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The Banking and Currency Power, Technology, and the Future of the Market Economy

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THE BANKING AND CURRENCY POWER, TECHNOLOGY, AND THE FUTURE OF THE MARKET ECONOMY*

Richard A. Givens†

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I. MARKET ECONOMIES AND TECHNOLOGICAL ADVANCE

A. The Key Issue

   Technological advance is the key to meeting the nation’s responsibilities of increasing both productivity and economic well-being. Much of the research and development (R&D) vital to such advancement benefits people, industries, and interests beyond the direct recipients of R&D’s yielded returns. Since Alexander Hamilton’s First Bank of the United States in 1791, the banking system has been relied upon for self-supporting, long-term efforts, which are vital to the national interest. This traditional tool — bank support — can be

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adapted to contemporary needs by the central banking system through R&D loans to private technology enterprises.

A failure to utilize bank financing for technological growth will have far-reaching effects. The United States, once the arsenal of democracy, and the first nation to put humans on the Moon, has begun to experience the erosion of its position as the most important worldwide center of technological advances. As a consequence, productivity advances have slowed and real income per working hour has decreased. This decline in overall prosperity has begun to diminish many Americans’ expectations that their children will be more prosperous than themselves.

The nation may lose its ability to afford needed activities due to the lack of increasing productivity. Many of these activities were formerly financed from a somewhat automatic productivity dividend of approximately three percent annually. Also, the United States risks the primacy of its defense industrial base — vital in dealing with threats to vital national interest.

More unemployed people have become homeless in recent decades; at the same time, society has learned to expect long-range unemployment for a significant percentage of the population. Concurrently, many businesses, that have substantial capital or borrowing ability, fail to find profitable new ventures for which to use those assets. Instead, businesses often opt to buy interests in existing companies.

Society in general and the investors in these efforts need an increasing number of new, beneficial developments. Examples of such developments are cost-effective desalting of sea water, ways of extending the useful human life span, and substitutes for techniques that inadvertently cause health or environmental problems.

To confront these challenges, the private sector must be able to expand and commercialize its research and technological developments. However, funding for research and development, which is vital to the national interest, has become less available. This raises a vital question for American interests in the next century: how can privately-implemented research and development be accelerated? Several methods have been suggested — and even tried — with mixed results. The challenge is thus presented, can longstanding traditional means of economic expansion be used to meet the new challenges of the next century?
B. Technological Advance and Economic Expansion

Technological advances are the mainspring of advances in material well-being during the present era¹ and have been for several millennia — a fact so well known that it may be frequently ignored.² Efforts to pursue such advances came primarily from those who would directly benefit from their use. For example, central authorities created what we now call infrastructure for their own benefit. Advances also come from the need of groups to keep ahead of others for the purpose of self-preservation. As transportation and communication have accelerated, the need also intensified to do something others could not do, and do it more cheaply.³

National isolationism is impractical⁴ and consumers benefit from international competition by receiving lower prices.⁵ Because of this, world marketplace is moving away from governmentally-imposed public or private monopolies.⁶ The increased competition accelerates innovative production of advanced goods and services while increasing the innovators’ ability to find buyers. Concurrently, new efforts to bar rivals are constantly made by insiders, new or old, in almost every field and on every possible ground.⁷


2. See generally Gordon Childe, What Happened in History (1946). When basic advance is built into our activities, its origin is obscured by its applications. Among the many developments of this magnitude, frequently achieved after much trial and error, are the discovery by ancient peoples that they could: (1) create and partially control fire, smelt metals, domesticate animals, use the wheel, and build oceangoing sailboats; and (2) develop the nautical compass, aqueducts, combustion engines, motor transportation, electricity, wireless message transmissions, aircraft, antimicrobial products, nuclear energy, space travel, and computer technology.

3. See John R. Commons, American Shoemakers, 1648-1895, in Labor and Administration 219 (1913).

4. For an early instance of the difficulty of barring contraband goods see Barbara W. Tuchman, The First Salute (1988) (detailing the ability of George Washington's forces to obtain smuggled arms despite British blockades).


Large projects, which are difficult to pursue absent long-term commitments to support them, become critical for numerous reasons. The first reason is the need to correct for (or develop alternatives to) technologies that have unintended harmful side effects on persons other than those who initially purchase them (called "negative externalities"). The second reason is the need to compete with others engaged in similar long-term efforts. The final reason is the need to discover and explore major opportunities that cannot be successfully pursued during a short period, which also may involve both high risks and far-reaching benefits.

C. Balanced or Interrupted R&D?

When technological advance occurs, several sequential, far-reaching economic effects accompany it. More people, ranging from experts to nonexpert workers to suppliers of many kinds of goods and services, are needed and called upon during both the research stage and the initial implementation stage. Funds for such activities, if likely to be profitable or considered vital for other reasons, can be generated to the extent desired (without subtracting monies available for other activities) by extending credit. This increases business and employee buying power. It also creates new business, adds to tax revenues, and reduces expenditures needed to aid unemployed people.

