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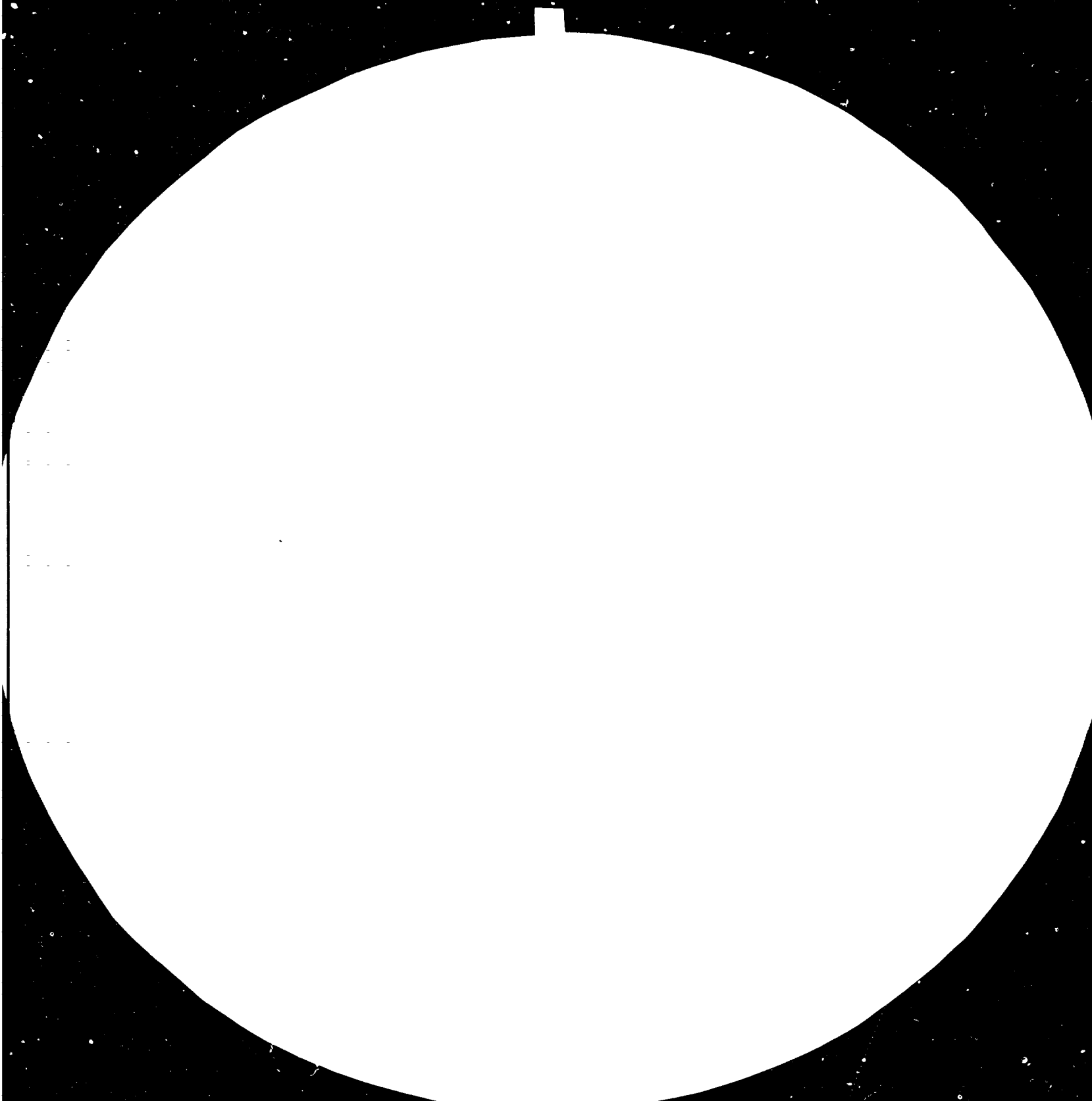

