius ubique docendi*.

### **The evolving legacy of medieval institutional innovation**

The dream of the *ius ubique docendi* is one that continues today to haunt the European Commission when it contemplates the advantages of creating a truly integrated labor market for science and engineering researchers that would embrace the entire European Research Area. Of course, that was not the only piece of business left “unfinished” by the medieval institutional innovators. Those who attended closely to the foregoing recitation will have noticed the glaring absence – from both the cryptic and the decoded versions of my “vision” of the medieval university system – of any explicit references to scientific or technological research, indeed to organized research activities of all kinds. Resistance to the new mechanical philosophy of the 16<sup>th</sup> and 17<sup>th</sup> centuries by the entrenched university faculties meant that the fusion of mathematics with experimentalism which created the epistemological foundations of the Scientific Revolution was not carried forward within that institutional setting. Even though many of the great names associated with the movement (including Copernicus, and Galileo) held university posts at some points in their careers, those who pioneered in the emerging experimental and observational sciences managed first to insinuate their new methods and style of discourse into the proceedings of the independent humanistic academies that had flourished during the late Renaissance era. At the end of the 16<sup>th</sup> century they had begun to form more specialized scientific societies, such as della Porta's *Accademia Secretorum Naturae* (founded in Napoli, 1589), the *Accademia dei Cacciatori* (in Venezia, 1596) and, of course, Federico Cesi's *Accademia dei Lincei* (Roma, 1603) Only subsequently, toward the latter part of the 17<sup>th</sup> century did mechanical philosophy -- and the associated behavioral precepts of the equally novel social structure of ‘open science’ become institutionalized under state patronage in the Royal Society of London (1662), and the Parisian *Académie royale des Sciences* (1666).

There ensued a further delay of almost two centuries duration before “research” as we know it became established alongside teaching as a central activity of the faculties of Europe's higher education institutions – on the model of Wilhem von Humbolt's proposed reform of Germany's universities. That development, and the subsequent importation of the Humboltian model into American universities during the two closing decades of the 19<sup>th</sup> century, belongs to

the longer story into whose details it will be neither possible nor necessary for me to enter on this occasion. It is worth noting, nevertheless, that this second great institutional innovation led relatively swiftly to the experiment of closely coupling of graduate instruction and faculty research activities, a pedagogical shift that was fully embraced in the U.S. university setting from the closing decades of the 19<sup>th</sup> century onwards. There it proved to be so effective a means of forming large cadres of productive researchers in the physical, engineering and life sciences, that today one observes it being taken up by countries (including France, and Japan) where science and engineering research formerly had been conducted largely in government laboratories and public institutes that were formally isolated from their universities' instructional activities.

With the progressive integration of advanced instruction with research in the universities, the institutionalization of open science throughout the modern world – albeit to a different degree in different places, was reinforced and its normative structure was imparted to successive cohorts of academics and public sector researchers. Generation after generation of graduate students were thereby exposed to, and inculcated with the ethos of open science that became more and more clearly articulated in the democratic societies of the West from the late nineteenth century onwards. This was a potent means of reinforcing the informal behavioral norms of cooperation in pursuit of knowledge, meritocratic universalism, and uninhibited intellectual skepticism. It promoted conditions in which the responsibility of faculty-researchers teachers to impart their knowledge fully to graduate students was well aligned with the open pursuit of scientific enquiry, rather than trammled by secrecy, restrictions on the usage new research methods, and potential conflicts arising from organizations' and individuals' ambitions to create economically valuable intellectual property from which they would benefit directly. Furthermore, it reinforced and sustained the ability of the universities in many parts of the work to continuing to function effectively as open nodes in an international information network that transmitted, received and validated claims to discoveries and inventions that represented advances in knowledge, and upon which further advances in knowledge could be based. In this way, the universalist promise of the original, medieval European institutional innovation came to be realized throughout a far more extensive and culturally diverse domain: the global domain of the Republic of Science.<sup>5</sup>

The ethos of open science – as much as any formal institutional regulations designed to avoid conflicts of interest and the misuse of public resources for purely private gain – formed an effective bulwark in the democratic societies against the more subtle distorting pressures that commercial and political interests could bring to bear upon the conduct of university-based research and the reporting of its outcomes. Upon this and kindred fragile structures of institutionalized behavior came to rest the public trust that once was more or less automatically accorded to “disinterested” academic research; and consequently to the reliability of universities as the loci of enquiries that could, more than any other, impartially ascertain and report on the meaning and implications of new discoveries and devices for human knowledge, individual well-being and the vitality of society.

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<sup>5</sup> On the economics of the ethos and institutions of open science, see P. Dasgupta and P. A. David, “Towards a New Economics of Science.” *Research Policy*, 23 (1994):pp.487-521; P. A. David, “The Economic Logic of ‘Open Science’ and the Balance Between Private Property Rights and the Public Domain in Scientific Data and Information.” in *The Role of Scientific and Technical Data and Information in the Public Domain*, eds. J. M. Esau and P. F. Uhler, Washington, D.C.: National Academies Press, 2003.

