UNITED NATIONS **A**

General Assembly

Distr.
GENERAL

A/49/502
12 October 1994

ORIGINAL: ENGLISH

Forty-ninth session
Agenda item 54

SCIENTIFIC AND TECHNOLOGICAL DEVELOPMENTS AND THEIR IMPACT ON INTERNATIONAL SECURITY

Report of the Secretary-General

CONTENTS

		Paragraphs	Page
I.	INTRODUCTION	1 - 6	2
II.	INTERNATIONAL SECURITY AND TECHNOLOGICAL CHANGE	7 - 12	3
III.	TECHNOLOGY TRANSFER	13 - 17	5
IV.	TECHNOLOGY ASSESSMENT	18 - 26	6
V.	ROLE OF THE UNITED NATIONS	27 - 30	7

I. INTRODUCTION

1. The present report is submitted in pursuance of General Assembly resolution 48/66 of 16 December 1993. It is the fifth report of the Secretary-General under the item entitled "Scientific and technological developments and their impact on international security".

2. The first report (A/44/487 and Add.1 and 2) was submitted to the General Assembly at its forty-fourth session in pursuance of resolution 43/77 A of 7 December 1988. It contained the replies received from the Member States in response to the Assembly's invitation to establish national panels to monitor and evaluate scientific and technological developments.

3. The second report (A/45/568) was submitted to the General Assembly at its forty-fifth session in pursuance of resolution 44/118 A of 15 December 1989. An overview of the changing international security environment was provided by the report. Particular mention was made of the dramatic improvement in East-West relations. A large part of the report contained scientific assessments of major trends in five broad fields of technological development, namely, nuclear technology, space technology, materials technology, information technology and biotechnology. It emphasized that the scientific community and policy makers should work more closely together to grasp the implications of technological change. It also concluded that, to use scientific and technological developments for peaceful purposes, the international community needs to position itself better to follow the nature and direction of technological change. An illustrative framework for technology assessment was included in the report with a view to assisting further discussions on the likely impact of technological changes on international security.

4. The third report (A/47/355) was submitted to the General Assembly at its forty-seventh session in pursuance of resolution 45/60 of 4 December 1990, in which the Assembly, inter alia, requested the Secretary-General to elaborate upon the criteria for technology assessment included in his second report and to continue to follow scientific and technological developments. The report referred to the efforts made by the Secretariat to expand its contacts with the scientific community and survey current literature in the field. It recalled that, in pursuance of resolution 45/62 B of 4 December 1990, the Disarmament Commission was addressing the item "The role of science and technology in the context of international security, disarmament and other related fields". The Secretary-General believed it would be premature to take further action to develop a framework for technology assessment at that moment in view of the fact that the Commission was scheduled to complete its consideration of the item the following year.

5. The fourth report (A/48/360) was submitted in pursuance of resolution 47/43 of 9 December 1992. It referred to the ongoing discussions in the Disarmament Commission and drew attention to the report of the Secretary-General on the relationship between disarmament and development (A/48/400), which had a bearing on the subject.

6. The present report is submitted in pursuance of resolution 48/66, in which the General Assembly requested the Secretary-General to continue to follow scientific and technological developments in order to make an assessment of emerging new technologies and to submit to the General Assembly at its forty-ninth session a framework for technology assessment guided, inter alia, by the criteria suggested in his second report (A/45/568). It takes into account the conclusion of the discussions in the Disarmament Commission, a survey of scientific literature carried out by the Secretariat (see annex) and results of its consultations with technology assessment experts.

II. INTERNATIONAL SECURITY AND TECHNOLOGICAL CHANGE

7. In the late 1980s, international security concerns over the nature and direction of technological change were essentially twofold. First, there was the concern that modern technology should assist rather than hinder the positive trends initiated by the end of the cold war and that application of new technologies to the qualitative improvement of weapon systems detracted from efforts to reduce and eliminate existing arsenals. Secondly, there was the concern that modern technology should be harnessed to address many of the pressing problems facing the world. For example, it could be used constructively in the field of international security for the verification of arms control and disarmament agreements or in other fields, such as environmental protection and disaster reduction.

8. Those two basic concerns persist. At the same time, some new developments have taken place in the relatively short period between the submission of the Secretary-General's first report on the subject and the present one. As the twentieth century draws to a close, national security is becoming as dependent upon economic power as it had been on military strength, particularly during the cold war. Consequently, the stakes are higher for both advanced and developing countries to master or acquire technologies that will give them a competitive edge. It may be too early to assert that technological changes in the post-cold-war era will be driven mostly by an economic agenda, but it is difficult to ignore the signs of a political shift in that direction.