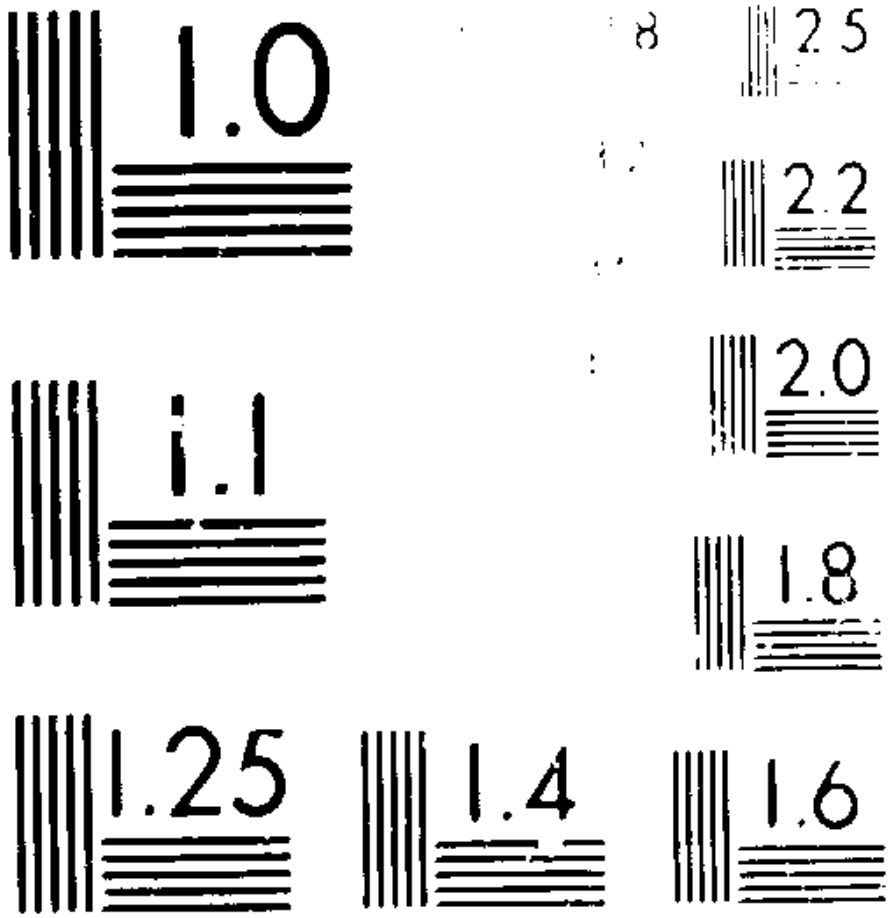
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CONDITIONS AND JUSTIFICATIONS FOR ACCEPTANCE OR REJECTION OF NEW TECHNOLOGIES WITH SPECIAL REFERENCE TO YUGOSLAVIA*

prepared by

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INTRODUCTION

1. Technology is an instrument through which the various needs of a society can be met. It can be embodied in products such as machinery or industrial complexes, or in legal documents such as patents, licences or know-how contracts. It may also be expressed in the form of a skill, a practice or even a "technology culture" which finally may be diffused so that it can no longer be noticed, even if it is on such a "culture" that the proper functioning of a given technical system ultimately depends.

2. Technology, as the result of human activities, is viewed as the body of systematic and applicable knowledge for the manufacture of a product, for the application of a process or for the rendering of a service, including associated managerial, organisational and marketing techniques. This body of knowledge is used by a given society at a given moment to resolve concrete problems facing its development, drawing mainly on the means at its disposal, in accordance with its culture and scale of values.

3. Due to the general system of dynamic interrelationships and feedbacks existing between the society needs and structures, conditions of human activities, technological patterns, economic and environmental structures, a spiral-like flow of changes is enacted, which answers to the needs of new technologies, altering environmental and economic as well as social processes, thus causing the growth of new priorities and needs. Through this endless process technological development is tailored toward the creation of more sophisticated technologies with each change.

4. The character of this originally spontaneous and (naturally) balanced process is at present altered taking more and more the shape of a planned and organised process in which direct changes in technology, somewhat in economic, environmental and to a lesser extent social structures can be introduced at man's own will and purpose.

5. This crucial change in attaining the power to decide the future of a society achieved through the advances of science and technology, and scientifically

based industrial production of new technologies, imposes many problems dealing with balances and rationalities in development of practically all the aforementioned complexes and their relations.

6. Due to the misuse of technologies, as well as the complexity of influences and consequences, many of which are at present insufficiently known, it is required that technologies are carefully screened so that their potential can contribute to the maximum to the overall social development objectives involving the least risks in producing side effects. This imposes the condition of a consistent criteria used in the selection of technologies with the intended path of social development.

7. For the establishing of an appropriate relationship between the demand and supply of technologies, market forces alone are not sufficient. Also the answer is not to be found in the machinery, techniques and systems of the advanced technology alone, but in the social purposes they are designated to serve. It can be said that the technology which mirrors the needs of society requires full and active participation of people and authorised public institutions in shaping it.

8. The patterns of technological development can thus be directed by a set of guidelines expressing social preferences. Identification of these preferences is more or less worked out in the process of planning of the social development, which means that guidelines can directly be reproduced or derived from the preference contents of these plans (objectives, programmes and means).

I. COMPATIBILITY REQUIREMENTS

9. Articulating the needs of minority social groups, for social preferences of a society as a whole, bears the hazard of rejection of "selected" technologies and/or introduction of disintegrating and destructive processes in society which can also be the consequences of a selective or fragmentary communication of verified social preferences to the agents pertaining to the supply of the technologies of both domestic and foreign origin.

10. This means that the appropriateness (and the acceptability) is to be judged in relation to the objective of development which is socially and environmentally sustainable over the long run.

11. Appropriateness so defined the personality and balance in a chain of changes and interrelationships between technology structures themselves, and technology development and social, economical and environmental complexes imposing the following compatibility criteria that must be met if a technology is to function efficiently:

(a) Social and Political Compatibility

- Technology should promote the value system of a society. Technology supplied should not be adverse to the habits, customs and beliefs of a social setting in which it is supposed to function;

(b) Development Compatibility

- The process of technology must be in harmony with its potential for further self-development;

- If during the period, when the supply of technologies is dominantly oriented towards foreign sources, potential for development does not materialise, problems will grow in cumulative order causing technological dependence and eventually respective technological dominance in the first instance, as well as social, economical and environmental imbalances;

(c) Infrastructural Compatibility

- Technology generated domestically or imported should be shaped in accordance with the availability of skilled manpower and legal framework;

