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CEMENT DEVELOPMENT AND RESEARCH CENTRE,
DP/TUR/72/034
TURKEY.

Technical report: Financial preparation of feasibility studies

Prepared for the Government of Turkey
by the United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Based on the work of Jean-Claude Antoine, consulting economist

United Nations Industrial Development Organization
Vienna

id. 78-1129

Explanatory notes

References to dollars ($) are to United States dollars.

The monetary unit of Turkey is the lira (LT). In May 1977 the value of the lira in relation to the United States dollar was LT 100 = $US 5.70.

A slash between dates (e.g. 1970/71) indicates a financial year.

The use of a hyphen between dates (e.g. 1960-1965) indicates the full period involved, including the beginning and end years.

A full stop (.) is used to indicate decimals.

A comma is used to distinguish thousands and millions.

The word "billion" means one thousand million.

References to tons are to metric tons.

GNP means gross national product.

The following abbreviations of organizations are used in this document:*

AI	Araştirma İnstitüsü (of ÇMB), (Research and Development Centre (of the Turkish Cement Manufacturers' Association))
APKM	Araştirma, Plânlama ve Ko-ordinasiyon Müdürlügü (of ÇISAN) (Research, Planning and Co-ordination Directorate (of the National Cement Industry of Turkey, Ltd.))
ÇISAN	Türkiye Çimento Sanayii T.A.S., (National Cement Industry of Turkey, Ltd.)
ÇMB	Çimento Müstahsilleri Birligi (Turkish Cement Manufacturers' Association)

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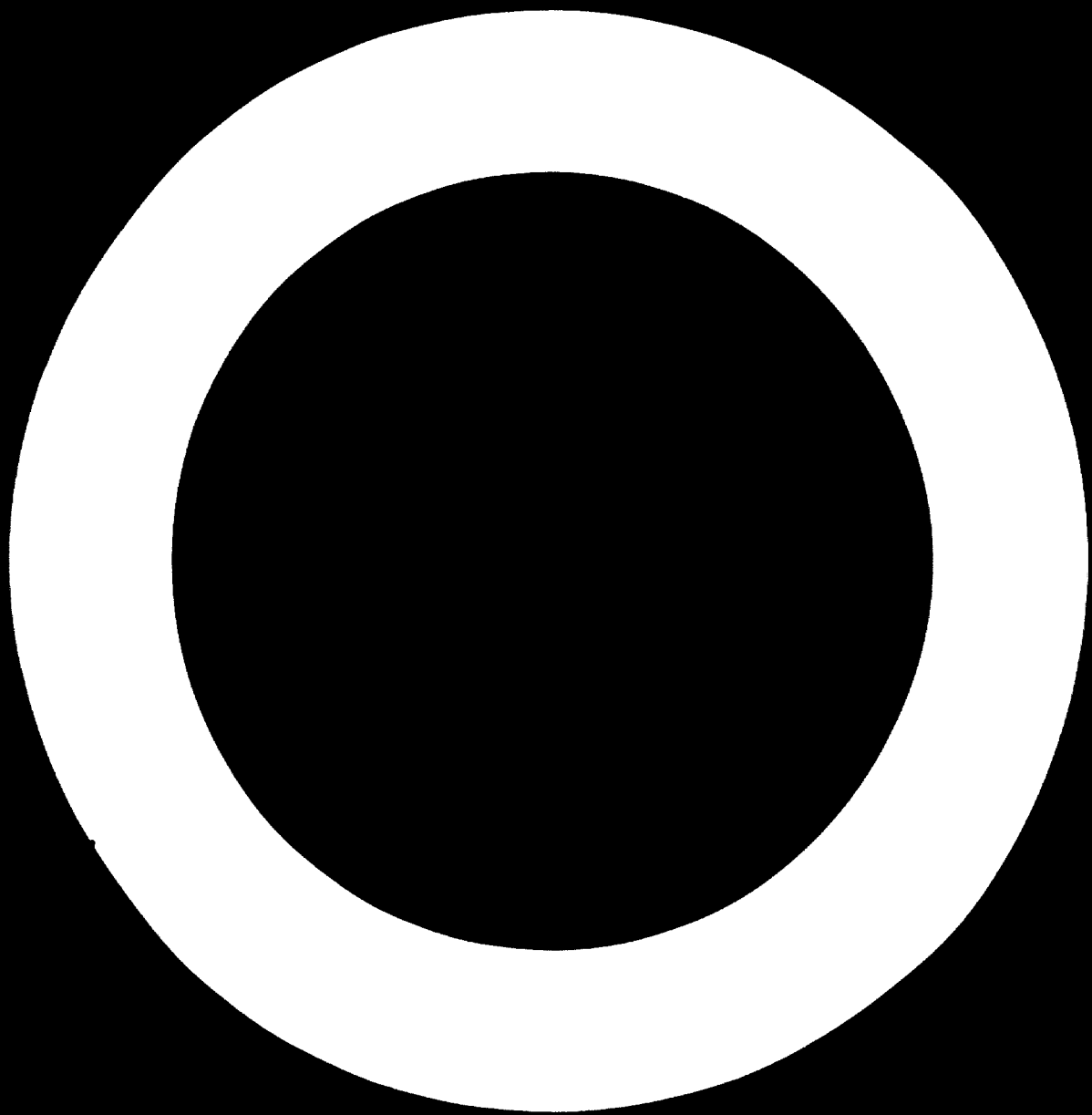
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* The English denominations are free translations of the official Turkish names.

ABSTRACT

The present technical report on the preparation of feasibility studies summarizes the work of an expert sent to Turkey for two periods (10 December 1976 to 22 January 1977 and May 1977) by the United Nations Industrial Development Organization (UNIDO). This mission was part of the contribution of UNIDO to the United Nations Development Programme (UNDP) project "Cement Development and Research Centre"(DP/TUR/72/034), for which UNIDO had been designated as executing agency. The mission was undertaken within a provisional arrangement whereby the functions of the Centre were being performed by the go ernment-owned corporation Tirkiye Çimento Sanayii T.A.S. (ÇISAN), or National Cement Industry of Turkey Ltd.

During these two visits, the expert advised the Research, Planning and Co-ordination Directorate (Araştirma, Plânlama ve Ko-ordinasiyon Müdürlügü - APKM) of ÇISAN on ways to improve its long-term projections of Turkish demand for cement. He also suggested improvements to the financial aspects of feasibility studies concerning cement factory projects and began preliminary research on the economic factors that must be taken into account in determining the optimal locations for new plants.

Recommendations were made on additional research to be undertaken by ÇISAN, with particular stress on the need to carry out field surveys of the local markets for cement. The expert recommended that a series of short follow-up missions be undertaken in 1978 and 1979 after APKM has begun to function as an autonomous organization on a permanent basis.

CONTENTS

Annexes

INTRODUCTION

Project background

The Turkish Cement Manufacturers' Association (Çimento Müstasilleri Birliği - ÇMB) is an organization grouping about 90% of all Portland cement producers in Turkey. Approximately 35% of present Turkish cement production is carried out, directly or indirectly, through subsidiaries and joint ventures, by a Government-owned corporation called the National Cement Industry of Turkey, Ltd (Türkiye Çimento Sanayii T.A.S. - ÇISAN). Another 10% is carried out by various corporations also in the public sector. The remaining 55% are produced by a handful independant private firms owned by Turkish nationals.

At the present moment ÇMB has only a small staff. The setting-up of an important research and development section is being planned with the assistance of UNDP, with UNIDO acting as executing agency. This section will be established as the Research and Development Centre (Araştirma Institüsü - AI) of ÇMB. Preparation of the project was started in 1974; the building which will accomodate it is under construction and is scheduled for completion by the end of 1977. Meanwhile, research and development work is carried out on behalf of ÇMB by the Research, Planning and Co-ordination Directorate (Araştirma, Plânlama ve Ko-ordinasiyon Müdürlüğü - APKM) of ÇISAN.

