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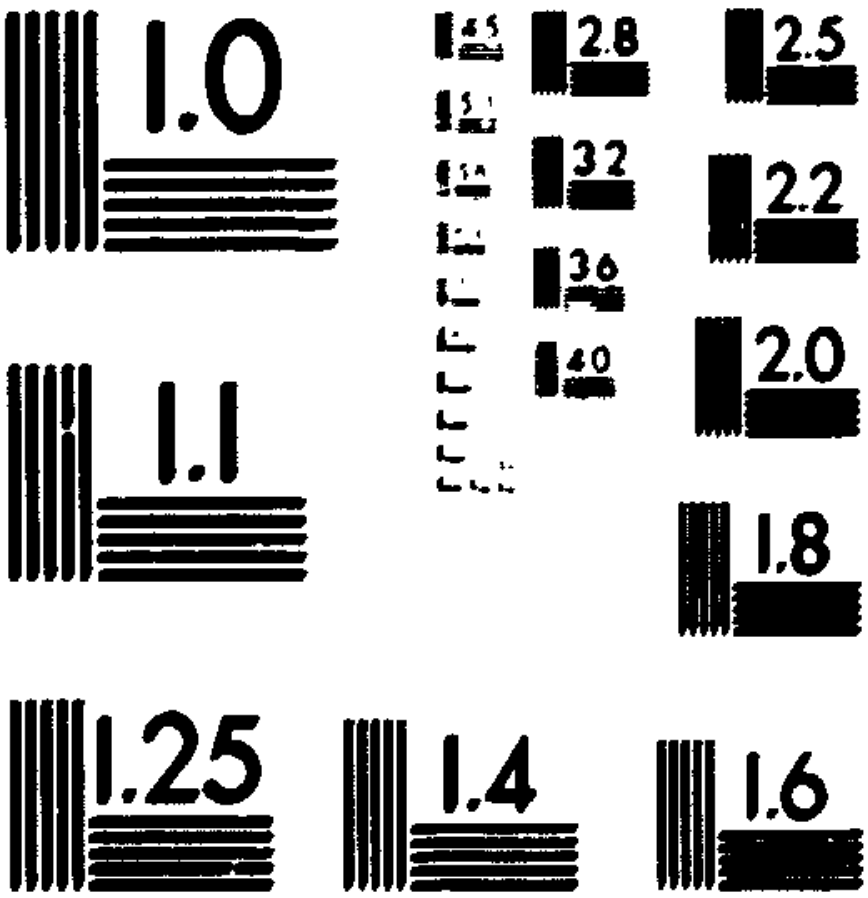

V.R.S. ARNI

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WORLD TECHNOLOGY REVIEW
(Consultant's report.

This Report is in response to a consultancy assignment whose essential requirements are summarised below:

1. The review of existing efforts of UNIDO to prepare periodical reviews on technology trends
2. To outline the contents of a world technology review periodical, taking into consideration the information needs of developing countries
3. To outline institutional requirements for the preparation of the periodical.

2. ORIENTATION OF THE PROJECT

‹2.1› The recommendation of this project is that Unido should provide, in the form of a Unido journal, THE WORLD TECHNOLOGY REVIEW, and through associated specialised reports, referred to here as WTR Special Study Supplements (SSS), an on-going perspective and comparitive assessment of the world-wide status and trends in technology development, the nature of the technology market (technology and information flows, and areas of technology emphasis), and major directions in industrial research. The journal, with its specialised reports, will be designed to act as an important source of information, assessment and analysis which should be capable of assisting developing countries, in a significant manner, in evolving and managing technology policies, institutions and programs, including the transfer of technology. To a very substantial extent, the content and orientation of the Report can be expected to be influenced by the nature of the feedback Unido receives from developing country agencies and analysts.

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‹2.2› The WTR is intended to be one of a plurality of instruments developed by Unido that will allow for the transmission and

effective use of new technology and technological information.

‹2.3› TO WHOM ADDRESSED: The target audience of the main WTR publication will be the decision-makers of developing country governments who are concerned with the management of technology, in its broadest sense, both in terms of national socio-economic objectives and in terms of arranging cooperation and convergence with other developing countries in respect of technology-related actions.