(d) Production Level Compatibility

- The choice between mass, serial or special order production should reflect the potentials of the market and it should be structurally balanced with neighbouring industries/plants in the same product chain;

(e) Materials Compatibility

- A prerequisite for an efficient use of a given technology is in the first place the availability of proper domestic raw materials, or availability of raw materials from abroad under favourable conditions;

(f) Energy Compatibility

- Another prerequisite for the efficient work of a technology is that adequate energy sources, if possible domestic, are available in the required qualities and quantities (oil, coal, gas, steam, electricity etc.);

(g) Monetary Compatibility

- Financial resources for the use of technology (maintenance costs included) must be secured. If possible the functioning of technology should not produce imbalance of foreign and national payments;

(h) Ecological Compatibility

- Technology should work in harmony with nature and should not harm the natural environment (water, air etc.) in terms of pollution, disruptions, squandering etc.

(i) Time Compatibility

- Adequate dynamics is required in choosing, implementing and utilisation of technology created in the first place due to the interaction between economical, environmental and social complexes of the given society as well as the interaction with other societies (countries);

(j) Information Compatibility

- In spite of its infrastructural nature this element is of vital importance;

- The better the information covering the existence and contributions of a set of potentially appropriate technologies, the better the decision making, the

better the function of the chosen technology in the sense of the most favourable conditions under which the input can be supplied, technology obtained and installed, output marked etc., the lower the risk of possible unknown or unpredicted negative consequences. If the specific requirements concerning the above mentioned compatibility criteria cannot be fulfilled they become the constraints, determining the orientation, intensity and overall dynamics of the technological development and in a sense the determinants of the choice between dealing with domestic or foreign sources of technologies needed.

12. The framework of criteria for decision-making in selection of technology is based on the compatibility requirements and constraints and the method of giving adequate weight to the importance of needs (guidelines or preferences) through comparison.

13. Due to the intangible nature of needs and diversity of technology effects and features, at the present state of the art, it is impossible to introduce in the selection of technology, the standard measures of appropriateness in all the aspects of compatibility requirements.

14. The framework of criteria thus usually consists of a "qualitative" guideline mostly concerning the social and political compatibility and a mixture of guidelines and quantitative indicators for other compatibility requirements.

15. Quantitative indicators are usually the criteria covering more detailed aspects of economic and technical/technological efficiency (rentability, rate of return, economic efficiency, technical standards, royalties expressed as the maximum or minimum percentage on production, balance of materials, energy, number of personnel required etc.). This method is mostly used in deciding whether or not to generate new technologies, while at the level of choosing among the existing alternatives.

16. In trying to total up the costs and benefits of technology to the society, respective methods fall into two categories: methods coupled with the price (shadow prices reflecting scarcities of given resources) and methods of "effects" evaluation based upon input-output models. Both methods are giving way to arbitrary judgement and are used for larger projects and investments encompassing the technological change.

II. FRAMEWORK OF CRITERIA USED FOR JUSTIFICATION OR REJECTION OF NEW TECHNOLOGIES IN YUGOSLAVIA

17. The framework of criteria presently in use in Yugoslavia is a mix of guidelines (or preferences) and quantitative indicators.

18. Social and political compatibility criteria rank at the top. These are formed as the guidelines which can be identified from various documents concerning the matters of the social plans of development as well as from legal regulations.

19. The consistency of the objectives of development and consequently of guidelines with the needs of virtually all the Yugoslav national population is achieved through a novel system of planning in which the participation of all agents of society (both "nongovernmental" and "governmental") is mandatory and nonhierarchical.

20. Self-managed democratic harmonisation of social and self-management planning is thus intended to ensure consistency between the national, regional or local considerations and goals and objectives of the enterprises.

21. The social and political guidelines are to be applied as the criteria in all cases of selection. The criteria emanating from the economy, ecological, infrastructural as well as time and information compatibility requirements are of the same rank. Those criteria can be presented with the mixture of guidelines and some standard quantitative indicators.

22. The guidelines and standard indicators are to be found in documents covering the plans of development, (social, compacts, self-management, social contracts, self-managed agreements) as well as in legal regulations, technical publications, norms and standards and economical/statistical studies of economic sectors.

23. Construction of the framework of criteria is specific for a particular branch of economy in which the technology to be assessed should be in the function of given objectives.

24. Standard procedures for selection are introduced covering the various forms in which the technology is to be supplied:

(a) screening and selection procedure covering capital investment projects in industry and agriculture especially;

(b) screening and selection procedure covering the import of capital equipment;

(c) approval procedure for the contracts containing the provisions dealing with the transfer of technology from abroad;

(d) screening procedure for the projects on generation of domestic or naturalised technologies.

25. As an illustration the following is a list of some key guidelines as well as standard indicators used in the framework of criteria.

26. Social Compatibility Guidelines

(a) preference for technologies which increase the possibility and effectiveness of social participation and control;

(b) preference for technologies which relate man to work (which require satisfying creative work);

(c) preference for technologies which facilitate devolution of power to the workers and other working people rather than its concentration in the hands of the elite;

(d) preference for technologies which lead to enhancement of the quality of life (and not only to an increase in the consumption of goods);

(e) preference for technologies developed endogenously from the local context (rather than imported from abroad).