It is thus within the material and administrative framework of ÇISAN that the mission reported here took place. In particular, all of the Turkish counterpart personnel were staff members of APKM.

Place of the mission within the general framework of
UNDP assistance to the Cement Development and Research Centre project

Since its inception in 1974, UNDP's assistance to the AI project has been chiefly concerned with the following problems:
  Setting up the organization through which the project will operate;
  Improving the technical conditions of operation of existing cement plants.

The rapid development of cement consumption in Turkey, particularly over the last 15 years, has induced APKM, acting as agent for the CMB, to promote the construction of 18 new cement plants between 1976 and 1984. Studies have been started to determine the optimum location and capacity of these plants as well as the best timing for their construction, to evaluate the investment required and to appraise the financial results to be expected of each project.

The projected cement factories will first be proposed for implementation by private investors. Projects for which no willing investor can be found in the private sector will eventually be implemented by ÇISAN, which will presumably find itself in charge of the least promising projects.

In view of the large investment at stake in this ambitious programme, it was considered essential to support it with accurate and reliable feasibility studies. It was felt that the preparatory work made by ÇISAN's own staff with respect to such studies would have to be reviewed by an external expert who could detect and correct possible errors and give proposals for further research work.

A foreign expert was considered particularly suitable for the task, as he would be better able to bring in independant views and fresh ideas. For this reason the study became a part of the UNDP assistance programme to the AI project.

Summary outline of official arrangements

The assignment of an expert for the mission reported here was officially agreed by the Turkish Government and UNDP, in October 1977 within the framework of the UNIDO Cement Development and Research Centre project (DP/TUR/77/034) in Ankara.

The job description dated 19 November 1976 called for "a financial expert in the preparation of feasibility studies". Under the heading Duties it was stated that "The expert will, in close cooperation with the Project Manager and Turkish experts, advise and assist in preparing feasibility studies for the Cement Industry. The expert will also be expected to prepare a final report, setting out the findings of his mission and recommendations to the Government for further actions which might be taken."

At the same time, a similar mission was organized on the technical side for a cement engineer, so that the two experts could cooperate when needed on appraising proposed industrial investments.

The financial expert arrived in Ankara on 10 December 1976, a few days after his cement engineer colleague. Both were assigned to work in the office of APKM, with a counterpart staff of five engineers and statisticians who participated on a part-time basis.

The mission, which was originally scheduled for two months, was later extended to 12 weeks, and divided into two parts so that the proposals and methods suggested by the financial expert could start being put to practice by the staff during his absence, so that he could see the results and make further recommendations upon his return.

The first phase of the mission took place from 10 December 1976 to 22 January 1977, and the second part during the month of May 1977. The present report was prepared later.

In order to insure a follow-up of the economic and financial research under way, a request was made by the project manager of the UNIDO Cement Research and Development project in Ankara, with the agreement of the expert, for further extensions of the mission over a number of short periods. For this reason, the present report is an interim technical report rather than a terminal report.

Objectives of the project

Total cement consumption in Turkey was about 11.3 million tons in 1976. The growth of domestic demand has been very rapid, particularly over the last fifteen years, and the trend is likely to continue, at least for another ten to fifteen years. As a result, a domestic cement consumption of between 28 and 38 million tons is expected for 1990. In addition, Turkish cement exports came close to 1 million tons in 1976 and could be substantially developed in the future.

To satisfy this considerable expansion of the demand for cement, both ÇMB and ÇISAN have been promoting an ambitious programme of new cement plants, at the same time as existing plants have to be expanded when possible.

Several new plants were commissioned over the last twelve months, so that the rated capacity of existing plants is currently estimated at 18.5 million tons/year. When all existing plants reach full production, presumably in 1978, the output should be about 15 million tons/year on the basis of 80% of rated capacity.[1]

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[1] Experience shows that actual output very seldom reaches rated capacity over a period of twelve consecutive months, because the operation of a plant may be interrupted by technical incidents. Historically, a 80% rate already appears to be a good performance in Turkey.

In addition, ÇISAN has started the construction of seven new plants, each with a rated capacity of 550,000 tons/year and identical equipment. As a result, Turkey should be expected to produce at least 18 million tons/year of cement by 1980, which would represent a 45% increase over 1976 and a 100% increase over 1973. For political and social reasons, five of the seven plants under construction are located in the eastern part of the country.

This investment programme was admittedly decided upon without sufficient economic and financial investigation. In particular, it is far from certain whether the new plants will find sufficient outlets for their production within reasonable distance from their sites. They will, at any rate, cause considerable disturbances in the markets of existing plants, whose sales will have to be partly redirected. At the same time, a shortage of cement may develop in the north-western part of the country, where increase in cement-producing capacity has recently been lagging.

It appears likely, therefore, that the new cement plants currently under construction will have to ship part of their expected production to relatively distant places, mainly in the form of clinker. If the principle of equal cement price throughout Turkey[2/] is to be maintained, the new plants will either need to have particularly low production costs or else some kind of subsidy. Adequate geographical distribution of clinker-grinding facilities will also have to be provided, as well as a large fleet of heavy trucks for transport.

Additional problems will be caused by the additional cement manufacturing facilities to be set up between 1980 and 1990. Considerable uncertainties still exist as to their required capacity. Overall cement production would have to be more than doubled over this period, according to some estimates, but increased by only 55% according to others. Moreover, the location of the new facilities will need carefully study.

2/ At present, this principle applies only to the ex-factory price of cement. In districts where no cement plant exists, the controlled price of cement may be substantially higher.

The figures given above clearly indicate that very large financial investments are at stake. After all, the new facilities to be erected in Turkey over the next 15 years may represent as much as 20% of the present cement-production capacity now existing in the United States of America. On the basis of current costs, the sums required for fixed investments in cement manufacturing facilities alone would be in the order of TL 30 billion, of which about 25% would be for imported equipment.

On the other hand, if cement-producing facilities were not sufficient in the future to meet local demand, this would also entail important economic consequences. The needed cement would have to be imported, at greater expense to the consumer and to the Turkey's balance of payments.

Mistakes in the location of additional cement-producing facilities and in the timing of their construction must therefore be avoided. Investment decisions will have to be based on very careful economic and financial studies.

In this perspective, the mission reported here and its results could make a significant contribution to the proper allocation of Turkey's limited investment and foreign exchange resources and thereby to the country's overall economic development.

I. FINDINGS

Organizational set-up of the mission

The task of the expert was described in the following terms in his job description (annex I): "in close co-operation with the project manager and Turkish experts, advise and assist in preparing feasibility studies for the Cement Industry."

In an earlier definition of the mission, the contribution expected from the expert had been specified in more detail: "The expert will assist and guide in the preparation of complete feasibility studies for cement plants to be set up in near future. Specifically, the expert will be expected to advise on:

1. Estimations and projections for cement consumption.
2. Measuring efficiency in inter-regional movements.
3. Marketing studies for the plants to be set up.
4. Selection of plant site.
5. Estimations of investment and operating expenses and their yearly distributions."

It is also noteworthy that, at the time of this earlier job description, the expert was expected to be an industrial economist, while in the present one, he was described as a financial expert; thus, it appears that the intention had been to shift the stress from the specific problems of cement economics to the more general methods of financial analysis of investment projects. The expert found, however, that the details set out in the earlier version of his job description gave a rather accurate picture of the chief problems, apart from cement technology, confronting the persons whom he was to advise.

Organization of the Cement Development and Research Centre project

As implied by the wording of the final job description, the expert was assigned to a UNDP project that was being implemented under the co-ordination of the Project Manager. At the time of the mission (the end of 1976 and the first half of 1977) AI was not yet operational. It was a project in the sense that a building to accomodate it was under construction in Ankara; this building was to be completed around the end of 1977. In the meanwhile, AI no staff of its own; its functions were being carried out by APKM, as explained in the Introduction to the present report.

The functions carried out by ÇISAN on behalf of the ÇMB extended to the technical aspects of cement production (technology, engineering, productivity and the like) as well as to the economic and financial problems confronting the cement industry in Turkey.