9. The economic and technological resources of the world continue to be unevenly distributed (see table). Nevertheless, the process of technological change today is more widely diffused than it was even a few years ago. During the cold war, the major military Powers were seen as those primarily responsible for technological innovation. Nowadays, technological change is generated along at least three different paths to economic growth and development. Several industrialized countries continue to rely upon technologies suited to standardization and mass production with heavy capital investment. In the relatively recent experiment of the Pacific and East Asian countries, there is a pronounced emphasis on science-based technologies and customized production. Newly industrializing countries may rely simultaneously on basic, key or enabling technologies. Irrespective of their levels of technological sophistication, however, most economies today share two challenges: changes in consumption patterns and competitiveness in global markets.

Table. World population and technological and economic resources a/

	GDP 1989		Population 1989		GDP per resident 1989		Patents 1989	
	Billion $	% of total	Million	% of total	$	World average = 100	Stocks thousands patents	% of total
World	20 204	100.0	5 201	100.0	3 880	100	3 883	100.0
OECD	14 505	71.8	831	15.9	17 447	450	3 392	87.4
Non-OECD	5 699	28.2	4 370	84.1	1 304	34	491	12.6
Americas	6 716	33.2	713	13.7	9 420	243	1 550	39.9
North America	5 670	28.1	274	5.3	20 722	534	1 493	38.4
Latin America	1 046	5.1	439	8.4	2 382	61	57	1.5
Europe	7 557	37.4	783	15.0	9 640	248	1 555	40.0
Western	5 642	27.9	384	7.4	14 691	379	1 243	32.0
Eastern	1 915	9.5	399	7.6	4 758	123	312	8.0
Asia	5 189	25.7	3 052	58.7	1 700	44	687	17.7
Japan	2 834	14.0	123	2.4	23 046	594	590	15.2
Oceania	335	1.7	26	0.5	12 836	331	64	1.7
Africa	407	2.0	628	12.1	653	17	27	0.7
South Africa	89	0.4	35	0.7	2 592	67	b/	b/

Source: OECD Observer, No. 179, December 1992/January 1993, p. 16.

a/ United Nations data adjusted by the OECD secretariat.

b/ Not available.

10. As long as technological changes were geared to benefit the military sector, issues related to consumption patterns and competitiveness in global markets were important but not critical. Neither the gap between a scientific discovery and the development of a new product, nor the cost of research and development, nor the lack of ready markets for the manufactured goods stood as major obstacles to developing new technologies for national security. That is no longer the case. With a downward trend in global military spending and an increased reliance upon lighter arms in situations of actual conflict, the technological base for more sophisticated weapon systems is getting narrower. Technological change is now more receptive to a new customer - industry. It has a new challenge - competitiveness. Taken together, these two considerations suggest that new technologies will qualify better for survival if they meet the criteria of reduced costs and enlarged markets.

11. Product and process innovation, and improvements in technology, are continuous features of a new economic environment. The coveted new technologies are likely to be those that satisfy several conditions: price of the basic element in the new technology falls continually; there is an ample supply of the

basic element so that its demand and application do not face bottlenecks; and the technology is pervasive so that it has application in several fields. Assessed on those counts, the new technologies emerging in the forefront are mostly in the field of information and materials.

12. A crucial challenge facing the global industrial sector today is how to take advantage of the vast possibilities opened up by new technologies. An equally crucial task facing national economies is how to integrate their defence and commercial industrial sectors. For those interested in acquiring or retaining a leading edge in economic performance, it is becoming important that commercial industry benefits from technologies serving its own ends rather than waiting for spin-offs from the military sector. These are welcome developments. The industry's thirst for global markets could act as a stimulus for promoting agreements on international transfers of technology. The high stakes that national economies have in technological innovation could encourage a closer scrutiny of the nature and direction of technological change.

III. TECHNOLOGY TRANSFER

13. Technology has a transforming effect. It improves the human condition for those who can afford it. It gives a comparative economic advantage to those who possess it. It also bestows military prowess on those who choose to employ it for that purpose. For all these reasons, technology transfer continues to arouse different concerns among suppliers and clients. Such concerns have echoed for well over two decades in United Nations conferences dealing with transnational corporate activities, technology transfers, restrictive business practices and peaceful uses of nuclear energy. Having moved back and forth between seeking assurances, reaching understanding and evolving codes of conduct, the discussions, so far, have fallen short of arriving at universally acceptable agreements. More recently, this was evident in the deliberations of the United Nations Disarmament Commission which concluded its work in April 1994 (see A/49/42).