## Back to the future: the quest for the “wealth-creating” university reconsidered

These qualities, achievements and potentialities of Europe’s universities should be borne regarded as unique societal assets that would in all likelihood be placed at risk by a concerted effort to develop commercially-oriented “knowledge management enterprises” within those institutions. Yet that is what appears to be contemplated today in Britain, where the Board of Trade and Industry speaks of the need to expand a “third stream” – in addition to the traditional channels of teaching and research – through which the university can contribute to national and regional “wealth creation,” specifically by creating and exploiting intellectual property rights, by offering the services of its faculty as consultants to private firms, by introducing specialized degree courses tailored to the needs of industrial sponsors who would be able to select candidates for instruction, by developing “distance learning” services that could be marketed to the public both at home and overseas via the Internet, and so forth.

Such a program constitutes perhaps the leading edge of reformist policy initiatives intended to **re-animate the universities with an entrepreneurial spirit of ‘wealth creation.’** Certainly it envisages a much wider array of university profit-seeking activities than those proposed for discussion and debate by the EC (2003) *Communication*. The latter, more conservatively, focuses attention upon the remaining changes in national regulations that would be needed not only to enable the universities to patent discoveries and inventions resulting from publicly funded research. It also would increase the incentives for those working in public research organizations to engage in more applied, commercially-oriented projects – by permitting them to share along with their institutions in the income derived from the exploitation of their findings. In this regard, the position presented by the Commission is hardly a radical one; it reflects policy initiatives that already were being actively considered and in some cases have been implemented by a number of OECD member nations, apparently in emulation of the experiment undertaken by the U.S. under the term of the Bayh-Dole Act and the Stevenson-Wydler Act, legislation passed by the Congress in 1980. The immediate effect of those Acts was **to simply and codify the terms on which institutions conducting federally sponsored research could seek intellectual property rights in the results.**<sup>6</sup> Their ostensible purpose at the time was to facilitate the commercial application of such inventions by permitting the universities to own and readily license the patents secured on them, especially to small and medium-sized enterprises that were thought to be an important source of “job creation.”<sup>7</sup> Only during the mid-1980’s, during the height of the “international competitiveness crisis” in the U.S., did the reorientation of public and private R&D toward “technology applications” as a basis for revived commercial innovation emerge as the *ex post* rationale for this legislative experiment.

The latter rationale has inspired subsequent initiatives elsewhere in the industrialized world, and beyond, to effect institutional change in universities and other public research organizations, although not in every instance by recourse to the same legislative measures.<sup>8</sup> In Italy, for example, legislation was adopted in 2001 to shift ownership of intellectual property based upon university research from the institution to individual researchers; whereas in

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<sup>6</sup> The Bayh-Dole Act was passed as Pub. L. No. 96-517, Section 6(a) 3015, 3019-28 and codified as amended at 34 U.S.C. Sections 200-212 (1994); the Stevenson-Wydler Technology Innovation Act of 1980, Publ. L. No. 96-480, 94 Stat. 2311-2320 (codified as amended at 15 U.S.C., Sections 3701-2714) pertained to the assignment of title to federal research institutes and national laboratories, and they complemented, whereas Bayh-Dole pertained to vesting title to IPR in universities.

<sup>7</sup> The restrictions in the 1980 Act, which limited licensing to small and medium sized firms, were relaxed under the Regan Administration by Executive Memorandum in 1983, and the Bayh-Dole Act was subsequently amended to remove the time limits on exclusive licenses to large corporations.

<sup>8</sup> On international emulation, see OECD, *Benchmarking Science-Industry Relationships*, Paris: OCED, 2002, and the discussion by D.C. Mowery and B. Sampat, “The Bayh-Dole Act of 1980 and University-Industry Technology Transfer: A Model for Other OECD Governments?”. U.C. Berkeley Haas School of Business Working Paper. 2003.

Japanese universities the allocation of ownership of IPR from publicly funded research is now being determined by a committee in each institution, and these bodies on occasion award title to individual researchers. In Britain there has been a trend to transfer ownership rights to patents (and electronic copyrights) on publicly supported research results from the funding agencies to the universities, and a variety of arrangements exist among the institutions for distributing royalties between individual researchers and their institutions. Professors in the university systems of Germany and Sweden long held ownership of intellectual property resulting from the activities of their laboratories, and while debate about shifting ownership to the university continues in Sweden, recent legislation in Germany has shifted the locus of ownership from the individual to the institution. In each of the countries mentioned, as well as in France, governments have encouraged the formation of external “technology licensing organizations.” These may be affiliated with a given university—as is the norm in Britain, and in the U.S.—or be entirely independent entities. Overall, there has been **an evident international movement towards engaging university faculty researchers in “patentable” research**, and the involvement of their respective institutions in the ownership and licensing of intellectual property based upon publicly funded research results.

The scale on which these institutional innovations are being promoted is a matter for concern – not only in my view, but in that of other economists and science and technology analysts.<sup>9</sup> In order for these policy initiatives to succeed there must be a significant reorientation of university-based research, pushing it away from areas in which these institutions have a demonstrable comparative advantage. Within the familiar context of academic, “open science” norms and governance structures, the comparative advantage of university-based researchers’ lies in conducting fundamental, exploratory enquiries that in many cases will turn out to have laid the foundations for subsequently fruitful investment in applications-oriented R&D. It is also the case that in some new, frontier areas of science physical effects are discovered and new research techniques are devised that quite readily can be translated into devices which provide prototypes for valuable commercial innovations – even before the fundamental underlying phenomena are thoroughly understood. One may think in this connection of contemporary fields as diverse as proteomics, nanotechnology, or the connection between advanced number theory and cryptographic algorithms; just as the exploratory, academic research of an earlier era in molecular chemistry, solid state physics, and photo-optics rather unexpectedly opened pathways for the industrial development of new synthetic materials, microwave devices and transistor technologies, and lasers.