‹2.4› The WTR publication can be expected to reach decision-makers directly and through 'reception centers' they create, or through already existing technology monitoring assessment organs of governments.

‹2.5› The specialised reports (WTR Special Study Supplements), to be associated with the WTR, will be focussed to inform senior scientific and technological personnel in developing countries, or development specialists, who act as contributaries to national policies, of global trends in particular sectors and parameters including major research results and emergent technologies.

‹2.6› These two publications will be supplemented by the present-day publications of Unido, the three 'Monitors' and the TIES Newsletter which, by and large, essentially provide data and information to those supervising research efforts in key sectors of new technology or to those regulating the transfer of technology, respectively.

‹2.7› However, by their very nature, the WTR and other publications can be expected to have a wider audience than for whom they are specifically designed. This can have a supportive effect.

3. BACKGROUND

‹3.1›In the last two decades technology has developed the

character of a mobile factor and has tended to move to less mobile factors, particularly towards the physical resource bases of the developing countries. While for many of these countries this has been a favorable direction, the process of technology transfer has, through its effects, steadily eroded the productivity differentials of the advanced countries in many basic sectors such as textiles, steel and petrochemicals. The impact of the erosion has become very evident to them in the present deep and pervasive industrial and economic recession. In consequence, various progressive and defensive mechanisms are at work which have very important implications for developing countries.

‹3.2› The potential this situation has for the changes in the international environment has been abetted by a facet of the present global long-term cycle - similar to that experienced in previous such cycles - the phenomenon of the 'bunching' or 'clustering' of major inventions and innovations in a short span of time, best illustrated by the well-publicised developments in genetic engineering, micro-electronics and robotics, now concentrated in the advanced countries. To this pool of technology has been added the commercial 'spin offs' from Government-supported space and defense research. Together, and in combination (as, for example, the science of telematics) they appear to have the capacity to pervade, influence and alter the whole span of conventional technologies and to establish new linkages between technologies and between products. Science-based innovations in the US and Japan, for instance, now parallel organisational innovations such as automation and quality control management, which have hitherto given them international leadership in many fields. In point and principle, a 'third industrial revolution' is at hand.

‹3.3› Advanced countries have found that capital movements tend to follow standardised production and methodologies and that this has accounted for the transfer of technology to developing countries even in such otherwise sophisticated fields as the

manufacture of computers and computer peripherals. Consequently there is both public and private effort to concentrate on non-standardised research-intensive and knowledge-based 'high-tech' industries to assure their immobility.

‹3.4› This has given rise to high-tech lobbies which effort to further immobilise the transfer of technology through changes in, or through the introduction of, new legislation in support of knowledge-based industries.

For instance, in the US, presently the most dominant source of the high technologies, anti-trust legislation is being softened, or its administrative actions eased, to permit joint R&D among large firms, which previously, on "per se" provisions of the anti-trust acts, they could not so engage. This is signalled by the Joint Research and Development Act of 1984. Similarly new legislation, such as the Semiconductor Chip Protection Act, is being enacted to allow the legal protection of microchip circuitry and software design, hitherto considered as weakly protected by the Copyright acts.

‹3.5› Together, these enactments have led to the formation of consortia, such as the 35-member SemiConductor Research Cooperative (which has participation from Motorola and IBM), the Council for Chemical Research (1982) which has membership from DuPont and Monsanto, the Centre for Advanced Studies (among its members, CBS, RCA, 3M), etc.

‹3.6› EEC's Strategic Program for Research in Information Technologies (ESPRIT- 1983) and the MITI-supported joint industry research combines in Japan are instances of this widespread strategy to create, through research objectives, newly privilieged and sheltered communities.

‹3.7› It is evident that a new form of cartels - which can be characterised as 'science cartels' - are emerging on the international scéne.

‹3.8› It needs to be noted that although a predominant part of the

new developments in technology have been initiated and developed by small firms, often in linkage with universities, many reknowned universities are accepting 'contract research'(think-tank) assignments from major industrial firms. These may hinder international science transfers which have hitherto taken place with great ease.