14. As companies and government agencies, the prime players in the defence industry, start looking for new markets, and as the new technologies find new applications, concerns about transfers of dual-purpose technology are becoming more acute. The task of the international community is to ensure that mutually acceptable arrangements are made to address with equal effectiveness two seemingly opposing concerns: to facilitate access to new technologies for economic development and to guard against the risks of weapons proliferation. In pursuing those divergent goals, suppliers weigh a variety of factors, for example, the item, its end use, the recipient and the international market. As very few suppliers gain by imposing unilateral restrictions, there are strong political pressures for multilateral action such as the formation of supplier groups, the promotion of wider acceptance of existing non-proliferation regimes and the formulation of universally applicable principles for technology transfer. Clients, for their part, continue to have reservations about signing away technological options ahead of time.

15. Lately there have been indications of increased transfers of certain technologies between economies at different levels of development. A recent

study by the United Nations Conference on Trade and Development (UNCTAD) noted that royalties of new technology licences to developing countries increased by over 10 per cent in the pharmaceutical and biotechnology fields between 1980 and 1992. This may be due to a greater willingness by the suppliers to reach out to global markets and also to revisions made by many developing countries in their foreign investment laws and practices. These developments could be indicative of a trend to give more weight to economic considerations in transferring technologies that have hitherto been considered likely to be used for military purposes and that have been subject to restrictions arising from the 1972 Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction.

16. Nuclear technology and space-related technologies also are covered by a variety of assurances, agreements and treaties banning their military use. 1/ This is, however, not true of the information and materials technologies per se. Although both have been associated with the defence sector in the past, they are presently incorporated in a vast array of civilian goods and services and can be readily applied to new products. The most effective way of ensuring that their transfer will not contribute to weapons proliferation would be through greater transparency and better understanding of the nature and direction of technological change in general.

17. To assess the international security implications of technology transfers in a changed economic climate, it is important to reshape the terms of the debate in which technology is evaluated. Would the suppliers and clients be better or worse off without the transfer? Are there some areas where technological cooperation would yield better results than doing it alone? What is the range of options available for ensuring that the end use of technology is for the purpose intended in the transfer? Issues like these have been routinely raised in the commercial industrial sector. That experience could provide some useful insights for technology assessment.

IV. TECHNOLOGY ASSESSMENT

18. At least three distinct constituencies - industry, government and the public - are at present interested in technology assessment.

19. Commercial industry needs to assess the performance potential of present and future technologies in order to increase the reliability of its decisions concerning technology and to be in a position to manage effectively an entire project - from the original concept, through its application to the marketing of the end-product. In the experience of industry, technology description and technology forecasting constitute integral components of technology assessment.

20. Technology description signifies the systematic knowledge of technology segmentation, current technology performance in the context of direct application and a technology's interrelatedness with other technologies.

21. Technology forecasting is understood as the systematic prediction of future performance characteristics and applications of familiar and yet to be developed technologies.

22. Technology assessment comprises the systematic identification and evaluation of past, current and future effects of technology in all areas of society and the environment.

23. In industry, the focus of technology assessment is on the product and the market, whereas Governments are also concerned with those organizations and agencies where technology is generated. Formulation of a technology policy for Governments involves an understanding of the relationship between private business, government laboratories and science institutes.

24. While Governments have always needed technology assessment, the establishment of formal institutions to serve that purpose is a rather recent phenomenon. In some countries, separate offices or bureaux for technology assessment have been established, for example, in Belgium, Denmark, France, Germany, Italy, the Netherlands, Spain, the United Kingdom of Great Britain and Northern Ireland and the United States of America. In others, the functions of technology assessment are carried out as a part of science policy planning, for example, in Brazil, India and Norway. The only known regional institution for technology assessment exists in the European Parliament. There is also an International Association of Technology Assessment and Forecasting Institutions. The European Commission has been involved in organizing periodic congresses on technology assessment.

25. The public's interest in technology assessment is related to broad issues such as the ecological consequences of technological developments and to personal concerns such as safety in the workplace. Societal surveillance of the direction of technological change has been a considerable factor in decision-making, specifically with respect to environmental protection and more generally with respect to the allocation of resources between the military and civilian sectors. Scientifically sound risk assessment of environmental hazards, ecologically safe methods of weapons disposal and employment of space-based technologies for disaster prevention are some of the areas that have been under the public's constant scrutiny.

