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State Committee of
USSR Council of Ministers
for Science and Technology

To the Counselor on Scientific Affairs
of the Embassy of the U.S.A. in the U.S.S.R.,
Dr. J. Tech

I am sending you materials on three topics prepared by the Soviet side of the working group on science policy for transmission to the U.S. side: Planning and management of scientific research and development, training and utilization of scientific and engineering/technical personnel and the system of incentives for basic research.

Additional material for topic III under the heading "Utilization of scientific personnel" and materials for the topic of "Financing of research and development" is in the process of being compiled and will be sent to you in the near future.

Science Policy

Sincerely yours,

E. Sklyarov
Chairman of the Soviet side
of the Joint U.S.-U.S.S.R.
Working Group on Science Policy

State Dept. declassification & release instructions on file

QUESTIONS TO THE AMERICAN SIDE ON TOPIC NO. I - "PLANNING
AND MANAGEMENT OF RESEARCH AND DEVELOPMENT"

1. Are unique principles and methods of planning and managing R&D used in all sectors of the national economy of the U.S.A.? If so, how is this uniqueness achieved? If not, what different sorts of principles are used in the different sectors (government agencies, private firms, universities)?

2. To what degree is there centralized management of R&D in the U.S.A. on a national scale? On the scale of the separate sectors of the economy?

3. How is national scientific policy reflected? To what degree does it depend on general government policies? How are the aims and priorities in the sphere of R&D formulated? How do they conflict with or correspond to general national priorities? Do contradictions exist between scientific policies of the government and of private firms and universities?

4. How is long-range planning of R&D combined with forecasting the development of the entire economy of the country?

5. How is the Federal budget for R&D formulated? Is this a total of the budgets of the individual departments and agencies? Or in formulating the general size of the science budget, do other factors influence it, for instance, those connected with the evaluation of the role of science and its needs as a whole?

6. What is the hierarchical structure of the administration of R&D in the system of Federal organs and how is this structure most commonly reflected in firms and universities?

7. Is there in the U.S.A. a government plan or list of the most important scientific and technical problems? If so, who makes up this list, how many of them are there, and what is their nature? How are the concepts of

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"problems" and "projects" defined?

8. What role in the introduction of programs and projects is played by various agencies and personages? What role in this is played by the President, his scientific adviser, the Congress, the Departments and other agencies, firms, universities, and the scientific community as a whole?

9. What factors are taken into consideration in the determination of the size and distribution of funds, personnel, and material for research and development in government agencies, firms, universities, and institutes? On what level are these decisions made?

10. How are questions examined and determined in regard to centralization and decentralization in the management of research and development in government agencies, firms, universities? What role do the states and local authorities play in the development of science?

11. To what degree are such instruments as the RRV and RERT [Russian abbreviations] systems and systems analysis used in the management of research and development? What tendencies are displayed in the utilization of these or other methods?

12. What are the most widespread formalized methods employed in the planning of research and development:

- for determining the aims of research and development on the scale of the whole country, of a federal Department, and of firms?
- for forming scientific and technical programs?
- for the selection, during the planning of research within a specific program, of those who are to carry out the work?

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13. To what extent is the cost-effectiveness method useful in planning and distributing resources for research and development?

14. How is the general evaluation of research and development projects determined, taking into account economic indices as well as other aspects (scientific, technological, social, and political)?

15. On what levels of planning of research and development is the application of formalized methods of evaluating the results considered to be most effective?

16. In the development of a program, how is the requirement of logical completeness of the program as such coordinated with definite limitations of resources?

17. How is research and development coordinated within the government sector, and between the government and other sectors of the economy? Under what circumstances is duplication of research and development considered useful and when harmful? What is the scale of the former and of the latter?

18. How is the management of interdepartmental government programs of research and development carried out? Are special supervisory bodies frequently created for this aim? What alternate methods are used for managing such programs?

19. How are scientific programs managed in which the government, firms, and universities participate? How are the problems of managing interdisciplinary and complex scientific and technical programs solved on different levels, interdepartmental, interinstitutional, interfirm, within universities, institutes, and firms? How is the relatively immobile organizational structure of institutes correlated with the creation of more stable integrated

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groups on the interdepartmental level? Does such a group carry out one or several projects?

