TECHNOLOGY, THE ENERGY CRISIS, AND OUR STANDARD OF LIVING

Here's a picture of the dynamic position of research and technology in the complex ebb and flow of U. S. economic health which supports our standard of living. But the current decline in technology investments is creating many of the problems we face today. Examples: technological unemployment, the energy crisis, our dwindling fuel supplies, and the like. Hence, an increasing R&D program is vital, not only to increase our standard of living but even to maintain it. Development of new products and processes—the "continuity of discovery"—is a must for U. S. economic health.

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We are now in the midst of a revolution, fully as far reaching in our daily lives as was the great American Political Revolution of the 18th Century and Industrial Revolution of the 19th Century. This 20th Century revolution is the Scientific Revolution. Because we are in the midst of this revolution, we are not often able to see where it is taking us, but that it is enriching our lives as well as posing problems common to all revolutions, such as rapid change, is obvious. Competing for primacy and threatening to supplant it are the major subdivisions now gaining attention such as the energy revolution and the social revolution, with the outcome still in doubt.

U. S. R&D Declining

The United States was and may still be the leading technological society of our day. It still enjoys the highest per capita standard of living in the world. Cheap energy does most of our work and sustains our transportation system. Our rate of technology investment has continuously increased during this century until 1965, when for the first time the rate of investment in research and development began to decline and is still declining. We sometimes forget that there is a definite relationship between standard of living and productive investment. Thus, Prof. Edward Shapiro of the University of Detroit has written that without technological innovation, investment will languish and without the

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necessary rate of investment, our private enterprise economy will stagnate. According to the United Nations, the five countries with the highest per capital GNP in 1970 were the United States, Kuwait, Sweden, Canada, and Switzerland, with per capita incomes ranging from $3,670 in the United States to $2,310 in Switzerland. All of these countries have enjoyed considerable research and development with the exception of Kuwait which does, however, enjoy a fantastic oil income and investment. It might be interesting to note that Kuwait consumes even more energy per capita than does the U. S., its consumption amounting to 11,905 kg coal equivalent per capita to 10,331 kg for the U. S. The countries with the lowest per capita national product are Burundi, Somalia, Upper Volta, and Ethiopia with per capita GNP of only $50 to $60 per year.

It is interesting to note that since 1910 the population of this country has increased 122 percent, while the real gross national product has increased 600 percent so that living standards have risen steadily despite the huge increase in population. The per capita income during this period rose from approximately $1200 to $3500 per year. But, and this is the important point, we are currently on a plateau, and there is no real growth in per capita national product. If there is no growth in the national product per person, how are we going to pay for better schools and better health and social needs? How are we going to provide the energy needed to make the U. S. comfortable and productive from fast-dwindling cheap energy sources without a high order of new technology? This decline in technology investment in the United States which commenced in 1965 may well have been the start of most of the problems facing us today. Since the United States enjoys high wages, it obviously requires jobs which can produce sufficient real wealth to support those wages. Furthermore, new industries must be created to absorb the approximately one million new workers who enter the labor force each year.

How can we do this without discovering new products and processes which are the direct result of research and development? How will nuclear breeders and fusion or solar energy progress from promise to fact? The answer is more research and development—*not less.*

Technology and the Dollar

But how does technology relate to the more direct everyday concerns of living standards. The dollar is under severe pressure from abroad. Inflation is very difficult to reduce. Advanced technology can help to solve both these problems.

Since 1964, net exports of U. S. goods and services have fallen from a surplus of $8.5 billion to the first deficit of the century last year, as shown in Fig. 1. Furthermore, the largest American exports, except for food, have been principally the high technology products of research and development such as elec-

Fig. 1 U. S. Foreign trade.