27. These guidelines have been derived from the following goals of the social development plan:

(a) further development of the delegate system;

(b) full affirmation of individual workers in the self-managed associated labour;

(c) economic and social liberation of workers, their working capacity and creativity, especially through a better affirmation of the labour productivity etc.

28. Economic Compatibility Guidelines

Material, Production Level, Monetary, Energy

(a) preference for technologies which are consistent with the basic factor endowments, e.g. energy saving, energy conserving, capital saving, employment generating etc.;

(b) preference for technologies based on local materials, rather then materials from abroad;

(c) preference for technologies for export expansion particularly in traditional sectors, and for the products and services with a higher level of finalisation;

(d) preference for technologies through which currency balance of payments should be improved by at least 20 per cent increase of exports, or imports substitution per unit of investment;

(e) preference for technologies that:

(i) warrant higher productivity than the best attained in the branch;

(ii) warrant higher income from the average in the branch;

(iii) increase competitiveness at the international market;

(iv) have better technical performance than the already existing ones in the same field;

(v) generate employment opportunities.

29. These guidelines are derived from the following goals of the socio-economic development plan as well as the investment criteria agreed upon in the social compact covering income distribution of social reproduction and other documents:

(a) intensive increase of production effectiveness, promotion and improvement of qualitative production factors;

(b) more efficient utilization of capacities;

(c) significant increase of export strengthening the ability of adjustment to the world economy changes;

(d) elimination of structural disproportion through adequate production orientation, especially in sectors of energy, raw material, food, transport and mechanical and electrical engineering as well as in small industry;

(e) increasing the living standard by strengthening the material base of the associated labour;

(f) achievement of equitable terms in foreign trade by a more open national economy, elimination of autarchy, improvement of co-operation and specialization within the country and achievement of world productivity;

(g) investment financing should take the form of a project oriented joint financing with (legally determined) minimum participation of the investor's financial resources from his own accumulation;

(h) income efficiency (profitability) of the investment should be higher than the efficiency obtained in the same industrial branch in the previous year;

(i) foreign currency effectiveness should be achieved by at least 20 per cent increase of export or import substitution per unit of investment;

(j) regional allocation of new plants;

(k) specific economic and technological criteria of the industrial branch concerned.

30. These criteria should be applied to the available domestic and foreign technologies as well as the R&D programming.

31. The branch economic and technology criteria contain the following common requirements for a technology:

(a) to warrant a higher productivity than the one obtained in the branch;

(b) to warrant a higher income than the average;

(c) to increase competitiveness at the international market and strengthen the position of the producer in the international division of labour to meet the demand of the national market;

(d) to maximise the self-sufficiency for purposes of national development by optimum use of domestic raw and reproduction material, spare parts, services and manpower.

32. At the final stage this framework of criteria is confronted with the results expected from a given project, presented in the form of a study by the domestic agent Organizations of Associated Labour (OAL) which is supposed to carry out this project.

III. SOME OBSERVATIONS ABOUT YUGOSLAV EXPERIENCE

33. Postwar Industrial Development

After the war Yugoslavia accepted foreign capital goods (equipment, machinery) as the reparation. The limited prewar industrial capacities had been destroyed entirely during the war. Different types of equipment and spare parts caused problems of unification and standardization and difficulties in introducing industrial norms etc.

34. In the fifties and particularly in the early sixties when Yugoslavia passed the threshold of technological sensibility and joined the countries in which technology plays the key factor of economic and social development (per capita income above $ 500-600 and the industrial sector shared 20-30 per cent of GNP) the technological progress relied greatly on imported technology, mainly acquired

through licensing.

35. Licensing contributed mostly to import substition and the production based on licences was directed to the rapidly growing national market demands.

36. During the seventies,simultaneously with the intensification of national R&D activities and faster growth of domestic technology sources, the industry managing staff gradually introduced some higher forms of technology transfer, such as joint ventures, co-operation in manufacturing with specialization and business-technical co-operation with foreign parties. These forms produced better effects to the modernization of industry, increase of export and productivity growth. They also contributed to the experience and better knowledge increasing the bargaining strength for licence acquisition.

Technology Import Regulation

37. The experience obtained during some 25 years of purchasing technology abroad, together with proper technology development, were essential for enacting and regulating technology transfer in 1978 1/. The main purpose was to eliminate restrictive business practice and attain an equitable position between national and foreign partners, and to obtain modern and appropriate technology under favourable terms, as well as to avoid the antisocial impact of acquired technology.

38. According to the regulation a contract on technology transfer must contain several provisions of obligations of the foreign partner (i.e. supplier of Technology) such as:

(a) specification of aims and conditions of production;

(b) guarantee that the transferred technology and documentation are complete and propitious to obtain the aims mentioned;

(c) personnel training commitment;

(d) obligation to advise the partner about any improvement of technology;

1/ The Law on Longterm Industrial Co-operation, Business and Technical Co-operation and Transfer of Material Rights on Technology between Organizations of Associated Labour (OAL) and Foreign Person of 14 July 1978.

(e) guarantee that raw material, reproduction material, spare parts and equipment are available;

(f) guarantee that the results specified in the contract will be obtained or penalty and/or payment of damages will be applied;

(g) guarantee that the technology does not produce harmful effects to human environment;

(h) obligation of covering the expenses incurred by damages caused by the use of technology or respective products;

(i) guarantee on the infringement of the right of third person;

(j) guarantee referring to the agreed upon business secret.