‹3.9› As the advanced countries enter the 'post industrial' era and become 'information based' societies, there is the unwelcome prospect that developing countries, if they do not, through conscious exercise of strategy, develop science and technology policies, they will inherit the not only the 'smoke-stack industries' - by the so-called de-industrialisation process of the advanced countries - but will import the 'business cycle' which is linked to the heavy industries' economy.

‹3.10› Developing countries individually and collectively will have to forge technology policies that will enable them to take advantage of the new trends in research while integrating them with traditional industries and the establishment of heavy industries which will provide them with a materials base. As the proceedings of the UNIDO IV Conference have pointed out, the new technologies, often requiring modest outlays of investment, can provide them with new solutions to the basic problems of food, fodder, fuel and fertiliser. New technologies can help in the upgrading of traditional technologies and contribute to the enhancement of the quality of life. New techniques in information processing can enable developing countries to reduce risks of large investments through pre-investment process simulation,modelling and vulnerability analysis, while helping them to bypass stages of incipient and experimental investment.

‹3.11› The aquisition, control and endogenous development of technology are critical aspects of technology policy. Nevertheless, all countries may not have the capability or the capacity, in a given parcel of time, to absorb advanced technologies. Some of them, as pointed out in the Proceedings, may have to adopt and manage a technological pluralism, the co-existence of the modern with the conventional or traditional,

that will be optimal in the light of alternatives, constraints and priorities. Countries, depending on their stage of development, will have to analyse and determine what should be their 'point of entry' in terms of the new technologies.

(3.12) The pace at which developing countries can introduce technologies and innovations will depend on their awareness of the direction and pace of research and technology in the international context. Technological evolution also depends on the technological infrastructure, the institutional matrix and linkages. There will be the constant need to examine the complementarity of new developments with traditional lines of action.

(3.13) Technology policy is not a policy instrument that is, or will be, unique to developing countries. In the last 10-15 years all major industrialised countries have adopted it as a prime instrument of economic development. An example of such a policy is the US National Science and Technology Policy,Organisation and Priorities Act of 1976, which requires inter alia that the public be informed, in a continuing manner, of the conditions which warrant special action in the area of scientific and technological research and of constraints to devlopment.EEC's Committee for Forecasting and Assessment in Science and Technology (FAST) is a contributary to the technology policy instruments of member countries.

4. SURVEY OF EXISTING EFFORTS

(4.1) The periodic publications Unido presently addresses to developing countries, on the subject of developments in science and technology and, allied therewith, on the dimensions of technology transfer, are the following:

(1) The UNIDO Newsletter (monthly)
(2) The TIES (Technological Information Exchange System) Newsletter (quarterly)
(3) The three 'Monitors' (quarterly):
Microelectronics Monitor
Genetic Engineering and Biotechnology Monitor
Advances in Materials Technology:Monitor

Except for the Newsletter, the other periodicals are supported by supplements. The UNIDO and TIES Newsletters have been operational for several years, while the Monitors are quite recent.

(4.2) At the present time there does not appear to be a single Unido periodical, or for that matter, any other single periodical or series which is oriented - even generally - to the purposes enlisted for the WTR. The closest efforts to assessing and publishing technology developments, on a global scale, are those of the US Congressional Office of Technology Assessment (OTA) and the 'sale' and 'restricted circulation' publications of OECD. These are semi-regular publications and while comprehensive and valuable (particularly in terms of data), they are not, by and large, of much significance to the advancement of science and technology policies of developing countries, except perhaps defensively.

(4.3) ECOSOC (UN Economic and Social Council for Europe), however, appears to be organising to collect,analyse and publish information somewhat similar to that intended for the WTR but apparently this effort will only relate to the interactive environment of the member countries of ECE.

(4.4) THE UNIDO NEWSLETTER: The Unido Newsletter is addressed to a very wide but amorphous developing country audience concerned with the transfer of technology. It primarily covers four areas: (a) news of conferences being organised by UNIDO and highlights of conferences (b) listings of UNIDO publications and reports on technology,importantly the findings of Expert Groups (c)

reader-inputted offers and quests for technology - most often of the type suitable for medium and small scale industry and (d) listings of short-term subject-experts sought by Unido. The Newsletter services the technical information needs of its readers through the use of Unido's information source INTIB (Industrial and Technological Information Bank).