These functions are essentially of an advisory nature and, particularly on the economic and financial sides, they are implemented by means of the preparation of studies and reports on questions raised by individual members of ÇMB or by the association collectively. In fact, most of the questions under study at the time of the mission appeared to have been raised by the association itself, chiefly within the scope of its relations with the Government (economic planning, price control and the like).

As a consequence of the provisional arrangements described above, it is within the framework of the APKM that the expert was assigned to work upon his arrival in Ankara in December 1976. This arrangement was still in force at the end of the mission in May 1977.

Organization of the work of the expert

The expert was especially assigned to co-operate with a number of staff members of ÇISAN in designing improved methods of coping with economic and financial problems and in applying these methods for the preparation or revision of the studies under way at the time. These staff members of ÇISAN are refered to as the local counterparts of the expert. It was understood that some of these people would later be given the opportunity to transfer to AI, of which they would constitute the cadre when it becomes operational.

In addition to his co-operation with the counterpart staff, the expert remained throughout his mission in close relation with the head of APKM, with whom he had numerous discussions on the economic and financial aspects of the problems under study, and who personally presided over all of the informal seminars organized for his staff by the expert.

As a rule, the individuals assigned to counterpart work had been selected both for their expertise in economics and finance and for their knowledge of English. Since some of them were among the most capable members of the APKM staff, they were often called away for other urgent tasks, a circumstance that sometimes created difficulties in the organization of the work of the expert. It also explains the changes in the counterpart staff during the second part of the mission.

With a single exception, the people from ÇISAN with whom the expert had opportunity to work had no formal university training in economics or finance; this applied to the counterpart staff as well as to others who attended the informal seminars and similar meetings. Most of them were engineers or statisticians who had been assigned within ÇISAN to the preparation of studies on the future of cement consumption in Turkey and of feasibility studies on projected cement plants. For that purpose, they had studied some books on the subjects and were doing their best to applying the knowledge thus acquired without the guidance of experience, and especially without the necessary background knowledge of economic and financial phenomena.

As these people had both high intelligence and excellent mathematical training, the logical structure of their work appeared to be quite satisfactory, but the models that they had constructed often did not take into account a number of important factors, so that the conclusions at which they arrived often appeared to the expert to be insufficiently grounded and occasionally quite dubious.

Following is a review of the work of ÇISAN's staff with which the expert was confronted. It describes the main points that he raised, the recommendations that he made with a view to obtaining improvements and the actions he undertook in some cases to redirect the work undertaken by ÇISAN into more appropriate channels.

Review of the problems submitted to the expert

Projection of Turkish demand for cement

A long-term projection of the demand for cement had been under preparation in ÇISAN for several years as a basis for programming the construction of new cement plants. The various attempts already made had been based essentially on the same method, namely the correlation found over the last ten years or so between cement consumption in Turkey, on the one hand, and real income per capita and population growth on the other. The statistical coefficients obtained in this way were then used to calculate the probable future increase in cement consumption, given certain assumptions concerning population growth and the increase in real income over the period under consideration.

On reviewing the conclusions that had been drawn, the expert felt that they were unrealistic. Specifically, they implied a future per capita consumption of cement in Turkey substantially higher than the consumption

presently found in countries w.th income levels comparable to that which
Turkey might reasonably be expected to attain at the time specified.

Important factors that had not been taken into account by the ÇISAN
staff explained this discrepancy. These factors were essentially the
following: the price elasticity of demand for cement, and changes in the
techniques of construction over time.

Available statistics showed that the price of cement in Turkey relative
to other building materials had been declining over the last 10 to 15 years,
thus imparting an upward bias to the historical relationship between the
demand for cement and real per capita income during this period. The same
trend in cement price is quite unlikely to continue in the future.

It was also demonstrated that, according to building permit statistics,
the importance of buildings chiefly made of concrete in relation to other
types of buildings had been increasing steadily in Turkey over the years.
Since this proportion is now quite high (about 60% in terms of square meters)
it could hardly be expected to continue growing at the same rate indefinitely,
since the saturation level will soon be reached.

These observations were incorporated in a number of technical papers
prepared by the expert and circulated to the staff (annexes II, III, IV and V).
They were also explained and discussed in informal seminars presided over by
the head of APKM.

Geographical distribution of the demand for cement in Turkey

The geographical distribution of demand for cement in Turkey was being
studied by ÇISAN as a basis for selecting the optimal locations for new
cement plants. The work already prepared had been based on a division of the
country into a number of areas supposedly representing the natural sales
areas, or "hinterlands", of the existing cement plants. The growth of demand
by area was then calculated on the basis of assumptions relating to the probable
increase of population, real income and similar factors and was applied to the
known production of existing plants, corrected, when needed, for cement import
or export in and out of the area in question.

Opportunities for the establishment of new plants would then be identified
whenever and wherever the combined increase of demand in two or three
adjacent areas would reach the 500,000 tons/year level considered by ÇISAN as
the optimum capacity size for a cement plant in Turkey under present conditions.

It appeared to the expert that these areas had been drawn on the basis of hypothetical assumptions, rather than on empirical evidence on tne actual distribution of sales of existing plants. Moreover, the lattice provided by the respective hinterlands of existing cement plants, even if it could be drawn more accurately, would not have a sufficiently fine mesh to determine the ideal localization of new plants with reasonable accuracy.

In view of the importance of the investments at stake, the expert advocated the need for surveys of cement sales and cement consumption to be carried out in the field, using the administrative offices of existing cement plants as local bases of operations. In the first place, it was essential to find out where exactly the cement produced by each of the existing cement plants was being sold and consumed, a question about which no information was currently available in Ankara.

As a test case, a small team accompanied by the expert went to the Çorum cement plant in January 1977 for a field survey of its market. A number of cement dealers and large contractors in Çorum and in surrounding cities were interviewed. Detailed statistics on sales were also obtained from the plant's accounting department. An analysis of the data collected showed that a considerable part of the plant's production was sold outside what had been considered its natural hinterland, sometimes very far away from it. It also showed that a part of the supposed hinterland was in fact supplied by another factory. It was thus proved that reasoning based on unproved assumptions was not a satisfactory substitute for empirical data, and that field surveys on cement consumption should be undertaken throughout Turkey to avoid serious mistakes in the siting of new plants.

The expert also advocated the need to prepare a detailed map of population distribution in Turkey and collaborated personally to its preparation. He then suggested that the value of this map as a tool for the study of plant siting would be improved by taking into account the known differences of wealth between regions, as well as population trends.

Optimun localization of new plants

The expert demonstrated that given the geographical distribution of consumption within a region, it is easy to determine the optimal location of a plant to serve it, so as to minimize the amount of transport between the plant and its local markets. He recommended the construction of simple analogic models, to be derived from the demand maps referred to in the preceding section.

Further refinements, however, should take into account such factors as differences in transport facilities over a given distance that may result from local conditions, or local differences in construction needs or building methods, or again, the existence of large public work projects. Detailed knowledge of these factors can only be obtained through systematic field surveys.

Financial appraisal of investment projects

The financial calculations previously made by ÇISAN for the projected cement plants did not make a clear distinction between the point of view of the prospective investor and that of the national economy. The expert explained that the calculations corresponding to these two different points of view should be kept quite separate for purpose of clarity. He also explained the distinction to be made between the expected profitability (or "return") of an industrial project and the profitability of its financial set-up (montage), which takes into account the leverage effect of loans on the calculated rate of profit.

The expert also tried to provide staff of ÇISAN with a better understanding of the discounting of financial flows. He advocated the calculation of the projects' own rates of return as a means of appraising their attractiveness as investment, rather than using discounting rates originating on the financial market, since the choice of such rates is necessarily rather arbitrary.

Finally, the expert was asked to indicate how calculations should be conducted in order to find the price at which the products of a projected factory would have to be sold to provide the project with a rate of return of a stated level. A note was prepared in answer, with a step-by-step explanation of the method to be followed (annex IV).