20. What value is given today to such forms of organization of science and its connection with production and education, as research parks and industrial parks?

21. What are the types and sizes of government and non-government contracts for research and development? What types of contracts are used for basic research, for applied research and for development? What is the effectiveness of different types of contracts as instruments for management of research and development?

22. Who receives preference in the distribution of subsidies or grants: scientific institutes or individual scientists?

23. What factors in the U.S. accelerate and which ones slow down the process of "research-development-production-utilization"? What are the methods of government and private stimulation of this process? What incentives and what sanctions are applied in its regulation? What interaction is there between researchers, developers, and producers? How are contradictions among them eliminated?

24. What size of scientific research and design centers in the USA is considered optimal?

25. What tendencies are there to develop a system of projects as a form of managing research and development? What are the main features of this system and how widespread is it? Is the budget of scientific institutions made up of the funds allocated for projects, or can a scientific institution as a whole receive financing, and under what conditions?

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26. Do contradictions exist, and if so, what kind, between financing requirements for programs of research and development and making and implementing budgets on the level of the federal government, firms, and universities?

27. How is accounting for and monitoring of implementation of research and development carried out? What are the forms and time intervals of such reports?

28. What are the average time periods and costs of implementation of R&D projects and what tendencies are there to change them?

29. What are the average time periods required for utilization of the results of research and development in production, and what tendencies are there to change them?

30. What percentage of R&D programs are successful? What percentage of results of research and development are patented? What percentage are utilized in production? What percentage of patents find practical application and within what periods of time?

31. How is the effectiveness of the U.S. patent system evaluated? What tendencies are displayed in its development?

32. How widely is new foreign equipment and technology used in the U.S.?

33. How widely do firms introduce the results of research and development that are received from other firms and organizations?

34. How is the system of scientific and technical information organized in the U.S. and how is its effectiveness evaluated?

35. What is the policy of acquisition and utilization of patents in conducting various research and development programs on the federal level and on the level of individual firms?

36. What are the quantitative and qualitative methods of evaluating the economic effectiveness and social usefulness of research and development and evaluating the consequences of practical implementation of their results?

37. What methods are used in analyzing and evaluating the work of researchers and developers?

38. During recent years the practice of "technology evaluation" has spread in the U.S. What is its essence and how is it applied in practice?

Subdivision I. Development and Implementation of Science Policy
in the Field of Basic Research

- Question 1. Does there exist a mechanism designed for developing policy in the field of basic science in correspondence with general governmental policy?
- Question 2. Is policy in the field of basic research a doctrine formed for a period of several years or does it consist of a set of unconnected ad hoc recommendations?
- Question 3. How is the selected science policy implemented?
- a) How can science policy be implemented with regard to basic research financed by the Federal government?
 - b) How can science policy be implemented with regard to basic research not financed by the Federal government?
 - c) What mechanism is used to redistribute resources among the fields of basic science in case of a change in scientific policy connected, for example, with changes in general governmental policies?
- Question 4. Is there any kind of analysis of alternatives of science policy from the standpoint of correspondence with general state policies and the availability of existing resources?
- Question 5. Is there feedback from the results of fundamental research to scientific or general government policy in the form of a constant mechanism of evaluation of the influence, on scientific or general government policy, of results received in the field of basic research? How does, this mechanism function?
- Question 6. Are formalized methods of decision making used in the determination

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of policy in the area of basic research?

- a) How effective is the use of formalized methods of decision making on various levels of organization of basic research: formation of science policy, distribution of resources between research centers or their groups, planning research in a specific research center (or within the framework of a project)?
- b) Are the methods of "cost/effectiveness" and "cost/benefit" used in the analysis of policy alternatives in the area of basic research?
- c) What methods are used to evaluate the possible results of basic research?
- d) Has there been evaluation of the overall economic effect (on a national scale) of the results of basic research?
- e) Are methods of social and technological forecasting used in developing science policy in the area of basic research?

