



General Assembly

UNITED NATIONS  
CENTRE FOR DISARMAMENT  
DEPARTMENT OF  
POLITICAL AND SECURITY COUNCIL AFFAIRS  
Reference Library

Distr.  
GENERAL  
A/S-12/7  
6 May 1982  
ORIGINAL: ENGLISH

Twelfth special session  
Item 9 of the provisional agenda\*

REVIEW OF THE IMPLEMENTATION OF THE RECOMMENDATIONS AND  
DECISIONS ADOPTED BY THE GENERAL ASSEMBLY AT ITS TENTH  
SPECIAL SESSION

Reduction of military budgets

Report of the Secretary-General

1. At its thirty-fifth session, the General Assembly adopted resolution 35/142 B of 12 December 1980, entitled "Reduction of military budgets". In paragraph 4 of that resolution the General Assembly requested the Secretary-General, with the assistance of an ad hoc group of qualified experts in the field of military budgets:

"(a) To refine further the reporting instrument on the basis of future comments and suggestions received from States during the general and regular implementation of the reporting instrument;

"(b) To examine and suggest solutions to the question of comparing military expenditures among different States and between different years as well as to the problems of verification that will arise in connexion with agreements on reduction of military expenditures;"

and also requested him to report on the implementation of paragraph 4 to the Assembly at its second special session devoted to disarmament.

2. In pursuance of resolution 35/142 B, the Secretary-General appointed the members of the Group of Experts on the Reduction of Military Budgets. 1/ By a letter dated 12 March 1982, the Chairman of the Group of Experts on the Reduction of Military Budgets transmitted to the Secretary-General the report which is hereby submitted to the General Assembly.

\* A/36/49, para. 18.

1/ For the names of the experts, see the letter of transmittal below.

ANNEX

Report of the Group of Experts on the Reduction of Military Budgets

CONTENTS

	<u>Paragraphs</u>	<u>Page</u>
Abbreviations .....		4
FOREWORD BY THE SECRETARY-GENERAL .....		5
LETTER OF TRANSMITTAL .....		6
PREFACE .....	1 - 6	8
SUMMARY CONCLUSIONS AND RECOMMENDATIONS .....	7 - 10	9
 <u>Chapter</u>		
I. INTRODUCTION .....	11 - 31	13
A. Earlier substantive developments .....	11 - 22	13
B. Some general considerations .....	23 - 31	16
II. REPORTING BY STATES .....	32 - 65	18
A. Overview of replies in pursuance of resolution 35/142 B ..	32 - 38	18
B. Analysis of States' replies with a view to refining the reporting instrument .....	39 - 50	20
1. Types of forces (columns) .....	42	20
2. Types of resource costs (rows) .....	43	20
C. Conclusions .....	51 - 54	22
D. Perspectives .....	55 - 58	22
E. Recommended new "General guidelines" .....	59	23
III. INTERTEMPORAL AND INTERNATIONAL COMPARISONS OF MILITARY EXPENDITURES .....	60 - 124	24
A. Meaning and purposes of intertemporal and international comparisons .....	60 - 75	24

CONTENTS (continued)

	<u>Paragraphs</u>	<u>Page</u>
B. Intertemporal comparisons .....	76 - 98	28
1. Meaning and suitability of constant-price series for military expenditures .....	77 - 81	28
2. Characteristics of the techniques, practices and prices relating to the calculation of constant- price series for military expenditures .....	82 - 91	29
3. Conclusions .....	92 - 96	31
4. Perspectives .....	97 - 98	31
C. International comparisons .....	99 - 124	32
1. Use of exchange rates .....	101 - 104	32
2. Purchasing-power parities and other available methods .....	105 - 117	33
3. Conclusions .....	118 - 122	35
4. Perspectives .....	123 - 124	36
IV. PROBLEMS OF VERIFICATION .....	125 - 187	37
A. Background .....	125 - 133	37
B. Purposes and criteria for verification .....	134 - 141	38
1. Definitions and forms of verification .....	134 - 136	38
2. Purposes .....	137 - 139	39
3. Criteria for adequate measures of verification ....	140 - 141	40
C. General characteristics of verification .....	142 - 163	41
1. Need for data .....	142 - 145	41
2. Verification and object of reduction .....	146 - 148	42
3. Verification and type of agreements on reduction of military expenditures .....	149 - 163	42
(a) Variables in agreements on reduction of military expenditures .....	150 - 151	43
(b) Illustrative types of agreements on reduction of military expenditures .....	152 - 163	44

CONTENTS (continued)

	<u>Paragraphs</u>	<u>Page</u>
D. Methods of verification .....	164 - 177	46
1. General methods of verification in existing or proposed agreements in the field of disarmament....	164 - 169	46
2. Proposed methods specific to reduction of military expenditures .....	170 - 174	47
3. Further developments .....	175 - 177	49
E. Conclusions .....	178 - 183	49
F. Perspectives .....	184 - 187	50
Working papers .....		51

Abbreviations

EUROSTAT	Statistical Office of European Communities
GDP	Gross domestic product
GNP	Gross national product
ICBM	Inter-continental ballistic missiles
ICP	International Comparison Project
PPP	Purchasing-power parities (method)
RME	Reduction of military expenditures

FOREWORD BY THE SECRETARY-GENERAL

By its resolution 35/142 B of 12 December 1980, the General Assembly requested the Secretary-General, with the assistance of an ad hoc group of qualified experts in the field of military budgets, to refine further the reporting instrument and to examine and suggest solutions to the question of comparing military expenditures among different States and between different years, as well as to the problems of verification that will arise in connexion with agreements on reduction of military expenditures. The Assembly also requested the Secretary-General to report on the question to the General Assembly at its second special session devoted to disarmament.

In pursuance of the above resolution the Secretary-General, after consultations with Member States, appointed the members of the Group of Experts on the Reduction of Military Budgets who prepared the present report during four sessions held in New York and Geneva between 9 February 1981 and 12 March 1982.

The report is the latest in a series of studies on the reduction of military budgets undertaken by the United Nations in past years, which resulted in the development of an instrument for the international reporting of military expenditures. In addition to the analysis of reporting on military budgets by Member States on the basis of the established reporting instrument, the Group discussed for the first time in detail two important related aspects, namely, the problems of international comparison of prices and those of verification of agreements that might be concluded on the reduction of military budgets.

The discussion confirmed the need for an ever-increasing and continuous use by Member States of the reporting instrument. Having also concluded that it was necessary to study further the technical aspects of the problem, the Group recommended that the General Assembly request the Secretary-General to undertake, with the assistance of qualified experts, the study, inter alia, of the construction of price indexes and the purchasing-power parities, under appropriate conditions.

The Secretary-General wishes to thank the experts for their unanimously adopted report which he hereby submits to the second special session of the General Assembly devoted to disarmament, for its consideration. It should be noted that the observations and recommendations contained in the report are those of the members of the Group of Experts. In this connexion, the Secretary-General wishes to point out that, in the complex field of disarmament matters, he is not in a position to pass judgement on all aspects of the work accomplished by experts.

LETTER OF TRANSMITTAL

12 March 1982

Sir,

I have the honour to submit herewith the report of the Group of Experts on the Reduction of Military Budgets, which was appointed by you in pursuance of General Assembly resolution 35/142 B. The members of the Group of Experts appointed in accordance with that resolution were as follows:

Mr. Isaac E. Ayewah  
Minister Counsellor  
Permanent Mission of Nigeria to the United Nations  
New York

Mr. Vito Caporaso  
General Programming Officer, Defence General Staff  
Ministry of Defence  
Rome, Italy

Mr. Hans Christian Cars  
Head of Division, Planning and Budget Secretariat  
Ministry of Defence  
Stockholm, Sweden

Mr. José A. Encinas del Pando  
Professor (on research leave)  
University of Lima  
Lima, Peru

Mr. Daniel Gallik  
Senior Economist  
United States Arms Control and Disarmament Agency  
Washington  
United States of America

Mr. Traian Grozea  
Colonel Doctor, Head of Section  
Centre for Studies and Research of History and Military Theory  
Bucharest, Romania

His Excellency  
Javier Pérez de Cuéllar  
Secretary-General of the United Nations  
New York

/...

Mr. Kenji Nozu  
Staff Official, Defence Division  
Defence Policy Bureau, Defence Agency  
Tokyo, Japan

Mr. Benjamin Parwoto  
Deputy Assistant for Planning  
Department of Defence and Security  
Jakarta, Indonesia

The report was prepared between February 1981 and March 1982, during which period the Group held four sessions: from 9 to 13 February and from 6 to 17 July 1981 in New York, from 16 November to 4 December 1981 in Geneva and from 1 to 12 March 1982 in New York.

The Group also wishes to thank the staff of the Secretariat of the United Nations, as well as the Consultant and the Guest Speakers for their valuable assistance.

In my capacity as Chairman of the Group of Experts, I have been requested to transmit to you this report which has been unanimously adopted by the Group. I also enclose some working papers.

Accept, Sir, the assurances of my highest consideration.

(Signed) Hans Christian CARS  
Chairman of the Group of  
Experts on the Reduction  
of Military Budgets



PREFACE

1. The present report has been prepared by the Group of Experts on the Reduction of Military Budgets which was appointed by the Secretary-General in pursuance of General Assembly resolution 35/142 B. The resolution, inter alia, recalled the "provision of paragraph 90 of the Final Document of the Tenth Special Session of the General Assembly, according to which it should continue to consider what concrete steps should be taken to facilitate the reduction of military budgets, bearing in mind the relevant proposals and documents of the United Nations on this question". It also expressed the conviction that "reductions of military expenditures could be carried out without affecting the military balance to the detriment of the national security of any country". It further recalled earlier resolutions requesting the Secretary-General to carry out the practical test of the proposed instrument, to assess the results of this test and to develop recommendations for its refinement and implementation. It noted with appreciation the report of the Ad Hoc Panel on Military Budgeting (A/35/479) and recognized with satisfaction that a carefully elaborated reporting instrument had now become available for general and regular implementation in the course of which it might be further refined, in particular through its testing by a widening number of States. Furthermore, the resolution emphasized the value of such a reporting instrument, once fully implemented in its refined form, as a means to increase confidence between States by contributing to greater openness in military matters. It recommended that all Member States should make use of the reporting instrument and report annually to the Secretary-General their military expenditures of the latest fiscal year for which data were available. The resolution requested that the Secretary-General report on these matters to the General Assembly on an annual basis. It also requested the Secretary-General, with the assistance of an ad hoc group of qualified experts, (a) to refine further the reporting instrument on the basis of future comments and suggestions received from States during the general and regular implementation of the reporting instrument and (b) to examine and suggest solutions to the question of comparing military expenditures among different States and between different years, as well as to the problem of verification that would arise in connexion with agreements on the reduction of military expenditures.

2. In pursuance of this resolution and upon consultation with their Governments, the Secretary-General appointed the Group of Experts on the Reduction of Military Budgets which met twice in New York from 9 to 13 February 1981 and from 6 to 17 July 1981, then once in Geneva from 16 November to 4 December 1981 and again in New York from 1 to 12 March 1982. All the members attended all sessions of the Group except for Mr. Encinas del Pando who was not yet a member of the Group at the time it held its first session. Under this mandate, the Group met under the chairmanship of Mr. Hans Christian Cars (Sweden).

3. Throughout this mandate the valuable assistance of the Consultant, Mr. J. Fontanel, was most appreciated by the Group. The Group also appreciated the valuable contribution of the following seven guest speakers: Professor W. Andreff, Professor A. Becker, Professor A. Heston, Mr. R. Huisken, Professor W. Leontief, Mr. S. Mateescu and Professor R. Summers.

4. The Group was assisted in its work by Mr. H. Matsumoto, Mr. F. Alem and Mrs. L. Waldheim-Natural of the Centre for Disarmament who served as Secretaries of the Group at its various sessions. The Group wishes to express its gratitude to all those mentioned above, and also to the Statistical Office of the United Nations which helped make this report possible.

5. At its final session in March 1982, the Group of Experts unanimously adopted its report.

6. The report consists of a preface, summary conclusions and recommendations, an introduction and three other chapters dealing with reporting by States, intertemporal and international comparisons, and problems of verification. The working papers which follow the report contain useful supplementary information on issues discussed in the report.

#### SUMMARY CONCLUSIONS AND RECOMMENDATIONS

7. Based on the analysis of replies from States, the Group reaffirms the conclusions of the Ad Hoc Panel on Military Budgeting (A/35/479) that the reporting instrument represents a viable and practical means for international reporting of military expenditures and that such reporting should be carried out on a general and regular basis.

8. On the basis of the replies by States, the Group concludes that:

(a) In order to facilitate the fullest use of the standard reporting instrument by reporting countries, a few minor changes should be made in the instructions of the matrix (see chap. II). It may also be advisable in the future to make further changes in the reporting instrument on the basis of suggestions and comments of reporting countries, taking into account the characteristics of varying accounting and budgeting systems;

(b) The continuous use of the reporting instrument by an ever-increasing number of States with the objective of ultimate universal participation would provide a constantly improving basis for a better assessment of its general usefulness and viability with a view to future agreements on reduction of military expenditures (RME).

9. The Group further concludes that:

(a) In general terms, price changes occur both in the military and the civilian sectors of the economy over periods of time. However, the rates of such price changes may not be the same. This makes it difficult to determine expenditures on military goods and services in constant prices (that is, real military expenditures). Therefore, in order to arrive at estimates of military expenditures in real terms, there is a need to develop price deflators applicable to the military sector in each country.

(b) Exchange rates are not an adequate instrument for making accurate comparisons of military expenditures among different States. For this reason, it is necessary to develop a set of parities reflecting the relative purchasing power of different currencies with regard to each State's military sector. Such purchasing-power parities could be developed in several ways using different samples of military goods and services.

(c) The political and technical aspects of international and intertemporal comparisons of military expenditures are closely and continuously interrelated. Furthermore, the political aspects may even be the fundamental ones. The Parties must show the political will and firm determination to arrive at agreed solutions and to provide the data and other assistance needed for comparison and verification purposes. Since several procedures for constructing appropriate price indexes and conversion rates may be used, a common understanding would be needed on the construction of relevant military deflators and purchasing-power parities (PPPs). Given such understanding, it should be possible to resolve the technical problems in a way satisfactory to all Parties.

(d) As in the case of other disarmament agreements, a verification system will be necessary in order to provide assurances that all Parties are in compliance with the agreement. In view of the specific nature of agreements on RME, their verification may require the use of techniques applying to both physical quantities and financial outlays. In fact, a variety of means will probably be required, and reliable assessments may involve a relatively high degree of political understanding and confidence. Nevertheless, in view of the vital impact that agreements on RME can have on the national security of the Parties, provisions for verification should provide said Parties with adequate assurances of compliance.

(e) Negotiations on the RME should proceed on the basis that their results would not diminish any State's security. On the contrary, the security of States would improve by prospective agreements resulting in decreased levels of military expenditures.

(f) Negotiations on RME could lead to agreements among various participating States. Such agreements could be concluded on a global, regional or subregional level, among nuclear-weapon States, among other militarily significant States or among any other States whether they are members of military alliances or not.

(g) Given their high sensitivity in relation to national security, agreements on RME would only function properly if all Parties could, at all times, consider them to be to their advantage.

(h) Preliminary discussions of certain technical problems aimed at reaching understandings on their nature and possible solution should be undertaken by prospective participating States, either in United Nations expert groups or directly among the States themselves. Such discussions could begin at any time and would greatly facilitate negotiations on RME. The Group also considers that greater efforts are needed in order to enable these negotiations to begin as soon as possible.

(i) The efforts on comparability of the countries' main economic aggregates in the International Comparison Project (ICP; see para. 111 below) should be continued. The United Nations may play an important role in increasing knowledge about price movements, quantities and expenditures of various countries. The number of participating countries ought to be increased to include all major powers, if possible. Specific studies should be undertaken along the lines of the ICP in order to improve the possibility of constructing military PPPs, especially those of the main countries.

(j) The successful demonstration of the feasibility of constructing military price indexes and PPPs for different States would contribute much to preparing the ground for future negotiations on RME.

(k) A reliable system for reporting military expenditures, such as the one provided by the standard reporting instrument, would facilitate various proposals to the effect that a share of savings resulting from disarmament measures should be devoted to economic and social development, particularly for the benefit of the developing countries.

10. The Group therefore recommends to the General Assembly that:

(a) The reporting instrument should continue to be used by an ever-increasing number of States from different geographic regions and with different budgeting and accounting systems;

(b) The instructions contained in the reporting instrument should be modified according to chapter II, section E;

(c) The Secretary-General, with the assistance of a group of qualified experts and with the voluntary co-operation of States, should undertake the task of constructing price indexes and PPPs for the military expenditures of participating States. This task should encompass a study of the problem as a whole, which would include the following:

- (i) To assess the feasibility of such an exercise;
- (ii) To design the project and methodology to be employed;
- (iii) To determine the types of data required (such as product descriptions, prices and weights);
- (iv) To ascertain the willingness of States to participate and to enlist their voluntary co-operation; and
- (v) To construct military price indexes and PPPs;

(d) The General Assembly should invite Member States to participate in the above-mentioned exercise, pointing out the vast political and technical implications that would result from such participation for the process of the RME and disarmament measures as a whole, as well as for international peace and security;

(e) The General Assembly should urge Member States, in particular the nuclear-weapon States and other militarily significant States, to help create the necessary conditions for fruitful negotiations on agreements on RME and to recognize that in the process of such negotiations a reasonable availability of statistical data would be required. On this basis, Member States should start negotiations as soon as possible.

## CHAPTER I

### INTRODUCTION

#### A. Earlier substantive developments

11. The question of the reduction 1/ of military budgets 2/ has been considered by the General Assembly on many occasions as an approach to disarmament, with the aim of allocating resources thus released for purposes of economic and social development, in particular for the benefit of the developing countries. The specific item of reduction of military budgets was included at the initiative of the Union of Soviet Socialist Republics, in the agenda of the General Assembly at its twenty-eighth session which adopted resolutions 3093 A and B (XXVIII) on the subject. Under resolution 3093 A (XXVIII), the General Assembly recommended that States permanent members of the Security Council should reduce their military budgets by 10 per cent, and it established a Committee on the Distribution of the Funds Released as a Result of the Reduction of Military Budgets. Under resolution 3093 B (XXVIII), the Secretary-General appointed the first Group of Experts on the Reduction of Military Budgets. In its report (A/9770/Rev.1), 3/ issued in 1974, the Group noted the complex nature of the problem, in particular with respect to finding an acceptable definition of the scope and content of military budgets, the question of developing a standardized system of measuring military expenditures, as well as the problem of verification.

12. A second group of experts on the reduction of military budgets, appointed by the Secretary-General, considered in its 1976 report (A/31/222/Rev.1) 4/ that the

---

1/ The General Assembly, in considering this question, has referred to it as "reduction" of military budgets. The Group during its work under this mandate has agreed to use the term "reduction" throughout the report without wishing to prejudge the value of other possible terms, such as constraining, freezing or limiting military budgets.

2/ Resolution 35/142 B was adopted under the agenda item entitled "Reduction of military budgets". The resolution itself, however, requests the Secretary-General, inter alia, to suggest solutions to the question of comparing and reducing military "expenditures". Throughout its work, the Group has dealt with the question of "expenditures" rather than "budgets", the latter reflecting planned expenditures in national accounting terms and not actual standardized expenditures for military purposes. Thus, it was agreed to use the term "expenditures" throughout the report.

3/ Reduction of the Military Budgets of States Permanent Members of the Security Council by 10 per cent and Utilization of Part of the Funds Thus Saved to Provide Assistance to Developing Countries, A/9770/Rev.1 (United Nations publication, Sales No. E.75.I.10).

4/ Reduction of Military Budgets: Measurement and international reporting of military expenditures (United Nations publication, Sales No. E.77.I.6).

/...

central purpose of its work was to provide the major components of a system of military-expenditure concepts, definitions and measurement procedures, along with a corresponding reporting structure. In particular, the Group recommended the implementation of an international reporting system for military expenditures and, on that basis, developed a reporting matrix as an instrument for a standardized reporting system. It also suggested that the reporting system should be operationalized, tested and refined.

13. Another group of experts appointed by the Secretary-General considered in its report (A/32/194 and Add.1), submitted in 1977, the future development of the reporting instrument and examined the practical problems involved in completing the recommended matrix. The Group felt that the testing and refining of the reporting instrument should be carried out with the co-operation of a small group of States representing different military budgeting systems, and it recommended the operational testing and refining of the reporting instrument, stressing the importance of the co-operation of States with large military expenditures.

14. At the request of the General Assembly, the Secretary-General submitted to the tenth special session in 1978 a report (A/S-10/6 and Add.1) containing the reactions of States concerning the pilot test of the instrument for reporting military expenditures as well as an analysis of the comments provided by States concerning the 1976 expert report "Measurement and international reporting of military expenditures". 4/ At its tenth special session, the Assembly reaffirmed the need to continue consideration of concrete steps to facilitate the reduction of military budgets.

15. The Ad Hoc Panel on Military Budgeting, appointed by the Secretary-General pursuant to General Assembly resolution 33/67 of 14 December 1978, carried out and completed, in 1981, the practical test of the instrument, consisting of a proposed reporting matrix and instructions which were circulated by the Secretary-General to all Member States with an invitation to participate, on a voluntary basis, in its testing. Fourteen Member States submitted their comments on the reporting instrument. On the basis of these replies, the Panel made its assessments and recommendations on the further refinement and implementation of the reporting instrument.

16. In its 1980 report (A/35/479), 5/ the Ad Hoc Panel concluded that the participation in the testing of the reporting instrument and the data submitted constituted a satisfactory basis for assessing the viability of the reporting instrument and for developing recommendations for further refinement and implementation of this instrument. It also concluded that the practical test of the instrument had been completed and that under the circumstances prevailing at the time, no further testing was necessary. This, however, did not exclude further refinement of the instrument in the light of future experience gained in the course of its implementation and the broader participation of States.

---

5/ Reduction of Military Budgets: International reporting of military expenditures (United Nations publication, Sales No. E.81.I.9).

17. Having recommended the early implementation of the revised reporting instrument in a general and regular system by all States of their military expenditures, which might entail comments by States leading to further refinement of the reporting instrument, the Panel expressed the view that it would be valuable if those comments came from a wider set of countries. It also recommended that steps should be taken in as many ways as possible to ensure increasing participation and to provide information about the recommended reporting instrument. The Panel felt that the general and regular implementation of the reporting instrument might require a special international body to collect, assemble and report, on a general and regular basis, military expenditure data received from Member States. Such a body might be entrusted with the task of further refining the reporting instrument. Further study should be undertaken of the problem of comparing of military expenditures, as well as the problem of verification.

18. In the meantime, the General Assembly at its thirty-fourth session concluded that a new impetus should be given to endeavours to achieve agreements to freeze, reduce or otherwise restrain in a balanced manner military expenditures, including adequate measures of verification satisfactory to all Parties concerned, and it requested the Disarmament Commission to undertake, during 1980, to examine and identify effective ways and means of achieving such agreements.

19. The Disarmament Commission examined the matter at its sessions of 1980 and 1981 and attempted to identify and work out the principles which should govern the further action of States in the field of freezing and reducing military expenditures, keeping in mind the possibility of embodying such principles into a suitable document at an appropriate stage.

20. In considering the question, the Commission had before it a report of the Secretary-General (A/CN.10/23 and Add.1-6) containing views and suggestions of Member States on the principles which should govern their action in the field of freezing and reducing military expenditures, as well as proposals and ideas offered during the discussion by the Commission on the subject. The Commission had also before it a document prepared by the Secretariat (A/CN.10/24 and Corr.1), containing all proposals made by States, resolutions adopted by the General Assembly and all studies prepared within the United Nations on the question of the reduction of military budgets.

21. The present report belongs to the series of reports published on the subject in 1974, 1976, 1977 and 1980 6/ resulting in the development, adoption and

---

6/ These reports on the reduction of military budgets were:

- 1974: A/9770/Rev.1 (United Nations publication, Sales No. E.75.I.10);
- 1976: A/31/222/Rev.1 (United Nations publication, Sales No. E.77.I.6);
- 1977: A/32/194 and Add.1;
- 1980: A/35/479 (United Nations publication, Sales No. E.81.I.9).



implementation of a standard reporting instrument which the General Assembly, in resolution 35/142 B, has recommended that all States should use to report their military expenditures to the United Nations. The first compilation of their replies appeared in 1981. <sup>7/</sup>

22. At this stage of efforts in the field of reduction of military expenditures, the Group hopes that the work so far accomplished may help to prepare the ground for future negotiations among States on the reduction of military expenditures. The Group also hopes that its work will serve to facilitate such negotiations.

#### B. Some general considerations

23. The previous paragraphs have made clear that the work of the present Group of Experts on matters of standardized reporting, comparison and verification of military expenditures is to be done in the context of agreements to reduce military expenditures. It has also been made clear in numerous General Assembly resolutions that such reductions could and should be carried out without impairing the national security of any country. This naturally gives rise to questions concerning the relationships between countries' military expenditures on the one hand and their national security on the other, as well as such intermediate concepts as military capability. A full examination of such questions is beyond the mandate of the group; nevertheless, some general views and considerations concerning these relationships seem called for.