Other questions studied

As explained in the Introduction, the mission of the expert took place simultaneously with that of a UNIDO expert in cement technology; this had been arranged purposely, so that the two experts could work together, when necessary, on techno-economic problems.

Jointly, the two experts undertook a critical review of the evaluations prepared by ÇISAN about the cost of equipment and about projected operating accounts of two cement plant projects currently under study.

They also made a techno-economic study of the alternative solutions available for transporting raw materials between quarry and cement plant. The study calculated, in particular, the comparative operating costs of the different solutions (such as lorries and conveyor belts) under local conditions; it showed to what extent the result of the comparison was dependent on the cost of capital.

Comment

As explained in the Introduction, at the time of the mission of the expert, the Cement Development and Research Centre was not yet operational. The functions of the future Centre (AI) were being performed provisionally by the staff of ÇISAN, a government-owned corporation, on a part-time basis. The mission took place within this context.

Whatever the organizational shortcomings unavoidable in a provisional set-up of this kind, the expert was impressed by the academic level of the people with whom he worked and by their capacity for analysis of economic and financial problems.

Because of their lack of experience and training in economics and finance, the work accomplished so far by the ÇISAN team, although generally well constructed, was open to criticism. A careful examination of a number of studies already prepared or in progress showed that they usually had the following shortcomings:

No calculation of the possible incidence of price effects, and especially of a significant price elasticity of demand for cement.

No concern for the fluctuating nature of most economic and social phenomena, and correlatively, a tendency to extrapolate observed short-term movements into long-term projections.

Unwarranted belief that reasoning can replace information when the latter is missing, combined with a tendency to minimize effort in the search for actual information.

Tendency sometimes to confuse simplicity with evidence or logic and to take for granted that some rules are right merely because they are simple or have been applied for a number of years.

Insufficiently clear distinction between certain notions pertaining to financial analysis, such as between the points of view of the national economy, of a project considered in itself and that of a financial investor, when evaluating the profitability of an investment project.

The ÇISAN staff did not seem to maintain sufficient contact with other organizations such as the Ministry of Industry, the Central Planning Office or the universities doing research work on similar or complementary problems. Within ÇISAN itself, there appeared to exist little co-ordination in the collection of economic information. Reference books and periodicals were dispersed among the staff or stored in disorder in a library room for which no one seemed to be responsible; there was consequently no list of the many documents that existed and should have been available.

II. RECOMMENDATIONS

The following recommendations have been arranged according to subject matter and the type of work concerned.

1. New directions for research carried out in Ankara in relation to long-term projection of demand for cement in Turkey should include:

A study of price elasticity of the demand for cement on the basis of statistics relating to past years. Application of the findings to the projection of future demand would then require an educated guess as to the trend of cement price relative to that of competive building materials.

Analysis of cyclical factors and logistic trends in the development of Turkish cement consumption over the years.

Projection of demand for cement by uses, on the basis of a technological analysis of the use of cement in construction and public works and separate projections of these uses.

2. Preliminary research in relation with locational studies for new cement plants and grinding mills:

Study of alternative solutions for a possible revision of cement pricing policy; economic consequences of the different solutions.

Further research on the geographical distribution of population and wealth in Turkey as a basis of demand for cement.

3. Field surveys of the cement market by region. The whole of Turkey would have to be covered by two or three small teams which could be based for a few days at a time in the existing cement plants. The commercial services of the plants could provide invaluable assistance, at the local level, as sources of contacts as well as sales statistics and other useful information on the local cement market.

4. Improving the format of the financial chapters of feasibility studies. The chief improvement recommended would consist in separating clearly the calculations pertaining to the profitability of the projected plant considered in itself and those concerning the expected return on own capital, as distinct from loans. In view of the tax privileges and other advantages generally granted to cement projects, it is also advisable to calculate the profitability of the projects from the point of view of the national economy, taking onto account external economies through such devices as shadow prices.

To make sure that these recommendations are followed, and to help solve the problems that could arise in the course of their application, it is suggested that a series of follow-up missions be undertaken. These missions could take place once or twice a year over the next two years for periods of four to six weeks each. The first should not be scheduled before AI has become fully operational, so that the expert could be in contact with the permanent staff that would be recruited for it and advise on the economic and financial aspects of the research work to be undertaken.

Annex I

JOB DESCRIPTION

Post title:	Financial Expert in Preparation of Feasibility Studies
Duration:	Two months, with possibility of extension
Date required:	As soon as possible
Duty station:	Ankara, with travel within the country
Duties:	The expert will be attached to the Government of Turkey and will, in close co-operation with the Project Manager and Turkish experts, advise and assist in preparing feasibility studies for the Cement Industry.
	The expert will also be expected to prepare a final report, setting out the findings of his mission and his recommendations to the Government on further actions which might be taken.
Language:	English
Qualifications:	Economist, with relevant experience in the preparation of feasibility studies.
Background information:	The first cement plant in Turkey was set up at Darica, Istanbul, in 1911, with an annual capacity of 20,000 tons.
	This plant was expanded in 1923. Other factories and expansions followed in the period from 1923 to 1960 where the installed capacity passed 2 million tons per year.
	Participating in the development and playing a role of growing importance since its establishment in 1953, the Turkish Cement Industry Corporation /_ÇISAN_7 has now a dominating position in the cement industry. The accelerated development of the cement industry is illustrated by the rapid doubling of both production and consumption. From about 2 million tons in 1960, 4 million was reached in 1966 and 8 million in 1972. The rapid growth of the cement industry in the past and projected growth in the future combined with the introduction of large and sophisticated plants with modern process control equipment has not enabled the cement industry to train· sufficient personnel to maintain and use the principles· of modern production control in the factories. Process and plants are designed abroad and the factories are erected and commissioned under supervision of foreign

experts. When local personnel continue operation
after the guaranteed performance has been reached
and plants taken over, a deteriorating performance
has been experienced. In particular production size
and economy have suffered because the instrumentation
without proper maintenance has failed to record
important production parameters. The results have
been large, and incidental variations in production
increase both fuel consumption and wear on equipment.
Consequently, UNIDO assistance is requested to
improve the situation.

Annex II

FORECASTING TURKISH CEMENT CONSUMPTION (1976-1990):
AN OUTSIDER'S VIEW

In the course of the last three years (1974-1976), APKM has devoted
a considerable amount of work to forecasting Turkish consumption of cement
over the next 15 years. The purpose of this effort is to determine the scale
of the new cement manufacturing facilities that will have to be built in the
country during this period.

The provisional conclusions point to a possible consumption of 16.4 million
tons in 1980 and 37.8 million tons in 1990, as against approximately 11 million
tons in 1976. On the basis of current population forecasts, these estimates
would be tantamount to per capita consumptions of 360 kg in 1980 and 650 kg in
1990, as compared with 270 kg in 1976.

At first sight, these forecasts appear very high; they imply that total
cement consumption would increase by 244% in 14 years (that is, at a compound
rate of growth of about $9\frac{1}{2}\%$ per annum), and consumption per capita by 143%
in the same time (that is, at a compound rate of growth of about $6\frac{1}{2}\%$ per annum).

Why these rates are probably too high, must, of course, be demonstrated.
This task is undertaken in the following sections:

An investigation of the probable range of cement consumption in Turkey
over the next 15 years.

Demonstration of the flaws in the methods through which APKM arrived at
its present forecast of future cement consumption.

Suggestion of alternative methods susceptible to provide a more accurate
forecast of total cement consumption in Turkey.

1. Probable range of future cement consumption in Turkey

A per capita cement consumption of 650 kg/year as currently forecast
for 1990 would provide Turkey with about twice as much cement per person as
Canada, the United Kingdom and the United States during the period 1971-1975,
about 50% more than the Soviet Union and Eastern Europe, 10 to 20% more than
Belgium, France, the Federal Republic of Germany, Greece or Spain and about 5%
more than Israel, Italy and Japan; among countries of substantial economic size,
only Austria and Switzerland consumed more than 650 kg per person/year on
average during the period.

