

in missile technology are continually threatening the whole offensive or defensive apparatus of one side or the other. Keeping ahead in the technological race is not in itself a guarantee of security in these circumstances; it remains essential to incorporate the technology in operational hardware ("forces in being") and to deploy them and use them with skill and intelligence. But no amount of production, skill, and intelligent use can compensate for significant technological inferiority. Our atomic monopoly in 1945 would have insured victory over Japan even if the ratio of our conventional forces to theirs had been reversed. Clever operations research can in exceptional cases improve some capability of a force by a factor of 3 to 10. Inventions can frequently change the same sort of capability by factors of 10 to 1,000.

Of course any particular nation will borrow much of its scientific knowledge and even its military technology from other countries. Science is international. Once a scientific discovery is made, it quickly becomes the property of scientists everywhere; frequently the same discovery is made nearly simultaneously in two or more widely separated research centers. Scientists in all leading countries (certainly including Russia) were familiar at the beginning of the Second World War with the basic scientific ideas that prompted us to initiate the Manhattan District Project. Few if any of these ideas were American in origin.

To a lesser extent the same is true of developments in military hardware. Despite military secrecy, the news of a new development leaks, and this leads to frantic copying on the part of potential enemies. The British "invented" the tank in World War I, but they disclosed it prematurely, and the most effective use of the tank in that war was made by the Germans. It is only a question of time before many additional countries perfect advanced nuclear weapons. Espionage is responsible for some of the transmission of new technological ideas from country to country, but espionage rarely does more than speed an inevitable process. New military hardware can usually be observed without too much difficulty when it becomes operational. In the United States and most Western countries full accounts are usually made available earlier than that to anyone who can read the public and technical press and the advertisements of contractors. Even if technical details are not revealed, the mere knowledge that a research objective has been achieved is an enormous help and stimulus. It means that the objective is achievable — that there is a treasure to be found and that a search (for that is what research is) is therefore definitely worthwhile. Other countries might not be developing atomic weapons today if we had not demonstrated their feasibility.

Therefore the net gains from a successful military development can only be counted on for a few years at most. If a nation's civilian economy is made more productive by research, the nation continues to gain from