‹4.5› By and large, the Newsletter is an information document and carries very little of interpretive content. Its basic attention is on servicing readers who are interested in obtaining preparatory information on traditional production technologies.

‹4.6› THE TIES NEWSLETTER: The TIES Newsletter, while it is attracting a large number and a diversity of readers from both developed and developing countries, primarily seeks to inform developing country government agencies - importantly regulatory agencies - on the changing legal and institutional environment in developing countries (to some element, also that of advanced countries) in the fields of technology transfer, direct investment and technology policy, and of the methodologies being adopted by various developing countries, to promote and regulate technology transfer and implement technology policies. The TIES Newsletter does not normally cover sectoral policies of governments and, thus, does not become involved in the scientific and technical content of technology transfer or technology policies.

‹4.7› The TIES Newsletter is concerned with the presentation of developing country experiences and thus is source of both raw information (e.g. technology payments of certain countries) and interpretation (e.g. the importance of patent licenses in technology transfer to geographical regions. The Newsletter often presents readers views and publishes extracts/articles from well-known publications. There is little linkage between the Newsletter and the Monitors.

‹4.8› THE MONITORS: Two of the three Monitors, the Microelectronic and Genetic Engineering Monitors, are addressed to people closely or professionally associated with latest trends in the development

and application of the two technologies. Much of the circulation, indeed, is directed to a select developing country readership. There is also specific intent in collating monitor material to draw the attention of developing country decision makers,and service them in terms of policy alternatives in industrial development. However, a good portion of the information currently presented (surveyed for the purposes of this Report), inspite of careful selection and editing, is because of technical complexity, likely to be valued and used only by senior leaders of research institutions or by corporate personnel of manufacturing companies (who, through feedback assessment,appear to be interested in the significant amount of hard data that is present in the Monitors).

‹4.9› The Materials Monitor: This Monitor is projected to serve a broad span of scientists and technologists, working in a multiplicity of disciplines, of the latest trends in materials sciences. A survey of the two issues so far released leads to the opinion that the Monitor can, because of its significant technical content, be of interest only to the working specialist.

‹4.10› It is recognised, in the context of the Monitors, that one of the principal concepts underlying them is that the scientist and technologist should be active contributories to science & technology policies which are framed at the national apex level - and that they be kept informed of international developments.

‹4.11› The generalisation can be made that the three Monitors, as presently implemented are, without their supplements, basically sorted information sources. There is little of information analysis in them. They, today, basically provide a 'current awareness' service.

‹4.12› The three Monitors are, however, supported by supplements (Unido commissioned expert studies) which specifically attempt to

interpret to policy-makers developments in fields of rapid change: The Bessant paper on Information Technology and the Zimmermann paper on Biotechnology, issued under the banners of the respective Monitors, are important examples. Even so, the interpretation is insufficient to propel a developing country posture.

‹4.13› Reader feedback, more experience in the editing of the Monitors,and wider choice of experts working at the developing country interface will undoubtedly help to intensify the interpretive element. (However, refer to Section 8.13)

‹4.14› One of the problems faced by the editors of the Monitors is the limited availability of published material relevant to the intrerest of developing country policy makers (position papers, case-studies or journals), particularly in the emerging technologies' field with which the three Monitors are expressly concerned. This has the consequence that information for the Monitors is excerpted from advanced country periodicals which are intended for a very different kind of clientele.

5. BASIC CONTENT OF THE WORLD TECHNOLOGY REPORT

‹5.1› Some considerations:

It is intended that the discussion and description of technology change, restucturing and evolution will comprise the core area of the journal. However,because of the close inter-relationship between government policies, market structure, resources and innovation,the WTR is inevitably compelled to addressing itself to economic and social issues and their dimensions. Consequently, the industrial organisation and business structures of developed and developing countries,or legislation relating to transfer of technology, can be expected to be part of WTR coverage. However, by intent, features such as trade and finance,while impacting on technology,will need to be considered as peripheral to the objectives of the Report.