Question 7. Is a programmed approach used in the planning of basic research? Has there been any experience in creating programs in the field of basic science? What factors interfere with successful application of such a programmed approach?

Question 8. What inadequacies exist in the system of grants? How can the conservatism of this system be overcome in which the distribution of resources is determined by past scientific successes of the research management?

Question 9. What mechanism is utilized to concentrate significant resources in narrow fields of basic research? How effective from the point of view of implementing a science policy is the concentration of basic

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research in specialized institutes (scientific centers)?

Subdivision II. Planning of Basic Research

Question 1. Is there a single mechanism for planning basic research on the scale of the entire country (including research not financed by the Federal government)?

Question 2. What is the present structure of expenditures for research and development?

a) What is the amount of expenditures on basic research for the country as a whole? What part of the total expenditures are borne by the Federal government?

b) What type of research conducted in the private sector is financed through the Federal government?

c) What proportion of general expenditures on research and development are comprised of expenditures for basic research?

d) Is the existing ratio of expenditures for basic research to overall expenditures for research and development a result of a specific policy or has it come about by chance?

e) What is the optimal relationship of expenditures for basic research to overall expenditures for research and development?

Does a common point of view exist on this subject?

Question 3. What period of time is covered in planning basic research:

a) In organizations financed by the Federal government?

b) In the private sector?

What determines the time period covered in planning basic research?

Question 4. Is there coordination of plans for basic research conducted by

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organs of the Federal government and by private organizations? What mechanism is utilized in achieving this?

Question 5. What is the typical mechanism of setting into motion basic research projects financed by the Federal government? How often does the initiative on the conduct of new lines of research proceed from organs of the Federal government? What is the analogous mechanism in the private sector?

Question 6. Through what channels and in what form does information on proposed basic research and basic research in progress come to the planning organs of the Federal government? Is this mechanism the same for research conducted in the government and in the private sector?

Question 7. How is analysis conducted regarding the state of basic research being carried out in:

- a) the government sector?
- b) the private sector?

Are formalized methods used to analyze the state of basic research (e.g. evaluation, using many criteria, of the state of research in the individual fields of science)?

Question 8. What is the mechanism of selecting the individual or organization which is to carry out the basic research?

Question 9. Under what circumstances in the conduct of basic research is it considered desirable to create new scientific research organizations?

Question 10. Is there duplication in basic research?

- a) Under what circumstances is duplication considered desirable and consciously planned?

- b) Under what circumstances is duplication a result of insufficient coordination?

Question 11. How are plans of basic research coordinated:

- a) among Federal organs financing this research,
- b) within individual Federal Departments.

Subdivision III. Distribution of Resources and Financing of Basic Research

Question 1. How are resources for basic research distributed?

- a) How are resources for basic research distributed in different scientific fields in a) the governmental sector and b) the private sector?
- b) What is the mechanism for distribution of resources among different projects within a scientific field?
- c) Are formalized methods used for distribution of resources among different scientific fields?
- d) What mechanism exists for distribution of resources among research organizations conducting research in one scientific field
 - in the governmental sector
 - in the private sector?
- e) Is there a comparative evaluation of competing scientific research organizations? What factors are considered in this evaluation? Is there a formalized methodology for conducting such evaluation?
 - to what degree are the name and previous achievements of the director of research taken into account in deciding the question of allocation of resources,

- do previous failures in research (inevitable in basic science) reflect on the chances of receiving new grants?

f) Are the criteria for evaluating the research of government in private scientific research organizations the same?

Question 2. How is financing and financial supervision in the field of basic research conducted?

a) What decision mechanism is utilized in allocating funds to very expensive research or for the acquisition of unique equipment? On what level are such decisions made?

b) How is utilization of allocated resources supervised?

c) What form does this financial supervision take and how often does it occur:

- at the level of the financing body,

- within an individual research organization?

d) Do financing organs trust scientific managers who determine the amount of expenditures for research?

e) Are cost overruns in research permitted? Are the reasons for cost overruns analyzed? Under what circumstances do the financing organs allocate additional resources for completion of research?