At the same time, it appears very unlikely that average income per capita
in Turkey will, in 1990, reach the level of the countries listed above in
1971-1975. Turkish per capita income was estimated at $486 in 1973, as
compared with $1,760 for Greece, $1,850 for Spain, $2,298 for Italy and
$2,526 for Israel, not to mention some wealthier countries.

Now, according to the long-term aims indicated in Turkey's third
Five-Year Plan, income per capita in the country should increase (in real
terms) at an average compound rate of 8.6%/year between 1972 and 1987 if
everything goes for the best. At the same time, the plan recognizes that,
if a very special effort is not made and if circumstances are otherwise
unfavourable, progress will be at a slower pace, such as, for instance, that
observed during the period 1967-1972, namely 6.9%/year.

Projecting these two alternative rates over the 17 years extending
between 1973 and 1990, the following results are seen:

At 8.6%/year income per capita will be multiplied by 4
At 6.9%/year income per capita will be multiplied by 3.1
At 5.5%/year income per capita will be multiplied by 2.5

Thus, if all goes for the best, Turkish income per capita might reach
$1,940 (of 1973) in 1990; if things don't work quite that well (while still
making a very good performance by any international standard), income per
capita might only reach between $1,200 and $1,500 (of 1973). This suggests
that, by 1990, Turkey will at best reach the present income level of Greece
and Spain and, more probably, will stay somewhat behind.

The average consumption of cement in Spain and Greece for the period
1971-1975 was about 580 kg per capita. How then could one reasonably forecast
that Turkish consumption would become as high as 650 kg? A more likely figure
would be in the neighbourhood of 550 kg per capita, and this should be considered
as an upper limit, in view of the fact that, considering their level of per
capita income, Greece and Spain are among the highest consumers of cement per
capita in the world. Other countries with similar income levels consume
much less cement per capita, and countries with similar cement consumptions
(such as France, the Federal Republic of Germany, Italy and Japan) have much
higher income levels.

For all of these reasons it would appear reasonable, to assume, as a central estimate for Turkish cement consumption in 1990, a figure in the neighbourhood of 500 kg per capita, with a possible margin of uncertainty of the order of ± 15%. Part of this margin of uncertainty reflects the basic uncertainty of any long-range forecast of this kind; in part, also, it reflects the fact that, at a level of about 500 kg/year per capita, consumption is likely to show substantial year-to-year fluctuations. In countries such as the Federal Republic of Germany, Greece, Israel, Italy and Spain for instance, the year-to-year fluctuations in consumption between 1971 and 1975 have exceeded ± 10% on the average.

To obtain the probable amount of total cement consumption in Turkey in 1990, the above figure of 500 kg per capita (± 15%) must be multiplied by the estimated population in that year. Various estimates of future population have been made by official sources. In 1973, the State Planning Organization considered that the population of Turkey was most likely to increase by 2.6%/year during the subsequent 15 years. However, the 1975 census indicates an unexpected slowing of population growth since 1970, the average yearly increase during the period being less than 2.4%. Moreover, a declining trend in birth rates is now manifesting itself throughout Europe, and it seems reasonable to assume that Turkey will eventually be affected. It may therefore be expected that the population of Turkey will only increase at an average rate of 2.2%/year between now and 1990. This would bring the total population figure from 40.2 millions in 1975 to 55.9 millions in 1990.

On this basis, total cement consumption would be approximately 28 million tons (± 10%) in 1990, instead of the nearly 38 million tons currently accepted by the APKM as the most reasonable forecast for the same period. The difference of 7 to 10 million tons between these two views is equivalent to the capacity of 14 to 20 new cement plants with standard capacity of 550,000 tons/year. In other words, question is raised whether 14 to 20 additional cement plants will have to be built over the next 15 years.

Critique of methods used so far by APKM

The forecasting method of APKM consisted essentially in extrapolating to the next 15 years the trend of Turkish cement consumption during the base period 1965-1975. This method was implemented through two different approaches; the first consisted in fitting selected analytical curves to the set of points representing cement consumption in each of the past years

by means of the least-squares method. Three kinds of curves were tried: straight (linear), parabolic and exponential, in order to determine which supplied the best fit.

A second approach consisted in comparing the development of cement consumption per capita in Turkey and in certain other countries. The study showed a striking similarity between the growth of cement consumption in Poland 15 years earlier, thus suggesting the availability of a sort of "Polish model" of future Turkish consumption.

As a refinement of these approaches, Turkey was divided into seven regions, and calculations were carried out separately for each. Cement consumption by region during the base period was taken as equal to the sales of cement factories located in a given region, adjusted for cement trade in and out of it; this trade, however, is not always accurately known.

Annual rates of growth of total cement consumption were thus calculated for each region, either directly with the help of the least-squares method or through multiplying the rate of growth of per capita consumption by the expected population increase when the Polish model was used.

The two approaches appear to have yielded rather similar results, that is, a total cement consumption in the order of 37 million tons in 1990. This convergence of forecasts, however, avowedly results in both cases from the arbitrary selection of those forecasts which fitted best with the preconceived idea of APKM about the magnitude of future cement consumption in Turkey. Various arbitrary choices were in fact made in the course of the calculations, such as choosing between the different types of curves to be fitted by the least-squares method, or choosing the "model" country (Why Poland, rather than, say, Greece or Yugoslavia?).

These methods lend themselves to several kinds of criticism, some of which are listed below:

1. The base period 1965-1975 is too short in relation to the length of the attempted forecast (15 years). For some data, the period used as a base was even shorter: 1970 to 1974. This goes against the common-sense rule that historical data can not be safely extrapolated over a period more than one half of the base period; experience shows that extrapolation over a period equal to the base period is quite hazardeous; extrapolation

over 1.5 to 3 times the base period, as was made by APKM must therefore
be considered practically meaningless! One of the reasons for this
rule lies in the existence in economic history of disturbances with
cumulative effects and of cyclical phenomena of various cycle lengths.
Cycles with a period longer than the base period cannot be identified.

2. No use whatsoever was made of the idea of cycles in analysing past
consumption and projecting its future development. APKM justifies this
surprising point of view with the remark that there never occured
a decline in the consumption of cement in Turkey during the base period.
This, however, is no proof, as the base period was very short, and as
the effect of possible cycles may have been partly concealed by other
factors resulting in rapid expansion of demand during the period.
Hidden fluctuations would have been made apparent by considering the
rate of increase of cement consumption instead of consumption itself.

3. The curves (analytical functions) used by APKM to approximate
historical development during the base period and to forecast future
developments were often inappropriate to the nature of the phenomenon
they were meant to represent. Simple exponential functions of time are
appropriate only to represent phenomena which tend to exhibit constant
rates of growth and whose growth has no intrinsic limit (such as prices)
or has a very remote limit (such as population or national production),
but such is not the case with cement consumption. The example of
economically advanced countries strongly suggests that cement consumption
does not grow indefinitely.

Parabolic functions are sometimes justifiable for linking two economic
magnitudes considered independently from time. Such functions may also
appear justified to represent the development through time of a phenomenon
that began abruptly, but this is not the case with cement, the use of
which in Turkey has developed progressively over a long period.

Functions of the types mentioned above have been used by APKM in order
accomodate in their curved lines the observed variations in the rate of
cement consumption during the period under study. In fact, these
variations were probably of cyclical nature, so that this type of
statistical interpretation may lead to completely false projections for
the future.

4. The only factors envisaged by APKM to account for the development
of cement consumption in Turkey in the past were the passage of time
and increase income per capita. These two factors appear largely
interchangeable, to the extent that income per capita increased at a
steady pace throughout the period under consideration. The possible
correlation of cement consumption with such factors as total investment
or the volume of new construction have not been examined, despite the
availability of statistical information on the subject.