(5.2) Another general aspect pertains to the identification of technologies or technology classes which can come within the coverage of the Report. For many developing countries, technologies that have reached maturity in advanced countries, but in which there is little of new development, may be new and relevant technologies in their environment, on which information and policy directions are sought. For other countries, information and analysis on technologies that will improve their international competitiveness can be of urgent interest. Accomodating such diverse requirements, as can be expected, will make the WTR unweildy.

(5.3) The WTR can best be oriented to technologies and technology systems that are 'generic' in character; that is, those capable of strongly influencing and supporting a very broad span of products and production systems; in other words, technologies which have, principally, trans-sectoral significance. The WTR will attempt to weave the inter-disciplinary web of the 'leading edge' technologies, in among themselves, and outline or analyse their inter relationship to traditional lines of technology usage and development.

(5.4) SUGGESTED CONTENT OF THE WORLD TECHNOLOGY REVIEW

I. MAJOR THRUSTS IN RESEARCH:
--- major directions of global research; research leadership in various fields;areas of rapid technological change;implications to developing countries

II (a). TRENDS IN MANAGEMENT OF RESEARCH & DEVELOPMENT AND IMPACT ASSESSMENT:
--- Research management;research structures (government-industry, industry-university, government-government cooperative arrangements; creation of R&D consortia, public and private; awards of significant contract research; R&D joint ventures;government subsidies;etc)

II (b) --- National and regional expenditures on research;

government subsidies;'science indicators'; R&D intensities (R&D/sales ratios,etc),etc

III. NATIONAL SCIENCE AND TECHNOLOGY POLICIES:
---presentations and case studies of national strategies (strategies as new discipline) ;issues management (identification and management of critical issues); exercise of policy options (import substitution, industry modernisation, rationalisation of production system,etc, industry relocation); science-technology linkages; institutions and institutional linkages; developing country perspectives

IV. TECHNOLOGIES FOR HUMANITY:

V (a). SURVEY OF TRENDS IN TECHNOLOGY MARKETS:
--- Transfer of technology global environment; developed and developing country environments; characterisation of technology transactions (fast moving sectors,penetration,etc) in such areas as international subcontracting, software licensing,CAD/CAM;consultancy services;

V (b). ---technology flows (North-North, North-South, South-South): technology payments and receipts (use of actual or proxy indicators);balance of payments on technology in global, regional and country terms;etc

V (c). --- impact on industrial development patterns

VI. TECHNOLOGY FORECAST AND ASSESSMENT STUDIES:
---major developed (OTA,OECD,RAND) and developing country/UN scenarios of science & technology development; industrialisation models; technology location and diffusion studies; socio-economic impact (global,regional;inter-sectoral) of technology change and

evolution.

VII. TRENDS IN TECHNOLOGY LEGISLATION:
--- Development and transfer of technology; attitudes to new forms of technology transfer (software, micro-organisms and plant strains;transborder data flows,etc);

VIII. DEVELOPMENTS IN INFORMATION BASES AND IMPACT ASSESSMENT:
--- identification of major public-domain and private sector data banks for scientific, technological and commercial information; methodologies and costs of obtaining access;emerging developed and developing country legislation on control of data flows; impact on personal privacy; etc

IX. S&T INFRASTRUCTURE:
--- high technology enclaves and science parks; technology monitoring institutions; university-industry linkages; computerised education; scientific manpower training;etc

X. ISSUES IN THE IMPROVEMENT OF PHYSICAL AND SOCIAL ENVIRONMENT:

XI. NEWS AND EVENTS:
---coverage of science and technology magazines for announcements of major developments; major international and regional meetings on science and technology;etc

6. ELABORATION OF WTR COVERAGE

‹6.1› Some considerations:

The WTR will be able to service its readership effectively only when interpretations of on-going developments, particularly on technology markets, are based on 'hard' information - that is, on

established results, such as major technology break-throughs, or on quantitative trends, such as expenditures on the development and aquisition of technology. Nevertheless, 'soft' information such as the placement of export barriers of sale of computer technology have great significance.