At first, such increases in money supply may make it possible for some providers of goods and services to raise prices because of increased demand. Unless offset, this may generate some degree of inflationary pressure. However, offsetting factors may include the increased availability of goods and services. Such increases are a result of prior research and development, which has reached the point of availability. Another offsetting factor is the competition from other industries, imports and other products, all of which limit the possibility of converting increased demand into higher prices. A third offset-


9. Contrary to some illusions, academic training as such is not necessarily crucial. Experience in the Second World War, Gulf War and other emergencies indicate that rapid training is possible where incentives are strong. See Leon H. Sullivan, Build Brother Build (1969) (where jobs were guaranteed upon success, workers needed for the Apollo project to put Americans on the Moon learned very quickly whatever skills were needed).

10. E.g., national defense, combatting disease, and providing substitutes for existing techniques involving environmental or health problems.

11. See infra part II.
ting factor is the enforcement of the antitrust strictures against collusion to fix manufacturer-level or resale prices.\textsuperscript{12}

Most importantly, new goods and services are made available as a result of prior research and development, absorbing available funds with an anti-inflationary effect. A surplus will develop, of goods above available funds to purchase them, unless new research and development in its initial stages, or other new sources of activity, make it possible to dispose of the fruits of the larger marketplace (which expanded as a consequence of prior research). This effect, avoidable if R&D continues to expand,\textsuperscript{13} tends to lead to cutbacks in production of goods and services, as well as in research and development to provide future (and now less marketable) items. Unless countervailing steps are taken, reductions in business activity and in jobs will further reduce buying power, thus generating a downward spiral.\textsuperscript{14} Even absent an actual decline, failure of new activity to absorb those who reach working age, or the unemployed, reduces business and individual income. Real productivity per work hour has failed to keep pace with the demands of a more complex society.\textsuperscript{15} This has led to more actual loss of real compensation per hour than during periods prior to the mid-1970s.\textsuperscript{16}

Growth in research and development must continuously accelerate to keep pace with society's ability to provide physical and human resources. Such development has a healthy anti-inflationary impact. As the fruits of discoveries reach the marketplace, they are balanced by a stimulative effect sufficient to make it possible for people to buy those fruits and to bring forth further growth.

D. Positive Externalities and the Investment Gap

The open market economy is the most efficient engine ever devised for distributing goods and services and encouraging new innovative activity. In addition, an investment gap in long-term research and development leads to instability, failure to develop substitutes for


\textsuperscript{13} See Christopher Freeman et al., Unemployment and Technological Innovation (1982); Joseph A. Schumpeter, Business Cycles (1959); David Dickson, Technology and Cycles of Boom and Bust, Sci., Feb. 25, 1983, at 933.

\textsuperscript{14} See Schumpeter, supra note 13.

\textsuperscript{15} See New York State Bar Ass'n Task Force on Simplification of the Law, Legal Complexity and Industrial Competitiveness 1, 2 (1989).

\textsuperscript{16} This fact is universally recognized and not documented here since whatever statistics are cited are rapidly obsolete.
problematic technologies, and failure to seize benefits which could be made available. This is especially true when preventing benefits to persons other than the direct purchasers of the proceeds (called "positive externalities").

While governmental support for basic and defense-related research is traditional, peacetime governmental subsidies have a less-than-spectacular success record. Political distortion based upon the intervention of political contributors also distorts the effectiveness of nonmilitary research, as do bureaucratic obstacles.

Even more hazardous in its consequences is confusion between research and development and government subsidies of post-development economic activity. For example, government subsidies for modernization of a plant can hurt other enterprises, leading to loss of as much business benefits or jobs as are created. Subsidies also create an often unwritten commitment that those accepting the subsidies will be protected through further subsidies or bailouts.

Such efforts amount to using political means to try to do what the marketplace can do far better. The marketplace alone is adequate for almost all ongoing economic activity where the chief benefit goes to those who choose to buy a product or service.