39. The contract is not acceptable by the federal authority if restrictive business practice clauses are incorporated. Those practices which are specifically forbidden, are:

(a) limiting or controlling the business activity, development of self-management functions of the OAL or otherwise affecting the equal rights;

(b) the limitation in application and development of transferred technology;

(c) limiting the acquisition on the part of the national OAL of similar technology elsewhere;

(d) payment of royalties after expiration of the contract;

(e) price fixing;

(f) limiting of proper adaptation or extension of technology;

(g) limitation of exports.

40. The Law on Protection of Inventions/Technical Improvements and Trade Marks (1980) forbids the right of the lincensor to sell more than once the same licence to the OALs. In other words once purchased, the licence becomes socially owned thus preventing a duplicated process.

Procedure

41. Each contract is subject to a procedure of approval before respective

registration. The procedure includes the republic/provincial authorities (commission) which consist of the representatives of the Committee for Foreign Trade, Committee for Science and Technology, Institute of Social Planning, Association of Banks, Self-Managed Community of Interest for Foreign Trade (monetary aspect) and Chamber of Economy. In addition to these permanent members of the Commission for screening the contracts, there are "ad hoc" members representing committees for each relevant sector (agriculture, civil engineering, energy etc.).

42. Each contract and pertaining techno-economic report is analysed on the grounds of its conformity to the provisions of the laws, assessment of economic and social effects, evaluation of technical/technological improvements. Qualified representatives of OAL (national partner) take part in all discussions providing additional explanations. In such a way a direct participation of the society (both at macro and micro levels) is included and in many cases since 1979 when this procedure was established some significant improvements of conditions and effects of technological transfer have been reached. We consider that this activity is essential in the precontractual phase when the terms of transaction are being negotiated. Out of 993 technology contracts with foreign partners valid in 1980 a half covers licensing agreements, one third covers long term manufacturing co-operation and specialization, 17 cover joint venture and some cover business-technical co-operation with foreign partners.

Analysis of Results of Foreign Technology Acquisition

43. An analysis of the results obtained through such arrangements during 1976-1981 has been recently made in the SR of Croatia in which some 26-28 per cent of Yugoslav contracts with foreign partners have been signed. The analysis shows that in general terms an improvement of conditions is achieved after enacting new laws and establishing the procedure on technology assessment and screening by the Commission (attached to the Croatian Government) composed of the above-mentioned group of representatives.

44. The main difficulties in application of regulatory provisions in case of licence agreement rest in the territorial clause (limitation of export), guarantee for technology performance and particularly its possible harmful effects, the level of royalty payments, the duration of after-contract obligation

of secrecy and other clauses. As the Federal Committee for Energy and Industry, the final authority to grant approval of contracts, may accept exceptions to some law provisions, the territorial clause has been accepted in 9-11 per cent of agreements - export forbidden, 65-68 per cent agreements - partial limitation and 21-26 per cent agreements - free export.

45. Licence agreements are known in many industrial branches but most frequent are those in mechanical engineering, chemical, pharmaceutical and food industries and tobacco processing. Know-how and technical documentation are the prevailing purchases through licence agreements.

46. Long term co-operation in manufacturing, commonly with specialization is the most frequent form of technology transfer in mechanical engineering and metal processing industry, and in electric industry.

47. While licence agreements are mainly made with western countries, co-operation in manufacturing is the most frequent arrangement with eastern countries. This mode of co-operation is considered as very convenient for it provides modern technology, access to the world market and does not cause any foreign currency problems, as the usual basis of co-operation is the exchange of goods in value ration 1:1. There is the trend of replacing the raw material and low value components with higher value added products.

48. Foreign investment in joint venture with Yugoslav organizations of asso labour (it is not ownership buying or equity capital, but investment in bus operations) is regulated by Law on Investment of Resources of Foreign Persons in Domestic Organizations of Associated Labour, of 7 April 1978. The principal interest of the Yugoslav party is to foster an increase in production, labour productivity, exports and construction of modern industrial facilities. Joint venture should also contribute to the scientific research and development of OAL. The share of the foreign partner (patents, licences, technology) must be estimated in terms of its real value. The maximum share of a foreign partner is 49 per cent. Other guarantees and obligations are similar to the Law on Industrial Co-operation.

49. The investment contract must place a limit on the amount of annual profit of the foreign partner. This is the most controversial requirement (Articles 19 and 23) subject to much foreign and domestic criticism. The decrease of joint venture arrangements over the last 2-3 years is attributed broadly to these articles. Proposals for the modification of the law are under public consideration.

50. Joint venture is generally considered a favourable form of co-operation with foreign parties due to joint risk which ensures the best technology and managerial skill contributed by . foreign partner.

51. In conclusion we may claim that the long term industrial co-operation and joint venture agreements are the most desirable form of technological transfer. Licence agreements are considered less convenient, and may produce unfavourable socio-political implications.

52. Two Outstanding Negative Results

Technology dependence on foreign suppliers of technology is caused by restrictive business practices. It has gradually diminished after the implementation of the two laws (1978).

53. However, some earlier contracts and particularly the import of capital goods (equipment, machinery) in which technology is incorporated for large investment projects are the principal reasons of technological dependence in spare parts, raw material, components, technical services, maintenance etc. The content of technology in capital goods has not been separately evaluated in order to assess economic and social consequences. Often such imports were conditioned as a package arrangement tied to the financing.