Yet, such **passages from exploratory science to commercially profitable R&D as a rule do not occur in a tightly-coupled, highly predictable fashion that attracts the attention of research-intensive companies whose managers seek identifiable and dependable payoffs streams from portfolios of new product development projects.** Moreover, for university administrators to

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<sup>9</sup> See e.g., D. Trune and L. Goslin, “University Technology Transfer Programs: A Profit/Loss Analysis,” *Technological Forecasting and Social Change*, 1998: pp. 197-204; R.S. Eisenberg, “Bargaining over the Transfer of Proprietary Research Tools: Is This Market Emerging or Failing?,” in D. I. Zimmerman, R. C. Dreyfuss and H. First, eds., *Expanding the Bounds of Intellectual Property: Innovation Policy for the Knowledge Society*. Oxford: Oxford University Press, 2001; R. R. Nelson, “Observations on the Post-Bayh-Dole rise of patenting at American universities,” *Journal of Technology Transfer*, 26, 2001:13-19; K. Pavitt, “Changing Patterns of Usefulness of University Research: Opportunities and dangers.” Brighton: SPRU, University of Sussex. Prepared for the Nobel Symposium 123: Science and Industry in the 20th Century, Stockholm, 21-23 November, 2002; J. P. Walsh, A. Arora and W. M. Cohen, “Research Tool Patenting and Licensing and Biomedical Innovation,” in W. M. Cohen and S. Merrill, eds., *The Patent System in the Knowledge-Based Economy*. Washington, D.C.: National Academies Press, 2003; D. C. Mowery, R. R. Nelson, B. N. Sampat and A. A. Siedonis, *Ivory Tower and Industrial Innovation: University-Industry Technology Transfer Before and After the Bayh-Dole Act*. Stanford CA: Stanford University Press, 2004.

encourage (or even permit) political leaders to entertain the hope that the energies of their faculties and students could be harnessed to yield accelerated productivity growth, showers of better quality products, enlarged export earnings, and local job creation – all within the brief time frame that will make a difference in the coming elections – is not merely deceptive. It is quite reckless in risking the almost certain disappointment of unrealistic expectations, and so may bring in its train public disaffection and damage to the university.

I believe it would be irresponsible to remain silent in the face of these possibilities and simply hope for the best. One must seriously question whether the prospects of gain can justify the potential costs of redirecting the energies of Europe's university communities in ways that surely complicate, even if they do not gravely jeopardize their ability to perform the social functions that traditionally have brought these institutions public respect, material support and a considerable measure of insulation from political inference in the conduct of their special educational and research missions.

Proceeding in this vein, however, there are only three main classes of questions that I can hope to answer on this occasion:

First: Is there really a problem arising from a failure of European scientific expertise in the academic sphere to respond to industry's innovation needs, a problem for which the proposed redirection of university research activities toward commercial goals would be at least an important part of the solution?

Secondly: Does the example of the U.S. experience with the Bayh-Dole Act (1980) indicate that, by imitating this institutional innovation the EU's member countries can expect to stimulate university researchers to develop and patent technological innovations which will provide that basis for new industrial products, private investment and job creation?

Thirdly: Is there an empirical evidence to support the expectation that by becoming better at "knowledge management" and accumulating intellectual property rights on the basis of the research of their faculty and students, Europe's universities individually and collectively will be able to contribute significantly to defraying the rising costs of public sector science and university education?

To come to the point immediately, my answer to these questions is simply: "No":

No -- the problem of the innovation gap in Europe, if it exists, is not attributable to the supposed failure on the part of the professoriate to patent inventions and discoveries in which industry would take an interest. Such statistical data as is recently being produced confirms a different picture: academic researchers in Europe are active in patenting, but the title to the intellectual property in their inventions tends – in contrast to the U.S. situation—to be assigned to industrial firms rather than to their universities.

No -- the Bayh-Dole regime is not an appropriate model for emulation: its apparently positive effects upon the rise of science-based technological innovation, and university patenting activity in the U.S. during the past two decades has been widely mis-perceived in European policy circles. Other factors, which may not be operative elsewhere under currently prevailing conditions, played a major role in those ostensibly positive developments during the 1980's and 1990's. On the other hand, the Bayh-Dole legislation interacted with features of the American university and legal systems to produce a number of unintended consequences that have been quiet perverse in their effects upon the some areas of scientific and technological research and the social benefits derived therefore, as well as creating new and costly issues with which universities have been obliged to contend.

No -- it is thoroughly misleading to suppose on the basis of the only reasonably well-documented experience with a regime of extensive university patenting activity – namely the recent American case, that the fiscal burden upon taxpayers of supporting research and human

capital formation in institutions of higher education can be significantly reduced by creating institutional incentives for faculty to disclose potentially patentable inventions, and for university technology managers to file for patent protection and then seek to exploit whatever intellectual property rights the institution thereby acquires.