Where persons other than direct buyers reap a large portion of the benefit by way of positive externalities, the need for nonexclusive en-


couragement without replacing, supplanting or interfering with independent efforts is obvious.\textsuperscript{24}

The investment gap is rapidly expanding because of the increased complexity of our technological society,\textsuperscript{25} and is enhanced by additional factors. One of these factors is the emphasis on the quarterly bottom line. "Money managers, bankers, accountants, stockholders, and business leaders should be challenged to deemphasize simple short-term financial, utilizing instead measures more consistent with long-range competitiveness and profitability."\textsuperscript{26} A second factor is that investors are generally averse to taking risks.\textsuperscript{27} Further delay may occur in obtaining internal approvals or external financial support because of the number of people who may object to any new project on one ground or another:

The tendency of the peer review process to favor "safe" or proven topics of research rather than radically new frontiers only exacerbates the problem of delays in bringing scientific discoveries to the marketplace. Despite its obvious merits, peer review seems as sure a block to innovation as the "don't rock the boat" nature of large bureaucracies.\textsuperscript{28}

E. The Need to Fill the Investment Gap

The consequences of a significant investment gap, affecting research and development involving positive externalities, are far reaching. One consequence is a lag in competitiveness with other countries, which has led to attempts to hold down domestic wages in an effort to allow the United States to compete.\textsuperscript{29} Another consequence is the loss

\textsuperscript{24} See Fournier & Rasmussen, \textit{supra} note 18, at 299-300 (approving such subsidies where there are positive externalities while disapproving them in other contexts).

\textsuperscript{25} See Eliot Marshall, \textit{Nuclear Meltdown: A Calculated (and Recalculated) Risk}, Sci., April 11, 1986, at 153, 154 (for an example of a complex risk analysis in the nuclear power arena where elements of risk which were not quantifiable were treated as having a risk factor of zero).


\textsuperscript{27} Dynamics Corp. of Am. v. CTS Corp., 794 F.2d 250, 258 (7th Cir. 1986), \textit{rev'd on other grounds sub nom.}, CTS Corp. v. Dynamics Corp. of Am., 481 U.S. 69 (1987) (Powell, J. for the Court).

\textsuperscript{28} Diebold, \textit{Commentary}, 2 Issues Sci. \& Tech. 119, 120 (1986); see Tribus, \textit{Applying Science to Industry}, U.S. News \& World Rep., Jan. 8, 1971 at 35 ("If too many approvals are required before an idea can be born, the probabilities are overwhelming against it.").

\textsuperscript{29} Concerning antitrust aspects where more such efforts extend beyond joint approaches to multi-employer bargaining with a particular union or group of unions, see Givens, \textit{Antitrust, supra} note 12, chs. 7, 21.
of vital career and job opportunities for young people just when society imposes more and more costs upon them (such as educational costs or loan repayments, health care when group insurance is absent, and support of dependents at both ends of the life span, including the educational costs of their own children).30 It is also crucial for society to compete with the crime world for the allegiance of many young people who are on the borderline.31

A third consequence is the erosion of the defense industrial base and its ability to respond when peace is threatened.32 Related to this is the loss of opportunities for business to keep ahead of the curve and to be in the lead (or readily compete for) future generations of technological advance. A fourth consequence is the loss of discoveries or technologies vital to such goals as obtaining abundant cost-effective clean water, replacing techniques that create environmental or health problems, developing ways for older people to remain alert and effective, finding ways to stop criminals without harm, and counteracting harmful drugs without new addictions.33 A fifth consequence is the loss of opportunities to use available assets to enhance future productivity rather than in controversial external acquisitions, which add little if anything to total income of the business sector or of the nation — and may at times reduce both.34

Some of the consequences involve intangibles, such as the loss of the kind of employee dedication achievable when those working on a project believe in its importance — a factor recognized in a long-running advertisement by a major corporation that the company “lets you

33. Far ahead may be other challenges, efforts to deal with which may be vital to the survival of the species — and to galvanizing high level efforts which will benefit current society in the same way as other grand efforts in the past. Among those involved may be effects of global warning, ozone depletion, shifts in the earth’s magnetic field, oceanic pollution and marine life destruction, future asteroid collisions, far beyond the conversion of the sun into a Red Giant, and much further ahead the potential falling in of the universe upon itself or its dispersion into cold darkness.
34. See Givens, Antitrust, supra note 12, § 4.05.
do great things." An analogous consequence is the loss of the thrill of what William James called the "moral equivalent of war," which is necessary to stimulate the energy, dedication and expansiveness needed to maintain the momentum of an advanced society.

Given the importance of overcoming the investment gap concerning research and development and the difficulties involved in public sector management or subsidies, the question arises: what other options are available?