26. The interaction between industry, public interest groups and Governments has always had an important influence on the direction of technological change. Market changes affect domestic groups, which, in turn, make demands on Governments and have an impact on decision-making. Formal institutions for technology assessment, however, are still in the process of being created.

V. ROLE OF THE UNITED NATIONS

27. The collective knowledge of technology assessment currently available to the United Nations as an institution is not comparable to that possessed by industry, Governments and public interest groups, particularly the scientific community. At the same time, this is a period in which Governments are likely to examine the methods of technology assessment developed by industry in order

to adapt them to decisions regarding the nature and direction of technological change. This is also a period in which a changed economic climate is encouraging greater inter-State cooperation in the area of science and technology. Historically, international organizations have registered the greatest impact on inter-State cooperation during periods of policy adaptation.

28. The United Nations as an international organization is well placed to provide a political milieu for policy adaptation. Many of the political priorities recognized as such today by the international community started as controversial issues on the agenda of the United Nations. The United Nations procedures for consensus-building make provision for gradual policy adaptation, which implies that each participant agrees to follow a course somewhat different from that which it would have pursued in the absence of a joint effort. Member States could be assisted in adopting cooperative policies for influencing the nature and direction of technological change by entrusting some or all of the following functions to the appropriate deliberative and negotiating bodies of the Organization:

(a) Recommending areas for potential collaboration through collective action;

(b) Shaping the agenda to prepare for future negotiations on technology assessment, including goals and means of cooperation;

(c) Building consensus to promote common understanding of the issues;

(d) Mobilizing public support for initiatives intended to ensure that science and technology contribute to international security.

29. The United Nations as an institution could equip itself better to follow scientific and technological developments by allocating additional responsibilities to the Secretariat for:

(a) Drawing on the experiences of national and regional institutions for technology assessment through contact or participation where possible;

(b) Remaining better informed and more knowledgeable through carrying out periodic surveys of scientific literature;

(c) Promoting greater public awareness and understanding of the ecological, developmental and security aspects of scientific and technologies developments.

30. In performing additional functions entrusted to it, the United Nations would stand to gain by encouraging greater interaction between industry, Governments and the public. National and regional initiatives to organize seminars and workshops to that effect would be as welcome in the future as they have been in the past. In carrying out its tasks as an institution, the United Nations should be promoting a more integrated approach to assessing the impact of technological change on international security. Greater interaction between the economic and political sectors of the Secretariat would contribute to that end.

Notes

1/ See A/INF/49/3 and *Status of Multilateral Arms Regulations and Disarmament Agreements* (United Nations publications, Sales No. E.93.IX.11), vol. 2.

ANNEX

Scientific and technological developments:
a survey of recent literature

ARNETT, Eric H. (ed.), New Technologies for Security and Arms Control - Threats and Promise, American Association for the Advancement of Science, 1989.

AURIOL, Laudeline, "What pattern in patents?", in OECD Observer, No. 179, December 1992/January 1993, pp. 15-18.

BALL, D. F., "Perceptions of United Kingdom exporters in transferring technology into the People's Republic of China", in R & D Management, January 1993, pp. 29-41.

BEGLEY, Ronald, "Risk-based policy could finally be on its way" in Chemical Week, vol. 154, No. 2, 19 January 1994, pp. 24-27.

BRAUTIGAM, Deborah, "South-South technology transfer: the case of China's Kpatawee rice project in Liberia", in World Development, December 1993, pp. 1989-2001.

BURTON, Daniel F., "High tech competitiveness", in Foreign Policy, No. 92, Fall 1993, pp. 117-132.

CASTELLS, Manuel, Technopoles of the World: The Making of Twenty-First-Century Industrial Complexes, London/New York; Routledge, 1994.

CHEN, Yanping, "China's space commercialization effort: organization, policy and strategies", in Space Policy, February 1993, pp. 45-53.

CLARKE, Roger, "Electronic support for the practice of research", in Information Society, vol. 10, No. 1, January-March 1994, pp. 25-42.

DIWAN, Romesh, "The new techo-economic paradigm and Brazilian competitiveness", in Revista Brasileira de Economia, vol. 47, No. 4, October/December 1993, pp. 603 and 604.

FEIGENBAUM, Susan, "Denying access to life-saving technologies", in Regulation, vol. 16, No. 4, 1994, pp. 74-79.