It should be appreciated that the questions I have just posed are not so simple when considered in all their ramifications. Consequently, the evidence and arguments that is available to support my bald conclusions in each in each instance are more intricate, and more subject to important qualifications than the foregoing un-nuanced assertions would suggest. A brief elaboration of my answers under the three headings will have to suffice to indicate the nature of the complicating issues, without – I hope – reducing the persuasiveness of my argument that Europe should be building new elements of an organizational infrastructure for science-based innovation, rather than setting new and inappropriate tasks for its existing academic institutions.

## **Towards “evidence-based policies” for science and technology in the ERA**

### *Is there a problem, and where does it lie?*

Is the problem of the Europe’s so-called “innovation gap” -- the alleged failure to fully apply the region’s scientific research capabilities to the generation of profitable innovations -- one that should be laid first at the door of the universities? We know that the proximate source of the shortfall in Europe’s relative R&D expenditure level vis-à-vis other industrial nation’s like Japan and the U.S. is not the lower rate of public sector research investment, but, rather, the comparative shortfall in private business investment in R&D as proportion of GDP.

Economists can think of two reasons why the private R&D rate is low: either the supply of potential innovations is very restricted, or the demand for inventions is weak for reasons having to do with market conditions, or financing costs, or lack of expertise on the part of industrial managers in perceiving existing opportunities, or all of these deficiencies. It is difficult to clearly disentangle the two main sets of forces, but it is possible to dispel the mistaken impression that researcher at Europe’s universities are not inventive, or fail to generate inventions that are relevant to the needs of industry. Recent empirical studies show that there is a big difference between institutional patenting of inventions by universities in European and successful involvement of university faculty researchers in patentable inventions that are taken up by industry. For example, during 1978-1999 there were only 40 patents filed by Italian universities at the European Patent Office, whereas during the same period the EPO issued 1,475 patents – mostly in the areas of biotechnology, drugs and organic chemistry – to Italian university faculty.<sup>10</sup> In the case of a single French institution, the University Louis Pasteur in Strasbourg, during 1993-2000 the EPO issued 463 faculty members to members of the faculty (mainly in the fields of genetics, biology and physics), but only 62 patents to the university itself. Of course, it is well known that until the recent change of the law in Germany, the professoriate received and could retain the rights to all patents – some 1800 of which were issued to them between 1986 and 2000, principally for inventions in scientific instruments, telecommunications, and biotechnology and pharmaceuticals.<sup>11</sup>

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<sup>10</sup> See M. Balconi, S. Breschi, and F. Lissoni, “Il trasferimento di conoscenze tecnologiche dall’università all’industria in Italia: Nuova evidenze sui brevetti di patenti dei docenti,” in A. Bonaccorsi, ed., *Il sistema della ricerca pubblica in Italia*, Milano: Franco Angeli, 2003; M. Balconi, S. Breschi, and F. Lissoni, “Networks of inventors and the role of academia: An exploration of Italian patent data,” *Research Policy*, 2004.

<sup>11</sup> The French and German statistics, as well as data for Belgium and Sweden are presented by A. Geuna and L. Nesta, “University patenting and its effects on academic research: The emerging European evidence,” (SPRU Working Paper, University of Sussex January 2004), forthcoming in *Research Policy* [Special Issue on Property and the Pursuit of Knowledge: Impacts of IPR on Scientific Research, eds., P. A. David and B. H. Hall].

What would it mean, then, to seek to fix the European innovation gap by administrative measures designed to raise the rates of university originated applications for patents?

--It would displace some part of the assignment of patents on faculty inventions to industrial firms, without necessarily increasing the total flow of patentable inventions arising from university research.

--There is nothing to assure that the resulting shift in the initial ownership of patent rights from firms to universities would enhance the value of patent portfolios in the economy. Indeed, the outcome might well work in the opposite direction because university patent holdings would provide government authorities with a convenient "indicator" of institutions comparative performance in meeting "targets" for commercially relevant research. The trouble with the use of patents for monitoring the universities is that their value to the institution in negotiations for research funding from government ministries may well make its administrators loath to part with them; by contrast, a private firm is less likely to consider the symbolic value that the patent has in some administrative transaction, and so will be ready to the rights assigned to them by their employees to be exploited by other firms, for whom their market-based value is higher.

--It would oblige firms that are interested in further developing those inventions and making them the basis for new products and new processes to negotiate for patent (or copyright) licenses with university technology managers; and it is likely to complicate some of the directly consultative relationships for knowledge transfer that would otherwise be concluded between faculty researchers and the companies to which they assign the patents on their inventions.

-- The views of large R&D-intensive corporations in the U.S. regarding the experience in trying to negotiate with universities over the intellectual property rights arising from collaborative research should be instructive in the foregoing connections.<sup>12</sup> As one may see they are hardly flattering about the performance of university technology management offices. (See the slide)

### ***Does the Bayh-Dole regime offer a suitable model for international adoption?***

Ideas for European institutional reform and regeneration along those lines clearly have been inspired by perceptions of vigorous university-industry research partnerships, rising patenting activity and the flourishing of academic entrepreneurship in the U.S. during the two closing decades of the past century. As those years followed immediately upon the date of the passage of the Bayh-Dole Act (1980), the latter has been accepted as a model for emulation. This is dangerously simplistic. Closer examination of the available record leads one to doubt that the Bayh-Dole regime offers an appropriate paradigm for the European Research Area, and indeed, a growing number of observers of the U.S. university scene have recently voiced doubts about the wisdom of the experiment.