II. ALEXANDER HAMILTON AND THE BANKING & CURRENCY POWER

It has long been established that the power "To coin Money [and] regulate the Value thereof," created by the Constitution, is a plenary power authorizing management of banking and currency without the need to resort to other congressional authority. The importance of a banking system created by the new nation as a means for financing industrial expansion was recognized by our first Secretary of the Treasury, Alexander Hamilton. Hamilton was aware that businesses in the new nation were unable to pay the startup costs of the major industrial expansion for which he hoped without access to bank credit. As a result, Hamilton proposed, and Congress enacted in

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35. See RUSSELL BAKER, THE GOOD TIMES 347 (1989) (referring to the satisfaction of journalists with "a passion for their calling, and a sense that there were things even more important than success").
36. WILLIAM JAMES, The Moral Equivalent of War, in MEMORIES AND STUDIES (1911); see also KONRAD LORENZ, ON AGGRESSION (1963) (including the efforts made in the Second World War, development of antibiotics, sending people to the Moon, jet aviation and the challenge of preparing for future risks to humanity).
37. See LORENZ, supra note 36.
38. Indeed, nuclear physicist and former Chair of the New York Academy of Sciences, Heinz Pagels speculated that the ultimate goal of life may be to bring forth hidden potentialities of the laws of nature and thus save the universe itself from self-destruction by falling in upon itself. HEINZ PAGELS, THE COSMIC CODE: QUANTUM PHYSICS AS THE LANGUAGE OF NATURE 322 (1982).
42. In particular, Hamilton was aware that it was "a well established fact, that Banks in good credit can circulate a far larger sum than the actual quantum of their Capital." HAMILTON, Draft, in PAPERS, supra note 41, at 259.
1791, a charter for a First Bank of the United States. The constitutionality of the Bank was upheld in an opinion by Chief Justice Marshall in *McCulloch v. Maryland* in 1819.

Banks lend money which they do not have in the traditional sense, instead relying on public confidence and sums due them from borrowers to support their profitability and solvency. This is supplemented today by the availability of support by the central banking system as discussed below. The reliability of paper issued by the First Bank of the United States, created in 1791, was supported by making it usable to pay taxes due to the new United States (then, primarily Customs duties).

After the charter for the First Bank expired, managers of the Second Bank became involved in alleged improprieties, leading Andrew Jackson to prevent its extension. A central banking structure was not recreated until the Federal Reserve System was established in 1913. During the interim many state-created banks fell into insolvency, creating panics with adverse effects on the economy.

The Federal Reserve System, supervised by the Federal Reserve Board consisting of members appointed by the President with the consent of the Senate for rotating terms, establishes minimum reserve requirements for member banks and can purchase (rediscount) paper held by member banks when they need access to currency to main-

43. 3 Stat. 191, ch. 10 (1791).
45. As discussed below, lending in excess of liquid assets by member banks of the Federal Reserve System is permitted within reserve limits established by the Federal Reserve System; Federal Reserve Banks, the Federal Deposit Insurance Corporation and other devices discussed later are utilized to protect depositors in the event of member bank insolvency.
50. Nongovernmental members in the Federal Open Market Committee exercising some Federal Reserve powers — primarily concerning purchase of government securities — have been challenged as acting improperly under the Constitution because not appointed by the Executive Branch ("inferior" officers need to be confirmed by the Senate). *U.S. Const. art. II, § 2, cl. 3. See Melcher v. FOMC, 836 F.2d 561 (D.C. Cir. 1987), cert. denied, 486 U.S. 1042 (1988) (finding Senator had no standing to raise the issue). Recent developments suggest that the Appointment Clause may be taken more seriously than in the past. *See Ryder v. United States*, 115 S.Ct. 2031 (1995); *see also* Suss v. ASPCA, 823 F. Supp. 181, 188-89 & nn.14-18 (S.D.N.Y. 1993) (delegation of sovereign authority to private entities).
tain their liquidity. These powers exert significant influence over interest rates and are important in avoiding panics such as those which preceded the central banking system.

Federal Reserve Banks, under the supervision of the FRB, issue currency (labelled "Federal Reserve Note"). Most of the operative money supply consists of bank accounts and similar assets, such as government bonds, which often circulate as rapidly as other funds and in reality function as part of the money supply. Whether as currency or as some other negotiable, money does not have an inherent existence of its own, unlike the gold in Fort Knox (which is no longer used for monetary purposes). Instead, money in the form of currency is created by a transaction between two parties, one of which—in this instance a Federal Reserve Bank—has the power to issue legal tender.

It has long been traditional for the banking and currency power to be used where activities that may pay for themselves on the average require long-term funding. Beginning shortly after the 1913 Act, a series of specialized financial institutions were created by Congress to provide additional credit for goals vital to the national interest.

The Federal Reserve System failed or was unable by itself to offset the rapid downward spin in the economic climate which led to the Great Depression beginning in 1929. In 1932, at the recommendation of President Herbert Hoover, the Reconstruction Finance Corporation (RFC) was created with authority to make loans to support segments of industry threatened with collapse.