No attempt was made, on the other hand, to evaluate the possible effect
on cement consumption of variations in the relative price of cement
vis-à-vis other construction materials. Between 1969 and 1976, the
relative price of cement in Turkey declined by 20%, and in addition,
the scarcity of cement which resulted in black market prices (unrecorded)
during summer months, has ended. Such significant developments cannot
fail to have contributed to the rapid increase in cement consumption
recorded during the period. Unless one assumes that the price of cement
will continue to decline substantially in relation to the price of other
construction materials (a rather unlikely prospect), this effect must
be discounted in evaluating future consumption on the basis of past
experience.

5. APKM has neglected to make use of various information which, properly
combined, could have provided a cross-check to its views concerning future
cement consumption. Among these is the consumption of cement for public
works and the listing of the main public works scheduled for implementation
in the coming years. Another example is the consumption of miscellaneous
building materials, housing equipment and construction labour associated
on average with the consumption of one ton of cement in the building of
a house or apartment. It would be important to make sure that cement
consumption forecasts are compatible with whatever we may know concerning
the present and future uses of cement.

6. When attempts were made to forecast cement consumption by region,
this was done without any attempt at appraising the regional economies,
their prospects for growth and their consequent requirements for cement.
Data concerning the different sales outlets of local cement factories were
not even analysed.

Considering the importance of the financial interests concerned by the
optimum location and dimensioning of new cement factories, intensive
market studies at the regional level would seem in order.

Suggested improvements in methods for forecasting

Improvements in the methods used for forecasting Turkish cement consumption could be obtained by applying a number of simple ideas, as follows:

1. There is no method that can guarantee exact results with perfect certainty. For this reason, it is advisable always to "encircle", from several directions, the reality which one wants to study. That is, one must make several separate forecasts, using different independent approaches.

> Extrapolating past tendencies with suitable statistical instruments (as done so far by APKM) provides one possible approach.

> International comparisons of cement consumption as a function of factors such as population and real income, will provide another approach.

> End-use analysis of the demand for cement, combined with forecasting the growth of cement-consuming activities such as housing and public works, can provide still another approach.

> One could also use a regional approach, as different from approaches dealing with Turkey as a whole.

These different approaches might well lead to rather diverging results. All one can reasonably assume is that actual events will fall somewhere in between; the spread between the different answer will provide some notion of the degree of uncertainty of the forecast.

2. It is generally admitted that a purely empirical approach to forecasting is illusory. The methods of statistical analysis are basically ways of checking the validity of preconceived models relatively to observed events (statistics on past data). Consequently, the validity of statistical findings depend on the quality of the models tested. This calls in the first place for the construction of a model of the demand for cement in Turkey, that is, an algebraic relationship between cement consumption and the different factors that can have determinant or causative effects on it. These factors will be suggested by economic and technical analysis. If there is doubt about the right model, several alternative models could be used; statistical analysis will then indicate which model fits best with observed facts.

At any rate, a reasonable model of demand for cement should take into account quite a few factors that have been neglected APKM.

3. Cement is essentially an intermediate product: different from foodstuffs, for example, its consumption does not provide direct enjoyment; rather, it is associated with the production of more elaborate goods, such as houses and public works, which are in the nature of investments. This has two consequences:

Cement must compete with materials such as stone and steel that provide alternative solutions for construction; the price of cement relative to such substitutes is necessarily an important factor.

The demand for cement is linked with investment rather than income, and the relationship between investment and national income is not simple.

4. Like many natural phenomena, economic phenomena tend to exhibit oscillations. These cannot fail to have repercussions on the demand for cement.

For basing a forecast on an extrapolation of past observations, it is therefore advisable, in the first place to analyse the oscillations that fall within the time series used. Such an analysis is susceptible of various approaches, such as a purely statistical approach (Fourier analysis or autocorrelation etc.) or an historical approach.

Naturally, all of these suggestions call for substantially more work than has been done so far. To begin with, they will require collecting a considerable amount of information on statistical series concerning the construction industry in Turkey, such as statistics on building and occupancy permits, and price series relating to building materials. It will also be advisable to collect information at the regional level, starting with cement consumption by province, but looking also for information on local construction activity, prices, wealth, and the like.

Annex III

A TENTATIVE THEORY OF THE HISTORICAL DEVELOPMENT
### OF CEMENT CONSUMPTION IN TURKEY

The Purpose of this short paper is to provide a schematic model of the chief factors at work in determining the trend of demand for cement in Turkey over a relatively long period. It provides a tentative explanation of past developmen s as well as a conceptual framework for the projection of future ones. The model strongly suggests that future developments are likely to be considerably different from a mere continuation of past trends. It therefore calls for caution in long-term planning for the cement industry.

The model exhibited here is only concerned with demand of cement for the construction of buildings; it does not take into account other uses such as public works (roads, waterworks and the like). This shortcoming, however, hardly lessens the relevance of the model, because the construction of buildings currently accounts for about two thirds of total cement consumption in Turkey.
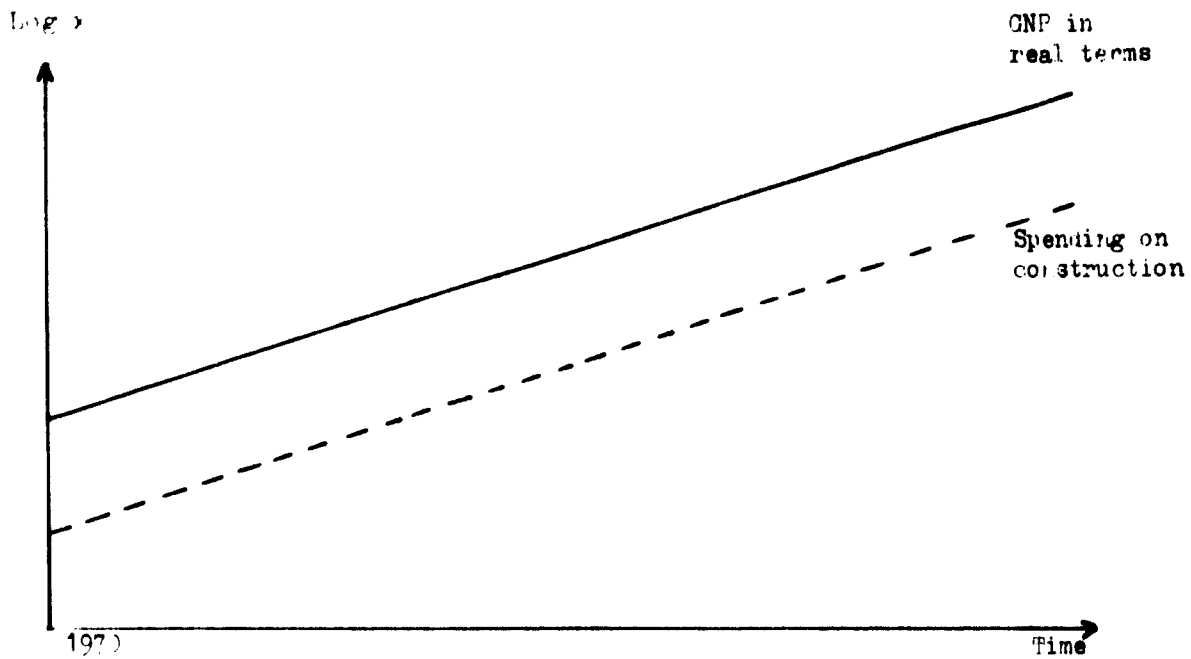
Spending on construction increases at about the same rate as real GNP
(e.g. about 9%/year)
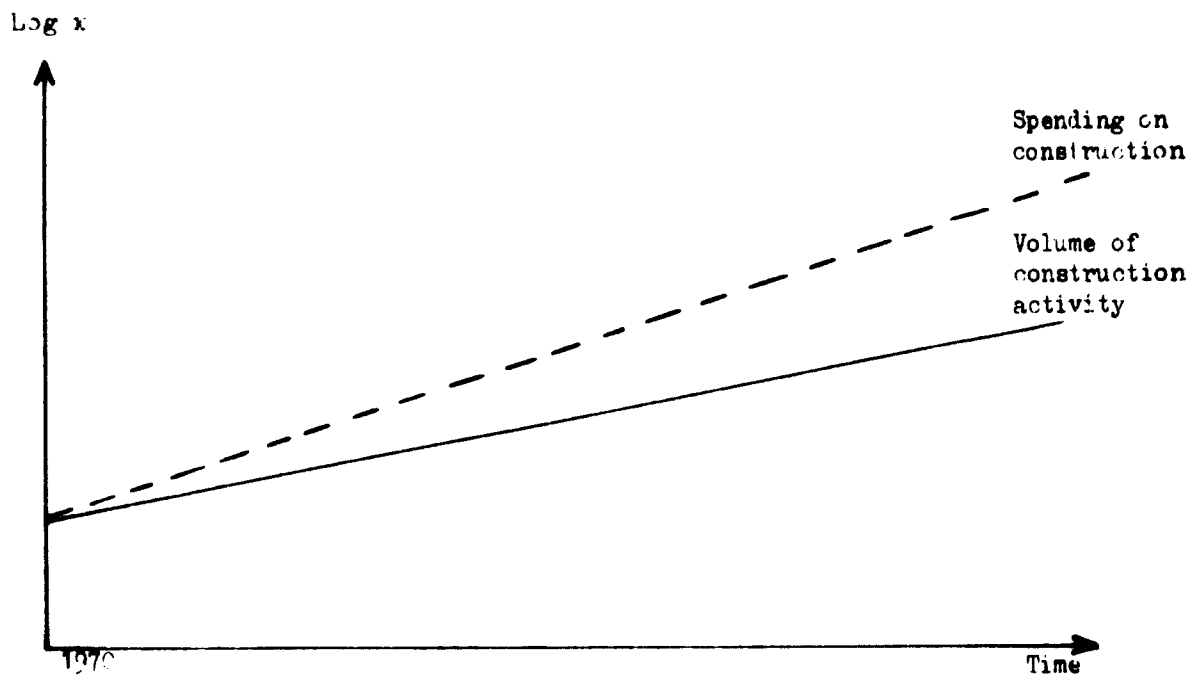
The volume of construction activity increases less rapidly than the
amount spent on construction, owing to the fact that construction
activity is labour intensive (labour currently accounts for more than