54. The second reason for insufficient results of technology transfers rests in poor assimilation and inadequate proper development of the imported technology. The purchase of foreign technology is obviously an obstacle (both psychological and other) to the domestic R&D development. Negative effects are multiple, i.e. not only because of incomplete utilization of imported technology, but also due to the stagnation of R&D in the relevant technology sector.

IV. CONCLUSIONS AND SUGGESTIONS

55. The process of restructuring of the world economy and the internationalization of production have brought about fast technical changes to which developing countries must adapt their technological development. Technology is one of the main factors for the restructuring of industrial production and the international trade.

56. The technological changes in Yugoslavia and in other developing countries should be directed towards two types of technologies and R&D activities: low-risk high-cost R&D for technological improvements, and high-risk high-cost R&D for new technological breakthroughs. Such technology pluralism requires:

(a) the identification of technological level of each industrial branch and inter-branch technology sector (technology reproduction cycle) so that advanced and lagging segments respectively could be given corresponding social R&D support in order to obtain maximum efficiency and exportability;

(b) the formulation of science and technology strategy at the national level and the industrial branch levels, indicating the priorities and intensifiers of technology development;

(c) there is an urgent need for preparing a methodology for and application of (social) technology assessment. In this procedure macro and micro level interests are confronted. Therefore, the fostering or establishing of national institutions based on wide participation of the society is a very important task.

57. Such institutions should promote technologies in harmony with national development goals and prevent those of possible adverse effects to the society and to the development goals.

58. The confidence of domestic enterprises in such institutions could be achieved if qualified assistance from the institution can be provided and if social and political participation to the institution is ensured.

59. National R&D potential in almost all developing countries is not sufficiently integrated in production flows. Strict division between scientists and practitioners, often even legally regulated is an entirely wrong concept. The research is not a monopoly of scientists. In R&D activity all creative forces of the society should be mobilised, particularly engineers, technicians and skilled workers, because many small improvements may be more valuable than a single great improvement based on fundamental research. R&D activity and potentials should be concentrated in industry. Industrial R&D institutes with staff mainly composed of experienced engineers are the best links with universities which in their role contribute to the national development of technology.

60. In view of the forecasted fast technological changes which will include developing countries too, the education system must be also changed and adapted to meet future needs. Modules of general technical knowledge instead of specializations should be provided by technical high schools and universities. Early graduation of technicians and engineers leaves them time for additional computer-based education or on-the-job training needed in practice, and provides them with flexibility to shift from skill to skill according to the opportunities. The institution of post-graduate studies closely relating to real needs and opportunities in the production sector should be given particular attention.

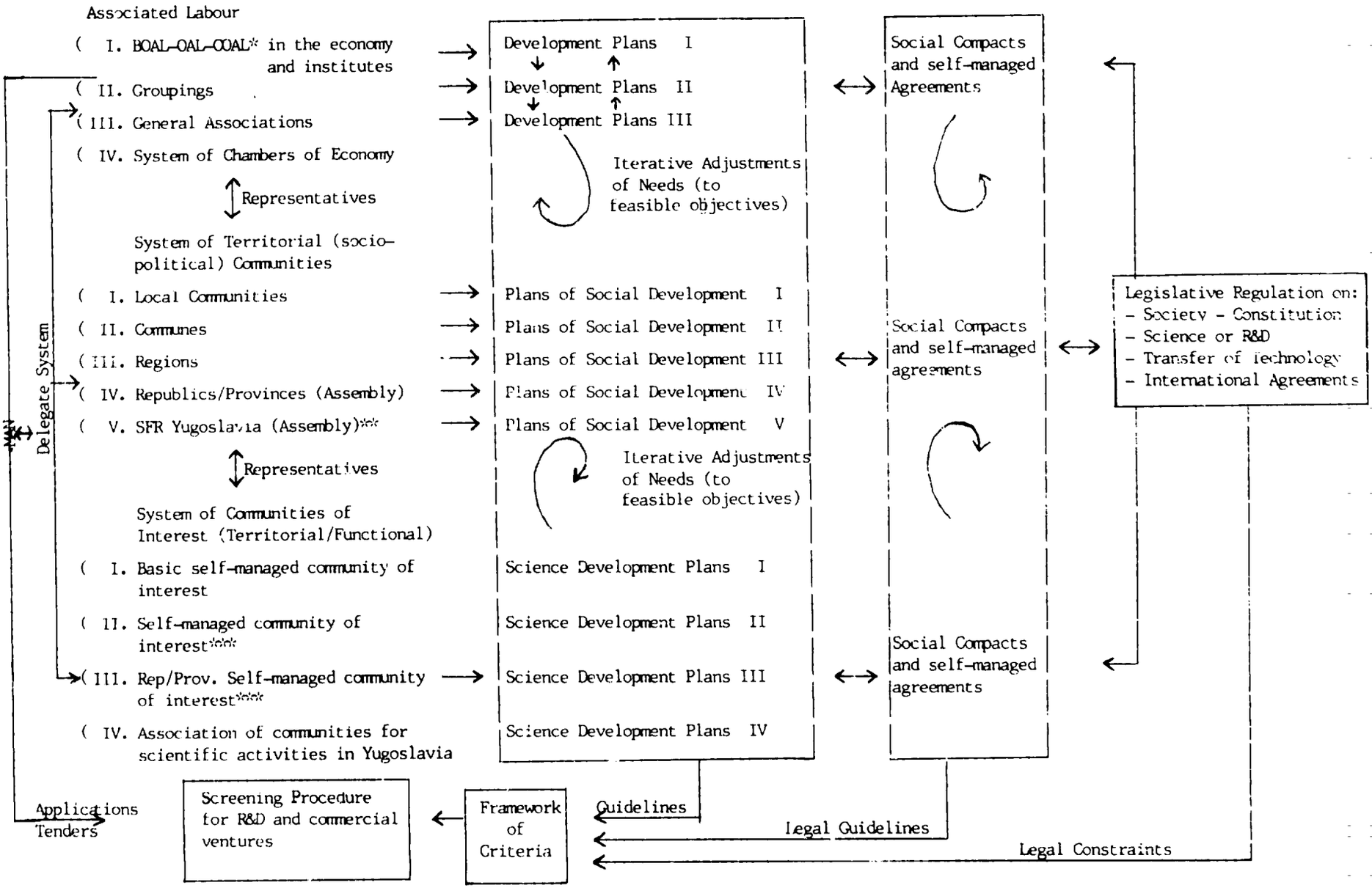
61. Fostering of domestic R&D and adaption of education systems are the most difficult tasks especially in developing countries which are less developed. However, these are indispensable prerequisites for attaining technological independence which means appropriate domestic technological development in principal production sectors and sovereign control of technology import. (No country is able to achieve technological autarchy in the modern world).