By 1933, depositors were withdrawing money at a rate beyond the capacity of many banks. The RFC provided loans to weakened banks, in return insisting that any corrective steps requested by the

53. See Jeffrey J. Hallman et al., M2 per Unit of Potential GNP as an Anchor for the Price Level, 75 Fed. Res. Bull. 263 (1989); Edwin L. Dale Jr., How the Federal Reserve Decides How Much Money to Put Into the Economy, N.Y. Times, May 5, 1976 at 43, 82 (whether frequent changes in interest rates with their disruptive effect on business activity are the most appropriate method to combat inflation or deflation is subject to debate). Cf. Givens, Antitrust, supra note 12, § 31.03.
54. Recognizing government securities as money for economic purposes would add several trillion dollars to the money supply as statistically defined, creating a far more stable picture of money supply and making almost all short-term gyrations insignificant.
RFC be followed.58 During this period, the Federal Deposit Insurance Corporation was created to protect, and provide confidence to, depositors— but not initially to bail out banks themselves. That function, then and traditionally, was handled by central banks or their adjuncts such as the RFC, rather than with tax monies which was done for the first time in the 1980s.59

The RFC, as an additional part of the central banking system, extended large amounts of credit to finance defense plant construction during the Second World War.60 To combat the Depression, the Federal Reserve Banks were authorized during the period from 1934 to 1958 to make direct loans to private businesses when necessary to bolster the economy.61 Indirect intervention through support to the member banks is ordinarily sufficient, however, to assure whatever credit is needed to support the financial structure. When the brokerage firm of Drexel-Burnham faced insolvency in 1990, the press reported that “the central bank was assuring commercial banks that were Drexel’s creditors that they would eventually get back most of what they were owed and that the Fed would provide loans to tide them over if necessary.”62 “The Federal Reserve had . . . conversations with top bankers . . . ‘This was a well-rehearsed contingency plan, far more so than [during the stock market drop] in 1987 . . . They were reaching out to every nook and cranny where an exposure to Drexel’s problems might exist’.”63 Similar support was furnished when the Continental Illinois Bank was in trouble and when an overhang in the silver market occurred during the 1980s.64

In many respects, as foreseen by Alexander Hamilton, the constitutional banking and currency power is one of the nation’s most significant powers. It does not involve compulsion and associated needs for enforcement or motives to bypass enforcement risks. Instead, it creates affirmative incentives for private entities to undertake creative

58. See generally Jesse H. Jones & Edward Angly, Fifty Billion Dollars: My Thir-teen Years with the RFC (1932-1945) (1951) (background material on the RFC).
60. See Jones & Angly, supra note 58.
64. See Lawrence J. DeMaria, Investing; Silver After the Hunt Debacle, N.Y. Times, Aug. 28, 1988, at D6.
risks benefitting them and the public. The banking power also permits specific steps to encourage private parties to act in concert with vital national goals. It does so without using coercion or bureaucratic interference.\textsuperscript{65} when justified, it does so by utilizing long-term commitments.

The functions of banking, as foreseen by Alexander Hamilton, may be awaiting the greatest renaissance in their history if the opportunities available are seized. In this connection, it may be relevant that, while banks cannot buy equity shares from their borrowers, there appears to be nothing in banking laws to prevent banks from calibrating interest rates charged to corporate borrowers to the profitability of the activities financed.\textsuperscript{66}

III. Positive Technology Assessment

As the need for, and the consequences of, scientific and technological advances increase, looking ahead to insure efforts that will lead to desirable results becomes increasingly important.

The National Science Foundation, created in 1950,\textsuperscript{67} was the first step toward a systematic, long-term comprehensive view of affirmative scientific and technological needs in the United States. Public support for research and development has remained high, especially during the period following the Soviet launching of the first global orbiter (Sputnik) in 1957.\textsuperscript{68} The public also began to focus its attention on hazards caused by technologies characterized by negative externalities.\textsuperscript{69}

To assist in evaluating technologies already in existence or proposed, Congress enacted the Technology Assessment Act.\textsuperscript{70} Until 1991, however, no systematic nationwide means was implemented to seek affirmative technology assessments of what new options should be pursued. In that year, such machinery went into effect for the first

\textsuperscript{65} For the author’s views, see Given, Advocacy, supra note 30, ch. 26.

\textsuperscript{66} See N.Y. Gen. Oblig. Law §§ 5-521, 5-527 & Practice Commentary (McKinney 1995). For a 20th century version of the Hamiltonian conception of the importance of the banking system, see Kellar, Statement, in 75 Cong. Rec. 12,187, 72d Cong., 1st Sess. (1932) ("[B]anks are the agents for carrying out the law in relation to our monetary system in the interest of all the people.").