(6.2) At the same time, it is possible to develop 'proxy indicators' which have a status inbetween that of a qualitative factor and its final quantitative manifestation. Proxy indicators can be in the nature of ratios (e. g 'research intensity' measured by research expenditures to industry sales), conceptual constructs (e.g. the LSIP ratio - licensor share of inherent profit of enterprise - used by the TIES group) or trend indicators based on value judgements (e.g.a five-starred degree of emphasis on the modernisation of the steel industry in ROK), etc. The use of proxy indicators may also permit economy in the collection and presentation of quantitative information.

The development and use of proxy indicators will permit substantial coverage of world research and technological information. Some examples of the use of these indicators are presented below.

(6.3) In terms of presentation of information, WTR coverage can be seen as constituted of the following components:

- technical news; reporting of major events; statements of actions of governments or agencies (policy announcements, enacted legislation, institution-creation,etc)

- reportage of journal-based assessments in the scientific/technological environment

- WTR's qualitative assessments of international technical change (e.g. advanced country actions vis-a-vis developing countries')

- summaries of Special Study Supplements

- presentation and discussion of 'real' and proxy indicators

‹6.4› The development and presentation of indicators:

REAL INDICATORS: The identification and presentation of real indicators presents few problems as in most cases they can be excerpted from industry and science journals. Some indicators, such as aggregate, regional or national technology payments made by developing countries or the nature of national 'mixes' of patent, knowhow,trademark and technical assistance fees will need to be estimated from TIES and other data, and can be assumed that such will be available from the DTT group.

('Technology flows' data, to make a beginning, can comprise of the following: disaggregated payments for technology classified by regions and industry; national origins of licensor companies; trends in the number of established joint-ventures, subsidiaries,etc; flows of direct and portfolio investment by region, industry, investor country, etc;flows of profits and dividends;trends in software licensing;etc)

INDIRECT AND PROXY INDICATORS: These indicators can be either quantifications on well accepted lines (e.g.'research intensity' measured by research expenditure per employee), or they may be custom-devised for the specific purpose of WTR reporting. Again, value-judgement criteria can be applied to get semi-quantitative evaluations of trends or used for purposes of comparison. A large number of proxy indicators have been devised by organisations such as Battelle and they make be examined for suitability in terms of the WTR.

‹6.5› Appendix A shows a sample set of assessments of trends made by OECD for member countries using indirect indicators (both quantitative and semi-quantitative).

The development of proxy indicators, and assessment yardsticks, may not be as much of a problem as much as the obtaining of raw data. At the same time it must be noted that UNIDO statistical tables and those made available by other UN organisations provide a substantial base, at least for a start.

‹6.6› Technology forecast and assessment studies:

Technology policies and programs are usually concepted on a long-term basis. Hence developing countries may be expected, individually or collectively, to be interested in scenarios of technology developments of the long-term, both in respect of the policy re-adjustments they may have to make to accomodate them, as well as from the viewpoint of building adequate defenses against adverse impacts flowing from them. Scenario development should, therefore, be seen as an important element of WTR's coverage.

Technology forecasting and assessment are important but expensive undertakings of advanced countries. Various methodologies have been developed for them, many of them quite complex. In servicing WTR's clientele, however, the issue arises: in what sectors of activity should technology forecasting/assessment be carried out ? The asking of the question itself implies that developing countries will need to co-engage in a selection as well as a forecasting process. It is the writer's opinion that selection cannot precede assessment.

While effort will have be expended for the establishment of a method which will be economic in terms of manpower and expense it appears on the surface that a Delphic type of forecasting exercise may be suitable. The implication of this choice is that developing country responding organisations are required. They will have to be identified and queried for the several cycles of questions and answers that are inherent in the Delphic forecasting technique. (A similar organisation and approach problem is likely to be present whichever forecasting method is finally applied). The inference of this discussion is that WTR's efforts to cover technology forecasts will require a system of national rapporteurs who will administer the Headquarter's program at the national

level.

A system of national rapporteurs will also enable the collection of data for the proxy indicators, which have been discussed above.

(6.7) It should be realised that in the presentation of information, change in certain identified sectors of WTR coverage will be gradual and in other sectors fast or sporadic. Every issue of the WTR will not, therefore, be able to cover all of the major subjects recommended in Section 5. Even the collection and presentation of information in sectors of gradual change will take time and effort.