24. Some States consider that their national security is positively linked to their military capabilities which, in turn, can be regarded as a function of their military expenditures. There are, however, other factors affecting a State's perception of its national security, as for instance, the volume, level and composition of its gross domestic product (GDP), the sophistication of its military sector, the preparedness and determination of its population to defend itself, the military and economic power of possible allies and adversaries, and the amount of military assistance the State may receive from other States.

25. When discussing the reduction of military expenditures, one should keep in mind that there is no well-defined, let alone exact, relationship between a State's national security and its own and other States' military expenditures. Therefore, the factors mentioned above do have an impact on national security and are likely to be considered by States, both in the process of negotiation and later when an agreement has been concluded.

26. When assessing a State's national security, one would be primarily interested in its military capability compared to that of other countries and only indirectly so in its military expenditures relative to those of other countries.

---

<sup>7/</sup> Reduction of Military Budgets: Report of the Secretary-General (A/36/353 and Corr.2 and Add.1 and 2).

27. Many arms-limitation negotiations aim directly at the restriction or abolition of certain weapons, thereby immediately affecting the force potential. One essential drawback to this approach is, however, that countries having concluded an agreement of this kind would be free to develop other weapons that would be equally or even more costly to produce and could have an equal or even more destructive power. If this happened, the result would not be real disarmament or arms reduction but merely the changing, if not the upgrading, of the arms race. As the concept of total military capability cannot be objectively measured, one can only focus on it partially, in terms of individual programmes or weapons systems. To try to cover all this in the context of disarmament negotiations would probably not turn out to be a practical approach.

28. An advantage of agreements on RME would be that each country would have the opportunity to change the composition of its forces but only within the economic framework given by the agreement. Another advantage of this approach is that military expenditures are less difficult to measure than military capability. Also, military expenditures can cover research and development efforts which are difficult to capture in any other way.

29. Because of these important advantages and despite some important difficulties which are examined in the remainder of this report, the Group believes that strong efforts should be made by States to reach agreements on RME.

30. When concentrating on military expenditures, it is necessary to consider military capability, which is the main reason for having military expenditures. What could be measured, however, and be the subject of negotiations are not the results of military expenditures but the expenditures themselves, that is, not military capability per se but the flow of all possible inputs into the military sector for the creation of military capability.

31. In conclusion, agreements on RME would affect military capability and thereby the State's perceptions of national security. It is desirable that agreements on RME should not diminish but improve the national security while military expenditures and military capability are reduced, thus enabling a reallocation of resources originally intended for military expenditures to promote economic and social development, particularly for the benefit of developing countries.

CHAPTER II

REPORTING BY STATES

A. Overview of replies in pursuance of resolution 35/142 B

32. On 12 March 1982, by the conclusion of the present report 16 States had submitted data on their military expenditures along the lines provided by the reporting instrument which had been adopted by the General Assembly at its thirty-fifth session. These responding States, hereafter referred to as the States, were: Austria, Belgium, Canada, Denmark, Finland, Germany, Federal Republic of, Indonesia, Italy, Mexico, Netherlands, New Zealand, Norway, Sudan, Sweden, Turkey and United States of America. Their responses have been published in a report by the Secretary-General. 8/

33. The 16 States may be geographically distributed as follows:

Africa	1
Asia	2
Latin America	1
North America	2
Oceania	1
Western Europe	9

34. Ten States filled in both the matrix and part II of the reporting instrument. Many States also submitted comments and supplementary information in foot-notes to the tables.

35. In its resolution 35/142 B the General Assembly recommended to all Member States that they make use of the reporting instrument and report their military expenditures of the latest fiscal year for which data were available. States provided information as follows:

---

8/ Ibid.

Country	1978	1979	1980	1981
Austria			<u>01.01</u> <u>31.12</u>	
Belgium		<u>01.01</u> <u>31.12</u>		
Canada		<u>01.04</u>	<u>31.03</u>	
Denmark			<u>01.01</u> <u>31.12</u>	
Finland	<u>01.01</u> <u>31.12</u>			
Germany, Federal Republic of		<u>01.01</u> <u>31.12</u>		
Indonesia		<u>01.04</u>	<u>31.03</u>	
Italy			<u>01.01</u> <u>31.12</u>	
Mexico				<u>01.01</u> <u>31.12</u>
Netherlands		<u>01.01</u> <u>31.12</u>		
New Zealand		<u>01.04</u>	<u>31.03</u>	
Norway		<u>01.01</u> <u>31.12</u>		
Sudan	<u>01.07</u>	<u>30.06</u>		
Sweden		<u>01.07</u>	<u>30.06</u>	
Turkey			<u>01.01</u>	<u>31.12</u>
United States of America		<u>01.10</u>	<u>30.09</u>	

36. The great majority of the States reported their actual outlays. However, one State (Turkey) reported budgetary data in addition to outlays, and another State (Mexico) reported only budgetary data. The analysis of the periods of time covered in the States' replies reveals that most of them possessed available data for the nearest two fiscal years (1979, 1980) prior to the year in which they were to report their military expenditures (1981).

37. In general, the States supplied information on their military expenditures according to the provisions of the reporting instruments. A few of them provided information only on high levels of aggregation which is a possibility provided for

/...

by the reporting instrument. No State suggested any changes in the standard matrix itself. However, the replies of some States contained minor changes from the standard matrix in order to adapt it to their accounting systems.

38. The number of States that have submitted information on their military expenditures is still very limited, which impedes the further refinement of the reporting instrument and the appropriate evaluation of its applicability. A wider utilization of the standard reporting instrument, especially by nuclear-weapon States, other militarily significant States and by an ever-increasing number of States characterized by different national budgeting and accounting systems and by various stages of development and from all geographic regions, would provide major information on the suitability of the reporting instrument in conjunction with the necessity of further refinement.

B. Analysis of States' replies with a view to refining the reporting instrument

39. The analysis is meant to favour the refinement of the reporting instrument on military expenditures on the basis of the replies from States, so that it can be used extensively by all Member States of the United Nations, thus strengthening confidence among all States and facilitating agreed on and balanced reductions of military expenditures.

40. Qualitative aspects. Responding States did not advance concrete proposals regarding the improvement of the reporting instrument on military expenditures. However, the analysis of the way in which the reporting instrument was used, as well as the analysis of the accompanying foot-notes, leads to certain observations.

41. Regarding the structure of the matrix, the States generally preserved its configuration concerning both types of forces and types of resource costs, with their different subitems. Only a few modifications were made, the most significant of which were the following:

1. Types of forces (columns)

42. Two States, Austria and Canada, regarded expenditures on civil defence as part of their military expenditures, which was reflected by their use of a slightly modified matrix. Austria introduced a new total column, including expenditures on civil defence. Canada used the same matrix which was used during the test and which included expenditures on civil defence among military expenditures. Another country, Norway, merged the two columns "Support (6)" and "Command (7)", reporting a single set of figures for both columns.

2. Types of resource costs (rows)

43. Two States used a slightly different matrix with regard to certain items or rows. Using the matrix as it appeared during the test, Canada employed the same terminology as it did when it submitted the filled in matrix during the test, and changed the content of two rows. The United States merged two figures in five different places within three columns and in eighteen places within another column.

44. In their replies, the States used the recommended symbols 9/ and, except for one State, they also used blanks and/or symbols other than those recommended, but with no indication as to their meaning. The blanks and symbols other than those recommended have been interpreted according to a reasonable understanding of available information, unless otherwise indicated by the States (see working paper II).

45. Quantitative aspects (see working paper I). The 16 States which answered used, on average, slightly over 50 per cent of the matrix for providing information on their military expenditures, leaving uncompleted almost 50 per cent of the matrix. The different types of information provided by States are: 18.72 per cent for information expressed in figures greater than zero; 18.37 per cent for information concerning the non-applicability of military expenditures; 7.17 per cent for information confirming the existence of such military expenditures but for which there are no available figures; and 5.81 per cent to indicate that military expenditures are negligible (less than half of the unit employed) or nil.

46. The use by States of the second part of the guidelines for filling in the matrix ranged from 35 to 100 per cent.

47. The States' replies contained a greater amount of information for the following categories of forces: "Land forces (2)", "Naval forces (3)", and "Air forces (4)", and for the resource-cost category "Operating Costs". The amount of information was relatively scarce for some other categories as, for instance, "Strategic forces (1)", "Paramilitary forces (8)" and "Military assistance (9, 10, 11)", and for cost categories "Procurement and Construction" and "Research and Development".

48. About half of the States provided information for the category "Civil defence (9)", the amount of information within this column being about one third of that within the column "Land forces (2)".

49. This shows that during the present stage, information on military expenditures as regards essential fields for the evaluation of military potential (strategic forces, procurement and construction, as well as research and development in the military field) was less available. The definition of the category of "Research and Development" and its subcategories remains a difficult matter which, however, has little to do with the structure of the matrix, but is mostly a consequence of the very nature of this particular kind of expenditure. In many instances, there was a poor response - or no response at all - to the subitems under the categories of "Construction" and "Procurement". This may indicate that at present such data are often not readily available.

---

9/ A/35/479, p. 41:

"0 (zero) = Nil or negligible (or less than half of the unit employed)  
.. (two dots) = not applicable  
( ) (brackets) = provisional figure  
... (three dots) = figure not available".

50. Despite its sometimes subjective nature, the interpretation of blanks and other symbols gives a more accurate picture of the responses received. In most cases, the intended meaning of the blanks employed in responses can logically be interpreted as having been either "zero", "not applicable" or "not available". Only for one blank out of ten no such interpretation could be found (see working paper II). Reporting States should be encouraged to use the recommended symbols. An appreciable improvement with regard to the use of symbols can be expected in the process of continuous reporting.

#### C. Conclusions

51. The implementation of the reporting instrument thus far indicates that it is a useful means of collecting data on military expenditures. Reporting countries from several geographic regions and in very different stages of economic development have generally been able to fill in the matrix.

52. The reporting countries have not proposed any modifications of the reporting instrument, neither concerning its matrix nor its instructions. However, some respondents drew attention to the fact that since their budgeting systems are based on somewhat different criteria than the ones taken into account when the matrix was drawn up, they encountered certain difficulties in filling it in.

53. Since the reporting instrument has only recently been adopted there is reason to believe that its continuous use will lead to an even better compliance of the submitted data with the standardized format represented by its matrix. This continuous use of the reporting instrument by an ever-increasing number of countries would also later enable a better assessment of its general appropriateness and utility, as well as its possible refinement.

54. In order to facilitate the fullest use of the standard reporting instrument by reporting countries, a few minor changes should be made in the instructions of the matrix (see below). It may also be advisable in the future to make further changes in the reporting instrument on the basis of suggestions and comments of reporting countries, taking into account the characteristics of varying accounting and budgeting systems.

#### D. Perspectives

55. As the reporting of military expenditures pursuant to General Assembly resolution 35/142 B is only in its earliest stage, it seems appropriate to study further the tendencies, difficulties and proposals regarding the reporting of military expenditures so that, on the basis of richer experience, the existing reporting instrument on military expenditures may meet the new requirements entailed by its continued use.

56. The use of the reporting instrument for the reporting of military expenditures to the United Nations by an ever-increasing number of countries is bound to improve the confidence among countries and reduce over-all international tensions. At the

same time, increased confidence among States would facilitate the reporting of data on military expenditures by all States.

57. The General Assembly may wish to examine the adoption of appropriate recommendations to promote the general and regular use of the standardized international reporting instrument in order to harmonize views and to facilitate a clear and well-defined concept of military expenditures that could be useful in the context of future negotiations on RME.

58. The publication of military expenditures and the solution of various technical aspects involved in the process of reaching agreements on RME could be favourably influenced by increased confidence among States. This would be enhanced by the clear expression of a willingness to negotiate agreements on RME, given favourable prospects for success.

#### E. Recommended new "General guidelines"

59. The Group recommends that the "General guidelines" presently contained in the instructions of the reporting instrument (A/35/479) be replaced by the following:

##### "General guidelines"

"1. The reporting instrument is in the form of a matrix whose vertical axis details expenditures by type of resource costs and whose horizontal axis details expenditures by type of force groups. Concerning the resource costs, the matrix has a pyramidal structure in order to permit reporting on different levels of aggregation. The vertical axis consists of three main cost categories, namely (1) operating costs; (2) procurement and construction; (3) research and development. Each of these categories is then disaggregated into different subcategories and most of the subcategories into sub-subcategories. The figure given for each main category should be equal to the sum of its respective subcategories, and the figure given for each subcategory should be equal to the sum of its respective sub-subcategories.

"2. It is desirable that data should be reported for all types of force groups and all categories of resource costs at all aggregation levels provided in the matrix. If this is not possible, the available data should be submitted.

"3. The figures to be reported should show actual military expenditures of the latest fiscal year for which data are available. The amounts shall be reported in the respondent's national currency and in current prices, that is, in prices prevailing in the reporting year. The unit of measure in which expenditures are reported may be the standard currency unit itself (that is, pound, rial, etc.) or a commonly used multiple number of units. This number, however, should not be larger than one ten-thousandth of the total amount of the country's military expenditures. For example, if total military expenditures are 78,453,296 national currency units, the reported amounts may be expressed in units as large as  $1/10,000 \times 78,453,296 (= 7,845)$ . That is, the reporting unit of measure may be expressed in thousands of currency units.

/...



"4. For the sake of uniformity and clarity of presentation, only the following conventional symbols should be used as required:

- = nil
- N = negligible or less than half of the unit employed
- ( ) = provisional
- .. = not applicable
- ... = not available

The use of blanks or symbols other than those listed above should be avoided. If, however, States feel compelled to use blanks or other symbols, they are requested to give clear explanations of their meaning.

"5. It is desirable that data should be reported for all types of force groups and all categories of resource costs, at all levels of aggregation provided in the matrix. If it is not possible to present figures representing expenditures for a certain force group due to unavailability of data, it is understood that these expenditures should be included in one or more of the other force groups, or at least in the total. For the same reason, if respondents find it possible to supply data on resource costs only for higher (and not for lower) levels of aggregation, they are requested to present the figures on the level of aggregation they find appropriate.

"6. With a view to the further refinement of the reporting instrument, the States are requested to comment upon any technical or other difficulties that they may encounter when filling in the matrix and to recommend such changes of the matrix as they may find advisable. Such comments should be attached to the completed matrix."

### CHAPTER III

#### INTERTEMPORAL AND INTERNATIONAL COMPARISONS OF MILITARY EXPENDITURES

##### A. Meaning and purposes of intertemporal and international comparisons

60. General Assembly resolution 35/142 B recommends that all States report their military expenditures by means of the standard reporting instrument. This instrument calls for expenditure data in national currencies and at current prices. ("Current" prices are the actual prices prevailing in the given time frame, with no adjustment to a fixed-price base.) To the extent the standard definitions are followed, the reported data have a great advantage over previously available unstandardized data in that comparisons of military expenditures with other standard national aggregates (for example, gross domestic product or gross national product) can now be done more uniformly among countries.

61. Direct comparisons of one country's military expenditures at different time periods and with military expenditures of other countries are also improved to some extent because of standardized reporting. However, standardized reporting does not of itself provide the information required for accurate comparisons. Such comparisons can only be approximated by "rough-and-ready" means, using available but inappropriate price indexes and exchange rates or other available inter-currency conversion rates as surrogates for more appropriate price indexes and conversion rates.

62. Therefore, resolution 35/142 B calls for the Group of Experts "to examine and suggest solutions to the question of comparing military expenditures among different States and between different years". Before embarking on a detailed examination of how to compare military expenditures, however, it may be useful to consider the questions "What can comparisons of military expenditures show?" and "To what uses can comparisons of military expenditures be put?"

63. The preambular paragraphs of resolution 35/142 B, as well as the general background of this effort as described in chapter I, indicate that questions relating to the comparability of military expenditures are of general interest in the context of disarmament and, more specifically, in the context of possibilities for reaching agreements on the reduction of military expenditures and improving and increasing real development assistance to developing countries. Furthermore, it has repeatedly been noted that greater openness and availability of detail regarding military expenditures would result in concomitant improvements in the ability to compare military expenditures, and this can have other benefits for arms control and disarmament.

64. The Group of Experts on the Relationship between Disarmament and International Security has also drawn attention to the negative influence of the arms race on confidence among States. It recently expressed its views in these terms (A/36/597):

"The arms race promotes mistrust and secrecy, thus further adversely affecting international security. The greater the mistrust and the secrecy, the more likely that perceptions of doubt and insecurity will grow among nations. Indeed, international security would be considerably enhanced by increased co-operation in many areas, including the broad exchange of ideas, trade, science, technology, culture, knowledge and information, contacts at all levels and sustained dialogue on all problems affecting peace, security and disarmament."

65. Improvement of the state of information on military expenditures could permit a better comparison of such expenditures, which would have advantages from the standpoint of arms reduction and disarmament agreements; that would help to create a climate of greater confidence among States.

66. The Group of Experts on the Relationship between Disarmament and Development, after studying the question of information on military activities, arrived at the following conclusions (A/36/356):

"In the view of the Group, these prevailing attitudes towards the generation and dissemination of information on military activities urgently need to be challenged and changed. There is at present a vicious circle in which excessive and unreasonable secrecy and the arms race tend to reinforce each other. A review of the post-war arms race would establish beyond any doubt that excessive secrecy has contributed to the intensity of the arms race by motivating the acquisition of weapons and yielding force levels that subsequently proved to be unnecessary or excessive, but which became irreversible due to inertia or countervailing actions by the adversary. This effect of secrecy is clearly of paramount importance, but the associated lack of data and information on the economic effects of military activities, particularly the real human and material resources consumed, is also very significant."

67. In addition to these two purposes, that is, general confidence-building and the direct use of military expenditures as the object of reductions in a disarmament measure, other disarmament-related purposes for comparing military expenditures have been proposed recently. These include the use of comparable military expenditures, in relative or absolute terms as a basis for determining such things as contributions to funds for development and disarmament efforts or for the distribution of development assistance from such funds, particularly for the benefit of developing countries (see the report entitled "Proposals by Member States concerning the reduction of military budgets", A/CN.10/24).

68. It should also be noted that various proposals that a portion of savings in military expenditures resulting from disarmament measures should be devoted to development assistance in developing countries implicitly presuppose a sufficiently reliable system of reporting military expenditures and agreed standards that would make the accounting of such savings feasible.

69. When interest centres on RME as a direct object of disarmament, a major concern may again be to reflect relative military capability through a comparison of the military expenditures of different countries. In doing so, it should be kept in mind, of course, that military capability is built up during long periods of time and is affected by many factors other than those that can be accounted for in monetary terms. It is evident that the purposes may differ rather widely and, consequently, the problems involved in the different cases enumerated above may also be quite different. Whether the purpose of the comparison is to assess military strength or the resources devoted to the military sector, it would be desirable to have indexes that reflect price increases and the purchasing power of different currencies with special regard to the military sector. This question is dealt with at some length below and in greater detail in working paper III.

70. In the event of an agreement on RME, one would have to deal with real military expenditures (that is, military expenditures that have been adjusted for price changes over time, or "deflated"): in order to avoid undue disturbances caused by differences in inflation rates. As a consequence of this, there is a need to specify the inflation rate which would be of most relevance to the military sector in each country being party to such an agreement. It would also be highly desirable, if not necessary, for the parties to agree on methods and data by which

real military expenditures could be determined. There would at least be a need to know in considerable detail how such calculations are made by each party. Another but similar question is that of comparing military expenditures of different countries at specific periods of time. Such comparisons may be desired by negotiating countries in order to obtain a better basis for their negotiations.

71. For disarmament purposes, it would be useful to have a relatively simple indicator that closely reflects military capabilities. More ambitious concepts, such as a State's "national security" are virtually impossible to measure, as has been noted above. However, even with unlimited data, objective summary measures of military capabilities could only be approximated with great difficulty. Military expenditures data, in this situation, may serve as one of the best available means of indicating at least the potential capability to apply military force, thus making agreements on RME more significant. This is so despite important limitations on military expenditure data as a means for measuring military force potential. 10/

72. One limitation is that military expenditures reflect essentially the costs of inputs to the military establishment, and not necessarily their military worth or value. However, prices that fully reflect costs, such as opportunity-cost or adjusted-factor-cost prices, can at least measure the value of the inputs in their average alternative uses. Thus, military expenditures can serve as some measure of the relative effort towards military force potential. If, at least in the short term, it can also be assumed that that effort remains constant, then changes in military force potential may also be measurable.

73. Another limitation of military expenditures for measuring military force potential is due to the fact that force potential derives mainly from stocks of military capital acquired in previous years and not from the expenditures in a given year.

74. Although information on capital stocks is not called for by the standard reporting instrument, the value of such information for the assessment of military power has been recognized in all previous expert reports, and the gradual widening of reporting to encompass supplementary physical data has been envisioned. It should be noted that, over time, even the present instrument provides data on the acquisition of military capital that could contribute much to stock estimates.

75. As previous expert reports have noted, effective comparisons over time and space require that national prices for military inputs contain the full costs of

---

10/ Although the Group designed the standard reporting instrument for military expenditures for the purpose of reflecting military force potential as well as possible, they were well aware of its limitations. See especially A/31/222/Rev.1 (United Nations publication, Sales No. E.77.I.6). A more detailed theoretical examination is contained in Abraham S. Becker, Military Expenditure Limitations for Arms Control: Problems and Prospects, Ballinger Publishing Co., Cambridge, Mass., 1977, pp. 11-24.

those inputs. Many countries sometimes employ multiple channels for funding the acquisition of one and the same input, whether these channels are within the military budget accounts or not. Such parallel financing, as well as any other tax or subsidy practices, would need to be taken into consideration to obtain a full accounting of the costs or factors of production.

## B. Intertemporal comparisons

76. Comparisons between different periods of time have been the subject of studies by the United Nations Statistical Office on data series in constant prices of systems of national accounts. Although recommendations made can be used as a basis for developing a similar scheme with respect to military expenditures, they are not sufficient with regard to the details required. Before drawing some conclusions and making some recommendations, we shall analyse in turn the meaning and suitability of constant prices with respect to military expenditures and the characteristics of the techniques, processes and prices relating to this calculation.

### 1. Meaning and suitability of constant-price series for military expenditures

77. The deflation of value data expressed in current prices is part of an effort to offset the effect of changing price levels over time. There are three reasons which may explain the desirability of deflating military expenditure data: to make real changes in the size of the defence sector clear and intelligible, to help to make international comparisons of military efforts over time and to appraise the impact of military outlays on the economies of all countries.

78. The reasoning that price trends for products in civilian markets behave in the same way as those for military products is a hypothesis which would have to be tested before it is used, unless the objective of the study is an approximate estimate of the opportunity cost in civilian terms of military expenditures.

79. As in the case of civilian expenditures, military expenditures do not form a homogeneous block, and the study of constant prices should take this into account. Total military expenditures are only an expression of the financial aspects of the defence effort and, even when expressed in constant prices, there is no clear relationship between a State's military expenditures and its defence capacity.

80. The prerequisite for a good approximation of the constant-price series is the availability of a detailed classification of military expenditures and of military goods and services, as well as accurate information on their prices.

81. The meaning of the constant-price series for military expenditures is not a matter of estimating national security but concerns the measurement of the defence effort made by States over a period of time. These calculations are of interest only if detailed information is available which would permit an analysis of the behaviour of the prices of the main categories of the military items in question.

2. Characteristics of the techniques, practices and prices relating to the calculation of constant-price series for military expenditures

82. Documentation on the methods used in studying military expenditures in constant prices is scarce. Usually, four main groups of military expenditures are considered: earnings of employees, current expenditures on goods and services, gross fixed capital formation, and buildings and other constructions. For the first group, military-sector wage/salary indexes are used as deflators, whereas for the other groups the application of the corresponding indexes for the private sector is the main means of deflation. These calculations are not very precise, since they do not take into account, for example, changes in productivity.

83. Some countries give information on the methods used to establish constant prices (see working paper III) but these countries are very few. Establishing constant prices for the military sector means using a trained and costly staff which many States cannot use for a task which, for the moment, has not mobilized international and domestic opinion.

84. International organizations and research institutes, however, have made efforts in this direction, particularly the United Nations Statistical Commission, with regard to national accounts data series. Other institutes use general and civilian deflators, thus obtaining questionable results.