\textsuperscript{68} See Colin Norman, Broad Public Support Found for R&D; Research and Development, Sct., Dec. 23, 1983, at 1311.


time and was analyzed in a prophetic article by Solomon & Schoch entitled *Developing Critical Technologies*.\footnote{71}

The first Report of the National Critical Technologies Panel to the President set forth a series of priorities\footnote{72} covering both civilian\footnote{73} and defense-oriented goals.\footnote{74} The initial efforts at defining such goals have, as might be expected, focused primarily on objectives which are reasonably within reach.\footnote{75} However, longer-range goals may be even more rewarding and may also contribute to the "moral equivalent of war" referred to by Williams James.\footnote{76}

For example, affirmative scientific and technological goals requiring additional investment might involve: ways to help older people remain active and effective for longer periods; ways to attack recalcitrant diseases and to overcome causes of loss of full use of human faculties; substitutes for processes and products causing health problems; substitutes for environmentally problematic products and existing technologies, and for materials not yet replaceable; ways of using the land which will both produce profitable results and make the land more rather than less valuable for future generations; space exploration and industrialization with returns to compensate for the costs incurred; antidotes for hazardous drugs and for legal and illegal hazardous or harmful substances of whatever nature, such that the antidotes themselves will not become habit forming; a means of temporarily disabling criminals without permanent harm or serious risks; defense technologies which will keep responsible democracies decisively ahead of irresponsible dictatorships and deter the risk of violent behavior.

To define positive goals that are meaningful, the means of implementing the goals also must be developed.\footnote{77} At the same time the

\begin{proof}

\footnote{71. Lewis D. Solomon & Suzanne E. Schoch, *Developing Critical Technologies: A Legal Policy and Analysis*, 9 Santa Clara Computer & High Tech. L.J. 153 (1993); see also Suss v. ASPCA, 823 F. Supp. at 184-85 & nn.2-8.}


\footnote{73. See 42 U.S.C. §§ 6681-85 (1988).}

\footnote{74. See 10 U.S.C. § 2508 (1988).}

\footnote{75. See National Academy of Science, *Outlook for Science and Technology: The Next Five Years* (1982).}


\footnote{77. See Dorothy Robyn et al., *Bringing Superconductivity to Market*, Issues in Sci. & Tech., Winter 1988-89, at 38, 43-44.}
\end{proof}
scientific and technological possibilities themselves must be sufficiently crucial to warrant the effort and stimulate the thinking necessary to doing this.

By way of example, it has been found practicable to drill down to the molten metal beneath the earth's crust, which is the source of the power of the volcanoes and continental shifts. This source is far more powerful than the geothermal energy found in trapped hot gas or liquid areas. Liquid pumped down to the level of magma would return as superheated gas that could operate a turbine, returning to pick up more heat energy as might a reverse refrigerator. Such an effort would require efforts akin to those of the Manhattan Project or the Apollo project to place Americans on the moon. However, if the numerous obstacles were overcome, a virtually limitless, clean and inexpensive power source would become available.

Results that would flow from this basic technology would include distilling (not merely processing) sea water, producing a clean, virtually unlimited, supply of drinkable water, and useful solid and gaseous residues. It would then be possible to construct pipelines to deliver clean water in desired quantities to all areas that are currently short of it and thus among other things halting tendencies toward desertification where they exist. A second effect of this pipeline project would be the ability to pump large quantities of water away from areas confronting floods and into those confronting droughts or fires. The basic geothermal source could produce electricity at a sufficiently low cost to permit cost-effective manufacture of hydrogen or other nonpolluting transportation fuels. Finally, this technology would enhance environmentally acceptable industrial activity to such an extent that the price of oil would probably rise because of its expanded chemical and plastic uses.

IV. The Bipartisan Gas-Line Crisis Proposal

During the mid-1970s a series of factors produced a nationwide energy crisis which led to efforts to develop new energy technologies. Some of these efforts involved highly unsuccessful direct governmental subsidies for specific types of energy production which would compete with other private activities.

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80. See Lueck, supra note 20; Pasztor, supra note 20. See generally Schultz, supra note 23.
An alternative approach, developed by Senators Mathias (R. Md.), Javits (R. N.Y.) and Humphrey (D. Minn.), was the creation of a National Technology Development Bank to assist in providing credit for high-risk long-term private scientific and technological research vital to the national interest. This concept received significant widespread support. It reflected the need for: (a) positive technology assessment, (b) long-term financing utilizing the banking and currency power rather than the taxing and spending power, and (c) investment by borrowers of their own money and expert abilities (and a premium for the risks incurred by the banking system through additional interest) if a project succeeds.

When the gas crisis dissipated, interest in the proposal waned. Since the mid-1970s, however, erosion of the United States' position as a leader in technological research and development has created an urgent longer-term crisis.

Among the drawbacks of the 1975-76 proposals were: 1) legislated numerical maximums restricting long-term investments, 2) the need for legislative action to extend or increase such authority, and 3) the concern that the Bank might develop its own bureaucracy.