It is therefore recommended that effort should be made for publishing two to three WTRs a year. As is suggested later (Section 7), these issues should be supported by three to four WTR Special Study Supplements. Certain WTRs, following the Supplements, can be expected to carry summaries of the Supplements.

7. NATURE AND CONTENT OF SPECIALISED REPORTS (WTR SPECIAL STUDY SUPPLEMENTS)

(7.1) As concepted in this Report, the relationship between the WTR and the WTR Special Study Supplements can be expressed as follows: The WTR issues 'inform, indicate and assess' the degee and quality of change in the science-technology environment; the Special Study Supplements 'analyse, explain and develop options' in such environment and, resulting from analyses, evaluate their impact on the socio-economic environment of the developing countries.

Candidate subjects for the Supplements can be, for example:
- inter-relationships between automation, computerisation and robotics
- the implication to developing countries of the new phenomenon of

R&D joint-ventures and R&D consortia among large firms;
- policy options for the establishment of high-technology sectors and enclaves in developing countries
- legislative options for developing countries in the regulation of transborder data flows and 'down-loading' of foreign data banks;
- energy options for developing countries in the context of genetic engineering capabilities;
- considerations relating to safety engineering in the context of the Bhopal pesticide plant and Mexican LPG plant disasters;
- international sub-contracting of software development: reverse transfer of technology?;
- strategies for the establishment of science parks and university-linked technology development by industry.

‹7.2› WTR Special Study Supplements can also be expected to cover sectoral aspects by geography, industry (e.g. maturity aspects of the petrochemical industry), etc, given the situation that the main WTR issues will, if accepted as recommended, have a trans-sectoral and cross-disciplinary appproach. Even so, subjects such as physical resources may have to be treated in the Special Study Supplements if they are to be dealt with in depth.

‹7.3› The number of Special Study Supplements which can be issued per year will depend not so much as the availability of data and time for data collection, but the budget available for technology impact studies,since it is estimated that more than half of the issues will be those written by outside Consultants.
About 3-4 issues in the first operational year are recommended.

8. INSTITUTIONAL REQUIREMENTS - PREPARATION,COMPILATION AND PUBLICATION OF WTR

‹8.1› The organisation for the issuance of the WTR as a periodical publication, together with that of the Special Study Supplements can be considered to comprise of the following four components:

(a) information collection, storage, sorting and retrieval

(b) information analysis and interpretation
(c) information organisation, and
(d) collation and presentation

(8.2) Because of the considerable experience accumulated in the publication of the four present periodical publications, the collation and presentation of the WTR is unlikely to pose any problems. This aspect does not therefore require any particular attention in this Report, except to mention that the size of the periodical and its graphical and tabular content may require special skills in editing and data presentation.

Information collection, together with analysis and interpretation, will, however, require critical attention, organisation and major effort.

(8.3) Information collection, storage, sorting and retreival:

The organisers of the WTR will have before them various computerised data banks within UNIDO (including INTIB), the books, journals and documents of the UNIDO/IAEA library, and theoretically, access to some of the international data bases, both through arrangements made by the library and by the Division of Industrial Studies.

(8.4) One of the major problems faced in considering the feasibility of information access, attempted by various experiments made by the writer at both the library and INTIB, is that the data bank classification system at INTIB and the library lack the descriptor coverage that will sort available information (literature citations), with some precision and economy, to meet the objectives of WTR coverage. Using traditional descriptors (for example, 'technology + developing country') results in a mass of refefences, most of which on perusal are irrelevant to the WTR, while the use of descriptors such as 'technology + developing country + payments', because of higher specificity, yield little or no information. It was also noted that much of the information output, in the various trials, is outdated. Subject searches, such as for example, 'vegetable oil +

technology', in this highly traditional field, throws up large amounts of laboratory-level scientific information.

Another problem from the point of view of WTR publication is that the databanks at Unido only contain literature references and not text and tabulations.