62. The process of foreign technology assimilation and its proper development is the most critical issue of technology transfer and national technological development. In order to avoid mistakes the primary condition is an adequate R&D capacity, as well as legal framework and qualified, interdisciplinary bargaining teams for technology acquisition.

63. Technology assessment requires an integral evaluation of all technology import flows, in order to avoid ever changing modes of importing technology

which may produce dependence. Planning as a tool is of utmost importance for the identification of socially determined criteria of selection which means the active and direct participation of the whole community. The scope of adaptation for socially acceptable technology is determined to a great extent by the difference in social, economical and environmental setting of the selected source of technology. Permanent monitoring of effects and adjustment of the criteria framework is required because of development of the society, economy and technology. This imposes intense exchange of experience within the country and among developing countries.

ANNEX I - DELEGATE SYSTEM

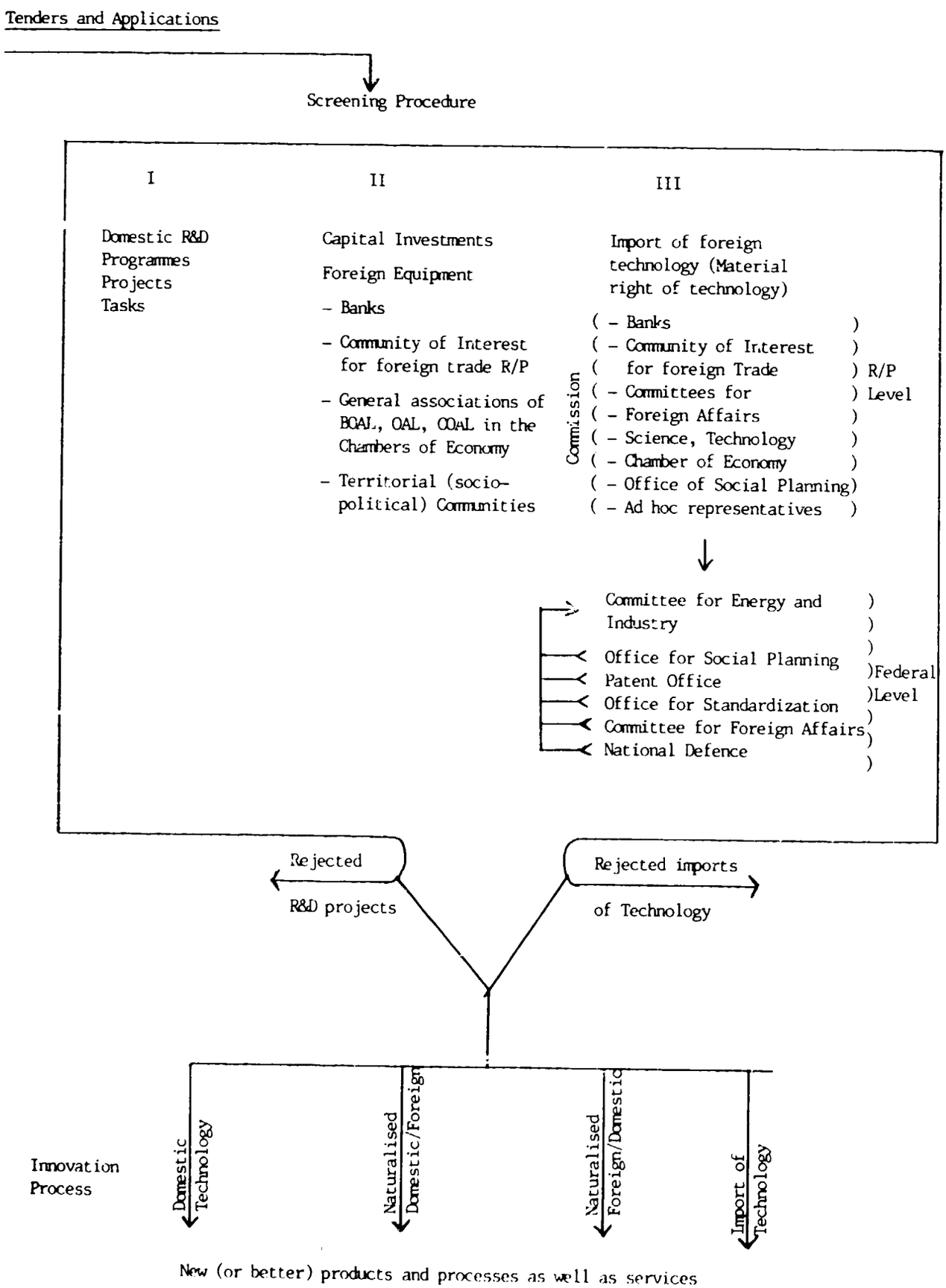


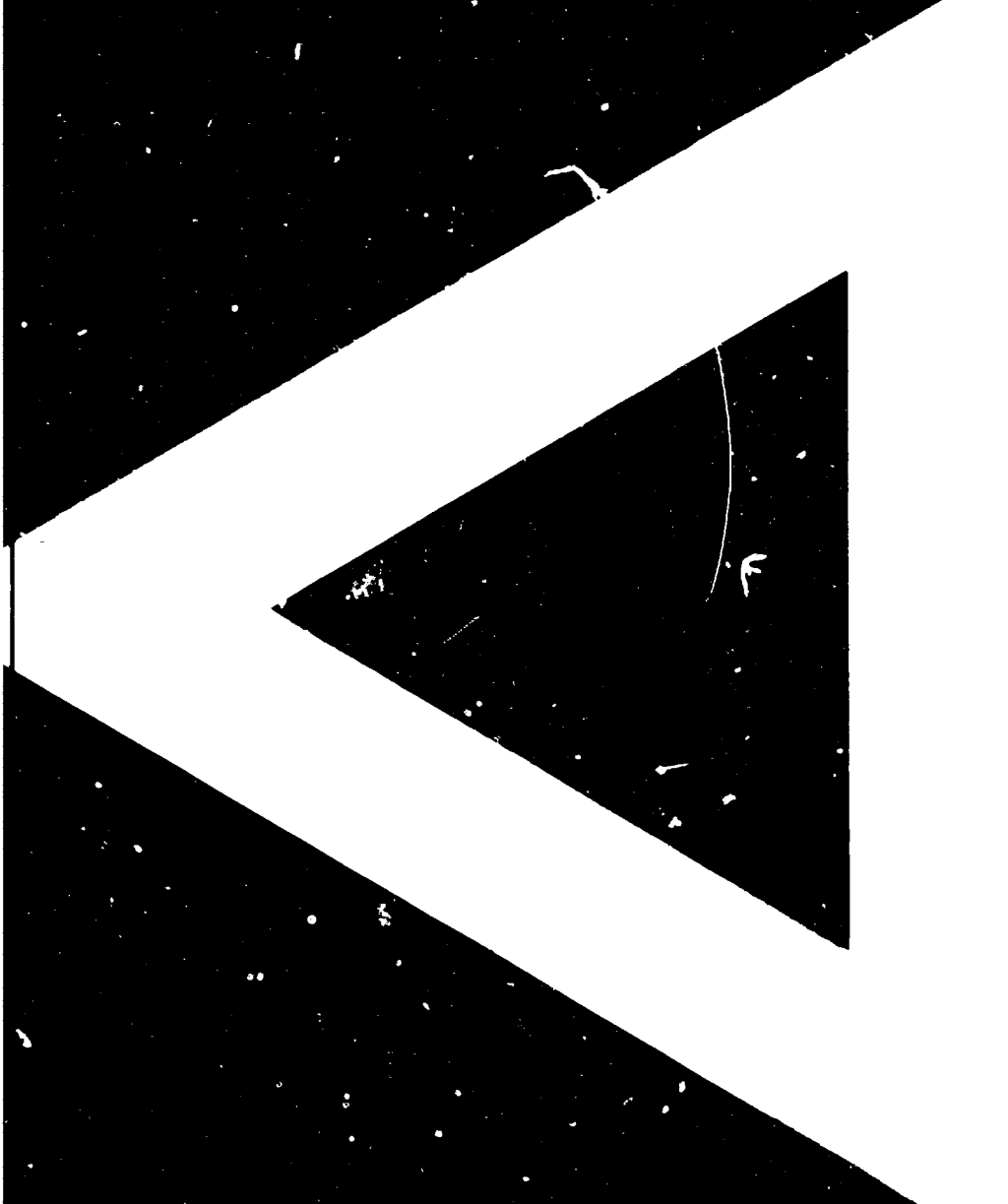
*BOAL - Basic Association of Unitel Labour, OAL = Organization of Associated Labour, COAL = Central Organization of Associated Labour

**Assembly consists of Chamber of Associated Labour, Chamber of Communes and Socio-Political Chamber

***Consists of Chamber of Service Procedures and Chamber of Service Users

ANNEX II - INTEGRATIVE APPROACH

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