Question 3. Is there any retrospective analysis of the allocations for basic research? Has the connection between past allocations and adopted science policy been analyzed? Are results of retrospective analysis used in developing recommendations in the area of science policy or in the making of regulatory models for distribution of resources?

Question 4. What happens in the case where financing of basic research is terminated within the frame of a particular scientific field or within a scientific research organization:

- a) In the governmental sector,
- b) In the private sector?

Question 5. Under what circumstances does the Federal government continue the financing of basic research carried out in the private sector if the private organization ceases to finance this research?

Question 6. Is there a practice of inviting leading scientists from abroad to conduct basic research

- a) In the government sector,
- b) In the private sector?

Subdivision IV. Utilization of the Results of Basic Research in Applied Scientific Research Work (SRW) and Applied Experimental Design Work (EDW)

Question 1. Does there exist a single mechanism for securing speedy transfer of the results of basic research into practice (applied SRW and EDW)?

- a) Does there exist beginning-to-end planning which covers the entire cycle of research - from basic research to EDW - within single projects?
- b) Is there a mechanism for stimulating the application of the results of basic research?
- c) What factors hinder the quick application of the results of basic research?
- d) What organizational forms would best accelerate the quick application of the results of basic research?
- e) What mechanism is utilized for the transfer of information on the results of basic research into the sphere of applied SRW and EDW?

Question 2. Is possible application of basic research taken into account before the beginning of research or in the early stages of research?

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a) Is there a generally accepted practice of evaluating the applied significance of the results of basic research? Who analyses the potential application of research results--the researcher, who obtained them or the organization which is the potential user of these results?

b) Is the applied significance of expected results of basic research one of the factors which determine the distribution of resources among scientific fields?

Question 3. Is there a mechanism of incentives for basic research in certain fields of science in which expected results could have an important influence on the development of specific applied research or development?

April 11, 1974

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SCIENCE AND TECHNOLOGY
POLICY OFFICE

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MEMORANDUM FOR

Dr. Jack Tech
Science Attache
American Embassy, Moscow

Subject: Working Group on R&D Planning and Management

(FYI) The U.S. Working Group anticipates significant study will be required once the Soviet questions are received in the U.S. If any more serious delays are encountered, we will have to request further delays of our meeting. When the attached correspondence is forwarded could you determine the status of the Soviet submission to the U.S. If the threat of postponement could be used as a lever to stimulate a response, please indicate our dilemma. We desire to have the meeting on time but also to have time to go over the USSR questions and prepare for our meeting in Moscow. You could point out that this will require the gathering together of our delegation from all over the United States after we receive their submission.

NSF
Science Policy

Hylan B. Lyon, Jr.

Hylan B. Lyon, Jr.
Special Assistant

Attachment

cc: / Dr. Oswald Ganley, SCI/State
Dr. H. Heffner, Stanford

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April 11, 1974

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SCIENCE AND TECHNOLOGY
POLICY OFFICE

Dr. E. Sklyarov
State Committee for
Science and Technology
Moscow, U. S. S. R.

Dear Dr. Sklyarov:

It is a pleasure to forward from Dr. Heffner the list of questions which the U. S. subgroup has developed for discussion in our May meeting. We are looking forward to receipt of the USSR questions.

On page 4 and page 5 of our submission, we have included questions related to the Academy of Sciences. We have coordinated these questions with our Academy of Sciences working group, in particular with Dr. Schull and Mr. Beckler. We will be prepared to discuss whether one or both of the subgroups should discuss these particular issues.

In the near future, I shall be forwarding the final list of U. S. members who will be participating in the May Moscow meeting. The U. S. delegation suggests that approximately three days will be required to adequately discuss these items. We also suggest that one or two hours every day be set aside for the subgroups to meet separately.

We shall be very interested in visiting USSR research and development related activities after our meeting. When the list of attendees is forwarded, we shall include the desires of the working group members for these post-meeting visits.

I personally am looking forward with great pleasure to the continuation of our discussions and to our visit in your Capitol city.