85. The prices of military goods present specific problems:

(a) The rapid evolution of technology makes the deflation of certain military products very difficult;

(b) The military sector is familiar with the problem of unique goods which constitute one of the extreme problems of index-number theory;

(c) The length of time taken to introduce new products into the sample used, by categories, for the calculation;

(d) Additional quality adjustments take no account of costless or reduced-cost improvements;

(e) Research and development is frequently left out of the cost and price of military hardware;

(f) The Government is often the main purchaser and its purchases may be the cause of price increases;

(g) Numerous military outputs have no market prices, while others are gifts the real cost of which is difficult to determine in terms of civilian economic advantages;

(h) Some military goods are received as a transfer in kind or are only partly paid for by the country in the context of a military assistance programme. Frequently, the recipient country does not have or has only very incomplete information regarding such goods.

those inputs. Many countries sometimes employ multiple channels for funding the acquisition of one and the same input, whether these channels are within the military budget accounts or not. Such parallel financing, as well as any other tax or subsidy practices, would need to be taken into consideration to obtain a full accounting of the costs or factors of production.

## B. Intertemporal comparisons

76. Comparisons between different periods of time have been the subject of studies by the United Nations Statistical Office on data series in constant prices of systems of national accounts. Although recommendations made can be used as a basis for developing a similar scheme with respect to military expenditures, they are not sufficient with regard to the details required. Before drawing some conclusions and making some recommendations, we shall analyse in turn the meaning and suitability of constant prices with respect to military expenditures and the characteristics of the techniques, processes and prices relating to this calculation.

### 1. Meaning and suitability of constant-price series for military expenditures

77. The deflation of value data expressed in current prices is part of an effort to offset the effect of changing price levels over time. There are three reasons which may explain the desirability of deflating military expenditure data: to make real changes in the size of the defence sector clear and intelligible, to help to make international comparisons of military efforts over time and to appraise the impact of military outlays on the economies of all countries.

78. The reasoning that price trends for products in civilian markets behave in the same way as those for military products is a hypothesis which would have to be tested before it is used, unless the objective of the study is an approximate estimate of the opportunity cost in civilian terms of military expenditures.

79. As in the case of civilian expenditures, military expenditures do not form a homogeneous block, and the study of constant prices should take this into account. Total military expenditures are only an expression of the financial aspects of the defence effort and, even when expressed in constant prices, there is no clear relationship between a State's military expenditures and its defence capacity.

80. The prerequisite for a good approximation of the constant-price series is the availability of a detailed classification of military expenditures and of military goods and services, as well as accurate information on their prices.

81. The meaning of the constant-price series for military expenditures is not a matter of estimating national security but concerns the measurement of the defence effort made by States over a period of time. These calculations are of interest only if detailed information is available which would permit an analysis of the behaviour of the prices of the main categories of the military items in question.

2. Characteristics of the techniques, practices and prices relating to the calculation of constant-price series for military expenditures

82. Documentation on the methods used in studying military expenditures in constant prices is scarce. Usually, four main groups of military expenditures are considered: earnings of employees, current expenditures on goods and services, gross fixed capital formation, and buildings and other constructions. For the first group, military-sector wage/salary indexes are used as deflators, whereas for the other groups the application of the corresponding indexes for the private sector is the main means of deflation. These calculations are not very precise, since they do not take into account, for example, changes in productivity.

83. Some countries give information on the methods used to establish constant prices (see working paper III) but these countries are very few. Establishing constant prices for the military sector means using a trained and costly staff which many States cannot use for a task which, for the moment, has not mobilized international and domestic opinion.

84. International organizations and research institutes, however, have made efforts in this direction, particularly the United Nations Statistical Commission, with regard to national accounts data series. Other institutes use general and civilian deflators, thus obtaining questionable results.

85. The prices of military goods present specific problems:

(a) The rapid evolution of technology makes the deflation of certain military products very difficult;

(b) The military sector is familiar with the problem of unique goods which constitute one of the extreme problems of index-number theory;

(c) The length of time taken to introduce new products into the sample used, by categories, for the calculation;

(d) Additional quality adjustments take no account of costless or reduced-cost improvements;

(e) Research and development is frequently left out of the cost and price of military hardware;

(f) The Government is often the main purchaser and its purchases may be the cause of price increases;

(g) Numerous military outputs have no market prices, while others are gifts the real cost of which is difficult to determine in terms of civilian economic advantages;

(h) Some military goods are received as a transfer in kind or are only partly paid for by the country in the context of a military assistance programme. Frequently, the recipient country does not have or has only very incomplete information regarding such goods.



86. The calculation of price indexes is both a technical and a political task. If the technical aspects may seem to be important, so are the political implications involved.

87. At the technical level, the price index must refer either to inputs or to prices paid. The choice of indexes depends on the categories of articles concerned. The implicit price deflator, based on Paasche's formula, is often used as an indicator of inflation and may be applied to the representative categories of military expenditures. It seems that, in military matters, it is essential to choose an input-price index (input or purchase) even if it cannot show the economic and military efficiency of a purchase by giving only the cost. There are several types of input-price indexes, of which the most useful ones seem to be the standard index, the cost-price index, and the modified cost-price index.

88. The base period chosen should be recent and not atypical. The frequency with which the weights based on expenditures are reviewed must be a question of experience. The selection of products represented in the price index must strike a judicious balance between the cost of the availability of the data and the error allowable in the final result. The choice of formulae should make use of the Paasche index when weights are available for later years and of the Laspeyres index when that condition is not fulfilled (see working paper III).

89. The calculation of these indexes requires a detailed classification of military expenditures. The large number of items purchased by the military sector makes it impossible to price all goods and services individually, so samples must be constructed and selected. Current studies use category deflators based on the private economy. If such studies are to be improved, one would have to accept the costs of collecting a vast amount of relevant information. Although these costs might seem relatively high, they would no doubt be quite small when compared with the military expenditures themselves and with the savings that could be obtained by an agreement on RME. An improvement of the international political climate would also strongly enhance the possibility that States would not regard the release of necessary information as inconsistent with their national security interests.

90. The procedures used in the construction of information on military expenditures at constant prices involve a large number of stages, which could be:

- (a) Definition of categories;
- (b) Specification of concepts;
- (c) Selection of samples;
- (d) Development of weights;
- (e) Selection of prices;
- (f) Adjustment for quality changes.

91. This procedure is an excellent point of departure for effective calculations of the constant prices of military expenditures.

### 3. Conclusions

92. In view of the fact that prices of military goods and services are often unknown or difficult to obtain, price indexes for civilian prices are used as surrogates for military indexes. However, price movements in the military sector do not always correspond to price movements in the civilian sector.

93. There have been very few published studies which give reliable data on price changes within a State's military sector.

94. The price deflators used by countries to compensate for price increases in their military sectors do not normally reflect such increases adequately. Most often they represent the price movements in the public sector or in the economy as a whole.

95. Given a political agreement on the selection of expenditure data, prices and deflators, sampling procedures and the treatment of quality changes, the technical problems could probably be solved in manner satisfactory to all parties. The political aspects of measuring military expenditures in constant prices are at least as important as the technical ones.

96. The existence of reliable military price deflators would make it possible to compare real changes in military expenditures by comparing similar time series for various countries. Even if such deflators were poor indicators of changes in the national security of the countries concerned and only indirectly reflected changes in their military capability, they would, however, provide quantitative measures of the changes in real inputs for each country.

### 4. Perspectives

97. General military price deflators should be devised for different countries in a manner that would be acceptable for all countries concerned. In doing this, one should pay due attention to the characteristics of different price systems because it is less important to use the same technique in all cases than to arrive at good estimates. To this end, sampling procedures should be established, qualities of selected goods and services should be described and assessed, price data for these items should be collected and indexing problems should be discussed and resolved.

98. In the development of military price deflators, one will have to face the difficulty of having to take into account the efficiency and the growth of productivity within the military sector in order to enable relevant comparisons over time and between different States. Ideally, the usefulness of a technological change should be evaluated in terms of its military utility. Since improvements in quality or performance which do not contribute to defence capacity (or to the discharge of a specific task by the relevant service) often distort the economic calculations, it would undoubtedly be desirable to develop measuring methods that could be practically and satisfactorily applied with a view to furnishing new indicators of the development of forces.

### C. International comparisons

99. International economic comparisons present one of the most difficult measurement problems for economists. This is because practices differ between countries with regard to conceptualizing and publishing economic information. Another reason is that exchange rates do not accurately reflect the domestic purchasing power of different currencies and there is a general lack of economic information, particularly in military matters. International economic comparisons are essential, however, for studying growth processes and for international aid, although the national accounts data series and estimates of military expenditures cannot give an accurate picture of a country's well-being and security.

100. The next section deals with the use of exchange rates for the purposes of international comparison of economic variables and military expenditures. The second section will give a brief review of the principles and the importance of the method of purchasing-power parities and their possible application to the military sector and will analyse other methods which could be used. Finally, conclusions and recommendations are presented.

#### 1. Use of exchange rates

101. The use of exchange rates is the commonest means of comparing the level of the economic aggregates of several countries. Calculations based on exchange rates are used by the World Bank and the United Nations Statistical Office for general economic variables and by USACDA, 11/ IISS 12/ and SIPRI 13/ for military expenditures.

102. Several limitations would lead to the rejection of a method of this type for obtaining reliable results, especially with regard to the need for comparing military expenditures in countries with different economic systems and in different stages of economic development. Official exchange rates are often arbitrary, and do not express the domestic purchasing power of currencies, owing to the existence of a large domestic sector which has no links with international trade. An exchange system which functions flexibly in market-economy countries gives rise to rapid and sudden variations which do not reflect any modification of compared military efforts in the countries concerned. Capital movements exercise a powerful pressure, modifying exchange rates without any reference to the notion of purchasing power. As a result of these and other limitations, exchange rates are inadequate instruments for making international economic and military comparisons.

103. Likewise, the use of special drawing rights and transferable rubles does not provide an adequate solution, since these instruments suffer from the same disadvantages as those described above.

---

11/ United States Arms Control and Disarmament Agency.

12/ International Institute for Strategic Studies.

13/ Stockholm International Peace Research Institute.

104. It is, however, possible to seek by negotiation a unit of account based on a basket of currencies which could serve as a basis for comparison, and to select, in the case of a reduction of military expenditures, the conversion numbers which would permit international comparisons.

2. Purchasing-power parities and other available methods

105. The International Comparison Project (see working paper III, para. 37) seeks to compare the purchasing power of currencies and the real per capita gross domestic product (GDP) of participating countries. Although only 10 countries constituted the sample in phase I and 77 countries are involved in phase IV, it should be pointed out that ICP activities have been reduced financially. The results of the preceding phases are interesting because they substantially modify traditional international comparisons and they would have different advantages and disadvantages for different States if these results were relied upon. The EUROSTAT project, for example, which seeks to estimate the purchasing-power parity (PPP) of EEC member countries has led to satisfactory results in comparing the GDP (and its final uses) of the countries concerned. Other projects have been carried out by the Council for Mutual Economic Assistance and the Latin American Free Trade Area.

106. The principles of international comparisons are similar to those used in comparisons over time but they have different requirements in view of the circularity property. The aggregates are subdivided into a large number of categories, for which representative goods with known prices and identical or equivalent specifications are chosen. The sampling principles depend on the methods used. Generally, it is recommended to use a sample of the distribution of physical units and to weight the different prices according to their expenditure weight for one country or, in a comparison, for several countries. For the purposes of simplicity it is certainly desirable to use the dispersion of relative prices as a criterion for classifying articles in the commodity group.

107. Four principles are generally used in selecting specific items:

- (a) They must be described as exactly as possible so that prices can be compared among the various countries;
- (b) The selection of goods with the largest expenditure weights diminishes the likelihood of sampling error;
- (c) The items must be representative of the subaggregate to which they belong;
- (d) Each specification chosen must be important in the military expenditures of the country concerned.

108. However, absolute comparability of items for all countries, although a theoretical requirement, cannot exist (EUROSTAT makes greater use of the identity of products than of their representativeness). The degree of price dispersion leads to less serious problems in the military area than in other sectors of economic activity and the choice between the Paasche and the Laspeyres index remains arbitrary. Furthermore, economists believe that quality is, in theory,

represented in prices but this hypothesis is difficult to maintain for imported military goods in relation to goods consumed by the supplier country. Moreover, the quality of a product is not perceived in the same manner by different countries. Special analysis must be applied to durable goods (power, capacity, comfort, durability, cost of operation). International comparisons require the definition of the quantifiable characteristics of goods.

109. There are five statistical requirements to consider when choosing samples and weights for international comparison purposes. Some of them are often incompatible, especially in multilateral comparisons (for a fuller description of these requirements, see working paper III, para. 44).

110. When comparing the military expenditures of only two countries, one would generally employ the bilateral method (see working paper III for details). In this method, a sample of relative prices are averaged using weights consisting of the relative expenditures of either of the two countries. This results in two alternative comparisons, which can then be averaged. The bilateral method is not suitable for multilateral comparisons; it would logically be used in comparing the military expenditure of two countries which differ considerably in types and over-all amounts of military expenditure.

111. However, it is also necessary to have simultaneous comparisons of the military expenditures of several countries. The multilateral methods used combine statistical information on representative items to obtain price and quantity indexes for each country at the requisite level of detailed category. The price and quantity indexes for those categories are then averaged to obtain the corresponding indexes at various aggregation levels. When choosing the weights, one has to consider different competing requirements and to look for an optimal solution.

112. Various technical procedures exist. The ICP uses the "country-product-dummy" method, which uses all the information available on prices to give transitive comparisons, even if some countries have no reference prices for some items. The method of aggregating detailed categories requires the establishment of a set of international prices for the various categories used to evaluate the quantities for each country. This method allows calculation of an international dollar with the same over-all purchasing power as the United States dollar but with a different purchasing power for the different categories (see working paper III, para. 53). EUROSTAT, on the other hand, used the European unit of account. The technical procedures and hypotheses of the various studies differ but the results obtained, when they are comparable, are not very different.

113. As far as military expenditures are concerned, the PPP method has not yet been used. However, it should be used in determining the military goods that are similar for each country, in selecting typical or calculating average prices, in indicating price ratios for goods and in aggregating categories to facilitate international comparisons of the annual military expenditures of the countries concerned.

114. Several problems arise, however. Military items are rarely the same and their technical specifications are rather poorly known. Furthermore, prices and

quantities of articles in the military sector are particularly difficult to obtain. These two limitations lead us to consider that an effort must be made to determine which military goods and services are comparable and to find a way of passing from one category of countries to another. Furthermore, it seems that the ICP method should be developed for the military sector, but this would require an agreement among the participating countries to supply the information required for a satisfactory estimation of their military expenditures. Without such an international agreement, this method cannot be applied with the necessary precision.

115. There are other methods based on indicators or on a simplification of the ICP method. The preparation of varied PPPs is tedious and time-consuming. It is possible to use comparable and simpler methods to avoid annual estimations by interpolating between two base years for which the full calculation has been made or by extrapolating some results obtained for the countries belonging to the sample to the significant information for other countries. It is thus possible, with PPP calculations for 1970 and 1975 for three countries based on particular indicators, to make PPP estimates for the years 1971-1974. Furthermore, with the PPPs for sample countries, some PPP estimates for other countries can be made by finding, for those countries, the significant explanatory variables required for such results.

116. Furthermore, some comparisons on national income or GDP have been made independently of any ICP-type studies. They are based on indicators, generally physical or volume, and regressive analysis. This method is, however, somewhat risky since the significant indicators change with time and can be manipulated, and their coefficient must be rather indifferent to the exactness of the information. The method is interesting but it is probably of questionable use for comparing military expenditures. Finally, another method uses abbreviated market baskets of military expenditures but, in view of the international differences among countries with regard to production and consumption, this method is probably not yet very suitable for use with regard to military expenditures - if studies in this field have improved the knowledge of existing forces.

117. The building-block method identifies the military programmes of the country in question and, on the basis of this information and with the help of a hypothesis with regard to prices, one attempts to determine the military expenditures in the prices of the base country. This method of estimating military expenditures avoids comparing the relative values of the national currencies and the conversion rates. It could be used for verification purposes.

### 3. Conclusions

118. Exchange rates do not reflect the relative domestic purchasing power of different currencies. This is particularly true for the relations between Eastern and Western currencies and between currencies of developed and developing countries. The sudden and often rather drastic changes in the parities that occur from time to time distort the basis for comparing real military expenditures since such developments do not correspond to any similar changes in the relative real value of military expenditures in the countries concerned.

119. The calculation of so-called purchasing-power parities (PPPs) could provide useful information for the purpose of comparing the monetary value of military efforts between countries. In this context they would, of course, be of particular interest if they were calculated on the basis of military goods and services. Any calculation of PPPs would have to depend on several hypotheses involving many subjective choices that would have to be agreed on in order to ensure a wide acceptance of the results. Therefore, the calculation of PPPs would involve co-operation between Government statisticians from each participating country.

120. There is no unique and infallible method for making international comparisons. In the case of an agreement on RME, countries could therefore be supposed to rely on different methods in an attempt to establish as good a basis as possible for their assessments. The use of different methods for comparison and verification would probably lead to somewhat different results, enabling the countries to obtain a reasonable interval of possible expenditure levels instead of just one figure. At the same time, it could be expected that an international agreement on RME would result in the release of new information which would enable the participating countries to arrive at better estimates no matter which method they use, thereby narrowing the interval mentioned above.

121. As in the case of intertemporal comparisons, the political aspects of comparing military expenditures of different countries seem to be no less important in relation to the technical problems involved.

122. For instance, comparisons of the military expenditures of the Soviet Union with those of the United States might not be made only by a multilateral method, because many items are specific to these two countries. The weights of other countries should not be allowed to influence the nature of the comparison. The selection of appropriate items should also be easier when there are only two countries involved. Using the bilateral method one would arrive at a better understanding of the relative military efforts of these two countries. Similarly, the multilateral method is useful for studying the relations between several countries at a time, as well as the link between military expenditures and development.

#### 4. Perspectives

123. The efforts of the International Comparison Project (ICP) to determine comparability of countries' main aggregates should be continued. The United Nations may play an important role in the work for increasing knowledge about price movements, quantities and expenditures of various countries. The number of participating countries ought to be increased to include all major Powers if possible. Specific studies should be undertaken along the lines of the ICP in order to improve the possibility of calculating military purchasing-power parities, especially those of the main military countries.

124. The group considers that the General Assembly should request the Secretary-General to undertake further efforts to examine and, if possible, to demonstrate the feasibility of constructing appropriate price indexes and purchasing-power parities for military expenditure. Such efforts would call for the voluntary participation of States in making available the required data.

## CHAPTER IV

### PROBLEMS OF VERIFICATION

#### A. Background

125. The mandate of the group as noted above requests it, inter alia, "to examine and suggest solutions ... to the problems of verification that will arise in connexion with agreements on reduction of military expenditures" (General Assembly resolution 35/142).

126. The reduction of military expenditures (RME) is one component of the disarmament process, and therefore all the principles applicable to disarmament itself are also applicable to this specific component, including those related to verification.

127. The need for verification has been recognized in various negotiations leading to multilateral arms control and disarmament agreements (see working paper IV), although none of these specifically deals with the reduction of military expenditures. States have, in practice, entrusted certain verification tasks to various international organizations and specialized agencies. 14/

128. In the Final Document of the Tenth Special Session of the General Assembly (resolution S-10/2), several general principles concerning verification were formulated and adopted. These include the following:

"31. Disarmament and arms limitation agreements should provide for adequate measures of verification satisfactory to all parties concerned in order to create the necessary confidence and ensure that they are being observed by all parties. The form and modalities of the verification to be provided for in any specific agreement depend upon and should be determined by the purposes, scope and nature of the agreement. Agreements should provide for the participation of parties directly or through the United Nations system in the verification process. Where appropriate, a combination of several methods of verification as well as other compliance procedures should be employed."

"91. In order to facilitate the conclusion and effective implementation of disarmament agreements and to create confidence, States should accept appropriate provisions for verification in such agreements."

"92. In the context of international disarmament negotiations, the problem of verification should be further examined and adequate methods and procedures in this field be considered. Every effort should be made to develop appropriate

---

14/ However, these practices have not been applied to military expenditures to a significant extent nor are implications for national security always involved here.



methods and procedures which are non-discriminatory and which do not unduly interfere with the internal affairs of other States or jeopardize their economic and social development."

129. Although these paragraphs refer to disarmament and arms limitation in general, the last two immediately follow other paragraphs (i.e., paras. 89 and 90) in the Final Document which refer explicitly to the gradual reduction of military budgets, and thus can be understood to apply to the latter types of agreements. These statements, however, are so general that they leave unanswered many important questions concerning the verifiability of agreements on the reduction of military expenditures.

130. Since 1974, four reports prepared by consecutive expert groups have analysed certain technical aspects concerning the reduction of military budgets (as noted in chap. I). However, only the 1974 report 15/ and, to a very limited degree, the 1980 report 15/ dealt with verification aspects.

131. The 1974 report considers verification to be a technical problem which seriously conflicts with a country's desire to keep the nature of its military preparations secret. It deals in some depth with the problem of verification and proposes, inter alia, a definition of it, giving a clear, albeit incomplete, picture of the possibilities of evasion of military expenditure limitations and underlining the intrusiveness of unlimited verification as an obstacle to confidence between States. The report, moreover, states the impossibility, at that stage, of identifying appropriate mechanisms of verification, but it cannot avoid considering that, should confidence between treaty partners grow, verification might be transformed from an irritating constraint into a mutually-desired means of conveying messages on intentions and capabilities. 16/

132. The report envisages a kind of scale on which, step by step, gradual improvements in the disclosure of information would be accompanied by appropriate increases in the stringency of agreements.

133. The 1980 report suggested that the time was ripe for further attention to this important issue and noted some approaches that might warrant further examination.

## B. Purposes and criteria for verification

### 1. Definitions and forms of verification

134. In general, verification may be considered a dynamic process for determining whether or not commitments assumed under an international agreement are being fulfilled. Reduction of military expenditures differs from most other measures of

---

15/ See foot-note 6.

16/ A/9770/Rev.1, chap. V, paras. 54-56, and annex II, paras. 121-133.

disarmament in that it involves financial accounts as well as physical objects. Thus, the means and methods encountered in other types of disarmament, which apply mainly to physical objects, are not sufficient to verify agreements on military expenditures. Taking into account, inter alia, the existing differences in the price systems of different economies and the general difficulties involved in verifying national accounts, verification of RME would be possible only under an international agreement whereby such expenditures and the way in which they are accounted are clearly defined. The agreement would also need to contain provisions for obtaining such financial and physical information as would be necessary to assure all participating States that the stipulations of the agreement were being complied with.

135. The different forms of verification that are applicable to a spectrum of agreements, including those relating to military expenditure reductions, may be thought of as a dynamic process with the following characteristics:

(a) Régimes: Five levels of confidence can be identified: absolute, adequate, limited, symbolic and no verification (see working paper IV);

(b) Methods: Seven basic conceptual methods, varying in degree of intrusiveness and technology, may be identified: general on-site inspection, selective on-site inspection, challenge on-site inspection, control posts/observer mission, remote sensing in situ, remote sensing by national technical means and collateral analysis;

(c) Systems: There are literally hundreds of conceivable specific verification systems, ranging from technologically complex to relatively simple.

136. A list of the régimes, methods and major systems, as they may approximately correlate with each other, is shown in working paper IV. The applicability of these to military expenditure reductions as a specific form of disarmament is further discussed below.

## 2. Purposes

137. Since an international agreement on the reduction of military expenditures should not diminish the security of participating States, some form of assurance must be agreed upon to make sure that the parties are really fulfilling the obligations they undertook in the agreement. Under these circumstances, machinery for verification of compliance cannot be avoided.

138. Requirements for verification conflict with a tendency to divulge the least possible information on the military establishment or not to provide such information at all. On the other hand, only a climate of reciprocal trust among all parties and sufficient information can support (or even render unnecessary) machinery for verification.

139. The criteria on which adequate measures of verification can be judged are contingent upon the scope and purpose of verification. These purposes may be summarized as follows:

(a) To protect the security of the parties to the agreement. The essential aim of verification is to obtain assurance that, notwithstanding the restriction or limitation to be adopted, national security would not be jeopardized by breach of the agreement on the part of the parties;

(b) To deter violation of a treaty. Even though a Government, wishing to alter its military budget in a covert build-up, need not wait for a military expenditure limitation agreement to do so, a verifiable agreement limits the freedom of the parties to act overtly in violation of the treaty;

(c) To function as a channel of communication. To be capable of demonstrating their compliance with the agreement, parties must be willing to accept the need for more complete and accurate information than was available before the limitation. At present, few Governments are entirely at ease with the state of the information they possess about the effective military capability of the other States;

(d) To evoke a response in the case of non-compliance. The lack of an established system of guarantees within present-day international law does not imply that such guarantees are completely absent from international agreements. In practice, parties to international agreements have made use of monitoring procedures.

### 3. Criteria for adequate measures of verification

140. Thus, verification should fulfil two basic functions. On the one hand, it should deter possible violations of obligations; on the other, it should help to generate a climate of international trust, which is indispensable for further progress in the military expenditure reduction field.

141. Taking into consideration these purposes, verification should be based on the following main criteria:

(a) Verification must be technically applicable. It would not be useful to make up a "basket of measures" that, although applicable for other and specific kinds of conventions, would not be applicable to military expenditures limitation agreements;

(b) Verification must be reciprocal among all parties. Unless it is agreed upon differently by the parties to an agreement on the reduction of military expenditures, verification should provide them with ways and means of implementation yielding an assurance of compliance satisfactory to all parties.