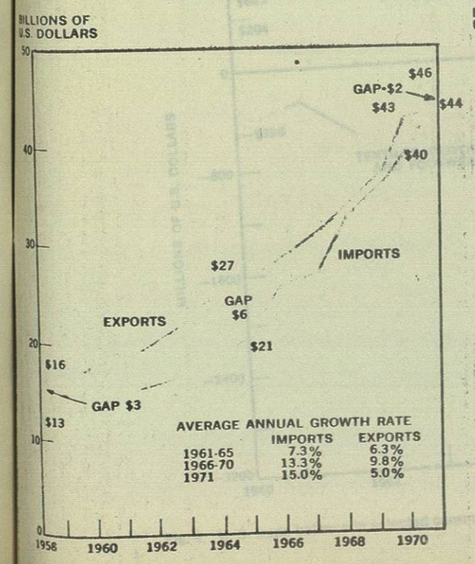
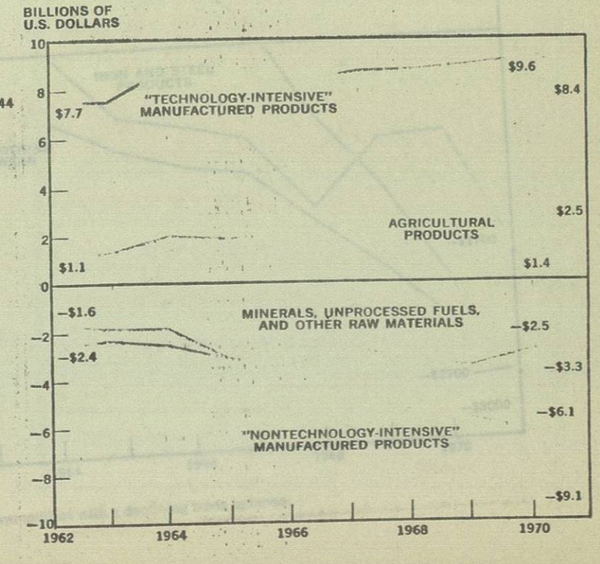


Fig. 2 U. S. trade balance trends.



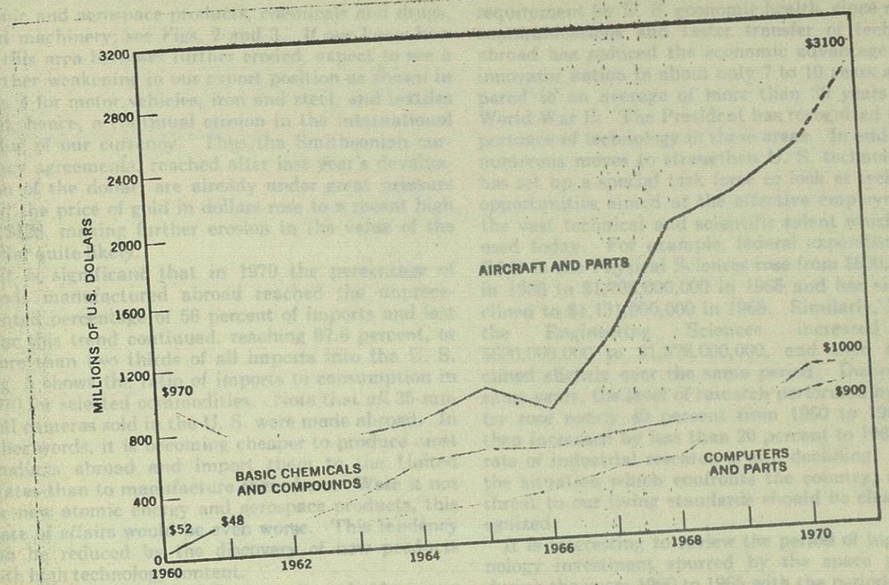


Fig. 3 U. S. trade balance in selected commodities with a rising trade surplus.