Sincerely yours,

Hylan B. Lyon, Jr.
Special Assistant

QUESTIONS FOR THE U. S. S. R. ON R&D POLICY AND MANAGEMENT

The Federal Role

1. What are the areas of responsibility of the GKWT, the Academy of Sciences, the Communist Party and other national bodies in the formulation of national technology policy? By whom and on what basis is the decision on annual volume of money, manpower, and materials for R&D made? Concerning the 250 key projects:

- a) How are the projects selected?
- b) How often is the list revised?
- c) Does it include military projects?
- d) What is the role of the Ministry to which the "head institution" carrying out the project belongs?

How is scientific advice mobilized and organized in the U.S.S.R.? What role does "independent nondepartmental expertise" play in evaluating new technological products and processes, in monitoring R&D programs, etc. Describe the place of technological forecasting in research and development planning.

2. Has the U.S.S.R. developed an analytic treatment of the R&D process? If so, what input measures and what output measures are used? How does the U.S.S.R. determine the quality of its R&D? What measures are used for determining technological advance? How does the U.S.S.R. estimate the economic, environmental, social and political side effects of new technology?

3. What are the mechanisms by which success is judged and unsuccessful programs terminated? Who decides whether or not a program has become obsolete? Who decides whether or not a scientific research institute or design bureau should be closed down or reorganized along new lines? What are the criteria used in reaching these decisions?

4. What is the nature of the U.S.S.R. R&D program control procedures, i.e., how are initial estimates of costs made, what means are used in determining whether a particular program is on schedule, how are cost overruns handled? Is responsibility for control of many programs centralized in a single office? Are funds for a program scheduled ahead for the complete program, or is the allocation of funds and materials contingent upon how well the program is progressing? R&D organizations have projects that are financed through contracts with other organizations as well as projects financed from the state budget. How are the proportions for the two kinds of financing determined in the planning process? Describe the process by which budget financed projects are allocated to R&D organizations. How does the U.S.S.R. estimate the amount of technical risk in an R&D program, i.e., the probability of success or failure?

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The Role of Branch Ministries

1. To what extent are the ministries free to determine their own R&D programs? What is the role of the ministries in planning the introduction of new technology? Who decides to put a particular product into series production or introduce a new process?
2. What problems have been encountered in organizing and administering scientific production associations? What is being done to solve these problems? How are the R&D planning and management functions of the ministries affected by the creation of scientific production associations?
3. What has been the Soviet experience in regard to the success of Design Bureaus? Is there a significant disadvantage in carrying out the design independent of the manufacturing organization? Where are the decisions made on what industrial prototype designs are to be initiated? What voice does the Design Bureau have in such a decision? How are the design and construction of industrial prototypes financed - by the central government, by enterprises, or in combination? What is the process by which a project is supposed to move from a research institute to a design bureau to experimental production and finally into mass production? What is the ministry's role? What steps are being taken to shorten the innovation-diffusion cycle? What is the nature and extent of R&D prototype design competitions between different factories? How is a decision made on whether to select one prototype or whether to have a competition between two or more competitors?
4. What steps are currently being taken to solve problems in applied R&D such as:
 - a. The resistance of enterprise managers to new technology.
 - b. The shortage of development facilities.
 - c. The inefficiency in the system for producing and allocating scientific equipment.
5. Describe the process by which new planning and management techniques become diffused in the U.S.S.R. How are pilot or experimental projects involving new methods initiated and evaluated within and across ministerial lines?
6. How are disputes over science policy issues resolved in the U.S.S.R.? Describe the nature of the mediation-reconciliation process for settling conflicts within a scientific research institute? between a scientific research institute and a design bureau or industrial enterprise subordinated to the same ministry? subordinated to different ministries? How are disputes between ministries handled?

7. How and by whom is the decision made on whether to purchase foreign technology or to undertake R&D in the U.S.S.R.? What are the bases on which such a decision is made? Who has the final authority for selecting the seller of the desired technology, and on what bases is the decision made? Who decides which enterprises will be responsible for exploiting foreign technology? Are there specific enterprises that specialize in exploiting foreign technology?