(c) Verification must be politically acceptable. A State would be most reluctant to be bound by an agreement on RME unless the verification machinery provided sufficient assurance of compliance.

(d) Verification must not be unduly interfering. <sup>17/</sup> Due to the extent and nature of military expenditure agreements, their verification is unique and would require access to national accounting systems (which can best be accomplished on site). On the other hand, there is general agreement that verification measures should not unduly interfere with the internal affairs of States or jeopardize their economic and social development. Proper measures of verification are those that, respecting the freedom of choice of the political proclivities of each individual country, and in a framework of significant balance in the volume of information given or received, guarantee to each of the parties a mutual compensation of gain and loss.

(e) Verification must be determinative. That is, it must be capable of resolving the matter under investigation. In this sense, verification must provide measures for detecting possible breaches of an international agreement. Among such measures, an international body capable of detecting such breaches and adopting decisions to correct them may be contemplated.

### C. General characteristics of verification

#### 1. Need for data

142. The problem involved in financial verification cannot be clarified because of the limited amount of data presently provided by States. Incomplete information is a factor which tends to inflate, or push up, military budget levels. An agreement which tends to deflate, or push down those same levels definitely needs a constant flow of exact information which tends to be more and more workable and complete.

143. To verify productively an agreement on RME, economic and financial data are of utmost importance. It is, of course, not really necessary to stress once again that the phase of confidence-building is the corner-stone for any real progress in the reduction of military expenditures.

144. But, apart from this confidence-building phase, the kind of information-disclosure ladder envisaged in the 1974 report <sup>18/</sup> seems to be on the right track in assisting to carry out a step-by-step, or a rung-by-rung, process. This process includes:

- (a) Gathering of information;
- (b) Checking of records;
- (c) Controlling to ensure that the actual situation corresponds to the information obtained;

---

<sup>17/</sup> Final Document of the Tenth Special Session of the General Assembly (resolution S-10/2), para. 92.

<sup>18/</sup> See A/9770/Rev.1 (United Nations publication, Sales No. E.75.I.10), p. 10.

- (d) Examination and evaluation of the information gathered;
- (e) Determining the degree of compliance, thus concluding the process.

145. The volume of information required and used in verifying RME agreements depends on several factors, including:

- (a) Approach employed to obtain information indirectly by observation of large physical objects, or directly from the subject State;
- (b) Extent of information flow available prior to an agreement;
- (c) Provisions of the agreement dealing with information.

## 2. Verification and object of reduction

146. The object of reduction in an agreement tending to push the level of military expenditure down is represented by military expenditures which are unique, in terms of verification requirements, among all patterns of production. A first relationship between verification and RME lies in the fact that military expenditures of necessity cover a great variety of items of expenditure. In the event of a total agreement on RME, for instance, verification should be provided for every component of the military sector.

147. Even if a relationship between military expenditures and physical counterparts, at least for the main expenditures, does exist, military expenditures involve primarily accounting entries on documents dealing with financial sums, prices and quantities. This fact implies that:

(a) The means of verification which are useful in other agreements in the field of disarmament seem to have very limited and indirect applicability in agreements on RME;

(b) Proper measures of verification, in this ultimate sense, should be those which provide for the auditing of ledger accounts in the framework of total military expenditures.

148. A second relationship between military expenditures and verification lies in the difficulty of interpreting the military expenditures of States whose accounting systems are different and not well known. On the other hand, if verification must be the same for known and little-known systems, a greater clarity must be expected in the latter case or else the nature of verification may need to differ.

## 3. Verification and type of agreements on reduction of military expenditures

149. In addressing the question of verification under a future agreement to freeze, reduce or otherwise restrain military expenditures, one has to take into account that there is, so far, little consensus on the actual nature, scope and content of such agreements. And yet, verification requirements for agreements on RME can be expected to differ depending on the type of such agreements. For example, it has

been suggested that so-called "mutual-example" arrangements would require less verification capability than formal limitations, or that an agreement on RME tied to a physical force limitation would be easier to verify than one which is not.

(a) Variables in agreements on reduction of military expenditures

150. Before examining such questions, it is well to keep in mind the numerous ways in which agreements on RME could vary. Among the most important of these variables are the following: 19/

(a) Object: that is, the scope and content of the expenditures being reduced, which can range from a broad concept of total military expenditures to a narrowly defined component (or some combination of these);

(b) Manner of valuation: in the respective national currencies or in some standardized unit of account at current or constant prices;

(c) Manner of expression: in absolute-value terms or in relative terms proportional to some reference value, such as a previous year's level, a negotiated level based on inter-country comparisons, or a national aggregate like GNP;

(d) Linkage to force limitations: ranging from a freely independent, totally unlinked measure to a very dependent relationship in which the expenditure reduction is an adjunct to a force limitation whose object is somewhat similarly defined but which is expressed in physical parameters for particular forces or weapons;

(e) Degree of formality of the agreement: ranging from a formally negotiated treaty specifying rigorous conditions to informal understandings of varying thoroughness, stringency and duration;

(f) Severity: ranging from a high ceiling through a freeze and varying degrees of reduction to zero;

(g) Duration: one-time, for a limited period, or indefinite, with expenditures after a given time being either free to rise or held under the last level's ceiling.

151. The above variables can be combined in numerous ways to produce a variety of potential types of agreements. The choice of type can have significant implications for verification. This is mainly because different types create an inherent need for different amounts and kinds of information in order to implement the agreement itself. Information made available for implementing purposes can be useful in facilitating verification, even though it is unlikely to be sufficient.

---

19/ A more extensive discussion of types of military expenditure limitations may be found in A/9770/Rev.1 (United Nations publication, Sales No. E.75.I.10), particularly pp. 30-31.

The implications for verification of the above variables can be discussed with the help of a few illustrative types of RME that could result from the many possible combinations of the variables.

(b) Illustrative types of agreements on reduction of military expenditures

152. The first three variables deal with the degree to which military expenditures have been identified, the degree to which principles have been specified for the valuation of military expenditure with regard to prevailing price- and cost-estimating practices in different States and the degree to which provisions have been made for expressing military expenditures, taking into account the different rates of price increases.

153. On the one hand, there may be an agreement in which none or very few, of these variables are specified. On the other hand, there may be agreements which provide for detailed methods or principles for identifying, valuing and expressing military expenditures.

154. In the first case, one may conceive of a type of agreement that only in very general terms calls for reductions in percentage terms or in absolute figures relative to a previous year's figures. The agreement would nevertheless be of a very incomplete nature since it would leave ample room for different interpretations of what could be expected from the parties in the matter of compliance with its stipulations. This, in turn, implies that the verification of such an agreement would be very difficult or practically impossible since, under such an agreement, it would not be clear what would have to be verified.

155. In the second case, there could be quite another type of agreement providing accepted methods for defining, evaluating and expressing military expenditures in real terms. Such an agreement would not by itself solve the problems of verification but would at least provide a realistic basis on which different methods and measures of verification could apply.

156. A limitation of this type, in the course of its negotiation and implementation, could be expected to elicit a large amount of information on national military expenditure accounting practices. The provision that limits be set in standardized terms would necessitate an examination of the relationship between current national practices and those standardized terms. Consequently, information on the scope and content of national military and other agency budgets, and on military pricing practices and their relationship to civilian pricing practices would be needed.

157. Such information would greatly facilitate verification but it would probably be insufficient for rigorous verification in any country. Assurance of compliance would require at least the ability to correlate military economic information with civilian and aggregate economic information. Networks of interrelated national, industrial and possibly regional economic data, such as input-output tables, might be very useful for verification. Such tables are now common in both market-oriented and planned economies.

158. In any country, a perfectly consistent set of statistical and accounting information would still need to be verified, at least to some extent, against physically observed information. Verification by national technical means could be used in some cases but it would probably not be sufficient.

159. A third type of agreement could be defined by adding another variable, for instance, one that links RME with force limitations in physical terms. Any force limitation, whether on types of weapons systems, such as strategic weapons or on regional forces, or on types of forces, such as naval, tank, or air, could conceivably be associated with a similarly defined expenditure reduction. Such a linkage would have certain implications with regard to verification.

160. Much would depend on the manner in which physical limits would be specified. Thus, arrangements in which limits would be expressed in relatively gross terms, such as numbers of general-type weapons (ships, tanks, ICBM launchers), would tend to rely on presently available means of verification. If the limits specified detailed characteristics of the weapons in order to capture "qualitative" distinctions, additional means of verifying the limits might be called for, such as additional special-purpose national technical means or on-site inspection. In this event, the verifiability of a related agreement on RME could be considerably enhanced as a consequence of the linkage.

161. Regardless of the level of detail and sophistication in which a physical limit may be specified, there would always be a disparity in concept between a physical limitation and expenditure reduction on the "same" object. This is due to the fact that physical limits in practical terms can apply only to major items of cost (for example, large weapons deployed or procured, military installations, military manpower). Expenditures, on the other hand, would cover all costs related to that object, including maintenance and operating costs after deployment, as well as development, testing or other costs before procurement. Such costs need not be closely related to deployment data alone. Therefore, even if the latter were verifiable with high confidence, associated expenditures need not be. Furthermore, even relatively detailed specifications on "qualitative" characteristics of weapons would leave considerable room for cost-affecting variance in such qualities as "gold-plating", ruggedness, reliability and ease of maintenance or operation.

162. Physical limitations that extend beyond deployment to cover the production of, for example, a major weapons system would enhance verifiability of a related expenditure to the extent that the physical limitation provided for additional verification means. If it did not, of course, the RME verifiability would not be improved.

163. Thus, whether and how linkage to a physical force limitation arrangement would affect the verifiability of a concomitant expenditure reduction would depend on the nature of the physical limits and the additional verification means it would bring about. It should be kept in mind, however, that, regardless of the verifiability of an expenditure reduction associated with one or several physical force limitations, the net effect of the expenditure reduction on total military expenditures would still be verifiable only to the extent that all other military expenditures could be verified. As the number and scope of the physical limitations increased, of course, this qualification would diminish in importance.



D. Methods of verification

1. General methods of verification in existing or proposed agreements in the field of disarmament

164. A number of general methods of verification relevant to RME agreements can be identified.

These include (see working paper IV):

- (a) Inspection (general, selective, challenge);
- (b) Remote sensing (by national technical means or on-site means);
- (c) Complaint/consultation/co-operation procedures;
- (d) Commission or similar monitoring body established by treaty;
- (e) Exchange of information.

165. The inspection method covers a wide range of possibilities. General on-site inspection, which entails access to any spot in a country, would presumably afford sufficient access to records at various levels and to information in support of records to yield very high levels of confidence. However, this method is unlikely to be acceptable on grounds of excessive intrusiveness. 20/ The selective and challenge on-site inspection methods could not serve as a basic means, since the nature of RME verification necessarily involves consistency between declared expenditure data and sufficient other government and non-government financial and other economic data or records to provide sufficient assurances of compliance; these methods would not provide such data or records. However, selective or challenge on-site inspection could play a role in authenticating selected expenditure or economic data. It could also be taken to mean access to data and records only at selected points, such as local agencies and enterprises.

166. Remote sensing, primarily by national technical means, 21/ may play a significant role in authenticating selected economic data. Little is known, however, of the capabilities of this method to interface with economic-data verification methods. It does play a role in estimating quantities that are then married to price data to produce expenditure estimates by the so-called

---

20/ It was, however, incorporated in the draft Soviet treaty on general and complete disarmament in connexion with military expenditure reductions in the third stage (complete disarmament).

21/ These are remote sensors normally employed for intelligence gathering, mainly by the two largest military Powers, although an "International Satellite Monitoring Agency" has also been proposed.

"building-block method", discussed below. However, the lack of accuracy of this method is an important factor limiting its utility for verification purposes. The obligation not to obstruct the national technical means of the other party has appeared in treaties concerning strategic arms limitations. It is uncertain how such an obligation might be applied to an agreement dealing with expenditure data, but it conceivably could play an important role.

167. Consultation and co-operation procedures would be almost indispensable as auxiliary methods in verification. Such procedures could be helpful in the solution of problems arising from comparisons of data and records and could thus greatly facilitate effective verification. Commissions, councils or other bodies that might be set up under the agreement and given a role in monitoring it could help provide a similar function. In most cases, the effectiveness of such procedures would, of course, depend on the spirit of co-operation and the amount of information provided by the primary parties.

168. The above methods have appeared in some form in existing arms control and disarmament agreements. Other general methods that have been proposed include control posts or observer missions, so-called "collateral analysis" or literature survey for openly available information, and specially designed and agreed exchanges of information. Exchange of information is discussed in the next section. The concept of control posts or observers would seem to have little applicability here.

169. Collateral analysis could have sharply divergent applications, depending on the States involved. Sources of information may be relatively accessible in some countries, although the opposite may be the case in other countries, and the situation may change from time to time. In other words, sharp asymmetries might prevail among different States at a given time or between different times in the same country.

## 2. Proposed methods specific to reduction of military expenditures

170. Exchange of information relating to military expenditures under the conditions of an agreement on RME has often been suggested as a possible means of providing verification. This method, particularly in combination with literature surveillance, should provide high levels of assurance with regard to those countries that provide relatively abundant information, although very high levels might require additional means. In other countries, the opportunities for concealment might be so great that little assurance would be afforded without such a large expansion of the amount of information provided, both budgetary and non-budgetary, that intrusiveness limits would be strained. If sufficient information were made available, however, "financial checks of claimed reductions in military expenditures should, in principle, be possible and adequate". 22/

---

22/ F. D. Holzman, Financial Checks on Soviet Defense Expenditures  
(D. C. Heath and Company, 1975), p. 2.

171. Sampling of payment documents through the highly centralized banking system prevalent in some countries has been proposed as a means of verifying declared expenditure data with less intrusiveness. <sup>23/</sup> It would seem, however, that, although a relatively small random sample might suffice, it might be considered quite intrusive. Also, the possibility of payment flows that bypass the central bank would be difficult to verify, particularly since not only budgetary but non-budgetary payment instruments would probably need to be monitored.

172. Voluntary demonstration of compliance has been suggested as applicable to RME agreements. In one version of this method, teams of economic specialists on each side would marshal and present data so as to convince the other side of compliance. Since this approach would obviously require a co-operative response to scepticism on the part of one side, some assurance that such co-operation would be forthcoming would be provided by the threat of prompt abrogation of the agreement. <sup>24/</sup> Such an approach would depend on a high degree of credibility on the part of each team to its own side, unless the data were made generally available. Also, the prospect of quick abrogation would produce uncertainties and might be difficult to achieve politically once an agreement was concluded.

173. Current estimates based on available information are commonly made for States that officially release little or no information on military expenditures, and it is sometimes suggested that these are adequate for RME verification purposes. The main method of verification is the so-called "building-block" method, in which detailed estimates are made of the quantities of major physical inputs to armed forces in a given year. The estimates include men, weapons and equipment, construction and operating materials. The quantities are then priced, mainly in the estimating country's prices and currency, but, with the help of estimated conversion rates, in the domestic currency as well. The summation of these detailed costs provides an estimate of total and component expenditures. Such estimates could provide useful orders of magnitude, particularly in the other country's currency (where prices are known). The estimates in the domestic currency, because of inadequate knowledge of domestic prices and thus of appropriate conversion rates, are less reliable. Little verification benefit, therefore, can be expected from this approach.

174. Other estimates of military expenditures are also attempted from the limited economic information available, particularly for military hardware (from data on the machinery industry) and research and development. Together with rather arbitrary interpretations of the undefined official budget, estimates of total military expenditures can be derived. The general reliability of such estimates is probably not sufficient to provide any substantial verification capability, since censorship of the published information on which the estimates are based can easily frustrate the known methods of estimation.

---

<sup>23/</sup> Ibid., passim.

<sup>24/</sup> Wassily Leontief, "Cutting U.S. and Soviet Military Outlays", The New York Times, 24 March 1977.

### 3. Further developments

175. In order to further assess and develop capabilities for verifying agreements on RME, one approach deserving encouragement might be to organize, if possible, the joint examination of these questions in working groups or seminars made up of unofficial teams of specialists from potential RME negotiating States. Since RME verification methods are so dependent on the budgetary, financial and statistical accounting characteristics of the subject State, experts from the verified States are the most qualified to design a verification method applicable to that State. This involves the "demonstrated-compliance" approach, but some experience and confidence in the capabilities of that approach is needed before negotiation on RME takes place.

176. The capabilities of information from remote sensing by national or international means to interface with economic and financial data surrounding a potential agreement on RME deserves some attention. This might be accomplished by those States having such means.

177. It is apparent that improvements in the practices of States with respect to openness in military matters could do much to improve prospects for achieving capabilities to verify potential agreements. The broader and deeper use of the present standard reporting instrument would be such a step. At the same time, a stronger commitment to the goal of achieving an agreement on RME on the part of every State might provide greater incentives towards openness. The lack of commitment on the part of States undoubtedly is fed by the discouraging prospects for designing a feasible agreement on RME, particularly in its verification aspects. Thus, a kind of three-cornered impasse has existed. It is hoped that the newly instituted standardized reporting instrument will help provide the needed impetus for reaching agreement on mutually acceptable methods of verification.

### E. Conclusions

178. Reduction of military expenditures differs from most other disarmament measures in that it involves financial accounts and physical objects as well. Taking into account, inter alia, the existing differences in the price systems of different economies and the general difficulties involved in verifying national accounts, verification of RME would be possible only under an international agreement. The agreement, in addition to a clear definition of military expenditures and the way in which they are accounted for, should provide for both financial and physical information.

179. In practice, compliance with international agreements to reduce military expenditures cannot be exhaustively proven on scientific or objective grounds alone. Compliance must also be subject to political judgement by the parties on the basis of the best possible evidence available.

180. Provisions for verification satisfactory to all parties will have to be an integral part of any international agreement on the reduction of military expenditures.

181. As there can be no single measure of verification which would be sufficient, a set of different measures will be needed in order to ensure satisfactory verification.

182. The verification measures would need to apply both to physical units, such as the number of soldiers and tanks, and to economic indicators, such as the amount of different kinds of military expenditures and the prices and qualities for different military inputs.

183. Any party that considers itself to be in compliance with the stipulations of an agreement on RME, and which is concerned with the survival of the agreement, should be strongly motivated to furnish all information needed to assure other parties of its compliance. Thus, it could be expected that a party intending to comply would have an interest not only in obtaining sufficient information from the other parties but also in providing the necessary information for creating the mutual confidence without which any agreement of this kind would not be achievable or sustainable.

#### F. Perspectives

184. Any agreement on RME must be based on confidence and openness among the parties. The idea of maintaining and strengthening this confidence and openness should be a basic principle reflected not only in the agreement itself but in the behaviour of all parties.

185. Technical and other methods for assessing military efforts in physical terms shall have to be retained as providing a complementary means of verification.

186. Participating States should submit such economic and other information that would make it possible to verify their military expenditures. For instance, well-elaborated input-output tables would provide useful information for such verification.

187. Relevant information should be submitted periodically. Questions about the relevance, exhaustiveness and reliability of this information could be addressed by special consultative bodies of experts established by the parties for the purpose of studying and settling various questions that could arise concerning the implementation and fulfilment of an agreement on RME. Such bodies may need to request and obtain supplementary information from all parties. The process of verification is likely to require a great deal of consultation among the parties.

WORKING PAPERS

## INTRODUCTION

The following working papers have been prepared and submitted by members of the Group of Experts and, in certain cases, in collaboration with the Consultant. The members of the Group agreed that these papers represented a most valuable contribution to their work and felt that they would provide the readers of the report with useful supplementary information. Although these papers have been frequently cited in the report, they do not constitute a part of the report itself.

### WORKING PAPER I: QUANTITATIVE ASPECTS OF THE STATES' REPLIES

#### Preliminary notes

A. Examination of the degree of employment of the reporting instrument on military expenditures

B. Analysis of the distribution of information submitted by the States by means of the polarization indicator

C. Examination of the distribution of information submitted by the States by means of percentage

### WORKING PAPER II: INTERPRETATIONS OF BLANKS AND OTHER SYMBOLS

- A. Canada
- B. Finland
- C. United States of America
- D. Sweden
- E. Federal Republic of Germany
- F. New Zealand
- G. Sudan
- H. Austria
- I. Belgium
- J. Denmark
- K. Indonesia
- L. Italy
- M. Norway
- N. Mexico
- O. Turkey
- P. Netherlands

**WORKING PAPER III: INTERTEMPORAL AND INTERNATIONAL COMPARISONS**

**A. Intertemporal comparisons**

1. Meaning and suitability of using constant-price series for military expenditure
2. Actual practices on military expenditures
3. Price characteristics in the military sector
4. Technical aspects

**B. Comparisons between countries**

1. The general problem of international comparisons
2. The use of exchange rates
3. Purchasing-power parities (PPP)
  - (a) Principles of the method
  - (b) Bilateral methods
  - (c) Multilateral methods
  - (d) Suitability of the purchasing-power parity methods for making comparisons of military expenditure

Annex I to Working Paper III: Abbreviations

Annex II to Working Paper III: Glossary

**WORKING PAPER IV: WORKING TABLES ON VERIFICATION**

Table 1. Verification categorization

Table 2. Bilateral arms control agreements and relevant verification provisions

Table 3. Multilateral arms control agreements and relevant verification provisions



WORKING PAPER I

Quantitative aspects of States' replies

Preliminary notes

1. Two fundamental methods have been used to analyse the quantitative aspect of States' replies: the polarization indicator and the percentage indicator. The process by which those methods were utilized is presented in this working paper.

2. The symbols provided by the instructions of the reporting instrument were not always applied by the participating countries. In such cases, possible logical interpretations of the blanks and other symbols utilized by the reporting States have been given. Such interpretations have been provided in order to present a more meaningful picture of the replies analysed.

3. From the whole range of various possible types of quantitative analyses, the Panel considered three types that yield significant results:

(a) Analysis of the extent to which the States employed the reporting instrument on military expenditures;

(b) Analysis of the distribution of information supplied by the States with the matrix by means of the polarization indicator;

(c) Analysis of the distribution of information in percentage per columns and rows.

A. Examination of the degree of employment of the reporting instrument on military expenditures

4. The examination of the degree of employment of the reporting instrument on military expenditures is meant to ascertain to what extent the States employed the various items of the matrix.

5. The reporting instrument on military expenditures is structured to permit a detailed account of military expenditures. The matrix comprises 588 items which, theoretically, allow the reporting of as many data.

6. From the way the matrix was filled in (Table 1), the conclusion can be drawn that the 16 States employed between 0.68 per cent and 35.03 per cent of the items in the matrix to report determinate outlays (figures greater than zero). Nine States used up to 57.82 per cent of the items to indicate that certain military expenses do exist but data concerning them are not available. Half of the States used between 1.70 per cent and 26.19 per cent of the items, reporting nil or negligible outlays (less than the half of the unit employed). Nine of 16 States reported information regarding the non-existence of military expenditures using for this purpose between 4.42 per cent and 73.63 per cent of the items in the matrix. Fifteen States did not fill in between 1.87 and 99.31 per cent of the items.

Table 1. Amount and type of information on military expenditures reported by the States (according to the recommended matrix: 588 items)

State	Figures	...	..	0	Blanks
Austria	57 (9.69%)	-	-	-	531 (90.30%)
Belgium	135 (22.95%)	100 (17%)	32 (5.44%)	33 (5.61%)	288 (48.97%)
Canada	169 (28.74%)	1 (0.17%)	353 (60.03%)	10 (1.70%)	55 (9.35%)
Denmark	39 (6.63%)	-	-	-	549 (93.36%)
Finland	87 (14.79%)	24 (4.08%)	-	20 (3.40%)	457 (77.72%)
Germany, Federal Republic of	192 (32.65%)	55 (9.35%)	-	35 (5.95%)	306 (52.04%)
Indonesia	140 (23.80%)	91 (15.47%)	168 (28.57%)	147 (25.00%)	42 (7.14%)
Italy	128 (21.76%)	-	-	-	460 (78.23%)
Mexico	21 (3.57%)	-	84 (14.28%)	-	483 (82.14%)
Netherlands	144 (24.48%)	-	433 (73.63%)	-	11 (1.87%)
New Zealand	127 (21.59%)	-	-	-	461 (78.40%)
Norway	136 (23.12%)	14 (2.38%)	30 (5.10%)	48 (8.16%)	360 (61.22%)
Sudan	76 (12.92%)	40 (6.80%)	385 (65.47%)	-	87 (14.79%)
Sweden	206 (35.03%)	10 (1.70%)	218 (37.07%)	154 (26.19%)	-
Turkey	4 (0.68%)	-	-	-	584 (99.31%)
United States of America	101 (17.17%)	340 (57.82%)	26 (4.42%)	100 (17.00%)	21 (3.57%)
<b>TOTAL</b>	<b>1762 (18.72%)</b>	<b>675 (7.17%)</b>	<b>1729 (18.37%)</b>	<b>547 (5.81%)</b>	<b>4695 (49.90%)</b>

/...