50% of value added) and is less susceptible to increases in
productivity per man-hour than other productive sectors. (Productivity
in the construction sector will probably grow at only half the
rate of other sectors.)

Log x

Volume of
construction
activity

Physical volume
of new buildings

1970   Time
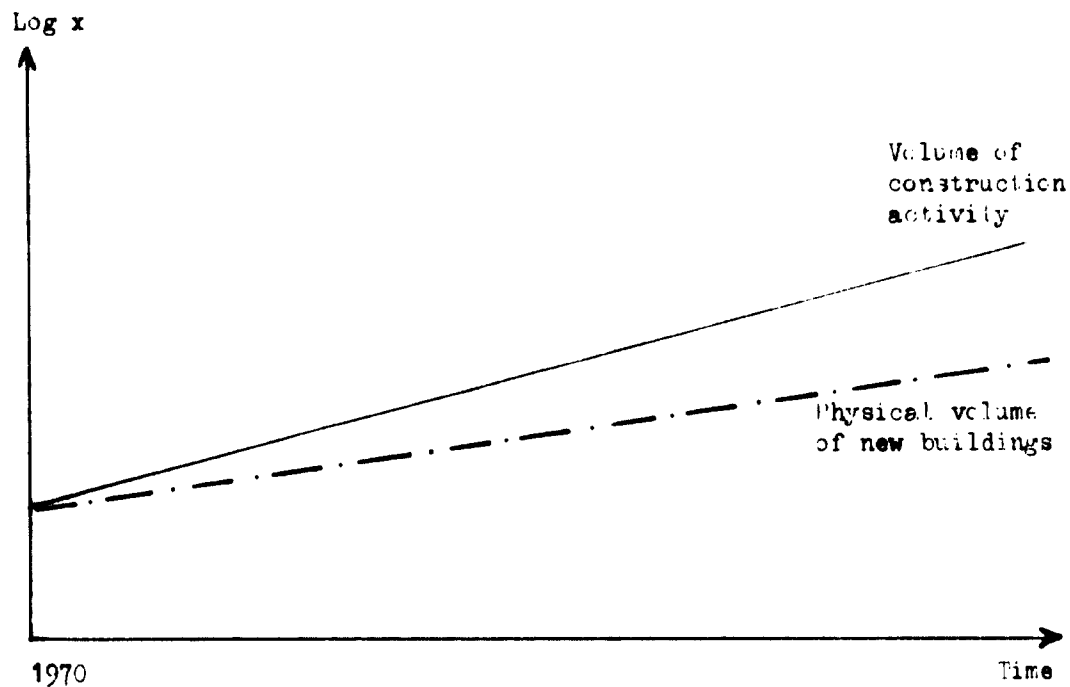
The physical volume of new buildings increases less rapidly than the
volume of activity of the construction sector. This reflects the fact
that, with increasing standards of living, people are calling for
more sophisticated constructions, that is, buildings fitted with
increasing amounts of equipment and luxury. Sophisticated constructions
require more labour per square metre.

Kg/m^2

Cement consumption
per square metre of
construction

1970   1990 (?)   Time
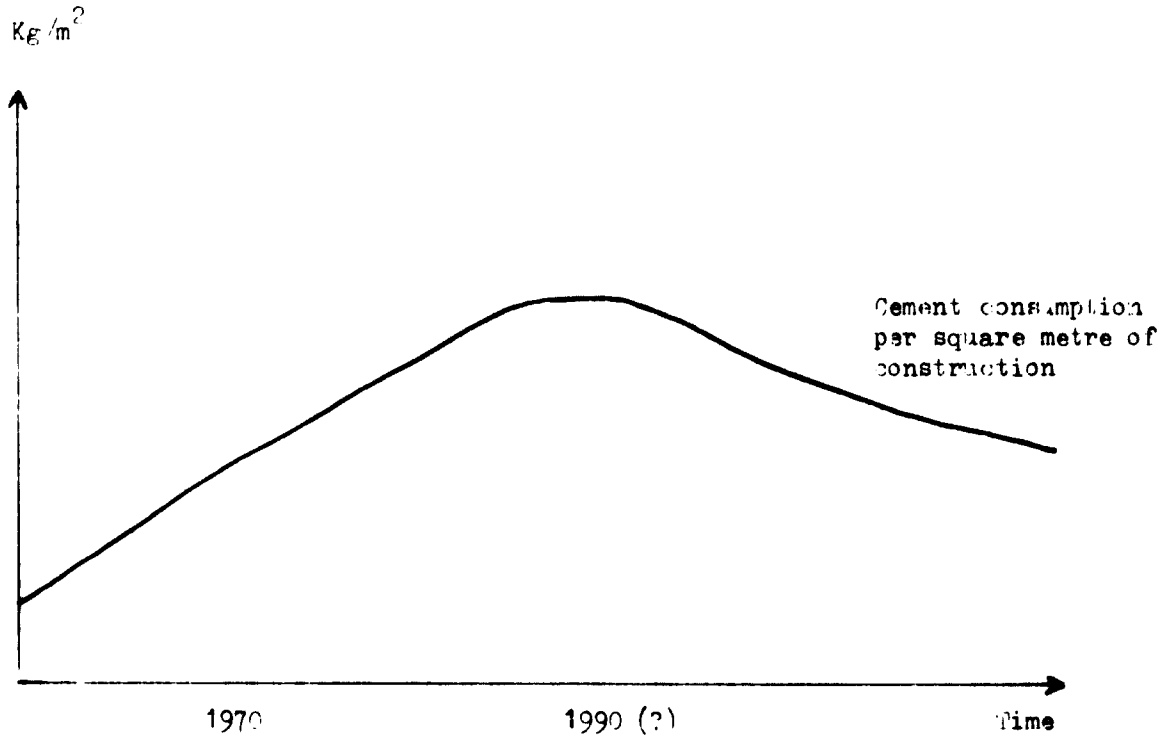
Cement consumption per square metre of construction varies through time
because of changes in the prevailing techniques of construction.