The Industrial Role

1. For R&D projects initiated within an enterprise (product improvement, improved manufacturing techniques, new product design, etc.), how is the decision to initiate such an effort made? Does the enterprise manager who wishes to initiate an R&D project require approval by higher authorities? How is the project financed? What monitoring processes are employed as the project continues? Does the plan for the project include specific goals to be met at specific times? Are there decision points at which management consciously determines whether the project should continue or be terminated? What is the experience on initial cost estimates compared to final costs? (In one well-managed U.S. technical firm this ratio is about 2 to 1.) Are there any market surveys to determine the potential demand for the product to be developed?

2. Roughly what proportion of all product innovations originate in enterprises, and what proportion are they ordered to introduce by the ministry. Are there any data on this?

3. Innovators often find that they have to use different quantities and types of materials than those used in the prototype model. Since their inputs were planned on the basis of the model, this can create difficulties. Are there any special provisions for innovators to get materials outside of the system of material-technical supply?

4. One pattern of innovation in the U.S. is "innovation by invasion," in which a progressive industry like petrochemicals "invades" the markets of conservative industries like textiles. Are Soviet ministries and enterprises encouraged to try to sell their new products to the customers of other enterprises and ministries? Are enterprises encouraged to spend funds for market surveys and for persuading potential adopters to try their new products? Who bears the responsibility if the sales of a new product are lagging, the producing enterprise or the ministry's glavsbyt?

5. The published sources describe some of the contents of the ministry manuals (metodiki) for setting prices on new products, but many of the details are not available. For example, in setting prices on "analogue" products, who decides whether the wholesale price will be closer to the "upper limit" price or the "lower limit" price? Could we see some sample price catalogues and manuals for setting prices? How are R&D costs accounted for in pricing new products? Are they charged to the first year of production, or capitalized over several years (how many)? Does it make a difference whether the product is initially assigned a temporary or permanent price?

6. If the introduction of a new product reduces the enterprise's average profit rate, does the enterprise lose material incentive funds? Does it make a difference whether the new product is provided for in the plan or whether it is introduced in the course of the plan year? Can the planned profit target be revised downward for an innovating enterprise?

7. If a scientist or engineer invents a new product or a new process that is outside the mission of the enterprise that employs him, what are the means open to him to interest other organizations in his new idea? What incentives are there for the inventor in this case to attempt to exploit his idea?

8. How is R&D organized within the enterprise? Is there a group whose sole responsibility is research and development, or are production personnel assigned to R&D projects as they arise? Does this pattern differ from enterprise to enterprise? What special incentives do R&D engineers and scientists have for successful completion of a project?

9. In the U.S., development and production efforts are generally well coordinated. Commercial aircraft production companies, for instance, have their own design teams. There are several advantages to this arrangement. Technological advances are easily implemented into aircraft designs. Development personnel are close at hand to provide implementation support for new technology items. Information channels are relatively short, allowing development and production personnel to exchange ideas and to mutually attack design and production problems. One disadvantage in this organizational set-up is that advanced technology is forced into all aspects of new aircraft. Furthermore, changes are continually made to an aircraft over the life of its production run. Cost analysts believe that this reluctance to freeze production designs increases costs significantly. Do the Soviets implement technology differently? If some organizational aspects of the Soviet development and production process were implemented in the U.S., would savings in time and manpower result?

The Role of Higher Education Establishments and the Academy of Sciences

1. What place do higher education establishments fill in the national R&D effort? To what extent are projects funded on a contract basis by non-academic organizations?

2. What influences operate to set the pattern of academic research? (For example, in the U.S., a self-selection of projects, but funding tied to federal view of national needs.)

3. How do the useful results of academic research get translated to new industrial products or processes? Is this the sole responsibility of the developer? Do representatives from ministries, firms, design institutes, etc. visit higher education establishments as a regular procedure in order to familiarize themselves of possible new scientific and technical results?

4. To what extent are research tasks assigned to laboratories of the Academy of Sciences? Who has the authority to make such assignments? Can

5. How are useful results from laboratories of the Academy of Sciences translated into new industrial products or processes? Is there a problem here, and if so, what steps are being taken to solve it?

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