GHOSH, Buddhadeb, "Productivity, efficiency, and new technology: the case of Indian manufacturing industries", in Developing Economies, September 1993, pp. 308-328.

"Government's role", in Machine Design, vol. 65, No. 15, 23 July 1993, pp. 62 and 63.

HEYLIN, Michael, "U.S. lacks plan to dismantle nuclear warheads", in Chemical & Engineering News, vol. 71, No. 39, 27 September 1993, pp. 8 and 9.

KAIMOWITZ, David, "The role of non-governmental organizations in agricultural research and technology transfer in Latin America", in World Development, July 1993, pp. 1139-1150.

KRAUSE, Keith, Arms and the State: Patterns of Military Production and Trade, Cambridge University Press, 1992.

LALL, Sanjaya, "Promoting technology development: the role of technology transfer and indigenous effort", in Third World Quarterly, vol. 14, No. 1, 1993, pp. 95-108.

LE COADIC, Yves F., "Politics and policies in the scientific and technical information sector in France", in Journal of Information Science Principles & Practice, vol. 19, No. 6, 1993, pp. 473-479.

LEPKOWSKI, Wil, "Export outlook modest for green technologies", in Chemical & Engineering News, vol. 72, No. 14, 4 April 1994, p. 23.

LEWIN, David I., "Redirecting nuclear weapons laboratories", in Mechanical Engineering, vol. 115, No. 7, July 1993, p. 39.

MANSFIELD, Edwin, "Intellectual property protection, foreign direct investment, and technology transfer", World Bank IFC Discussion Paper No. 19, 1994, pp. 37-43.

MANUTA, Lou, "Mission to planet Earth", in Satellite Communications, vol. 18, No. 3, March 1994, p. 21.

MCCLENAHEN, John S., "Is ARPA the answer?", in Industry Week, vol. 242, No. 14, 19 July 1993, p. 33.

MORROCCO, John D., "ARPA blazes trail on defense conversion", in Aviation Week & Space Technology, vol. 139, No. 19, 8 November 1993, p. 42.

"US Strives for Balance in Defense Export Policy", in Aviation Week & Space Technology, vol. 138, No. 23, 7 June 1993, pp. 82-91.

OFFICE OF TECHNOLOGY ASSESSMENT, Proliferation of Weapons of Mass Destruction, August 1993.

_____, Technologies Underlying Weapons of Mass Destruction, December 1993.

_____, The Future of Remote Sensing from Space: Civilian Satellite Systems and Applications, July 1993.

ROTMAN, David, "OTA: U.S. firms face big bills and stiff competition", in Chemical Week, vol. 154, No. 9, 9 March 1994, p. 12.

SALIMBENE, Franklyn P., "US business and technology transfer in the post-UNCED environment", in Maryland Journal of International Law and Trade, Spring 1993, pp. 31-40.

SALOMON, Jean-Jacques, Mirages of Development: Science and Technology for the Third Worlds, Boulder, Colorado; L. Rienner, 1993.

SANDHOLTZ, Wayne, High-Tech Europe: The Politics of International Cooperation, Berkeley: University of California Press, 1992, chap. 2.

_____, "Institutions and collective action: the new telecommunications in Western Europe", World Politics, January 1993, pp. 242-270.

SCOTT, William B., "Shift to commercial R & D sparks new relationships", Aviation Week & Space Technology, vol. 138, No. 11, 15 March 1993, pp. 59 and 60.

_____, "NASA aeronautics budget fuels high-speed, subsonic research", in Aviation Week & Space Technology, vol. 138, No. 19, 10 May 1993, p. 61.

SIKKA, Pawan, "Strategies for technology development in India", in Technovation, vol. 11, No. 7, November 1991, pp. 445-451.

"Taking bombs apart in the United States", in Energy Economist, No. 145, November 1993, pp. 2-4.

TSCHIRKY, Hugo P., "The role of technology forecasting and assessment in technology management", in R & D Management, vol. 24, No. 2, April 1994, pp. 121-129.

VERGARA, Walter, "The materials revolution: what does it mean for developing Asia?", World Bank Technical Paper No. 202, Asia Technical Department Series.

WORLD INTELLECTUAL PROPERTY ORGANIZATION, Asian Regional Training Workshop on the Use of Industrial Property and Technology Transfer Arrangements in the Electronics Industry, Beijing, China, 24 to 28 February 1992, Geneva, 1993.

YOUNG, Oran, "Political leadership and regime formation: on the development of institutions in international society", in International Organization, No. 45, Summer 1991.