7. The 16 States used the matrix in the following average percentages:

Information expressed in figures greater than zero .....	18.72 per cent
Information attesting to the existence of military expenditures but for which there are no available figures .....	7.17 per cent
Information indicating nil or negligible military expenditures (less than the half of the unit employed) ..	5.81 per cent
Information indicating the non-existence of military outlays .....	18.37 per cent
Blanks .....	49.90 per cent

B. Analysis of the distribution of information submitted by the States by means of the polarization indicator

8. The analysis of the distribution of information submitted by the States by means of the polarization indicator (P) is aimed at identifying the types of determinate outlays (expressed in figures greater than zero) for which most data are available. Attempts were made to ascertain the polarization of information relating to determinate military expenditures. Military expenditures have a special significance since it is on their grounds that certain investigations can be made with a view to starting negotiations for the reduction of the military budgets.

9. The polarization indicator (P) was created from the consideration that, in order to obtain a more comprehensive picture of information polarization within the matrix, it is useful to consider both the number of items used for reporting the respective information and the amount of information in a row or column.

10. The polarization indicator (P) was formulated so as to satisfy the following criteria:

- (a) To be synthetic and easy to calculate;
- (b) To express the number of items employed per column or per row;
- (c) To express the number of pieces of information submitted per column and per row;
- (d) To enable differentiations between columns or rows containing similar data.

11. On the basis of the above-mentioned criteria, the conclusion was reached that the polarization indicator P should be determined by multiplying the number of

items employed (per column or per row) by the number of pieces of information contained in the items employed:

$P = \text{number of items} \times \text{number of pieces of information.}$

12. The P indicator has the following characteristics:

- (a) It requires a single mathematic operation: multiplication;
- (b) It expresses the combined value of the number of items employed and the number of pieces of information supplied;
- (c) It permits differentiation in the case of close vlaues. For instance, 4 items x 5 pieces of information = 20; 3 items x 6 pieces of information = 18.

13. The analysis also resorted to the maximum polarization indicator (P maximum) 1/ and the medium polarization indicator (P medium). 2/

---

1/ The maximum polarization indicator (P maximum) for a row can be obtained by multiplying:

- (a) The items existing in a row (= 14) by
- (b) The number of maximum possible pieces of information in a row (14 x number of responding States).

$P \text{ maximum/row} = 14 \times (14 \times \text{number of respondents});$

The maximum polarization indicator for a column can be obtained by multiplying:

- (a) The items existing in a column (= 42) by
- (b) The number of maximum possible pieces of information in the column (42 x number of responding States).

$P \text{ maximum/column} = 42 \times (42 \times \text{number of respondents});$

P maximum/category of costs can be determined by multiplying:

- (a) The items existing in a row (= 14) by
- (b) The maximum possible number of pieces of information in a row (14 x number of responding States) and
- (c) The number of existing rows within the respective category.

$P \text{ maximum/category of costs} = 14 \times (14 \times \text{number of respondents}) \times \text{number of existing rows in a category.}$

2/ The average polarization indicator (P medium) for a category of costs can be obtained by summing up the polarization indicators (P) of all rows and dividing the sum by their number.

$$P \text{ medium} = \frac{P_1 + P_{1.1} \dots + P_{1.n}}{n}$$

14. The analysis of information distribution on types of forces (Table 2) revealed:

(a) Most available data concern the "Land forces (2)", whose polarization indicator (P) represents 39.79 per cent as compared to the maximum polarization indicator (P maximum). The fact seems quite natural, since this category of costs holds a great share in all armed forces;

(b) The second place is held, at closest values, by information polarization in two columns:

	P as compared to P maximum
"Naval forces (3)"	34.82%
"Air forces (4)"	31.46%

(c) Column "Central support administration and command" (merging columns 6 and 7), with P of 18.13 per cent as compared to P maximum, is ranked third;

(d) Column "Civil defence (14)", with P of 11.57 per cent of P maximum, comprises about one-third of the information in column "Land forces (2)";

(e) Little information is submitted in the columns "Other combat forces (5)", with P of 3.35 per cent as compared to P maximum; "Paramilitary forces (8)", with P of 6.47 per cent as compared to P maximum; "Military assistance (9, 10, 11)" with P of 0.86 per cent as compared to P maximum; "Undistributed (12)", with P of 2.30 per cent as compared to P maximum;

(f) No information is provided concerning the "Strategic forces (1)".

15. The analysis of the distribution of information for types of resource costs (rows) leads to the following conclusions (Table 3):

(a) Out of the three great categories of costs ("Operating costs", "Procurement and construction", "Research and development"), the greatest amount of information is submitted for "Operating costs". The average polarization indicator (P medium) for this category of costs is about three times greater than for the other two;

	P maximum	P employed	Average P employed	Share of P as compared to P maximum
1. Operating costs	34 496	8 550	777.27	24.78
2. Procurement and construction	84 672	7 082	262.29	8.36
3. Research and development	9 408	647	215.66	6.87

(b) When comparing the information polarization indicator (P) with the maximum polarization indicator (P maximum), the share of P ranges between 6.87 per cent (Research and development) and 24.78 per cent (Operating costs);

Table 2. Distribution of information provided by the States within the matrix using polarization indicator (distribution per column)

		Items used	Number of pieces of information	Polarization indicator	Share of P as compared to P maximum (percentage)
Strategic forces	(1)	0	0	0	0
Land forces	(2)	39	288	11 232	39.79
Naval forces	(3)	39	252	9 828	34.82
Air forces	(4)	37	240	8 880	31.46
Other combat forces	(5)	22	43	946	3.35
Central support administration and command	Support (6)	36	150	5 400	19.13
	Command (7)	31	156	4 836	17.13
Paramilitary forces	(8)	29	63	1 827	6.47
Military assistance	Home territory (9)	3	6	18	0.06
	Abroad (10)	11	29	319	1.13
	UN peace-keeping (11)	10	39	390	1.38
Undistributed	(12)	21	31	651	2.30
Total military expenditures (1-12)	(13)	42	366	15 372	54.46
Civil defence	(14)	33	99	3 267	11.57

Table 3. Distribution of information provided by the States within the matrix using polarization indicator (distribution per row)

	Items used	Number of pieces of information	Polarization indicator P	Share of P as compared to P maximum (percentage)	
1.	OPERATING COSTS	12	81	972	30.99
1.1	<u>Personnel</u>	12	101	1 212	38.64
1.1.1	Conscripts	11	49	539	17.18
1.1.2	Other military personnel, incl. reserves	12	62	744	23.72
1.1.3	Civilian personnel	9	71	639	20.37
1.2	<u>Operations and maintenance</u>	12	76	912	29.08
1.2.1	Materials for current use	12	78	936	29.84
1.2.2	Maintenance and repair	11	68	748	23.85
1.2.3	Purchased services	12	63	756	24.10
1.2.4	Rent costs	9	40	360	11.47
1.2.5	Other	12	61	732	23.34
2.	PROCUREMENT AND CONSTRUCTION	12	72	864	27.55
2.1	<u>Procurement</u>	11	73	803	25.60
2.1.1	Aircraft and engines	8	51	408	13.01
2.1.2	Missiles, incl. conv. warheads	4	12	48	1.53
2.1.3	Nuclear warheads and bombs	2	2	4	0.12
2.1.4	Ships and boats	6	26	156	4.97
2.1.5	Armoured vehicles	4	16	64	2.04
2.1.6	Artillery	5	19	95	3.02
2.1.7	Other ordnance and ground force weapons	7	20	140	4.46
2.1.8	Ammunition	8	44	352	11.22

Table 3. (continued)

	Items used	Number of pieces of information	Polarization indicator P	Share of P as compared to P maximum (percentage)	
2.1.9	Electronics and communications	10	49	490	15.62
2.1.10	Non-armoured vehicles	9	45	405	12.91
2.1.11	Other	10	49	490	15.62
2.2	<u>Construction</u>	12	76	912	29.08
2.2.1	Airbases, airfields	4	16	64	2.04
2.2.2	Missile sites	6	10	60	1.91
2.2.3	Naval bases and facilities	2	11	22	0.70
2.2.4	Electronics, etc.	7	22	154	4.91
2.2.5	Personnel facilities	8	31	248	7.90
2.2.6	Medical facilities	8	21	168	5.35
2.2.7	Training facilities	7	27	189	6.02
2.2.8	Warehouses, depots, etc.	8	28	224	7.14
2.2.9	Command and adm. facilities	7	20	140	4.46
2.2.10	Fortifications	9	17	153	4.87
2.2.11	Shelters	3	8	24	0.76
2.2.12	Land	9	24	216	6.88
2.2.13	Other	7	27	189	6.02
3.	RESEARCH AND DEVELOPMENT	8	39	312	9.94
3.1	<u>Basic and applied research</u>	8	20	160	5.10
3.2.	<u>Development, testing and evaluation</u>	7	25	175	5.58
4.	TOTAL (1 + 2 + 3)	13	112	1 456	46.42



(c) As a direct result of the fact that, in several cases, data were provided only for the lower levels of aggregation and not for the higher ones of the respective group, row "1. Operating costs", which contains the total for the respective category, has a smaller polarization indicator than the subordinated row "1.1 Personnel". Likewise, the row expressing the total of the respective category "2. Procurement and construction" has a smaller polarization indicator than the subordinated row "2.2 Construction";

(d) For more than a half of the total rows within the matrix the information polarization is low. Out of a total of 42 rows, 22 have a polarization indicator below 10 per cent of the maximum polarization indicator. These provide details within various groups and subgroups of expenses, with the following distribution:

Procurement = 6

(2.1.2.; 2.1.3.; 2.1.4.; 2.1.5.; 2.1.6.; 2.1.7.).

Construction = 13

(2.2.1.; 2.2.2.; 2.2.3.; 2.2.4.; 2.2.5.; 2.2.6.; 2.2.7.; 2.2.8.;  
2.2.9.; 2.2.10.; 2.2.11.; 2.2.12.; 2.2.13.).

Research and development = 3

(3 ; 3.1.; 3.2.).

16. Since the 22 rows contained little significant information, it is evident that many of the responding States were not willing to provide thorough details concerning their military expenditures.

C. Examination of the distribution of information submitted by the States by means of percentage

17. The examination of the distribution of information submitted by the States by means of percentage was aimed at ascertaining the way in which the different types of information are polarized within the matrix.

18. The following types of information were taken into account:

(a) Information on determinate outlays (expressed in figures greater than zero);

(b) Information testifying to the existence of military expenditures (expressed in figures greater than zero and by the symbol three dots);

(c) Information attesting to the non-existence of military expenses (symbol two dots);

(d) Information which can be considered nil or negligible (symbol zero);

(e) Blanks.

19. Percentage (PC) as compared to the total amount of possible information in the respective column or row was calculated for each type of information. 3/

20. The analysis of information distribution by types of forces (columns) led to the following conclusions (Table 4):

(a) Column "Land forces (2)" contains most of the information (about 50 per cent) proving the existence of military expenditures ( $PC_1 = 42.85$ ,  $PC_2 = 51.33$ ), a relatively limited amount of other information on military outlays ( $PC_3 + PC_4 = 13.83$ ), as well as blanks in a ratio slightly over 34 per cent ( $PC_5 = 34.82$ ).

(b) Second place, at closest values, was held by two columns:

(i) Column "Naval forces (3)" contains information attesting to the existence of somewhat smaller military expenditures as compared with column "Land forces (2)" ( $PC_1 = 37.50$ ,  $PC_2 = 46.13$ ), the same ratio of other information on military expenditures ( $PC_3 + PC_4 = 13.68$ ) and over 40 per cent blanks ( $PC_5 = 40.17$ ).

(ii) Column "Air forces (4)" contains almost 10 per cent less information relating to the existence of military expenditures than does "Land forces (2)":  $PC_1 = 35.71$ ,  $PC_2 = 44.34$ , other slightly greater military expenditures ( $PC_3 + PC_4 = 15.16$ ) and over 40 per cent blanks ( $PC_5 = 40.47$ ).

(c) Information distribution for the three columns "Land forces (2)", "Naval forces (3)" and "Air forces (4)" is part of a qualitatively higher structure as compared with the other columns. These columns contain about 45-50 per cent of the information attesting to the existence of military expenditures, about 15 per cent of other information on military expenditures and about 35-40 per cent blanks.

(d) Column "Central support administration and command" (a merger of columns 6 and 7) ranks third. Information on military expenditures is 20 per cent less than in "Land forces (2)" ( $PC_1 = 22.76$ ,  $PC_2 = 34.22$ ), other information concerning military outlays amounts to slightly over 20 per cent ( $PC_3 + PC_4 = 22.60$ ), while there are about 43 per cent blanks  $PC_5 = 43.14$ ).

---

3/  $PC_1$  = percentage of information on determinate military expenditures (expressed in figures greater than zero);

$PC_2$  = percentage of information attesting to the existence of military expenditures (expressed in figures greater than zero and by three dots);

$PC_3$  = percentage of information indicating the non-existence of military outlays (two dots);

$PC_4$  = percentage of information considered nil or negligible;

$PC_5$  = percentage of blanks.

Table 4. Distribution of information provided by the States, keeping in mind the usage percentage per column

	Figures										
	Figures greater than zero		Figures greater than zero and Three points		Two points		Zero		Blanks		
	Data	% PC <sub>1</sub>	Data	% PC <sub>2</sub>	Data	% PC <sub>3</sub>	Data	% PC <sub>4</sub>	Data	% PC <sub>5</sub>	
Strategic forces	(1)	0	0	45	6.69	215	31.99	4	0.59	408	60.71
Land forces	(2)	288	42.85	345	51.33	50	7.44	43	6.39	234	34.82
Naval forces	(3)	252	37.50	310	46.13	44	6.54	48	7.14	270	40.17
Air forces	(4)	240	35.71	298	44.34	51	7.58	51	7.58	272	40.47
Other combat forces	(5)	43	6.39	79	11.75	195	29.01	6	0.89	392	58.33
Central support administration and command	(6)	150	22.32	228	33.92	69	10.26	64	9.52	311	46.27
Paramilitary forces	(7)	156	23.21	232	34.52	94	13.98	77	11.45	269	40.02
Military	(8)	63	9.37	112	16.66	169	25.14	31	4.61	360	53.57
Assistance	(9)	6	0.89	8	1.19	221	32.88	45	6.69	398	59.22
UN peace-keeping	(10)	29	4.31	73	10.86	253	37.64	11	1.63	335	49.85
Undistributed	(11)	39	5.80	125	18.60	159	23.66	41	6.10	347	51.63
Total military expenditures (1-12)	(12)	31	4.61	31	4.61	85	12.64	76	11.30	480	71.42
Civil defence	(13)	366	54.46	405	60.26	39	5.80	19	2.82	209	31.10
	(14)	99	14.73	146	21.72	85	12.64	31	4.61	410	61.01

(e) Within the column "Civil defence (14)", information testifying to the existence of military expenditures amounted to about 20 per cent ( $PC_1 = 14.73$ ,  $PC_2 = 21.72$ ), other information on military expenditures amounts to below 20 per cent ( $PC_3 + PC_4 = 17.25$ ), while blanks amount to over 60 per cent ( $PC_5 = 61.01$ ).

(f) Columns "Other combat forces (5)" and "Paramilitary forces (8)" contain up to 15 per cent of the information relating to the existence of military expenditures ( $PC_1 = 6.39$  and  $9.37$ ,  $PC_2 = 11.75$  and  $16.66$ ), almost 30 per cent of other information on military expenditures ( $PC_3 + PC_4 = 29.90$  and  $29.75$ ) and over 50 per cent blanks ( $PC_5 = 58.33$  and  $53.57$ ).

(g) Column "Undistributed (12)" includes less than 5 per cent of the information attesting to the existence of military expenditures ( $PC_1 = 4.61$ ,  $PC_2 = 4.61$ ), while the amount of other information on military expenditures amounts to 25 per cent ( $PC_3 + PC_4 = 23.94$ ) and blanks represent 70 per cent ( $PC_5 = 71.42$ ).

(h) Within the column "Strategic forces (1)", no information concerning determinate military expenditures (expressed in figures greater than zero) was recorded. Only data indicating the existence of military expenditures was supplied; however no value was assigned ( $PC_2 = 6.69$ ). The column also contained information on the non-existence of some military expenditures ( $PC_3 = 31.99$ ), which can be accounted for by the fact that 15 out of the 16 States reporting their military expenditures do not possess strategic forces. The number of blanks was quite high, amounting to almost 60 per cent ( $PC_5 = 60.71$ ).

21. When comparing the results of the analyses by means of the polarization indicator (P) and percentage (PC), it becomes clear that both types of analyses record a better information distribution for columns "Land forces (2)", "Naval forces (3)" and "Air forces (4)", which indicates that the most important data on military expenditures are available for these categories of forces.

22. Information distribution is less relevant for columns "Other combat forces (5)", "Central support administration and command (6, 7)", "Paramilitary forces (8)", "Military assistance (9, 10, 11)" and "Civil defence (14)", while it is wholly irrelevant for column "Strategic forces (1)".

23. Taking into account the special significance of information concerning determinate military expenditures (figures greater than zero), a parallel ascertained by means of the two types of analyses, was drawn between their distribution (Table 5). The following conclusions may be noted:

(a) In 13 out of the 14 columns, the two P and PC indicators have close values, with difference ranging to 5 per cent;

(b) For "Total military expenditures (13)", values are identical;

(c) The greatest amount of information was submitted for columns "Land forces (2)", "Naval forces (3)", "Air forces (4)";

Table 5. Distribution of information (figures greater than zero) within the the matrix using polarization indicator and percentage per column

			Share of P as compared to P maximum (percentage)	Figures greater than zero (percentage)
Strategic forces		(1)	0	0
Land forces		(2)	39.79	42.85
Naval forces		(3)	34.82	37.50
Air forces		(4)	31.46	35.71
Other combat forces		(5)	3.35	6.39
Central support	Support	(6)	19.13	22.32
administration and command	Command	(7)	17.13	23.21
Paramilitary forces		(8)	6.47	9.37
Military assistance	Home territory	(9)	0.06	0.89
	Abroad	(10)	1.13	4.31
	UN Peace-keeping	(11)	1.38	5.80
Undistributed		(12)	2.30	4.61
Total military expenditures (1-12)		(13)	54.46	54.46
Civil defence		(14)	11.57	14.73

(d) Except for column "Total military expenditures (13)", where the amount of information submitted on determinate military expenditures is 54.56 per cent, the other columns contain less than 50 per cent of all possible information, and in certain columns values are as low as zero per cent.

24. The analysis of information distribution by types of resource costs (rows) has led to the following conclusions (Table 6):

(a) The use of average percentages of information distribution within the three important categories of costs reveals an information diffusion structure with particular characteristics for each separate category:

	<u>Average percentages</u>				
	PC <sub>1</sub>	PC <sub>2</sub>	PC <sub>3</sub>	PC <sub>4</sub>	PC <sub>5</sub>
1. Operating Costs	30.43	36.20	15.13	2.84	45.81
2. Procurement and construction	13.49	21.23	19.49	7.07	52.19
3. Research and development	12.50	20.53	22.47	6.69	50.29

(b) This analysis shows that the row "Operating costs" has a better information distribution than the other two categories: it contains almost 35 per cent of the information attesting to the existence of military expenditures (PC<sub>1</sub> = 30.43, PC<sub>2</sub> = 36.20) and almost 20 per cent of other information on military expenditures (PC<sub>3</sub> + PC<sub>4</sub> = 17.97) and 45 per cent blanks (PC<sub>5</sub> = 45.81);

(c) With the other two categories of costs, rows "Procurement and construction" and "Research and development", the amount of information affirming the existence of military expenditures is 10-15 per cent less than in "Operating costs", amounting to values of about 20 per cent (PC<sub>2</sub> = 21.23 and 20.53). On the other hand, the amount of other information on military expenditures is greater and reaches almost 30 per cent (PC<sub>3</sub> + PC<sub>4</sub> = 26.56 and 29.16), while blanks exceed 50 per cent (PC<sub>5</sub> = 52.19 and 50.29);

(d) As a direct result of the fact that, in certain cases, information was submitted only for lower levels of aggregation and not for the higher level of the respective group, in rows "1. Operating costs" and "2. Procurement and construction" the amount of information concerning determinate military expenditures (expressed in figures greater than zero) is smaller than that contained in the subordinated rows "1.1 Personnel" and "2.1 Procurement", respectively.

25. When examining the amounts of determinate military expenditures (expressed in figures greater than zero) in the 41 rows of the matrix (except the row containing the total) it is clear that they represent under 50 per cent, which may be demonstrated as follows:

Number of rows and percentages as compared to the total (41)	The value of percentage PC <sub>1</sub>
1 row (2.43%)	50-40%
8 rows (19.51%)	40-30%
8 rows (19.51%)	30-20%
10 rows (24.39%)	20-10%
14 rows (34.14%)	under 10%

26. Comparison of results achieved by employing the polarization indicator (P) and percentage (PC) reveals that, although differences sometimes amount to 10 per cent (Table 7), similar tendencies in the distribution of determinate military expenditures exist within the three groups of costs. When the value criterion is under 10 per cent, the presence of information in 14 rows appears insignificant when percentage (PC) is used. When the polarization indicator is used, all 14 rows established by means of PC are included in this category, to which another 8 may be added, resulting in a total of 22.

27. The two types of analyses (by means of P and PC) indicate that the States tended to submit less detailed accounts of their military expenditures as regards groups "2. Procurement and construction" and "3. Research and development".

Table 6. Distribution of information provided by the States,  
keeping in mind the usage percentage per row

	Figures greater than zero		Figures greater than zero and three points		Two points		Zero		Blanks	
	Data	% PC <sub>1</sub>	Data	% PC <sub>2</sub>	Data	% PC <sub>3</sub>	Data	% PC <sub>4</sub>	Data	% PC <sub>5</sub>
1. OPERATING COSTS	81	36.16	95	42.41	33	14.73	7	3.12	89	39.73
1.1 <u>Personnel</u>	101	45.08	107	47.76	31	13.83	4	1.78	82	36.60
1.1.1 Conscripts	49	21.87	52	23.21	47	20.98	7	3.12	118	52.67
1.1.2 Other military personnel, incl. reserves	62	27.67	71	31.69	37	16.51	13	5.80	103	45.98
1.1.3 Civilian personnel	71	31.69	78	34.82	31	13.83	7	3.12	108	48.21
1.2 <u>Operations and maintenance</u>	76	33.92	82	36.60	32	14.28	3	1.33	107	47.76
1.2.1 Materials for current use	78	34.82	95	42.41	31	13.83	4	1.78	94	41.96
1.2.2 Maintenance and repair	68	30.35	85	37.94	32	14.28	4	1.78	103	45.98
1.2.3 Purchased services	63	28.12	80	35.71	31	13.83	4	1.78	109	48.66
1.2.4 Rent costs	40	17.85	64	28.57	37	16.51	9	4.01	114	50.89
1.2.5 Other	61	27.23	83	37.05	31	13.83	8	3.57	102	45.53
2. PROCUREMENT AND CONSTRUCTION	72	32.14	86	38.39	39	17.41	8	3.57	91	40.62
2.1 <u>Procurement</u>	73	32.58	82	36.60	33	14.73	8	3.57	101	45.08
2.1.1 Aircraft and engines	51	22.76	62	27.67	40	17.85	16	7.14	106	47.32
2.1.2 Missiles, incl. conv. warheads	12	5.35	26	11.60	46	20.53	26	11.60	126	56.25
2.1.3 Nuclear warheads and bombs	2	0.89	27	12.05	58	25.89	14	6.25	125	55.80
2.1.4 Ships and boats	26	11.60	44	19.64	42	18.75	18	8.03	120	53.57
2.1.5 Armoured vehicles	16	7.14	35	15.62	41	18.30	24	10.71	124	55.35
2.1.6 Artillery	19	8.48	32	14.28	52	23.21	15	6.69	125	55.80
2.1.7 Other ordnance and ground force weapons	20	8.92	45	20.08	44	19.64	14	6.25	121	54.01
2.1.8 Ammunition	44	19.64	56	25.00	38	16.96	20	8.92	110	49.10
2.1.9 Electronics and communications	49	21.87	60	26.78	45	20.08	9	4.01	110	49.10

/...