-- The Act initially was justified as a measure that would promote the transfer of university inventions to the business sector for further development and job creation, and therefore contained provisions that allowed universities to license their patents only to small and medium size firms; it was not intended as a stimulus to university applied research. Originally, universities were restricted to granting exclusive licenses on their patents to small businesses, on the grounds that such rights would be needed to enable them obtain an attractive rate of return on their investment in developing new products; the encouragement of small business at the

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<sup>12</sup> The following is drawn from H.R. Hertzfeld, A.N. Link, and N.S. Vonortas, "Intellectual Property Protection Mechanisms in Research Partnerships," (Working Paper, George Washington University, January 2004) forthcoming in *Research Policy* [Special Issue on Property and the Pursuit of Knowledge: Impacts of IPR on Scientific Research, eds., P. A. David and B. H. Hall].

time was very much driven by government concerns for job-creation and the then fashionable belief that small business formation was disproportionately responsible for generating increases in employment. Only in the course of the 1980's, as worries about competition from Japanese firm's penetration of the U.S. domestic and foreign markets hitherto held by large manufacturing companies, did the rationale for the institutional experiment undergo a transformation. The transfer of technological discoveries from universities to the private sector became subservient to the stimulation of university-research based businesses in the new scientific fields where – it was hoped – the U.S. was less likely to face immediate challenges from either Europe or the new industrial nations.<sup>13</sup>

-- The rise of university patenting and start-ups are traceable in significant part to factors other than to the U.S. congressional initiative, particularly to the antecedent emergence of biotechnology and new foundational breakthroughs in the biomedical sciences more generally. The available data show that university patenting was rising in the 1970's, in advance of the Bayh-Dole Act, and in significant measure the impetus for the drafting of the legislation derived from the concern on the part of a small number of universities active in the biomedical research area about a possible reversal of the policies of the funding agencies that had enabled them to secure patent rights under individually negotiated Intellectual Property Agreements (the so-called called "IPA's").

A number of factors quite distinct from the legislative innovation of the Bayh-Dole Act underlay the emergence of university research as a driver of patented inventions in the U.S. What the quantitative evidence show, first, is that the rapid growth of patent citations to scientific papers in U.S. was not an unprecedented development, having begun during the 1970's. The trend certainly has become more salient since the mid-1980's, an 8-fold increase having occurred in the number of such citations in a random sample of utility patents during 1987-1997. But, rather than being a reflection of an across the board tightening of the connection between advances in academic science and technological invention, it reflected a number of features that were more specific to the participation of university researchers in the biotechnology revolution:<sup>14</sup>

- A 3.4-fold rise in the number of university-industry research centers during 1985-1995 brought firms' researchers into closer contact with academic research publications: the "general propensity" of patent applications of all kinds (mainly by firms) to cite scientific publications surged in the 1980's.
- A 3.5-fold increase in patenting by research universities during 1985-1995 contributed disproportionately: university-assigned patents (in the aggregate and in every major technical field) cite scientific papers more frequently than other patents,
- The rise of biotechnology -- promoted by the shift of federal R&D funding toward the life sciences -- is the main factor behind in the aggregate trend of patent citations to scientific publications: drug & medicine patents are 260-times more likely to cite science than mechanical patents; biomedical research paper are 38 times more likely to be cited than biology papers.

Thus, with regard to the Commission's strategic vision of the existence of an easy path to renewed industrial innovativeness via university research, the burden of evidence on the factors underlying the rising trend of patent citations to university science suggests that this strategy could be tantamount to "betting the farm on the future of biotech." Moreover, even were one to suppose that the concentration of citations in the 'bioscience-biotech nexus' reflects the actual

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<sup>13</sup> On this background, see B. N. Sampat, "Patenting and U.S. academic research in the twentieth century: The world before and after Bayh-Dole," (Working Paper, University of Michigan, January 2004), forthcoming in *Research Policy* [Special Issue on Property and the Pursuit of Knowledge: Impacts of IPR on Scientific Research, eds., P. A. David and B. H. Hall].

<sup>14</sup> The following draws on L. Branstetter, "Measuring the Impact of Academic Science on Industrial Innovation: The Case of California's Research Universities," Working Paper, Columbia University, NY. August 2003; B. N. Sampat, op.cit., 2004.

underlying distribution of knowledge “spillovers”, rather than the peculiarities of citation practices in this particular research area, the clearest positive lesson to be drawn from the U.S. data points to a rather different policy than the emulation of the Bayh-Dole regime. The massive shift of U.S. public funding towards the life sciences laid foundations for expanded industry R&D expenditures in the biomedical field, and a rising stream of product innovations. That “payoff,” however, required matching increases in levels of private sector investment. Perhaps the right lesson for Europe to draw from this experience, therefore, is to emulate the U.S. focused public funding approach-- in a newly emerging area of science, and to prepare its private sector firms to take advantage of the expected “spill-overs.”