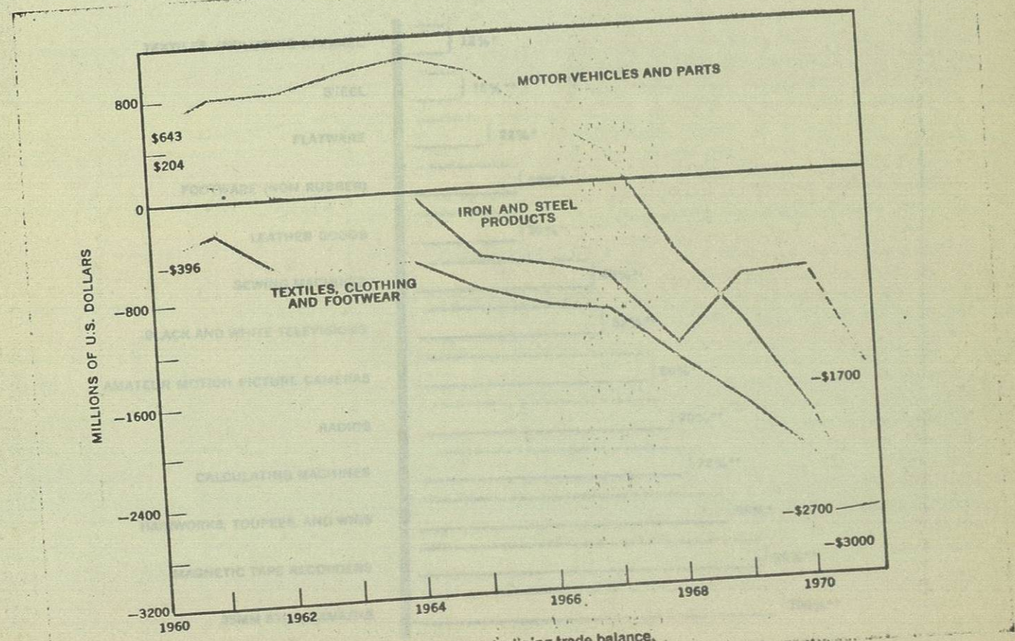


Fig. 4 U. S. trade balance in selected commodities with a declining trade balance.

tronic and aerospace products, chemicals and drugs, and machinery; see Figs. 2 and 3. If our know-how in this area becomes further eroded, expect to see a further weakening in our export position as shown in Fig. 4 for motor vehicles, iron and steel, and textiles and, hence, a continual erosion in the international value of our currency. Thus the Smithsonian currency agreements, reached after last year's devaluation of the dollar, are already under great pressure and the price of gold in dollars rose to a recent high of $128, making further erosion in the value of the dollar quite likely.

It is significant that in 1970 the percentage of goods manufactured abroad reached the unprecedented percentage of 56 percent of imports and last year this trend continued, reaching 67.6 percent, or more than two thirds of all imports into the U. S. Fig. 5 shows the ratio of imports to consumption in 1970 for selected commodities. Note that *all* 35-mm still cameras sold in the U. S. were made abroad. In other words, it is becoming cheaper to produce most products abroad and import them to the United States than to manufacture them here. Were it not for new atomic energy and aerospace products, this state of affairs would be even worse. This tendency can be reduced by the discovery of new products with high technology content.

In fact, *continuity of discovery* is probably a new requirement for U. S. economic health, since modern communications and faster transfer of technology abroad has reduced the economic advantage to the innovator nation to about only 7 to 10 years as compared to an average of more than 30 years before World War II. The President has recognized the importance of technology in these areas. In addition to numerous moves to strengthen U. S. technology, he has set up a special task force to look at technology opportunities aimed at the effective employment of the vast technical and scientific talent which is unused today. For example, federal expenditures for R&D in the Physical Sciences rose from $600,000,000 in 1960 to $1,705,000,000 in 1965 and has since declined to $1,131,000,000 in 1968. Similarly, R&D in the Engineering Sciences increased from $690,000,000 to $1,576,000,000, and then has declined slightly over the same period. During those same years, the level of research performed by industry rose nearly 40 percent from 1960 to 1965, and then increased by less than 20 percent to 1968. The rate of industrial research is still declining. This is the situation which confronts the country, and the threat to our living standards should be clearly recognized.

It is interesting to review the period of high technology investment spurred by the space program during the years 1960 to 1965 with the periods imme-

Fig. 5 U. S. ratio of imports to consumption, 1970.