‹8.5› It was not possible for the writer, while at Unido, to test data and sorting techniques with external data banks, bearing on the needs of the WTR. However, experience with British Reference Library (to which the IAEA library is said to have access) on particular technological and commercial matters has been much more rewarding. It is doubtful,however, that the particular set of descriptors which will satisfy the needs of the WTR will yield much more information even with external databanks. But this may be an erroneous conclusion. More investigative work is necessary and is recommended.

‹8.6› Till further work can be carried out, it is suggested that the journals base of the IAEA/Unido library be used as the primary source of routine information for the WTR.

A fairly thorough search was carried out by the writer of the journals carried by the Library (including the stacks) with examination of journal contents. Appendix B, with some subclassification, presents a list of journals which will be useful for the preparation of the WTR. They will provide the information called for in the component sections of the WTR as covered under Section 5.4 . The journals base of the Library must be considered excellent although, in the case of some journals listed in the Appendix, subscription has lapsed for some years.

Appendix C presents a sample of recent articles, drawn from the journals, to illustrate relevance. These may be usable, in precis or analysed form, for a portion of the first issue of the WTR.

‹8.7› From the long-term point of view, it will be necessary to carry out the following <u>routine</u> operations:

(a) identify, with the help of consultants (who will prepare

the WTR supplements - see below) the range of journals and special series documents issued by particular institutions (e. g. Arthur D. Little, RAND Corporation, Battelle,etc) which should be consulted for routine collection of information for the WTR

(b) arrange with the library to compile, on a routine basis,in file form,a 'table of contents' of each of the selected journals

(c) have the special officer for WTR (see below) and his staff tag selected articles of the above files with the WTR descriptor together with other descriptors

(d) store the tagged references in a WTR-dedicated databank - which is recommended - in one of the existing databanks of the Division of Industrial Studies, or in one of the Library's databanks

(e) for the potentially important WTR references, store text in the WTR-dedicated databank.

‹8.8› Information analysis and interpretation:

In the terminology of this Report, the interpretive material of the WTR can be considered to comprise of two parts:

(a) routine analysis and interpretation of data and information, and

(b) special analysis and interpretation of data and information

The reporting of advanced and developing country research expenditures, the assignment of relative magnitudes of sectoral research effort in countries by technology classification, technology payment flows, patent registrations in developing countries, industry-wise classification of patents, transborder data and software flows, etc will be the type of analysis carried out in (a) above.

This type of activity requires constant attention and is therefore a routine function . However, by its very nature it is a specialised function. The analysts who will man this assignment will be professionals, probably long-term staff or Consultants of Unido.

‹8.9› It is the recommendation of this Report that the functions enlisted by (b) above be carried out both by in-house specialists as well as experts, depending on the subjects treated. Technology policies of developing countries may, for example, be best done within Unido (say, by the TIES group) while the help of outside experts might be needed to discuss internationally-developed S&T scenarios.

In this connection, it should be recognised that Expert Group Meetings also produce forecast and interpretive information . These should be considered as information inputs to the WTR.

‹8.10› WTR Department and Personnel Organisation:

The WTR, formalised on the lines of this Report, with a fairly unique coverage, can be of great value to the planning processes of developing countries, provided it is in practice feasible to support it with expertise,high quality data and interpretation.

Considering its potential importance it is recommended that the WTR be supported by a WTR-dedicated functional unit whose principal officer will have the key responsibilities of:

(a) identifying the issues for treatment in a projected sequence of WTR publications with patterns of information analysis,interpretation and presentation

(b) organising for the routine aquisition, collection, compilation and storage of data and information pertinent to the defined purposes of the WTR

(c) defining topics for in-depth examination by Department staff and consultants and ensuring the preparation of studies for publication,

(d) publishing the WTR and Special Study Supplements.

‹8.11› It is suggested that the management of the three Monitors should be within the scope of work of the WTR department since it may be more economical to organise information collection for the Monitors along with that of the WTR.

If the Monitors do come under the supervision of the WTR functional group, then the interpretive component of their function (the supplements now issued under the banner of the Monitors) can be integrated with that of the WTR study supplement . In this case, the role of the Monitors will be to basically and fundamentally to provide a "current awareness service".

Unido activities relating to the establishment of systems and linkages with external data banks should take into account (provide for) the specific needs of the WTR program.