### **Could the exploitation of intellectual property really offset universities' costs?**

The results universities' attempts to exploit IPR, whether by licensing or by faculty “start-ups,” is likely to bring significant financial gains for only a very few institutions at best, whereas the increased administrative problems and the private and social costs almost inevitably will be quite widespread and represented an added distraction (and expense) that will deflect resources from the performance of the institutions main social missions.

The plain truth is that most of the OTL's (offices of technology licensing) at American universities do not produce enough revenue to cover their own costs. Only for a very few institutions is it likely that the net income from their intellectual property rights will be substantial enough to materially contribute to solution of the universities' funding problems. There is a pronounced skew in the distribution of patent income receivers, as there is in the distribution of public R&D funding. In 1993, for example, 50% of public R&D funding for university based research in the US went to the top 25% of the 200 research universities. The skew in the returns to patenting are more pronounced than that: just 3 institutions (the University of California, Stanford, and Columbia) received one-third of all the royalties earned by U.S. university patent licenses in 1995. The top 10 royalty-earners garnered far more than two-thirds of university patent licensing revenues; whereas roughly 45% of the institutions with OTL's received no royalty income at all in 1997.<sup>15</sup>

Nor have the institutions that subsidize the operations of technology licensing offices been willing to bear the adverse publicity and, in the case of state universities, pay the possible political costs of shutting them down. What president of a state university wants to explain to the institution's politically appointed Regents, and ultimately to the legislators, that her budget cannot afford to go on paying for patenting inventions that might be of interest to local businesses, and might be the basis for regional job growth – just because there hasn't been any noticeable revenue from any of the past patents its technology managers have managed to obtain? Patenting for profit is a lottery. The business of lotteries thrives on hope. It is politically costly to deny hope, even when doing so would favor the public interest.

Besides, the political economy of university patenting has made the collective commitment to this institutional experiment more and more difficult to reverse. Even if a core of university administrators at leading institutions became convinced that the Bayh-Dole regime require significant reforms, they would need to contend with vigorous public opposition in defense of the *status quo*. Another unintended consequence of the federal legislation has been the fostering of a new profession, and the building of a new professional organization: the Association of University Technology Managers. With its nearly 3000 members, newsletter, and conference program, the AUTM now constitutes a well-organized and vocal professional lobby -

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<sup>15</sup> See D.C. Mowery et al., *Ivory Tower and Industrial Innovation*, Stanford CA: Stanford U.P., 2004, for further statistics.

- a vested interest whose very survival is dependent upon the perpetuation of university patenting activity.

And so we have had all this for in exchange for \$1.4 billion in annual licensing revenues,<sup>16</sup> which amounts to well less than a tenth of U.S. expenditures on university research, and roughly one-hundredth of the costs of operating the nation's 200-odd research universities.

If major revenue generating patents have not been induced by the promise of returns to academic inventors and their institutions, programs modeled upon the U.S. Bayh-Dole Act – which the EC's "Communication" much admires – what then is their effect? From the economist's perspective the patenting outcomes of research that would in any case have been undertaken under public or private foundation sponsorship is tantamount to permitting universities to levy a tax on users of the new knowledge. The tax falls first upon the business firms that wish to invest in exploiting those discoveries and inventions, but, by granting exclusive licenses, the universities can sell private parties a chance to collect the tax in the form of monopoly profits (rents) extracted from the ultimate users of their new, knowledge-based goods and services.<sup>17</sup>

The sale of monopoly rights to private parties was utilized by Europe's kings and princes assiduously as a mechanism of financing various purposes of the state – which, in the political theory of the day, generally were not distinguishable from their own purposes. But that took place in the epoch before the modern state acquired its extensive fiscal powers. Quite quite apart from the political troubles that historically ensued on more than one occasion from a sovereign's grants of such rights to favorites, and the high leakage of revenues gathered by "tax-farming", this means of arranging what are in effect transfer payments has long been eschewed for sound economic reasons. As a government device for financing university activities, even the most visible successes of the Bayh-Dole university-patenting regime stand indicted as involving a doubly inefficient allocation of society's resources: firstly, because monopoly pricing imposes a restraint on the use made of new knowledge, and secondly, because in the situation considered, the university research was publicly subsidized and its outcomes can not reasonably be ascribed the effects of prospects of eventual financial rewards deriving from commercial exploitation of the results.

## Developing Institutional Innovations for Innovative Europe

The proposal for today's public universities (along with the state-subsidised private institutions of higher education) to help support themselves financially by owning and exploiting intellectual property is a bad idea. It is a misuse of the economic rationale for the system of intellectual property protection, namely that the granting of legally enforceable monopoly rights is justifiable as a means of providing incentives for undertaking investment in intellectually creative activities.

The modern university form, having fused pedagogy and research, has been privileged and supported by tax-paying members of society at large because it provides a home and haven,

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<sup>16</sup> See AUTM, *Licensing Survey: FY 2002*, Norwalk, CT: Association of University Technology Managers, Inc., 2003.

<sup>17</sup> One might cite as particularly appropriate the supporting statement by Niels Reimers, formerly the director of the Office of Technology Licensing at Stanford University, and in a sense the modern founder of the profession of university technology managers, to the effect that university patenting is simply "a tax" whenever the ability to grant an exclusive license for commercial development of the innovation does not induce further, complementary R&D investment from industry. See N. Reimers, "Tiger by the Tail," *Chemtech*, August 1987, 17 (8), pp. 464-471.

and a social institution with distinctive internal incentives and norms governing the activities of individuals who independently are motivated to engage in creative activities.