If an entity of this type were defined as a governmental agency, additional difficulties might arise if it were treated as on-budget. Being on-budget would combine its long-term commitments with current expenditure funding, forcing them to (a) compete with short-run activities which would not necessarily pay for themselves financially, (b) force the activity into a short-term mold preventing predictable sup-

port necessary for effective research, and (c) force long-term research and development needs into the maelstrom of the political free-for-all of annual budgeting.  

V. OPTIONS FOR THE TWENTY-FIRST CENTURY

An alternative to creation of a separate government-created financial institution is to use the flexibility of existing institutions.

For example, Federal Reserve Banks might, in return for higher interest payments in the event of success, agree to underwrite potential losses to member banks of the Federal Reserve System that extended credit for research and development concerning already defined critical technologies. The member banks would be required to use their own entrepreneurial incentive to insure that an effort was worthwhile.

This would have several advantages. One advantage is that the use of private bank credit granted to private enterprises supported by a central bank does not involve tax funds, and has never been considered part of the government budget. A second advantage is that no additional legislation is necessary. Finally, no new governmental agencies would be required with the attendant risks of adding expense or bureaucratic delays.

Eligibility for central bank support might be based on an application demonstrating that the funding would be used for critical technologies as defined. The applicant should also demonstrate that adequate private investment (not involving central bank support) was being committed. It would also be important that the borrower


88. See 2 GIVENS, ADVOCACY, supra note 30, ch. 26.


90. The amount necessary from all sources must depend on the scope of the project involved; the portion required apart from central bank supported loans would logically depend on numerous factors including among others:

(a) the importance of the project to the national interest,
(b) the difficulty of obtaining the necessary effort to reach the objective,
(c) the risk run by the private investors,
(d) the financial risk run by the banking system,
(e) the probable profitability of the project if successful,
(f) the likely delay prior to earning returns,
(g) the ability of the private sponsor to obtain other sources of funds, and
could and would obtain adequate expert assistance,91 and the research and development would be carried on in the supporting country (or member countries of a consortium).92 To receive central banking support, an applicant's plan must include reasonable compensation, e.g., a percentage of profits as additional interest would be paid to the Federal Reserve Bank involved (if the project succeeds).93 This is not considered usury where a corporate borrower is involved under most banking rules.94 In addition, any patents obtained would be enforceable only if the patent was practiced. The central bank support should not be employed to obtain blocking patents.95 Another option is to permit applications to be filed after the fact if an advance application would involve risks of harmful disclosures or cause excessive delay. However, it must be shown that the necessary criteria were met during the period between the time when the project was initiated and when the application was made.

As with any important innovation, objections can be raised and should be considered. For example, support for private research might be diverted to other, or improper, purposes or pork barrel.96 The inevitable risks can be minimized by prohibiting direct legislative or Executive Branch involvement in project approvals, and by making public all approved applications. This risk of improper appropriation, however, is worth taking to offset the vast investment gap which costs far more than the inevitable errors or abuses attendant upon any significant activity.97 Permitting anything akin to bid protests would destroy

(h) and the amount of the additional share of profits the private sponsor is willing to commit to offset the risk run by the banking system.

91. This requirement should under no circumstances involve the necessity of obtaining approval, under the guise of peer review, of those who may have differing if arguably valid views such as to block innovative and necessarily initially unorthodox efforts. See John Diebold, A Commentary on Nat'l Research Strategy, 2 IssuEs Sci. & TECH. (Spring 1986) at 116.


93. Such credit enhancement could be negotiated by the lending bank as well as the supporting Federal Reserve Bank if appropriate.

94. See, e.g., N.Y. Gen. Oblig. Law § 5-521 (West 1989); see also § 5-527 (West 1989) and Practice Commentary (concerning compound interest).


97. Imperial China is believed to have stagnated because it ceased to pursue technological advance. Wen-Yuan Qian, The Great Inertia (1985), reviewed by John B. Henderson, Steps Not Made, 230 Sci. 534 (Nov. 1, 1985).
effective or timely implementation of national goals\textsuperscript{98} and provide disproportionate advantages to those firms which could afford to litigate and afford attendant delays.\textsuperscript{99}

Some may point out that the marketplace can determine which research projects will be profitable far more efficiently without any form of governmental or quasi-governmental intervention. This important fact should limit government support to those goals involving positive externalities and vital to the national interest.\textsuperscript{100}

The question may be asked, “where is the money coming from?” This question should first be approached from a mechanical standpoint. The central banking system has the power to create money (as indicated by the text of the circulating Federal Reserve Note) as part of a transaction between a Federal Reserve Bank and another entity, usually a member bank of the Federal Reserve System, which in turn may make loans to private parties.