Table 6. (continued)

	Figures greater than zero		Figures greater than zero and three points		Two points		Zero		Blanks	
	Data	% PC <sub>1</sub>	Data	% PC <sub>2</sub>	Data	% PC <sub>3</sub>	Data	% PC <sub>4</sub>	Data	% PC <sub>5</sub>
2.1.10 Non-armoured vehicles	45	20.08	59	26.33	37	16.51	16	7.14	112	50.00
2.1.11 Other	49	21.87	65	29.01	39	17.41	11	4.91	109	48.66
2.2 <u>Construction</u>	76	33.92	82	36.60	34	15.17	12	5.35	96	42.85
2.2.1 Airbases, airfields	16	7.14	37	16.51	47	20.98	20	8.92	120	53.57
2.2.2 Missile sites	10	4.46	25	11.16	49	21.87	27	12.05	123	54.91
2.2.3 Naval bases and facilities	11	4.91	32	14.28	47	20.98	23	10.26	122	54.46
2.2.4 Electronics, etc.	22	9.82	37	16.51	45	20.08	21	9.37	121	54.01
2.2.5 Personnel facilities	31	13.83	52	23.21	43	19.19	12	5.35	117	52.23
2.2.6 Medical facilities	21	9.37	36	16.07	46	20.53	20	8.92	122	54.46
2.2.7 Training facilities	27	12.05	48	21.42	44	19.64	11	4.91	121	54.01
2.2.8 Warehouses, depots, etc.	28	12.50	43	19.19	49	21.87	12	5.35	120	53.57
2.2.9 Command and adm. facilities	20	8.92	41	18.30	46	20.53	13	5.80	124	55.35
2.2.10 Fortifications	17	7.58	42	18.75	49	21.87	11	4.91	122	54.46
2.2.11 Shelters	8	3.57	34	15.17	47	20.98	21	9.37	122	54.46
2.2.12 Land	24	10.71	49	21.87	45	20.08	13	5.80	117	52.23
2.2.13 Other	27	12.05	47	20.98	34	15.17	13	5.80	130	58.03
3. RESEARCH AND DEVELOPMENT	39	17.41	61	27.23	49	21.87	18	8.03	96	42.85
3.1 <u>Basic and applied research</u>	20	8.92	35	15.62	52	23.21	14	6.25	123	54.91
3.2 <u>Development, testing and evaluation</u>	25	11.16	42	18.75	50	22.32	13	5.80	119	53.12
4. TOTAL (1 + 2 + 3)	112	50.00	123	54.91	26	11.60	4	1.78	71	31.69

/...

Table 7. Distribution of information (figures greater than zero) within the matrix using polarization indicator and percentage (per row)

	Share of P as compared to P maximum (percentage)	Figures greater than zero (percentage)
OPERATING COSTS	30.99	36.16
<u>Personnel</u>	38.64	45.08
.1 Conscripts	17.18	21.87
.2 Other military personnel, including reserves	23.72	27.67
.3 Civilian personnel	20.37	31.69
<u>Operations and maintenance</u>	29.08	33.92
.1 Materials for current use	29.84	34.82
.2 Maintenance and repair	23.85	30.35
.3 Purchased services	24.10	28.12
.4 Rent costs	11.47	17.85
.5 Other	23.34	27.23
PROCUREMENT AND CONSTRUCTION	27.55	32.14
<u>Procurement</u>	25.60	32.58
.1 Aircraft and engines	13.01	22.76
.2 Missiles, including conv. warheads	1.53	5.35
.3 Nuclear warheads and bombs	0.12	0.89
.4 Ships and boats	4.97	11.60
.5 Armoured vehicles	2.04	7.14
.6 Artillery	3.02	8.48

Table 7. (continued)

	Share of P as compared to P maximum (percentage)	Figures greater than zero (percentage)
2.1.7 Other ordnance and ground force weapons	4.46	8.92
2.1.8 Ammunition	11.22	19.64
2.1.9 Electronics and communications	15.62	21.87
2.1.10 Non-armoured vehicles	12.91	20.08
2.1.11 Other	15.62	21.87
2.2 <u>Construction</u>	29.08	33.92
2.2.1 Airbases, airfields	2.04	7.14
2.2.2 Missile sites	1.91	4.46
2.2.3 Naval bases and facilities	0.70	4.91
2.2.4 Electronics, etc.	4.91	9.82
2.2.5 Personnel facilities	7.90	13.83
2.2.6 Medical facilities	5.35	9.37
2.2.7 Training facilities	6.02	12.05
2.2.8 Warehouses, depots, etc.	7.14	12.50
2.2.9 Command and adm. facilities	4.46	8.92
2.2.10 Fortifications	4.87	7.58
2.2.11 Shelters	0.76	3.57
2.2.12 Land	6.88	10.71
2.2.13 Other	6.02	12.05

Table 7. (continued)

	Share of P as compared to P maximum (percentage)	Figures greater than zero (percentage)
3. RESEARCH AND DEVELOPMENT	9.94	17.41
3.1 <u>Basic and applied research</u>	5.10	8.92
3.2 <u>Development, testing and evaluation</u>	5.58	11.16
4. TOTAL (1 + 2 + 3)	46.42	50.00

Number of rows and percentages as compared to the total (41)	The value of percentage PC <sub>1</sub>
1 row (2.43%)	50-40%
8 rows (19.51%)	40-30%
8 rows (19.51%)	30-20%
10 rows (24.39%)	20-10%
14 rows (34.14%)	under 10%

26. Comparison of results achieved by employing the polarization indicator (P) and percentage (PC) reveals that, although differences sometimes amount to 10 per cent (table 7), similar tendencies in the distribution of determinate military expenditures exist within the three groups of costs. When the value criterion is under 10 per cent the presence of information in 14 rows appears insignificant when percentage (PC) is used. When the polarization indicator is used, all 14 rows established by means of PC are included in this category, to which another 8 may be added, resulting in a total of 22.

27. The two types of analyses (by means of P and PC) indicate that the States tended to submit less detailed accounts of their military expenditures as regards groups "2. Procurement and construction" and "3. Research and development".

[Original: English]

WORKING PAPER II

Interpretation of blanks and other symbols

The intended meaning of blanks and other symbols can be logically interpreted as figures, "zero", "not available" or "not applicable". Reporting States should be encouraged to use the recommended symbols.

A. Canada

We use ... (three dots) for Canada's responses to columns 2, 3, 4 and 6 for "Research and development" because the two dots used are not correct.

B. Finland

1. For the columns "Strategic forces", "Home Territory" and "Abroad", the blanks are interpreted as zero because the total equals zero.

2. For "Land forces", "Naval forces", "Air forces", "Other combat forces", "Support" and "Command", the blanks are interpreted as ... (three dots) because the subtotal indicates ... (three dots).

3. For the column "Command", the line "Conscripts" equals zero and one of the two following lines equals three dots. The other blanks for "Operating costs" equal zero. The other cells of this column for "Procurement and construction" are interpreted as ... (three dots).

4. For paramilitary forces, the blanks for "Operating costs" equal zero.

5. For "Procurement", when there are no figures and no zeros, we interpret the blanks as three dots.

6. For "Construction", lines 2.2.1, 2.2.2, 2.2.3, 2.2.10, 2.2.11, 2.2.12 and 2.2.13 equal zero. The other lines equal three dots. The same interpretation must be made for "United Nations peace-keeping".

7. For "Civil defence", the blanks equal zero.

C. United States of America

All the blanks are interpreted as information not available (three dots).

D. Sweden

No blanks.

/...

E. Federal Republic of Germany

1. Blanks for "Strategic forces" and "Other combat forces" are interpreted as zero.
2. Blanks for "Paramilitary forces", "Military assistance" and "Civil defence" equal zero.
3. Blanks for total military expenditures are interpreted as three dots when three dots are in lines, and as two dots when two dots are in lines.

F. New Zealand

1. For "Strategic forces", blanks are interpreted as two dots.
2. For "Land forces", the total indicates that the blanks are equal to zero. The same interpretation must be made for "Naval forces", "Air forces", "Command", "Abroad", "United Nations peace-keeping" and "Total".
3. For "Other combat forces", "Support", "Paramilitary forces" and "Home territory", the line "Total" indicates that the blanks are equal to zero.
4. For "Civil defence", the blanks have no clear interpretation.

G. Sudan

For Sudan, blanks often mean zero. This is the case in columns 2, 3 and 4, for instance. For column 13, blanks equal three dots. We can obtain, in column 13, the figure of "Procurement and construction" by subtraction.

H. Austria

1. The subtotal of the reported resource costs and the total of military expenditures were indicated, although there appeared to be some miscalculation in the total amount.
2. The blanks for "Strategic forces", "Naval forces" and "Other combat forces" are interpreted as .. (two dots).
3. From an assessment of the reported total amount, the blanks for "Support", "Paramilitary forces" and "Military assistance" are interpreted either as zero or .. (two dots).
4. "Air forces" expenditures were included in "Land forces", thus the blanks are interpreted as ... (three dots).
5. Some blanks where figures were reported for lower aggregates are interpreted as ... (actually a figure for the total sum of the subaggregates).

I. Belgium

1. For "Strategic forces", blanks were apparently .. (two dots).
2. Where lower aggregate figures were reported, the blanks are interpreted as ... (three dots).
3. "Other combat forces" can be interpreted as .. (two dots).
4. For "Civil defence", the blanks give no information whatsoever.

J. Denmark

1. There appears to be a miscalculation for "Support", but the "Total" seems to justify the reported figures.
2. For "Strategic forces", "Other combat forces" and "Paramilitary forces", the blanks are interpreted as .. (two dots).
3. Blanks for resource costs where the lower aggregates are reported can be interpreted as ... (three dots).
4. For "Research and development", the blanks are actually zero if calculated from the total expenditures reported.
5. For "Civil defence", the blanks can only be interpreted as no information.

K. Indonesia

Blanks occur only in the column "Undistributed" and can be interpreted as zero.

L. Italy

1. For "Strategic forces", blanks should be interpreted as .. (two dots).
2. For columns 2, 8 and 13, five blanks can be filled in with figures and 13 out of 18 blanks should be interpreted as ... (three dots). Five blanks (1, 1.2, 2, 2.1, 3) are cells for subtotals for which detailed figures are available. (Note: The row "1.1 Personnel" should be for subtotal cells, which is not the case with the Italian matrix.)
3. Thirteen blanks are cells for detailed figures of "2.2 Construction" and should be interpreted as ... (three dots) because we have figures for the subtotals.
4. For columns 9, 10 and 11, blanks should be interpreted as .. (two dots).
5. For column "Civil defence", we cannot decide whether blanks mean .. (two dots) or ... (three dots).
6. The symbol - is used and should be interpreted as .. (two dots). (For example, "Nuclear warheads and bombs" and "Ships and boats" for "Land forces".)

M. Norway

1. For columns 1 and 8, blanks should be interpreted as .. because the totals of these columns indicate .. (two dots).
2. For columns 5 and 14, blanks should be interpreted as ... because the totals of these columns indicate ... (three dots).
3. For columns 2, 3 and 4, blanks for rows 1.2.3 and 1.2.4 may be interpreted as .. or ... and blanks for rows 3.1 and 3.2 should be interpreted as ... because we have the figure for subtotals of these two cells.
4. For column 6, blanks may be interpreted as .. (two dots) or ... (three dots).
5. For column 7, blanks for rows 1.2.4 and 1.2.5 may be interpreted as .. or ..., blanks for rows 2.2.1 to 2.2.13 should be interpreted as zero and blanks for rows 3.1 and 3.2 should be interpreted as ... (three dots).
6. For columns 9 and 10, blanks for the rows 1 to 1.2.5 may be interpreted as .. or ..., blanks for rows 2.1.1 to 2.1.11 should be interpreted as zero and blanks for rows 3 and 3.2 should be interpreted as .. (two dots).
7. For column 11, blanks for the rows 1.2.4 and 1.2.5 may be interpreted as .. or ..., blanks for rows 2.1.1 to 2.2.13 should be interpreted as zero and blanks for rows 3 to 3.2 should be interpreted as .. (two dots).
8. For column 13, blanks for rows 1.2.4 and 1.2.5 may be interpreted as .. or ..., and blanks for rows 3.1 and 3.2 should be interpreted as ... (three dots).
9. There are figures below zero, which cannot be understood.

N. Mexico

The Mexican matrix contains too little information on military expenditures. It is therefore difficult to find suitable interpretations for the blanks because of the scarcity of data provided.

O. Turkey

Blanks are interpreted as ... (three dots).

P. Netherlands

Blanks are interpreted as zero.



Explanation of blanks

State	Blanks and other symbols	0	..	...	Figures	Blanks unexplained	Other symbols
Austria	490	0	337	63	0	90	0
Belgium	239	13	155	19	0	52	0
Canada	0	0	0	0	0	0	0
Denmark	506	45	172	247	0	42	43
Finland	439	269	114	56	0	0	0
Germany, Federal Republic of	251	170	76	5	0	0	0
Indonesia	0	0	0	0	0	0	0
Italy	279	0	93	104	40	42	139
Mexico	-	-	-	-	-	-	-
Netherlands	10	10	0	0	0	0	0
New Zealand	419	335	42	0	0	42	0
Norway	319	60	91	92	0	76	0
Sudan	85	77	0	7	1	0	0
Sweden	0	0	0	0	0	0	0
Turkey	538	0	0	538	0	0	0
United States of America	0	0	0	0	0	0	0
	3 575	979 (27%)	1 080 (30%)	1 131 (31.6%)	41 (1.1%)	344 (9.6%)	184

/...

[Original: English/French]

WORKING PAPER III

Intertemporal and international comparisons

A. Intertemporal comparisons

1. Recommendations have been issued by the United Nations Statistical Office for the development of data series in constant prices in the context of a system of national accounts. They cover all goods and services flows (gross product and imports) and their destinations or uses (intermediate consumption, private and government final consumption expenditure, gross fixed capital formation and exports), as well as value added and some of its cost components, that is, earnings of employees, indirect taxes and subsidies. The extent of approximation involved in the recommended data-compilation procedures for establishing price and quantity indexes varies considerably among the above-mentioned transaction categories and also among the economic activity groups (sectors) that are distinguished in a system of national accounts. The degree of approximation is particularly weak in the services sector, which embraces the production of government services, including the military services component in government final consumption expenditure and the military services contribution to gross national product (GNP). Although the recommendations of the United Nations Statistical Office can be used as a basis for the development of a method for comparisons of military expenditures over time, they are not sufficient with regard to the details required, since they were elaborated in the context of the broader system of national accounts.

2. This working paper will deal with comparisons over time within one country. However, it should be understood that there are some links with inter-country comparisons. Military expenditures, particularly in developing countries, often include imported military hardware, and the valuation of such equipment depends, among other things, on the use of exchange rates or other conversion factors in order to make the value of the imported items comparable to the value of domestic military goods and services. Also, if one uses the input approach to obtaining military expenditures in constant prices, different input structures of the production of military goods in different countries may affect the comparability of the constant-price series.

3. The meaning and suitability of using the constant-price series for military expenditures will be clearly explained in the next section. The second section will deal with the availability of price indexes in various countries and with the particular approximations that countries have adopted in arriving at constant-price series for military outlays. The third section analyses the characteristics of military expenditures that make constant-price estimation particularly difficult. The fourth section explains the technical aspects of this problem and indicates to what extent the index numbers accommodate the special characteristics of these expenditures when the indexes are applied to the present information that is

available within the country and for the group of countries that have responded to the military expenditures questionnaire. Finally, the last section will present some conclusions and make recommendations that take into account the special characteristics of the military-expenditure data and index-number types and the experiences of the particular country.

1. Meaning and suitability of using constant-price series for military expenditures

4. The deflation of value data involves the effort to set aside the effect of changing price levels over time. Values expressed in current prices are deflated by an index of relative price change to obtain real estimates of those values. Usually, the means of measuring the effects of price changes on military spending are inadequate and the statistical literature contains no substantial discussion on the use of market-price changes or on the difficulties and the feasibility of finding new solutions to the problem of military-price measurement. However, three reasons can explain the desirability of deflating military expenditure data:

- (a) To make real changes in the size of the defence sector clear and intelligible;
- (b) To help make international comparisons of military efforts;
- (c) To appraise the impact of military outlays on the economies of all countries.

5. National security varies not only with the military expenditures of a nation but inversely with the effectiveness of adversaries' defence efforts. The price of national security is virtually impossible to calculate because it is impossible to define objectively and to measure accurately a unit of national security. Often, the quantity of military expenditures is thought of as a good indicator of national security, but there is no objective proof of this assumption, which involves many hypotheses, such as the rationality of military-spending decisions or constant and equal military productivity per dollar spent.

6. The "bang-for-a-buck" approach explains the specific purpose of each item of complex equipment or personnel services purchased. The unit of measurement may be the explosive power needed to destroy a specific target and the price is the outlay for the equipment and personnel needed to accomplish this task. This type of index is very difficult to construct. In military matters, prices are only indicators of the value of weapons because many inputs, such as transportation charges or maintenance capabilities, vary from country to country. Moreover, some military strengths, such as geographical situation or "troops' morale", are not accountable by economic indicators. The lack of objective means for measuring national security leads to the conclusion that estimating the value of the military output is not a practical possibility.

7. The reasoning that price trends for products in civilian markets behave in the same way as those for products in the military sector is an unsatisfactory hypothesis. However, in terms of expenditures, it can be said that there are

opportunity costs to each military item. The calculation is then an indication of the cost, in civilian terms, of military expenditures. However, this calculation is not very precise.

8. All military expenses are included in public consumption, except those that involve military construction works that can also be used for civilian purposes, such as roads and bridges. However, in the specific treatment of military expenses in which the aim is to arrive at a measurement of military security, it does not seem appropriate to treat all military expenses in the same manner. Outlays on military hardware add to the military capability of the country while current expenses and the payment of wages and salaries to military staff reflect payments to a military capability which already exists and should be maintained. In other words, the total of military expenses will certainly be a useful concept when it expresses the financial aspects of such outlays, but the constant-price series relating to that aggregate do not have any precise meaning.

9. The prerequisite for a good approximation of constant-price series is that a detailed classification of military expenditures be available, so that each category of outlays with particular problems can be separately identified. This implies that separate information is available on military hardware that is produced by the government and on military hardware that constitutes outside purchases of strategic systems. It also implies that imported military hardware is separated from domestically produced military hardware, and even that a distinction should be made between imported military hardware that is acquired under different purchase conditions. It is important that these distinctions be made between equipment items themselves, so that changes within categories can be dealt with as changes in quality, while the introduction of new items takes place in new categories that can be dealt with in different ways when estimating constant-price series.

## 2. Actual practices on military expenditures

10. Documentation on the method used in studying military expenditures in constant prices is not systematically collected and often, when it exists, is not published. Usually, four main groups are used to deflate military expenditures: earnings of employees, current expenditures on goods and services, gross fixed capital formation (except for buildings and other constructions) and buildings and other constructions. For the first group, military-sector employment indexes and wage/salary price indexes are used, whereas for the other groups the application of indexes calculated for the private economy is the principal way of deflating expenditures. This last method is justified only if price movements in the private sector are closely parallel to those of the military sector. This needs to be proved, not merely assumed. But these calculations are not precise and contain many weaknesses, such as lack of knowledge about changes in productivity and inadequate use of new technological goods in the items of the wholesale price index.

11. There is no satisfactory, clear-cut method for measuring real changes in public-sector expenditures. The use of the method of double deflation (which involves the simultaneous measurement of outputs and inputs at constant prices) is not applicable to the military sector. Sweden employs a mixed method which

consists of deflation of intermediate consumption and deflation of earnings of employees and consumption of fixed capital (normally included in value added). Canada establishes a deflator for "wage category" and "non-wage category", while Japan uses different deflators for current expenditures on goods and services and gross fixed capital formation and their various components (subaggregates). But information for all components of expenditures are not always available and often statisticians employ very detailed and sophisticated weighting systems on false or inadequate data.

12. Two methods of calculation of constant-price payment to employees are used: (a) a direct measurement of weighted quantities which avoids the need for a deflator and (b) an indirect approach which develops a wage/price index as deflator. Two principles are used: (a) the average output of employees is unchanging through time within an employment category and (b) the output of employees is measured by their earnings. Moreover, the application of price indexes based on the private economy is a usual way of deflating current-price expenditures on goods and services of governments, and gross fixed capital formation. These assumptions would need to be proved.

13. There are many methods of deflation specific to the military sector. For instance, for national accounting purposes Sweden evaluates military expenditures in constant prices. Payments to employees are extrapolated by employment index numbers based on hours worked. The price index for domestic supply is used for estimating the real values with regard to the procurement of military equipment and fuel consumption. The consumer price index is used for deflating other costs such as transportation charges, services and postal and telephone communications. In the United Kingdom, the Central Statistical Office calculates current military expenditures according to 11 components (or subaggregates). The price index which deflates expenditures for goods relates to the costs rather than to the prices of goods produced in the military sector, since it does not usually employ market price. For the different components of military expenditures, the Central Statistical Office employs several methods: index of a strength of armed forces (forces' pay), weighted index of wages and wage rates (civilian wages and salaries), price index for input costs of research and development, the retail price index (transport, maintenance and repairs of buildings), price index for costs of new construction, etc.

14. The Department of Defense of the United States and the Bureau of Economic Analysis research and produce measurements for estimating defence purchases in constant prices within the structure of NIPA (national income and product accounts). The steps used in constructing constant-price defence purchases are:

(a) Define work units. Work units group individual products and services into categories in order to reduce the number of price series necessary to provide adequate measurements of price change. The main criterion for this grouping is similarity of price movements.

(b) Specify concepts. Each category must specify prices, qualities and quantities.

(c) Select sample. Usually, selection on the basis of probabilities proportional to size is used because it leads to statistically unbiased estimates. The number of items necessary for a reliable estimate of price changes depends on the variance in price movement among items.

(d) Develop weightings. Expenditures data are appropriate "weights" for items purchased in a given time period, but for new products other "weights" or weightings must be selected.

(e) Select prices. In general, the transaction prices are used, but in the construction of price indexes it is essential that the data collected relate to the same specifications (or qualities) over time. Some adjustments are made for any changes in quality.

(f) Adjust for quality change. A quality change affects performance and costs. It is necessary to know if the change is a quality increase or decrease. The cost associated with the change must also be known.

The Bureau of Economic Analysis of the United States Department of Commerce calculates a deflator in the process of constructing constant-dollar series for the government sector of the National Accounts. At present, these data are available but are not published.

15. For the socialist countries, it is very difficult to know constant-price military expenditures because there are no publications on this subject and the notion of price is very different from that which exists in market economies. The concept of inflation is also very dissimilar. It seems very difficult to have an international agreement on theoretical approaches which are so different.

16. International organizations and institutes of research produce some results which are not adequate. NATO (North Atlantic Treaty Organization), for instance, hopes to standardize the selection of data and methods of construction employed by its member countries on price changes and estimation of real military expenditures. At present, two major deflators, personnel and non-personnel, are used and recommended. But NATO wants to establish first a six-deflator system, then a 27-deflator system. The Statistical Commission of the United Nations is developing proposals for an integrated system of price and quantity indexes, but it is building a general framework which has little information on military expenditures. The United States Arms Control and Disarmament Agency (USACDA) gives constant prices, a constant-dollar series using the GNP price index as a deflator. The International Institute for Strategic Studies and the Stockholm International Peace Research Institute also produce constant-price indexes, constant-dollar estimates, using the consumer price index of the countries concerned. These analyses provide some interesting data in opportunity-cost terms, but they cannot supply a satisfying estimate of the behaviour of the military efforts of the various countries. At present, few countries give information on their military outlays in constant prices and the methods used are not very sophisticated. Additional research should be done on the availability of particular price indexes in individual countries in order to judge the feasibility of an "approximate"

deflation, at the Centre for Disarmament, of the present statistical data series that have been obtained through the military expenditure questionnaire.

### 3. Price characteristics in the military sector

17. One of the characteristics of government services and, in particular, of the military services sector is that different levels of output are included among the military outlays of a government. These range from the inclusion of outside-purchased integrated military systems, via the outside purchase of individual military equipment items and military components, to the inclusion of all inputs in government expenses in which the production of military services (and also equipment) takes place. Obviously, the ultimate form of military output, that is, military security, is always produced in the government sector itself and the aforementioned expenditure items behave as if they were inputs for military security. The deflation of some military items is very difficult because they are subject to fast-changing technology.

18. Military goods are constantly changing in quality over time. This applies to the characteristics of missile systems, the strength of aircraft, naval vessels and submarines, etc. The military sector is the sector in which the problem of unique goods, well known in index-number theory, applies in its most extreme form. This means that the cost structure of military items constantly changes from one period to another, which makes the use of the input approach to calculating index numbers more problematic because of constantly changing weighting patterns. Base-year weightings will be sooner outdated than in other sectors. Usually, specialists too strongly resist the view that a new specification represents a new product, because of the possible loss of the necessary continuity of the series. There are no infallible signs to identify a new product, and the distinction between new goods and existing goods with new qualities becomes essential in this sector, but more difficult to establish. Quality adjustments must be made according to the criterion of added cost of the improvement rather than based on measurement of performance change. Ameliorations which are costless are ignored. The military-expenditure deflator is very difficult to construct because of changes in equipment use and performance over a limited period.