Asking, let alone demanding that those responsible for university administration to attend to the profit-potentialities of their faculties,' has turned out to be pernicious in its unintended side effects. If pursued rigorously, it is likely to be destructive of the very qualities for which these institutions rightly have come to be admired and maintained by open societies – however grudging and inadequate their support may be at the present time. Although not in the habit of appealing to Papal Authority to reinforce my economic arguments, the occasion calls for an exception: I would direct your attention to the following thoughtful passage in a letter to the apolostic nuncio in Poland on 25th March, 2002, in which John Paul II decried the “overriding financial interests” that had become particularly manifest in the areas of biomedical and pharmaceutical research:<sup>18</sup>

“[T]he pre-eminence of the profit motive in conducting scientific research ultimately means that science is deprived of its epistemological character, according to which its primary goal is discovery of the truth. The risk is that when resesarch takes a utilitarian turn, its speculative dimension, which is the inner dynamic of man’s intellectual journey, will be diminished or stifled.

Moreover, as has been amply demonstrated by the experience of U.S. universities with institutionalized technology licensing under the terms permitted by the Bayh-Dole legislation, it offers no realistic solution to the problems of university finance. At best, and for a very few institutions, direct and indirect licensing of patents returns only a small portion of the costs of research performed by university personnel; whereas, for the overwhelming majority the activities of their technology licensing offices represent a net financial burden.

### ***Hopeful Monsters, and Plain Monsters***

The Bayh-Dole regime in the U.S. has developed into something rather different than that which its creators intended. They argued that socially useful innovations often could not be derive immediately from publicly-funded discoveries and inventions, but that the additional R&D investments which were needed would be forthcoming from business firms if only they could be assigned exclusive rights exploit those university research findings that proved to be patentable. Installing the profit-making impulse into the body of the research university was not the original intention, although that outcome -- surely the creature of a Frankenstein experiment, if ever such a thing could be conceived of in the area of institutional reform -- has been celebrated by some enthusiasts for the emerging “entrepreneurial university. There was never a reason to believe that throwing opening the doors of university offices and laboratories to commercial entrepreneurship was a proposition entirely different in its ability to yield unwanted consequences than was another particularly American higher education innovation -- the idea of having universities meet the cost of their athletic programs (and why not operating expenses in general?) by the commercial exploitation of admission and media broadcast rights to college football, basketball, and other sports events.

Earlier in this essay I alluded to the European medieval university innovation in metaphoric, evolutionary terms, as one of those “hopeful monsters” – a mutant form of the Cathedral schools, so to speak, which turned out to be not only viable but marvelously adaptable, and socially productive. Nevertheless, as widely as this innovation has propagated itself, the individual organizations carrying the germ of the “university idea” remain fragile

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<sup>18</sup> This passage is reproduced as quoted in Richard Horton, “The Dawn of McScience,” *The New York Review of Books* (vol. 1.1, no. 4), March 11, 2004, p. 7.

bequests from the past, and history has shown that whole populations of such institutions are terribly vulnerable to shocks from alterations in the political climate, as well as to adverse trends in their economic environment. The proposed transformation of the university into a knowledge-management business would undoubtedly constitute a further innovative enterprise. Even if it is advocated with the best of intentions by political leaders and their policy advisors, we would do well to protect this remarkable institutional heritage from pressures to embrace new and potentially self-debilitating missions.

Innovation, as a human activity is good. It carries risks, but modern societies are right to give it encouragement, for without the novelty that regenerates diversity, the possibilities of learning and selecting new social and cultural ways eventually would be exhausted. By the same token, we must be prepared to accept the reality that even the best-intended innovations may turn out not be “good enough.” Society must be ready to experiment, and even to experiment in more radical ways than thinking up new purposes to be tackled with familiar devices. But it must also recognize and act decisively on the difference between a “hopeful monster,” and an attempted hybrid such as the proprietary research university, which can be seen to be “a hopeless monster”.

It is not just a matter of preserving the cultural legacies that are “the historical universities of Europe,” and freeing those who wish to work therein from the distractions and tensions of managing, or trying to manage multiple and mutually conflicting missions. Another purpose is served by my sceptical examination of European policy makers’ too-ready surmise that the U.S. has discovered the secret of universal institutional “best practice” in the organization of its innovation system. Not only is the Bayh-Dole regime a dubious paradigm for Europe to emulate – a growing number of my fellow economists now argue that the legislation and the system it has spawned stands in need of significant reform in the very place where it has become entrenched. What Europe needs, in my view, and what Europe has to offer the knowledge society and the knowledge-driven economy, is a new surge of institutional innovation, complementing its universities and institutions of higher education with novel organizations that are better suited to fostering the generation of commercially successful innovations based upon the results of publicly supported research.

If latter is accepted as a truly important and enduring societal priority, then the attention of creative people and the necessary public resources should be liberated from the distraction of tinkering with inherited institutional forms that are ill-suited for that mission, however well they serve society in other vital respects. It is clearly a job for talented individuals with a wide variety of public and private sector experience with various aspects of the worlds of R&D-based enterprise and “open science” throughout western Europe -- and why not also in the accession states of the EU?