At a deeper level, the true question is whether adding the amounts involved to the money supply will be inflationary. Over a period of time, R&D is counter-inflationary. In the short run, if the amounts involved amount to only a few percentage points of the Gross National Product, no significant inflationary impact is anticipated. However, numerous methods to combat inflation are available. These are beyond the scope of the present discussion.\textsuperscript{101}

The question may also be asked, “how are we going to pay for the R&D to be promoted?” Where a bank makes loans the necessary resources are initially called out by adding to the money supply. Those projects which are successful return money supply back to the banking system, and also provide additional goods and services to be purchased with the available money supply, with an anti-inflationary effect.

If short run additions to the money supply are excessive, inflationary pressure may arise \textit{unless offset} by additions to goods and

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\textsuperscript{100} See Fournier & Rasmussen, supra note 18, at 299-300.

\textsuperscript{101} For the author’s views, see GIVENS, \textit{Antitrust}, supra note 12, § 31.03 (describing several means of reining in inflationary pressure without throttling back the economy, including but far from limited to antitrust enforcement against horizontal and vertical price fixing).
services to be purchased with the money in circulation, or offset by other events or deliberate steps, as discussed in Part I above. However, this is not likely to occur as a result of research and development involving less than four or five additional percentage points of the gross national product.

Some critics may suggest that large businesses will be most able to formulate large-scale projects, submit convincing applications, and have inside connections, thus obtaining disproportionate benefit from the proposed approach. To the extent this is true, it is already the case where current means of financing are involved.

In any event, small businesses could qualify for support to the same extent as larger entities.\textsuperscript{102} In some cases, of course, large entities are necessary to pursue sufficiently large-scale projects, but they must in turn use smaller expert contractors for specific aspects of the effort.

A further objection is that whatever discoveries are made may be copied by industry in other countries and that, if secrecy is maintained, this will throttle use by domestic industry as well. This is undoubtedly true as to all R&D, financially supported or not, and intellectual property barriers to copying are thin. However, getting the jump on competitors often produces both continuing customer relations, the ability to get there first during the next generation of advances, and unforeseen discoveries appearing as side effects. In order to reap these benefits it is necessary that supported activities be located in the nation or nations contributing the financing and expertise.

Perhaps the most important difficulty is that we know only of a minute fraction of what is to be discovered in any important field. If one asked in 1776 whether people could someday combat large numbers of infectious diseases with medicines, fly across oceans, reach the moon, and send messages across continents at the speed of light, no one would have believed it would have been done.

A related objection is that we already have the critical scientific and technological knowledge we need. This objection is refuted by the very partial, limited list of goals set forth earlier in this article. History shows that most of the scientific and technological advances we now possess were considered impossible a few decades ago.

Accelerated research and development in the private sector, supported by the banking system when vital to the national interest, is

\textsuperscript{102} See \textsc{Jane Jacobs}, \textit{The Economy of Cities} (1969); \textit{see also} authorities cited in \textsc{Givens, Advocacy}, \textit{supra} note 30, ch. 26.
likely to produce additional profitability to businesses while benefitting employees and providing additional jobs.

Apart from positive attractions, failure to pursue scientific and technological advance has harmful economic effects, turns the future over to those who do pursue such advance (for whatever motives), and leads to an imbalance in which immediately profitable R&D (desirable in itself) is not balanced by filling the investment gap concerning R&D with positive externalities.

Thus, apart from the desirability of pursuit of accelerated research and development, in the end there is no choice. By eating the fruit of the tree of knowledge, we acquired advantages, risks, and inevitable obligations, which we ignore at our peril — and ultimately at the peril of the species itself. If we seize the challenge, much energy now consumed in less interesting (and at times harmful) side eddies can be channeled for the benefit of all.

VI. CONCLUSION

The importance of research and development to technological advance vital to the national interest is clear. To assure fully supportable private R&D aimed at critical technologies, credit supported by the central banking system to encourage private bank loans is important (where the efforts are likely on the average to be profitable). This can be achieved through adapting traditional uses of the banking and currency power which draw their origins back to Alexander Hamilton and the First Bank of the United States created in 1791. Such an approach would not require legislation or any additional bureaucracy.

103. The concept of inevitable acceleration of scientific and technological advance which could be guided but not stopped was suggested in Henry Adams, The Education of Henry Adams, ch. 24 (1928).

104. The concept that power implies responsibility is a deep one in human consciousness, exemplified at the highest level within the legal system in Chief Justice Stone's opinion for a unanimous Court in Steele v. Louisville & Nashville R.R. Co., 323 U.S. 192, 198 (1944) (collective bargaining representatives have implicit inherent obligation of fair representation of all employees represented whether members of the union or not).

105. Goals of this lofty nature have been articulated in such pronouncements as the Four Freedoms. See White, The American Idea, N.Y. Times Magazine, Sept. 6, 1986, at 13; Sakharov, supra note 76.