19. The measurement of military-expenditure price change offers some special problems: timing of the price decision, long-term contracts, transportation charges, inventory changes or introduction of new products. Another problem is the frequent occurrence of military outputs without a market price or without adequate market pricing. This, of course, relates to the ultimate output of military security, but it also applies to intermediate consumptions of military hardware and equipment. Many of these are especially designed for government purchasing agencies and never enter the market. If there is a price, it may not include all costs. For example, research and development are frequently excluded. Another problem arises where military goods are received as a transfer in kind or are only partly paid for by the country in the context of a military-assistance programme. Frequently, the recipient country does not have or has only very incomplete information regarding such goods. Then there is the question of military goods that are transferred under a loan agreement whereby the price of the goods not only covers their cost, but also includes the price of the credit. The timing of the

price decision is often crucial when there are large inventory holdings or rapid changes in inventory or when the production cycle is very long. The use of revolving funds must be minimized and it seems right to price items at the price at which they are bought by the government and to employ the resulting index to deflate funds of the same time period. Some long-term contracts determine prices and quantities bought over a considerable period of time. This may not pose a particular price problem if the amounts purchased at the various prices are known or available. Timing differences occur because purchases are largely recorded on a delivery basis, while outlays are recorded on a payment basis. Revolving funds consist of management funds (which concern financial transactions and make no purchases themselves), stock funds (which finance the acquisition of inventories of equipment for use in case of mobilization), industrial funds (which finance activities of an industrial or commercial nature, such as scientific research, operations of arsenals or printing) and trust funds (such as military sales to foreign countries, military assistance programmes). These funds must receive special analysis. The need to adjust inventory changes in terms of price changes arises, first, in order to establish inventory change values and, second, in order to determine the deflators of operations where the production cycle is very long (construction, missiles or shipbuilding). Finally, separate prices for items bought abroad (and separate weightings) must be established, even in the case of the indexes for countries where foreign purchases are not very important.

20. Many other problems arise in the calculation of constant-price military expenditures:

(a) Price data published by government services are often suspect. The credibility of this information - information which is expressive of a feeling - is, for our subject, very important.

(b) Contracting parties often indicate low prices to obtain contracts, and it is always difficult to know the exact cost of a long-term operation.

(c) Governments are often the major buyers and their purchases may be a cause of price rises.

(d) Research and development are very difficult to evaluate. Price indexes are both a technical and a political task. We must build up precise methods to measure price changes, but some methods give false information which is partial to the interpretation of governmental data. At present, the technical aspect is perhaps the most important one to resolve, but an agreement on the divulgence of information must include a verification process.

#### Technical aspects

21. A double choice must be made. First, the price index must be comparable with a defined-value concept: the price data must refer to expenditures or purchases. Second, the choice between indexes must be made for the different items decided on. Usually, the method used for measuring price changes is the same as that used for the consumer price index and the producer price index. The specification of the price determines the characteristics that influence the price of an item. For



instance, the quality of the material may be a price-determining or price-influencing characteristic but its colour may not. Because of changes in military needs, these characteristics do not remain constant and it is often difficult or impossible to price an item with a particular new specification. The implicit-price deflator (ratio of purchases in current dollars and purchases in constant dollars) is often used as an indicator of inflation. It is based on the Paasche formula and uses changing weightings which reflect the current basket of significant products. These choices must be made with representative groups of military expenditures.

22. The United Nations Statistical Office recommends dealing with military services in the context of public administration services and suggests using the input approach to the estimation of gross output in this sector. Should price measurements refer to the prices of the military output or to purchases? The type of price data and the index constructed are different, but the desired data are not always available. Purchase-price indexes differ from output indexes: incorporation in the price of transportation, tax, installation charges or special discounts. Usually the input approach is recommended, but it cannot show the economic and military efficiency of a purchase; it looks only to the cost. But prices of outputs are lacking and it seems conceptually feasible to combine purchase-price indexes as indicators. The input-price index, which measures changes in the price of units bought by a producer, seems much easier to obtain than an output index which measures changes in the output unit price of producers.

23. Several types of input-price indexes exist, namely, the standard index, the cost-price index, the modified cost-price index and the cost-of-living index:

(a) The standard index implies revaluing a basket of goods and services period by period. The implicit assumption that the quantities of goods produced are in fixed relative proportions reduces the credibility of this method as regards military expenditures.

(b) The cost-price indexes permit some substitutions in the price index when technology changes. The assumption is made that the outputs are in fixed proportions, but technological changes are taken into account.

(c) The modified cost-price index permits the substitution of the contribution of inputs to output. Instead of putting a new material into the index at no price change, an assumption is made on the cost reduction.

(d) The cost-of-living index deals with substitutions based on equivalent satisfaction or on the ability to identify a given defence goal. The use of indifference-curve analysis is employed to evaluate durability, performance and maintenance with respect to prices. That analysis is very difficult to make and is based on the contestable neoclassical theory.

The appropriate index must be based on the first three kinds of index, according to the availability of data and to the influence or the reducibility of the hypotheses used in the calculation.

24. The choice of the base period of the index must meet the following two requirements: (a) the year chosen should be relatively recent and (b) it should not be atypical. The weighting base period affects the percentage changes and determines the structure of the index for the period used. The weightings come from the budget values. They provide structure to the index and they define a broad sampling framework for the use and the intensity of the class of items selected for the index. The frequency of revision of the weightings must be determined on the basis of experience. The selection of products represented in the price index must strike a judicious balance between the cost of the availability of the data and the error allowable in the final result. The sampling problem is the same for civilian or military purposes, but in respect of the latter there are, in addition, many problems of availability of data. A great variety of index structures can be built, but it seems very judicious to use the matrix of our Group of Experts as a general framework for the establishment of a deflator for military expenditures.

25. Various formulae for price indexes exist. The major ones that are relevant for the deflation of current-value series or the extrapolation of base-year current values are the Paasche and Laspeyres price and quantity indexes. The Laspeyres price index and the Paasche quantity index are compatible in the sense that their product is a value index. The same applies to the Laspeyres quantity index and the Paasche price index. The Laspeyres index works with base-year price or quantity weightings whereas the Paasche index uses its weightings from the current period. The Laspeyres index "weights" are soon outdated, particularly in the area of military expenditures. This disadvantage can be mitigated, however, through the use of Laspeyres chain indexes with regularly updated weightings. Paasche indexes require annual updating of the weightings and therefore give detailed statistical information. The difference between the Laspeyres and Paasche indexes depends on the absolute size of the correlation between price changes and quantity changes. These two types of indexes are close to each other when such correlation is small. Harmonic indexes are used in order to integrate detailed indexes into an index for total outlay. Such indexes have values between the Paasche and Laspeyres indexes. Fisher's indexes are defined as the square root of the product of the Paasche index and the Laspeyres index and therefore the product of a Fisher's price index and a quantum index is compatible with a value index. Other formulations might be shown, such as the Edgeworth, Geary-Khamis or Iklé formulations. But the most practical methods for deflating military expenditures are the Laspeyres and Paasche indexes because they are more readily understood and the two forms complement each other. The construction of price or quantity indexes in both forms seems the best way but, if resources do not permit it, the use of the Paasche index when weighting data are available, and of the Laspeyres index when weighting data are not available, must be recommended.

26. Ideally, there should be a detailed classification of military expenses. Generally, however, the requirements of detail are not met in all respects, either when a country uses constant-price series for its particular military expenditures or in the data that are compiled through the military-budget questionnaire for the Group of Experts. The large number of items purchased by departments of defence makes it impossible to price all goods and services and so samples must be

constructed and selected. The United States Department of Commerce uses six categories: military personnel (active and retired military and civilian personnel), operation and maintenance, procurement (aircraft, ships, electronic and communication equipment, weapons, tactical and support vehicles, ammunition, missiles), research and development, military construction and family housing. The application of price indexes prepared for the private economy is the principal means of deflating expenditures for other goods and services in the military sector, but the studies of the United States Arms Control and Disarmament Agency expand on their application. For instance, the methods developed by the Bureau of Census in constructing price indexes for single-family houses and for apartment buildings are recommended for the estimation of similar products in the military sector. The pricing of missiles is an especially difficult task and for this purpose indexes are developed from comparable specifications of the machine-tool category of the Wholesale Price Index. The present report proposes six categories (personnel costs, procurement of equipment, construction, imports, research and development, and miscellaneous) and six deflators based essentially on the private economy. The greater availability of military data must reduce that analogic method. It is certainly possible to construct an input-price index for defence expenditures by using purchasing data of the developed Western countries but, with present information, it seems very difficult to establish this index for other countries. Two conditions must be fulfilled: (a) some countries must be helped because the cost of the information required is too high, and (b) a satisfactory political climate must be achieved in order to reduce the need for secrecy.

27. Military goods are constantly changing in quality over time, and the measurement of quality change is one of the most difficult aspects of constructing price indexes. The high technology of military goods produces quick changes and it is always difficult to show this evolution in an index. Performance/cost of production may be used; this assumes that a change in performance is a quality change and that the production cost is the appropriate value of the quality change, which must be analysed as the improvement of the service and the mission in the military field. The decorative paints of ships may be analysed as a quality change (camouflage), or they may not be so analysed. The valuation of the quality change is based on costs and not on usefulness. Two special cases of quality, that is, costless quality change and quality increase at decreasing cost, are not covered by this method. For the consumer, changes must contribute to the utility and efficiency of products. Many characteristics prevent the calculation from being satisfactory; for example, new and old models are not equally available on the same market, involuntary purchases and enforced substitutions exist, the information is not perfect and its cost is not negligible, the change of model is often an opportunity to increase prices, some change in the law (antipollution laws, for instance) modify the significance of the price changes and the price of military goods does not satisfy economically rational criteria. Methodology on quality adjustments refers alternatively to simple linkages, specific-cost-of-performance adjustments, regression analysis (by an attempt to disaggregate the price into several components of assigned quality) or other empirical analyses. When new goods include various changes in their characteristics, an effort can be made to break down the values and the price of these goods into the values and price of their components through regression, in order to make them comparable with the

earlier versions of the product. This method is at the basis of the hedonic price and quantum indexes. It may be a method that could be of particular use in representing military expenditures in constant prices, where frequent quality changes occur.

28. The procedures used in constructing information on constant-price military expenditures imply several steps, namely:

- (a) Definition of categories;
- (b) Specification of concepts;
- (c) Selection of samples;
- (d) Development of weightings;
- (e) Selection of prices;
- (f) Adjustment for quality changes.

This procedure is recommended by the United States Department of Commerce. It seems that it would be an excellent point of departure for our purpose.

## B. Comparisons between countries

### 1. The general problem of international comparisons

29. Economic comparisons between countries present one of the most difficult problems for economists. There are four essential reasons for this:

(a) Definitions and classifications of economic information and the extent to which this information is published differ widely from country to country, while the economic indicators for evaluating the functioning and efficiency of a country's economy also differ according to the economic system of the country concerned. A major international effort must therefore be made to find or develop common indicators.

(b) The exchange rates between the various currencies do not accurately reflect their relative purchasing power.

(c) The Statistical Offices of the various States publish only a certain amount of economic information. It is often quite difficult to verify the quantitative estimates of the aggregates, and many countries are not equipped with the statistical resources that would enable them to produce reliable results. For reasons of national security, much information on military matters is kept secret, and it is therefore often difficult to obtain information on the prices and quantities of the various weapons. Some strategies, such as deterrence, favour information retention.

(d) For comparisons to have meaning, it is necessary for them to be applied to areas where there is a common interpretation by the States. At the economic level, there is no international agreement on basic human needs and it is thus very difficult to compare the results of two different economies by using simple statistical figures which often express only the monetary sector of human activities. The same is true of military expenditures, which have meaning only in relation to the country that has to be protected and its own perception of danger. Thus, the comparisons are not always pertinent.

30. International economic comparisons are, however, of great use in studying the growth process and for determining international aid. What, then, are the conditions to be met in establishing such comparisons? Is it possible and meaningful to compare the purchasing power of villagers in Asia with that of inhabitants of New York, who have such radically different patterns of consumption? In economic theory, comparisons are justified only from the standpoint of a given person, at a given moment in time, with a given income within a given price structure. Because a person's tastes do not remain identical over time, comparisons of his well-being cannot be made with complete accuracy. Inter-country comparisons are even more difficult to make, because the tastes and needs of various peoples are not the same at a given point in time. Some products have no equivalent in the consumption pattern of other countries because purchases have a sociological connotation. We may observe that, while the basic needs are the same in different periods and places, the ways of satisfying these needs may be very different. Technological differences can lead to the production of very different goods and services and also to very different methods of production. It will thus be evident that the well-being of a country cannot be strictly measured by its gross domestic product (GDP) or by its consumption.

31. GDP is one - and only one - indicator of the well-being of a country. It does not reflect, for instance, the impact of production on the environment in terms of polluted atmosphere or high noise levels. If a country has a cold climate, more money must be spent on heating houses. If one country is flat and another is mountainous, the costs of building the same road in each country are very different. The same is true of national defence, which may be more or less expensive on account of geographical conditions, population dispersion and the structure of production. The same GDP and the same defence expenditures of two countries do not necessarily produce the same amount of well-being or security.

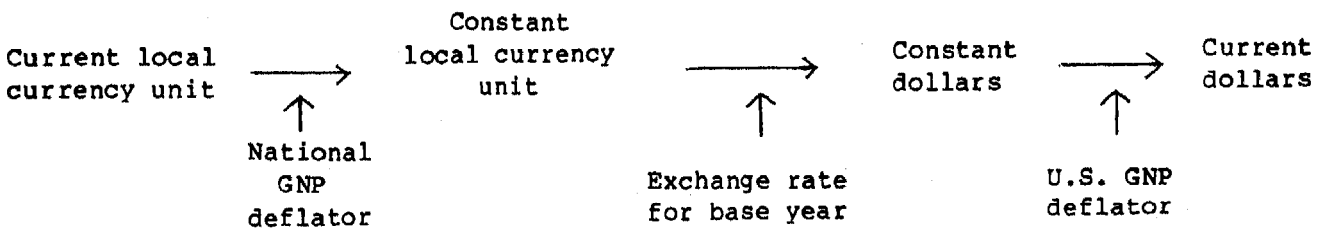
32. Comparisons between countries with similar economic systems are not always obvious, but there are many works on this subject which make use of correct hypotheses. From the point of view of methodology, there is little difference between comparisons relating to countries with different economic systems and those relating to countries with similar systems. There are three major problems to be solved: differences in the national accounting concepts used, institutional differences and the conversion of national data to a common unit. These questions have been analysed by the Statistical Office of the United Nations. In comparisons between countries with similar economic systems, the System of National Accounts (SNA) for market-economy countries and the System of Balances of the National Economy (MPS) provide an appropriate basis for the selection of these aggregates.

The choice of concepts will depend on the purposes of the comparisons and the resources available for the study. It seems that there are considerable advantages in comparing national aggregates using simultaneously both SNA and MPS concepts, but his procedure does not necessarily produce the best results for inter-country comparisons. For instance, the SNA concept of the final consumption of households depends on the participation of the Government in health-service financing. Sometimes, the definition used in national statistics differs on certain points from those adopted in the systems recommended by the United Nations and the comparisons thus lose their relevance and their accuracy. Moreover, the comparability of national data is affected by institutional differences. Similar economic activities are carried out by different institutions, with a different participation by the public sector in economic decision-making or in the provision of social services. The statistical data are then very difficult to compare.

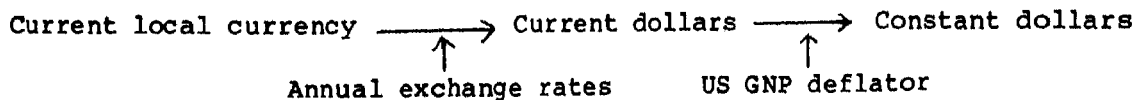
2. The use of exchange rates

33. The most common method used to compare the level of the economic aggregates of different countries is the exchange rates. In Atlas, which is an annual publication of the World Bank, national figures on GNP are converted to constant United States dollars by means of a three-year weighted average of prices and exchange rates, so as to soften the impact of fluctuations. First of all, the World Bank converts the constant market-price GNP series in national currency units into one measured in constant average three-year prices by multiplying the original constant-price series by the weighted average domestic GNP deflator for the base period. Then it converts the series measured in constant average prices in national currency into one in United States dollars by dividing it by the weighted average exchange rate for the base period. Next, it converts the series measured in constant average United States dollars into one measured in current dollars by multiplying it by the implicit GNP deflator of the United States. The United Nations Statistical Office uses the conversion factor corresponding to the official exchange rates established with the International Monetary Fund. In the case of currencies with fluctuating exchange rates, these factors are averages of the monthly exchange rates, weighted by the corresponding monthly or quarterly values of the aggregates.

34. For World Military Expenditures and Arms Transfers, published by the United States Arms Control and Disarmament Agency, the comparisons between the military expenditures of the various countries are based on the exchange rates. The process can be presented as follows:



We should note that (a) the national GNP deflator series represent average rates of inflation within the economy as a whole and may not accurately reflect the rates of inflation of the military sector alone, (b) the data of one edition are not comparable to those in another edition because of the change in the base year and (c) the choice of the year's rate to be used is very difficult. USACDA indicates another method, summarized as follows:



This method is simple, but these annual exchange rates do not reflect relative inflation trends with adequate accuracy. USACDA recognizes that little promise for improving international expenditures comparisons can be expected of exchange rates which tend to underestimate the aggregates of the developing countries. In this case the comparisons do not depend on the exchange rates for a single year but on the exchange rates for all the years for which national expenditures figures are converted into dollars. As a result of this, important changes in the exchange rates may produce a false impression of equally strong fluctuations in the volumes of military expenditures. The International Institute for Strategic Studies (IISS) uses the exchange rates prevailing at the end of the first quarter of the relevant year, with the exception of the aggregates of the Soviet Union and certain European socialist countries, since their official rates are unsuitable. The Stockholm International Peace Research Institute (SIPRI) uses the annual averages of the exchange rates, except for those centrally planned economies for which parities are estimated and customarily used for this purpose. However, we should note that these institutes are very unenthusiastic about their methods and are hoping for an improvement in the PPP system in the field of military expenditures.

35. There are two trends which affect relationships among prices in the various countries, one leading to the integration of markets and the other to their separation. The first favours equality between prices in the various countries, while the second provokes international price differences. If perfect competition prevailed and there were no transport costs, there should be no differences in prices, but the real world is very different and exchange rates cannot resolve these distortions so as to produce effective comparisons.

36. The use of a single exchange rate for all sectors is a simplifying assumption made for all countries, but many problems arise from the use of this indicator. We shall indicate briefly its main short-comings:

(a) Official exchange rates are subject to abrupt changes and must reflect temporary variations in the value of currencies. The averages of exchange rates are not very reliable at the theoretical level.

(b) Some official exchange rates are arbitrary and are not suitable for measuring the relationship between foreign and domestic prices.

(c) Official exchange rates are unsuitable as price deflators for comparisons because they fail to measure the internal purchasing power of currencies, even in the case of market economies with similar structures and pricing practices.

(d) In the event of imperfect substitutions for international trade, the existence of a large domestic sector unconnected with international trade and of the imperfect working of the exchange market, exchange rates are unsatisfactory indicators for international comparisons.

(e) For most economies, the volume of domestic output or expenditure, exported or imported, is only a small fraction of total output or expenditure.

There are three main causes of erratic variations in exchange rates: (a) changes in the differential rates of inflation between countries, (b) changes in the rates of technological change and growth of productive and selling capacities and (c) capital movements. Even if special drawing rights avoid large erratic variations, they suffer from the same general disadvantages as those of exchange rates.

### 3. Purchasing power parities (PPP)

37. Interest in methodological problems connected with intercountry comparisons is growing apace on the subject of gross domestic product (GDP). The International Comparison Project (ICP) is the most important work being done. Its purpose is to compare the purchasing power of currencies and the real per capita GDP of the various countries. The first phase of the ICP had two objectives: (a) to develop methods of constructing a system of multilateral comparisons and (b) to make some preliminary empirical comparisons. Ten countries, representing countries with different economic and social systems, various geographical regions and different income levels constituted the first sample: Colombia, France, Germany, Federal Republic of, Hungary, India, Italy, Japan, Kenya, the United Kingdom and the United States. The second phase of the ICP had the same objectives. Comparisons are provided for GDP as a whole, the three main components of GDP and 34 subaggregates for 16 countries and two reference years. <sup>1/</sup> The third phase has also been finished. It included more than 30 countries with reference dates for 1975, but it has not yet been published. The fourth phase of ICP is to analyse the PPP of 77 countries, but the question of financing this ambitious project has not yet been solved.

38. EUROSTAT <sup>2/</sup> estimates the PPP of the member States of the European Economic Community. It indicates that the method of assessing PPP is directly linked with

---

<sup>1/</sup> I. B. Kravis, Z. Kenessey, A. Heston and R. Summers, A system of international comparisons of gross product and purchasing power (Baltimore, Johns Hopkins University Press, 1975). I. B. Kravis, A. Heston and R. Summers, International comparisons of real product and purchasing power (Baltimore, Johns Hopkins University Press, 1973).

<sup>2/</sup> EUROSTAT, Comparisons in real values of the aggregates of ESA: 1975 (Luxembourg, 1978).



the aim of the exercise, which is to make reliable comparisons between the various aggregates represented in national accounts. It draws up the PPP of the national currencies in order to compare the GDP and its final uses (final consumption of households, collective consumption of general government and gross capital formation and collective consumption of private non-profit institutions). The method used differs slightly from the ICP method. Some studies on the PPP of the Council for Mutual Economic Assistance and of the Latin American Free Trade Area have been made. 3/

(a) Principles of the method

39. For the purpose of comparison, the aggregates must be subdivided into a large number of classifications. For each of these categories, some representative goods are selected for which the prices of identical or equivalent specification can be found. In principle, an international price comparison would be based on a random sample of the prices relative to the commodities, on the assumption that the purchases of identical products are the same in all the countries. This is extremely unlikely. In a random sample of the population of identical items appearing with identical frequencies, each transaction has an equal chance of being represented in the sample and, consequently, a few transactions of high value have as many chances of appearing in the sample as numerous transactions of low value. A better way of dealing with the difference between the value and physical-unit distribution is to sample the physical-unit distribution and to weight the various prices according to their expenditure weight for one country or the other, or a combination of both countries (in the case of binary comparisons).

40. In the real world, it is very difficult to use an ideal scheme of random sampling. One is confronted not with a list of individual transactions but with a classification of final expenditures divided into commodity groups. The groups can be combined as may seem fit, and subdivided so as to obtain categories which have homogeneous prices. It would be very interesting to use the dispersion of price relatives as a criterion for the classification of items into commodity groups. "The idea is to choose among alternative classification systems the one which minimizes the variance of price relatives within categories relative to the variance between categories ... A more feasible procedure is to start with the basic classification used by most countries, to modify it with some subdivisions designed to improve homogeneity and to cope with the remaining problems of heterogeneity within classifications by increasing the size of the sample within the more heterogeneous categories". 4/

---

3/ J. Salazar-Carrillo "Price, purchasing power and real product comparisons in Latin America", The Review of Income and Wealth (March 1973). Ivanov and Ryzhov, "A new stage in the activities of the Council for Mutual Economic Assistance in the field of international comparisons of national product", The Review of Income and Wealth (March 1978).

4/ See Kravis and Kenessey, "Output and prices in the international comparison project", The Review of Income and Wealth (March 1973).

41. Four principles were used in the selection of the specific items: the items had to be described as precisely as possible to ensure that the prices were comparable between the various countries. Equivalent conditions of sales and accurate technical descriptions of the products are required. The criterion of "concentrated selection" has been adopted. The selection of the goods with the largest expenditure weights must be a rule, since it diminishes the likelihood of the sampling error of omitted items and produces a large coverage of expenditures. It leads to an under-representation of items of low importance within each group and it produces an unambiguous rule for the selection of items applied to the expenditures of one country. The items must be representative of the subaggregates to which they belong because the price of the products included in the survey must reflect the parity of all the items in the subaggregate. Each specification chosen has to be important in the consumption of each country. The selection of items which are too uncommon to provide a representative basis for price comparisons should be avoided. This principle is very important in the case of military expenditures.

42. The selection of products is based on a large number of different considerations. A set of products representative of all countries concerned must be found. Absolute comparability of items between countries is theoretically required, but the number of products which are identical and representative in all countries is very small. "The identification of equivalent representative items was a focal point for much of the work. It involved the exchange of expert members of the staffs of the national statistical offices and the ICP, consultations with industry experts and government experts outside of the statistical offices, and the use of samples, catalogues and price sheets." <sup>5/</sup> The differences in the degree of dispersion of prices for a given specification around the national average are negligible, especially in the case of military expenditures. Although real-term comparisons in space indicate a close similarity to comparisons in time, they do bring in some new conceptual requirements. Comparisons in time are mainly achieved in two ways: (a) by comparing the aggregate for period  $t$  with the aggregate for base period  $t-0$ , and (b) by comparing the aggregate for period  $t$  with that for period  $t-1$ . The Laspeyres, Paasche and Fisher indexes can be used for the comparisons in space, but it is not sufficient to calculate the  $K-1$  parities (in the case of  $K$  countries) and to extrapolate the others. All the  $K(K-1)$  parities for the Laspeyres and Paasche indexes and the  $K(K-1)/2$  for the Fisher index (reversibility of situations) must be calculated. Finally, a system of comparison with Laspeyres indexes, using a country as a basis for the calculations, or with a Paasche index produces two different results and the choice between these two indexes is arbitrary. The international comparisons give rise to various technical problems.