It is not as though there were no experiments from which to learn, and on which it might be possible to build: there bridge institutions like the Fraunhofer Gesellschaft, independent research consortia operating under sponsorship of business firms and public foundations, such as IMEC, regional incubators linked to universities and to research parks. But rather than being peripheral, and rather marginal, the development of novel institutional forms and procedures – to populate the organizational terrain situated between the university, the state agency and the business corporation, now should be brought to the center of the stage, promoted, and accordingly resourced. It calls for a commensurately serious response if the European Research Area is to become more than a wishful conceptualization --- a suitably symbolic gesture with which to usher in a new millennium -- that the European Commission was able to persuade the national leaders of the EU member states to embrace on the occasion of their meeting in Lisbon in October of 2000. In my vision of the future, the creative task of enriching the institutional

infrastructure for scientific and technological advance in a way that protects and sustains the vital heritage of the universities within that structure, is the critical challenge that should and can be met by an “innovative Europe.”

## A Summing Up

This essay has been framed as a response to the February 2003 *Communication on the role of the universities in the Europe of knowledge*, issued by the Commission of the European Communities. That thought-provoking document assessed Europe’s critical needs in the epoch of “knowledge-driven economic growth,” and identified the university as the institution uniquely suited to meeting those needs. It called for debate on the means by which the conditions of European universities can be changed to satisfy the requirements of the new societal role for which the Commission believes them to be destined. Reduced to its essence, this presented a view of Europe’s institutions of higher education as possessing the potential to be more effective than its industry at the business of technological innovation. But, it also faulted the university researchers and administrators for failing to make the realization of that potential a priority. What is being advocated, therefore, is tantamount to a program of institutional reforms intended to mobilize of that capability in order to meet a dual societal problem: financing the rising costs of public education and research, and enlarging the share of EU gross domestic product that is devoted to public and private investment in R&D.

This approach to fostering what the Commission referred to as “a Europe of knowledge” aims to “harness” the energies of university professors, students and administrators to a new and highly instrumental goal, the advancement of knowledge for national and regional “wealth creation.” But the likely costs, as well as the promised benefits of this proposal deserve more careful consideration than they have been receiving from enthusiasts for the grand goal. With regard to the costs, it is apparent that many of the features of universities that have rendered them particularly effective when called upon to perform in their historical societal role as “nodes” in the international dissemination of knowledge – and, since Humboldt, as generators of fundamental advances in scientific understanding, might have to be sacrificed in order to effectively carry through the institutional reforms suggested by the EC’s *Communication*. Within the familiar context of academic, “open science” norms and governance structures, the comparative advantage of university-based researchers’ lies in conducting inquiries that may provide the foundations for valuable commercial innovations. But the best way to do this is precisely not the closely managed, tightly-coupled search for discoveries and inventions that fires the imaginations of many political leaders, policy-advisors – and financially hard-pressed university administrators -- who are seeking predictable and readily identifiable near-term payoffs.

Turning to the supposed benefits, it is equally apparent that the EC’s *Communication* (and many similar policy pronouncements of national government ministries) have failed to show that there is an adequate evidentiary basis for supposing that the envisaged societal gains will be substantial enough to justify attempting to transform Europe’s most prestigious academic institutions into “knowledge-management enterprises.” It is not plausible to suppose that more than a few among Europe’s research universities would, by exploiting the intellectual property created by the people who study and work there, be enabled to contribute materially to the costs of their own upkeep. Ideas for European institutional reform and regeneration along those lines clearly have been inspired by perceptions of vigorous university-industry research partnerships, rising patenting activity and the flourishing of academic entrepreneurship in the U.S. during the two closing decades of the past century. As those years followed immediately upon the date of the passage of the Bayh-Dole Act (1980), the latter has been accepted as a model for emulation. This has been seen to be dangerously simplistic in several respects.

Firstly, closer examination of the available record leads one to doubt that the Bayh-Dole regime offers an appropriate paradigm for the European Research Area. The rise of university patenting and start-ups are traceable in significant part to factors other than that U.S. congressional initiative, and particularly the advances in biomedical knowledge driven by the rise of massive public research funding predating 1980. Secondly, the universities' attempts to exploit IPR, whether by licensing or by faculty "start-ups," has brought significant financial gains for only a very few U.S. institutions, whereas the increased administrative problems, and the private and social costs of patenting – especially in the biomedical areas are widely felt. Thirdly, there have been unforeseen and somewhat perverse consequences of this institutional experiment. The highly decentralized approach of the Bayh-Dole Act, in giving every university and public research institute the responsibility for securing and exploiting its the intellectual property portfolio, has imposed significant "learning costs" on the system as a whole and brought into existence a new professional group – university technology managers – who have personal and collective interests in the perpetuation of the these arrangements. Concomitantly, there are few if any large, R&D intensive firms in the U.S. that now express general enthusiasm for the Bayh-Dole regime, and, many of their executive now speak in very critical terms about the performance of most of the universities' technology licensing offices.

In sum, then, European policy-makers concerned with the scientific and technological foundations for business innovation and economic growth should be considering reforms and revitalizing measures that build upon the region's own rich and diverse institutional foundations, rather than risking doing damage to them by blindly imitating a dubious American experiment.