43. The differences in the quality of goods are difficult to demonstrate because, according to economic theory, quality is normally represented in prices. However, the same model is sometimes sold by the same seller at different prices according to the buyer, or differences between two products appear to be relatively unimportant. Often, however, the quality of a product is not perceived in the same

---

<sup>5/</sup> Kravis, Heston and Summers, op. cit., p. 4.

way by different countries, identical items do not serve the same needs, or two different products satisfy the same need. Tastes differ and the prices of the same products are perceived differently by people of different countries. Moreover, special treatment must be given to durable goods (power, capacity, comfort, durability). The international comparisons of aggregates involve the definition of the quantifiable characteristics of products.

44. Five requirements are very important, particularly for international comparisons "characteristicity" of the weights, transitivity, unbiasedness, additivity and the factor reversal test. 6/

(a) The weights used for any index computation must be characteristic of the economic structures of the countries. It is very difficult to know what importance should be attached to this requirement because of the controversies among the statisticians themselves.

(b) If  $P_{A/B}$  represents the parity of country B in relation to country A, and  $C$  represents another country, transitivity occurs when the following equation is valid:  $P_{A/B} = P_{A/C}/P_{B/C}$ . Often, characteristicity and transitivity are incompatible but, in multilateral comparisons, circularity is an important requirement. Circularity makes it possible to achieve volume ratios which are invariant in relation to the base country of the parities. Any country may be selected as the base for the parities, since the volume ratios are not determined by this choice.

(c) The "Gerschenkron effect" indicates that, in the case of inter-spatial price indexes, the use by a given country of its own quantities as weights involves a relatively lower price level than the use of another country's weights. The reason for this effect is the negative correlation between the quantity and the price proportions.

(d) Additivity is a very important requirement for real-term comparisons of national-account aggregates; it ensures that the aggregates and their components are consistent. The sum of the real value of each component must be equal to the real value of the over-all aggregate. The additivity rule solves the problem of internal consistency.

(e) The factor-reversal test verifies the fact that the product of the quantity and price indexes is equal to the ratio of values. Usually, this requirement is completely satisfied apart from the Edgeworth-Marshall formula.

International comparisons involve finding solutions which meet these five requirements. There are two major ways of calculating the PPP: the bilateral method or the multilateral method.

---

6/ See L. Drechsler, "Weighting of index numbers in multilateral international comparisons", The Review of Income and Wealth (March 1973). Kravis, Heston and Summers, op. cit. EUROSTAT, op. cit.

(b) Bilateral methods

45. Using two sets of data for two countries, we can produce bilateral comparisons. The first stage in making the bilateral comparisons is to average the price relatives or, occasionally, the quantity ratios relating to different product specifications. The basic method uses a simple geometric mean of the price relatives. We have the following formula:

$$PPP_{ij} = (P_j/P_n)_i = \frac{A}{a} = 100 (P_{aj}/P_{an})_i^{1/A}$$

where

$PPP_{ij}$  = The purchasing-power parity for category  $i$  in the  $j^{\text{th}}$  country

$P_{aj}$  = Price of the  $a^{\text{th}}$  item in the  $j^{\text{th}}$  country

$P_{an}$  = Price of the  $a^{\text{th}}$  item in the numéraire country

$(P_j)_i$  = Price of the  $i^{\text{th}}$  item in the  $j^{\text{th}}$  country

$(P_n)_i$  = Price of the  $i^{\text{th}}$  item in the numéraire country

$A$  = Number of items within the category.

46. If, for a small number of categories, direct quantity indexes information is not available, then in most cases, indirect quantity indexes are derived by dividing category PPPs into category expenditure ratios. If  $(Q_j/Q_n)_i$  is the quotient of the quantities of the  $i^{\text{th}}$  item between both countries, and  $(E_j/E_n)_i$  is the quotient of the corresponding expenditures, we have:

$$(Q_j/Q_n)_i = 100 (E_j/E_n)_i / PPP_{ij}$$

47. These statistical data are subject to sampling errors, especially when the consumption habits in the two countries are different. It is sometimes possible to have both direct quantity and direct price comparisons for the two countries, but their product does not equal the expenditure ratio. "The convenience of having consistent (in the factor-reversal sense) price and quantity ratios seemed to make it worthwhile to tolerate the small differences in the aggregate figures ... that result when only one direct index is used". 7/

48. The second stage consists in calculating the  $i^{\text{th}}$  PPPs for each of the partner countries in two ways, according as we utilize the first-country expenditure weights or the second-country expenditure weights. If  $e_{ij}$  and  $e_{in}$

---

7/ Kravis, Heston and Summers, op. cit., p. 69.

are per capita expenditures in the  $j^{\text{th}}$  country and in the  $n^{\text{th}}$  country, expressed in their own national currencies, we have two indexes for country  $j$ :

$$I_j (n) = \sum_{i=1}^m (P_j/P_n)_i \cdot (e_{in} / \sum_{i=1}^m e_{in})$$

$$I_j (j) = \sum_{i=1}^m (1 / \left[ \sum_{i=1}^m (P_n/P_j)_i (e_{ij} / \sum_{i=1}^m e_{ij}) \right])$$

49. The classical EEC studies used this kind of calculation for two basic indexes (Laspeyres and Paasche types). From a practical point of view, this method is uncomfortable to use since it gives two answers to a single question. If we wish to compare the GDP for different periods, the duplication of answers upsets the discernment. When the analysis becomes multidimensional, the authors use the average of the two indexes. The main disadvantage of using the expenditure weights of one of the participating countries is that the arithmetic mean does not satisfy the factor-reversal test and that the result depends on which country is the numerator and which the denominator. The Fisher test (geometric average of a given country's own weights and weight indexes of the country with which it is being compared), used by ICP and the Conference of European Statisticians, satisfies all the requirements but, in theory, internal consistency is not achieved. Binary comparisons have the advantage of simplicity of calculation and interpretation but they cannot be applied to the analysis of more than two countries.

(c) Multilateral methods

50. Circularity is a basic requirement for multilateral comparisons because international organizations and analytical studies need it. Binary comparisons have serious disadvantages in that the number of possible binary comparisons soon becomes very large (for 20 countries there are 200 possible pairs). It is necessary to have simultaneous comparisons which possess certain statistical properties. The methods used combine items data to obtain price and quantity indexes for each country at the detailed category level, and then average the price and quantity indexes for the different categories to obtain price and quantity indexes at various levels of aggregation.

51. The central problem of multilateral comparisons is, however, to choose between characteristicity and circularity, the two requirements being often incompatible. Characteristicity is often sacrificed. It is necessary to obtain a compromise which achieves circularity without neglecting characteristicity.

52. The ICP method has two main steps:

(a) First, it combines items data to obtain quantity (or price) indexes for each country at the detailed category level;

(b) Second, it averages the price and quantity indexes for the various categories to obtain, at various levels of aggregation, the price or quantity indexes desired.

53. It uses the "country-product-dummy" (CPD) method. This employs all the price data available to give transitive price comparisons, even if there are some holes in the table of items prices. This last property is very important because, if the set of items used were restricted to those in common consumption in every one of the countries involved, the list would be a very short one. "The preferred way of obtaining a base-country invariant PPP for each country relative to the United States - by computing the simple geometric mean of the ratios of a country's price to the U.S. price for all items in the category - could not be carried out for most categories because of the missing entries. Therefore, the ICP adopted the so-called country-product-dummy (CDP) method, a multiple regression procedure that in a systematic way allowed for the absence of price entries for particular items in particular countries. Specifically, a linear regression equation was formed in which the dependent variable was the natural logarithm of price. The independent variables consisted of two sets of dummy variables, one relating to the various countries (excluding the numéraire country) and the other relating to the various items." <sup>8/</sup> Thus, the method of aggregating the detailed categories in the multilateral comparisons necessitates the establishment of a set of international prices for the various categories used to evaluate the categories quantities for each country by the Geary-Khamis procedure. The international dollar has the same purchasing power as the United States dollar over the whole GDP of the United States but its purchasing power differs for the individual categories because it is determined by the structure of international prices. If  $PI_i$  = international price of category  $i$ ,  $P_{ij}$  = the price of product  $i$  in country  $j$ ,  $PPP_j$  = purchasing power parity of country  $j$ , and  $q_{ij}$  = weights of the product  $i$  in country  $j$ , we obtain a system of  $r$  linear equations and  $r$  unknowns as follows:

$$PI_i = \sum_{j=1}^n \frac{P_{ij}}{PPP_j} \left( \frac{q_{ij}}{\sum_{j=1}^n q_{ij}} \right)$$

$$PPP_j = \frac{\sum_{i=1}^m P_{ij} \cdot q_{ij}}{\sum_{i=1}^m PI_i \cdot q_{ij}}$$

Although it is very complex, this analysis is the most useful, if the use of exchange rates is rejected.

54. Before calculating the rates, EUROSTAT chooses a reference country and a unit of value. The calculations are based on the European Economic Community as a whole. The total gross domestic product of the Community is calculated in units of

---

<sup>8/</sup> Kravis, Heston and Summers, op. cit., p. 72.

account, using the relevant exchange rates for converting national currencies into European units of account (currency basket). If the Community's GDPs are expressed in European units of account this unit can be defined in economic (not monetary) terms. Choosing a specific method depends on the problems to be solved. EUROSTAT has chosen the method proposed by Gerardi. The average prices for each product are thus defined as the non-weighted geometric average of national prices expressed in national currency. In this technical area, statisticians have not succeeded in coming to an agreement.

55. One of the problems of calculating the PPP is the choice of basic headings. They are selected in such a way that, for each pair of countries, there is at least one item for which a price has been recorded; this condition is not very difficult to meet when comparing the structures of the EEC countries. The calculation of the parities for the basic headings, the application of the method to the material available and the choice of the common unit (purchasing-power standard) are set out at length in EUROSTAT. 9/

56. There are other methods of calculating the PPP:

(a) Two sets of indexes can be used: one which is completely characteristic and another which satisfies the transitivity test; however, the results are often ambiguous;

(b) The van Yzeren method satisfies the circularity requirement. It proposes three useful ways of making intercountry comparisons based upon a complicated definition of sets of Common Market baskets. These methods differ from the Geary-Khamis method in that they do not make use of weighting factors, and their approach is concentrated on the price indexes;

(c) The Elteto-Koves and Szule method (EKS) proposes to satisfy the circularity requirement while paying the least possible penalty in terms of characteristicity. This means that, for a whole set of comparisons, the deviations of the indexes from the characteristic binary indexes are minimized (least square method);

(d) The Economic Commission for Latin America (ECLA) averages quantities instead of prices. The procedure is a simple one but it requires acceptance of the assumption that all groups are governed by the same quantity vector. This assumption appears less acceptable than those involved in the Geary-Khamis method.

57. The above methods have certain disadvantages because the requirements for constructing perfect indexes are too high. It would be better to take a set of countries representative of the world, with different economic systems and levels of development, but such a set is, unfortunately, very difficult to construct and the ICP calculations in this field are not very interesting. We should note, however, that all these different methods produce close and comparable results and

---

9/ EUROSTAT, op. cit.

that the controversies on the subject appear slightly out of place when compared with the importance of the other hypotheses.

Table 1. Estimates of per capita quantity indexes for gross domestic product, 1970: a comparison of alternative estimating methods, and estimates of degree of accuracy 10/

	Kenya	India	Korea, Republic of	Philip- pines	Colom- bia	Malay- sia	Iran	Hungary
1. Methods								
A. Geary-Khamis	6.33	6.92	12.1	12.0	18.1	19.1	20.3	42.7
C. EKS	5.72	6.01	10.3	10.2	16.1	17.9	18.2	41.2
D. van Yzeren	5.73	6.02	10.3	10.2	16.1	17.9	18.2	41.2
F. Exchange-rate basis	2.99	2.07	3.86	5.39	7.24	8.10	8.37	21.6

	Italy	Japan	United Kingdom	Nether- lands	Belgium	France	Germany, F.R.
1. Methods							
A. Geary-Khamis	49.2	59.2	63.5	68.7	72.0	73.2	78.2
C. EKS	49.6	57.6	65.1	66.8	71.1	73.4	77.0
D. van Yzeren	49.6	57.7	65.2	66.7	71.0	73.5	77.1
F. Exchange-rate basis	36.0	39.8	45.7	50.8	55.1	58.2	64.1

d. Suitability of the purchasing-power parity methods for making comparisons of military expenditures

58. Purchasing-power parities are usually recognized as the best way of converting local currency data into a common denominator for the purpose of making

10/ Kravis, Heston and Summers, op. cit., p. 82.



comparisons. In the case of military expenditures, we must first match up similar products in each country, describing and calculating the typical or average prices and determining the quantities bought. Next, we calculate for the individual products the price ratios among the countries (weighted by expenditure) and we then aggregate by economic sector in order to calculate the sectoral PPPs.

59. Accurate PPPs are usually difficult to obtain, in spite of the progress made by all the projects mentioned above. Their preparation and calculation are very time-consuming and very expensive. In the case of military expenditures, two problems arise.

60. First, in the case of military expenditures, problems that to some extent are strictly related to the method per se arise with more technical evidence. The items are usually not the same. It is very difficult to say whether one rifle is equivalent to another rifle and, still more so, whether the space shuttle can be compared to a certain kind of rocket. There would be many holes in the matrix of the various categories and it is not, perhaps, very enlightening to use this method for comparing the military expenditures of the super-Powers with those of the poor countries. If we want to compare the military expenditures of the super-Powers, it would seem better to use the prices and weights for those countries alone, in order to improve their characteristicity. As a first approximation along these lines, it would seem that a distinction must be made between the different levels of defence: atomic and non-atomic Powers.

61. Second, the prices and quantities of items of the military sector are very difficult to obtain. Some estimates on the subject have been made, particularly as regards quantities, but it is difficult to determine expenditures and prices. Statements of prices must be requested from the countries, and a number of consistency checks would have to be built into the collection process. Prices cannot be checked by visiting shops but, if sufficiently detailed specifications were available for 500 items, it would be possible to lay the foundations for constructing purchasing-power parities for the various military expenditures. The ICP project, directed by Mr. Picard, proposes a questionnaire which would take account of defence expenditure in the category "Public final consumption expenditure". It would be very interesting if this questionnaire could be drafted in consultation with the Group of Experts. On practical grounds, however, without a consensus between the two major Powers, it would be illusory to use this method in the hope of obtaining accurate estimates. If one wants to find out the prices and quantities in the case of the other countries, it should be made clear that the object of these estimates is, above all, based upon the study of the two major Powers. The deterrent strategy is opposed to making known the factors required for using PPP. Without such a verification procedure and an international agreement, this method is very difficult to use with the accuracy required.

62. A document, written and presented at the third session by Mr. Mateescu, entitled "Comparability problems of military budgets", is available at the Centre for Disarmament, Department of Political and Security Council Affairs.

ANNEX I TO WORKING PAPER III

Abbreviations

ABM	Anti-ballistic missiles
EEC	European Economic Community
EUA	European unit of account
EUROSTAT	Statistical Office of European Communities
GDP	Gross domestic product
GNP	Gross national product
IAEA	International Atomic Energy Agency
ICBM	Inter-continental ballistic missiles
ICP	International Comparison Project
IISS	International Institute for Strategic Studies
MIRV	Multiple independently targetable re-entry vehicle
MPS	Material product system
NATO	North Atlantic Treaty Organization
NIPA	National income and product accounts
PPP	Purchasing-power parities (method)
RME	Reduction of military expenditures
SBNE	System of balances of the national economy
SDR	Special drawing rights
SIPRI	Stockholm International Peace Research Institute
SNA	System of national accounts

ANNEX II TO WORKING PAPER III

GLOSSARY

Base period: This is the reference period of time on the basis of which the weights necessary for the construction of an index have been established. The length of this base period is determined by the nature and purpose of the index in question. It is necessary to choose a period free from any abnormal influence (expressed in quantitative terms).

Constant prices: The value of money varies, and \$100 today does not necessarily have the same value as it did yesterday. In order to compare economic variables over several different periods, the variations due to the depreciation of money must be eliminated. Constant prices can be briefly defined as the relationship between the prices prevailing in the current period and the corresponding price indexes: if a given product sold for \$200 in 1980 and \$220 in 1981, and if the inflation rate is 10 per cent per annum, the constant price of this product (at 1980 prices) is \$200 for the year 1981.

"Country-product-dummy" (CPD) or "Auxiliary-country" method: This is a statistical method used by the International Comparison Project, the object of which is the international comparison of economic aggregates. If a country uses its own quantities as weighting coefficients, this produces a result which is skewed downwards owing to the negative correlation between prices and quantities. Thus an estimate of the military expenditures of the Union of Soviet Socialist Republics (or of the United States of America) based on the weights produced by the United States (or the Soviet Union) is distinctly higher than an estimate based, in each case, on the country's own weights. A fictitious country is therefore created to avoid this skewing and to make international comparisons more credible.

Current prices: These are defined as the prices actually in effect during the period of time under consideration.

"Explosive-power-per-dollar" method: This hedonic method seeks to establish a relationship between the cost of each item in a weapons system and the related military power. The unit of measurement could be the explosive power necessary to destroy a given target, while the price could be represented by the expenditures on the equipment and personnel necessary for this purpose. The object of this method is to bring out the value of a dollar for each type of expenditure in terms of military effectiveness.

Fisher index: This index which was introduced by Fisher in 1922, is defined as the geometric mean of the Laspeyres and Paasche indexes.

Linear regression: This designates the straight line which estimates a variable, Y (dependent variable), by means of another variable, X (independent variable), on the basis of the equation:  $Y = aX + b$ . The coefficient a indicates how many units of Y change as the result of a unit variation in X; it is called the coefficient of regression.

**Laspeyres index:** This index was introduced by Laspeyres in 1871 and is widely used. If the prices of a set of goods during the base period are given as  $p_{10}$ ,  $p_{20}$ ,  $p_{30}$ , ...,  $p_{n0}$ , and those during the period being analysed as  $p_{1m}$ ,  $p_{2m}$ , ...,  $p_{nm}$ , and if  $q_{10}$ ,  $q_{20}$ , ...,  $q_{n0}$ , are the quantities sold during the base period, the Laspeyres index is written as follows:

$$I_L = \frac{\sum_{i=1}^n p_{im} \cdot q_{i0}}{\sum_{i=1}^n p_{i0} \cdot q_{i0}}$$

with  $n$  goods involved. In brief, the prices are weighted by the quantities for the base period.

**Multiple-regression analysis:** This designates the general method used to estimate a variable,  $Y$  (dependent variable), on the basis of other variables,  $X$  (independent variables), by means of the equation:

$$Y = b_0 + b_1 X_1 + \dots + b_n X_n$$

The coefficients  $b$  are called the coefficients of regression.

**Opportunity cost:** Owing to scarcity, economic choices imply sacrifices - costs in terms of satisfaction. If someone buys (or produces) an economic good, he thereby reduces his own resources (or factors or production). The choice costs everything that is not bought (or produced) for the same expenditure; the opportunity cost is defined as the price of the sacrifice made by a choice.

**Paasche index:** This was introduced by Paasche in 1874. Using the same system of symbols as for the calculation of the Laspeyres index, the Paasche index is written as follows:

$$I_p = \frac{\sum_{i=1}^n p_m \cdot q_m}{\sum_{i=1}^n p_0 \cdot q_m}$$

In brief, the prices are weighted by the quantities for the period under consideration.

Purchasing-power parities (PPP): This is a method allowing comparison of the economic aggregates of different countries. The PPP expresses the number of units of national currency which has the same purchasing power for each category of products as one United States dollar.

[Original: English]

WORKING PAPER IV

Working tables on verification

The following tables were prepared by the Arms Control and Disarmament Division of the Department of External Affairs and by the Operational Research and Analysis Establishment of the Department of National Defence of Canada. The tables were published in "A conceptual working paper on arms control verification" (pp. 7, 42, 43, 44) on 23 January 1981 in Ottawa, Canada. For a more exhaustive analysis of the issues, reference may be made to the above-mentioned document as well as to the document entitled "Disarmament and verification: Background paper prepared by the Secretariat" (A/AC.187/109).

Tables

- Table 1. Verification categorization
- Table 2. Bilateral arms control agreements and relevant verification provisions
- Table 3. Multilateral arms control agreements and relevant verification provisions

Table 1. Verification categorization

Régimes	Methods	Systems
1. Absolute verification	1. General on-site inspection	1. Photo-reconnaissance satellite
2. Adequate verification	2. Selective on-site inspection	2. "Ferret" satellite
3. Limited verification	3. Challenge on-site inspection	3. Nuclear-radiation detection satellite
4. Token verification	4. Control posts/observer/liaison missions	4. Spacecraft laboratory
5. No verification	5. Remote sensing in-situ	5. Seismic sensors
	6. Remote sensing national technical means	6. Control posts
	7. Complaints consultation	7. Remote-sensing posts
	8. Collateral analysis	8. Peace-keeping observer missions
		9. Literature survey
		10. International information exchange
		11.
		12. et cetera, et cetera

Table 2. Bilateral arms control agreements and relevant verification provisions

Agreement	Limitations	Verification régime	Verification methods
Anti-Ballistic Missile Systems Agreement (1972) (to be reviewed at five-year intervals; next review in 1982)	Deployment of ABM systems limited to national capital regions of each country plus one other area	Adequate	Remote sensing - national technical means (satellites)
SALT I (1972) Interim agreement on limitation of strategic offensive arms (expired but continues to be observed)	A freeze of aggregate numbers of fixed land-based KRM launchers and of ballistic-missile launchers on submarines	Adequate	Remote sensing - national technical means (satellites) Parties undertook not to use deliberate concealment or to impede national technical means
Threshold Test-Ban Treaty (TTBT) (1974) (not in force)	Undertaking not to test underground nuclear weapons with a yield of more than 150 kt	Adequate	Remote sensing - national technical means (seismic)
Treaty on underground explosions for peaceful purposes (the PNE Treaty, 1976) (not in force)	Bans underground nuclear explosions for peaceful purposes in excess of 150 kt or aggregate yield in excess of 1,500 kt	Adequate	Remote sensing - national technical means (seismic) Collateral analysis Possible challenge on-site inspection
SALT II (1979) (not ratified but continues to be observed)	Provides for over-all ceiling on strategic nuclear delivery vehicles, subcelling on launchers for all MIRVs plus heavy bombers with air-launched cruise missiles over 600 km range, MIRV launchers, warheads, etc.	Adequate	Remote sensing - national technical means (satellites and telemetry) Parties undertook not to use deliberate concealment, telemetry encryption and to include functionally related observable differences
Treaty on the Non-Proliferation of Nuclear Weapons (1970)	Prohibits transfer of nuclear weapons by nuclear-weapon State parties and the receipt, manufacture or acquisition of nuclear weapons by any other means by non-nuclear weapon State parties.	Adequate	Selective/challenge on-site inspection (modified) Reporting to IAEA



Table 3. Multilateral arms control agreements and relevant verification provisions

Agreement	Limitations	Verification régime	Verification methods
Geneva Protocol (1925)	Prohibits the use in war of asphyxiating, poisonous or other gases, and the use of bacteriological methods of warfare	None	None
Antarctic Treaty (1959)	Prohibits nuclear explosions, the disposal of radioactive wastes, any measures of a military nature and the testing of any type of weapons	Absolute	General on-site inspection Remote sensing (using aerial observation)
Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water (1963)	Prohibits any nuclear weapon test explosion in the atmosphere, in outer space and under water	None	None The original parties to the treaty expected verification by national technical means
Outer Space Treaty (1967)	Prohibits the placing in orbit of objects carrying any weapon of mass destruction, the establishment of military installations and fortification and the testing of any type of weapon, or the conduct of military manoeuvres on celestial bodies	Limited	Selective on-site inspection (if possible) Observation of the flights of space objects
Treaty for the Prohibition of Nuclear Weapons in Latin America (Treaty of Tlatelolco) (1967)	Prohibits the testing, use, manufacture, production, acquisition, receipt, storage, installation or deployment of any nuclear weapon by any means whatsoever	Adequate	Challenge on-site inspection Reporting to IAEA
Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Sea-Bed and the Ocean Floor and in the Subsoil Thereof (1972)	Prohibits emplacement of nuclear weapons as described in treaty title	Adequate	General on-site inspection

Table 3. Multilateral arms control agreements and relevant verification provisions (continued)

Agreement	Limitations	Verification régime	Verification methods
Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction (1975)	Prohibits the development, production, stockpiling or acquisition of bacteriological and toxin weapons and provides for the destruction of existing stocks	Symbolic	Complaint/consultation procedure
Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (1977)	Not to engage in military or any other hostile use of environmental-modification techniques having widespread, long-lasting or severe effects as the means of destruction, damage or injury	Symbolic	Co-operation/consultation procedure