During the first stage, the use of cement increases as it is substituted
for more traditional materials.

At a later stage, it will be decrease for two reasons: builders will
learn to use cement more efficiently, especially by using prefabricated
cement products; and more advanced materials such as steel, plaster
and glass will be progressively substituted for concrete.

Log x
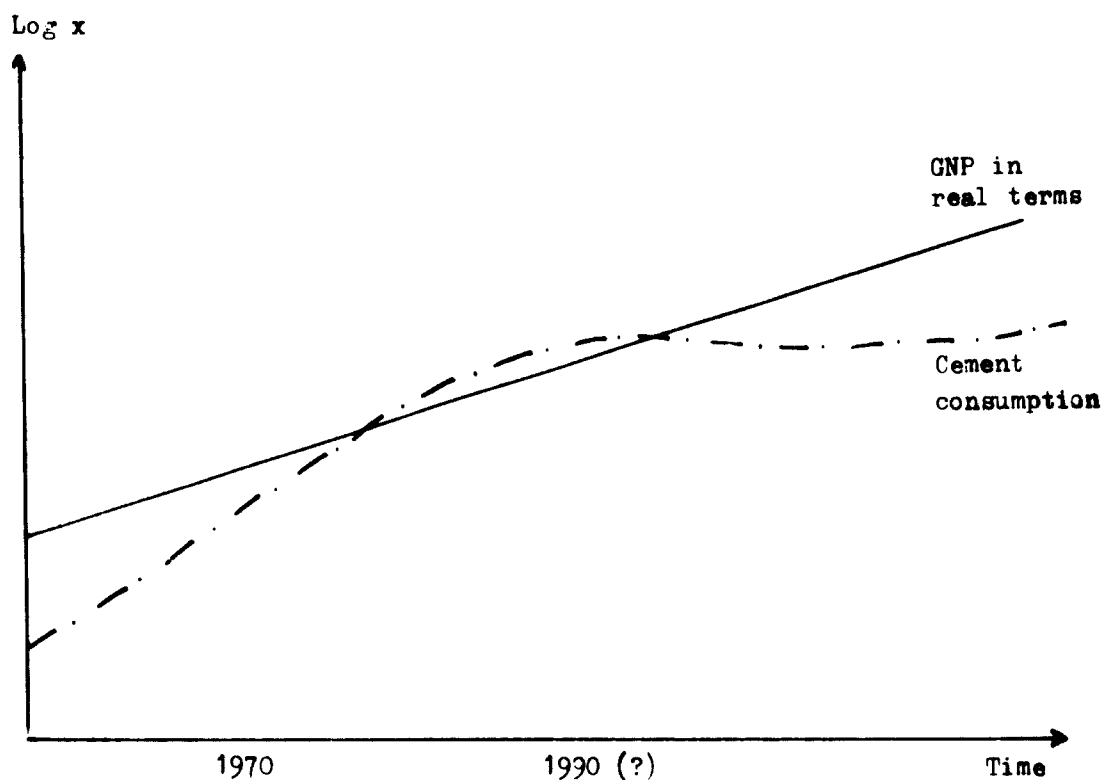
The trend of cement consumption is obtained by combining the preceding
two curves: that of the physical volume of new buildings and that of
cement consumption per square metre of construction.

This shows that cement consumption may well increase at a faster
pace than real GNP at the beginning, but its growth is bound to slow;
at a later stage, cement consumption might even stop growing alltogether.

When exactly the turning point will take place in Turkey can only
be a matter of conjecture. The experience of more advanced countries
suggests, however, that such a point is reached when per capita cement
consumption reaches between 650 and 800 kg/year. Beyond this point,
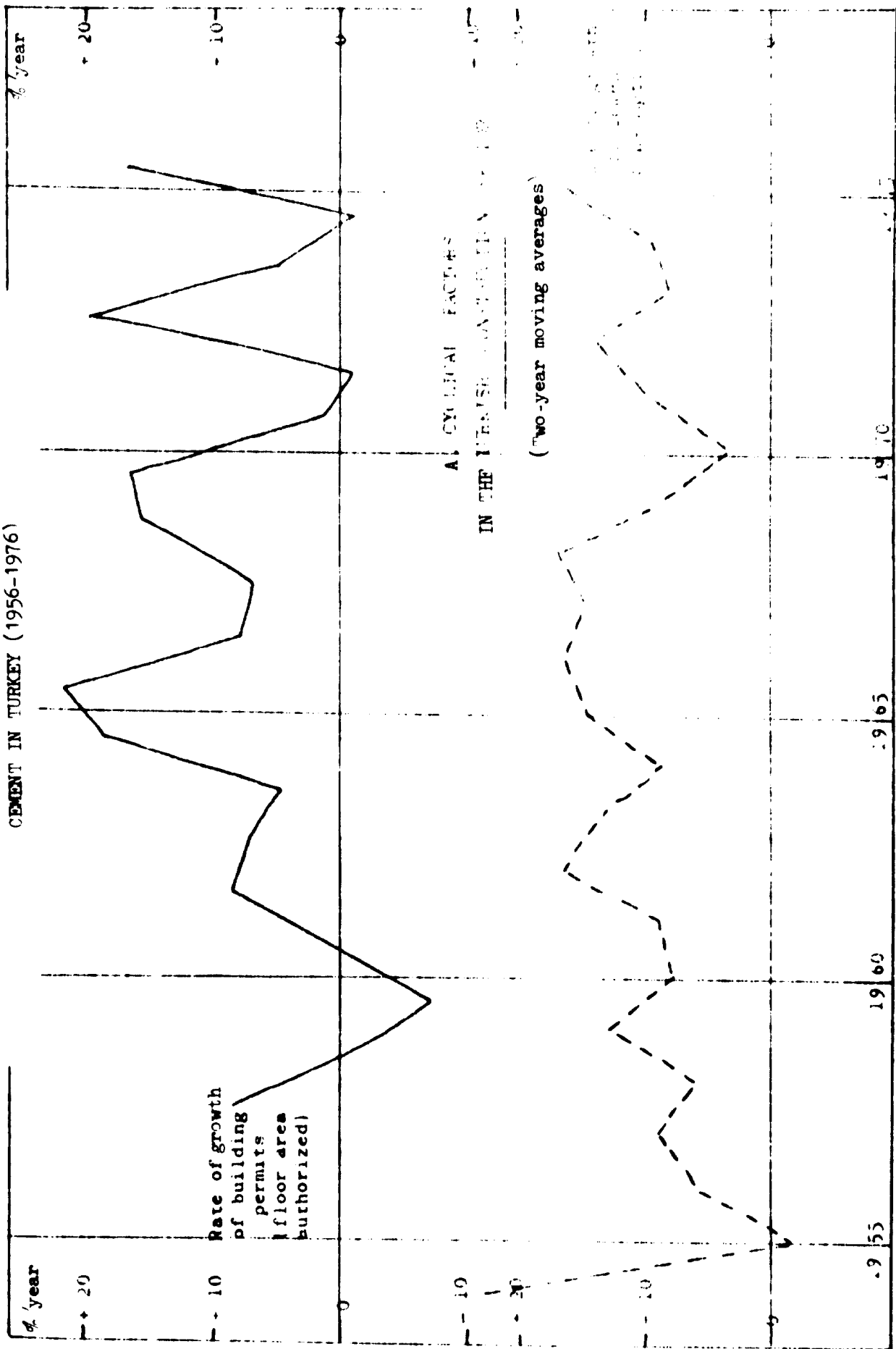steady growth is generally replaced by oscillations.

Annex IV

PROCEDURE TO BE FOLLOWED IN ORDER TO DETERMINE THE INCREASE IN
PRODUCT SALES PRICE NECESSARY TO YIELD AN INDUSTRIAL PROJECT
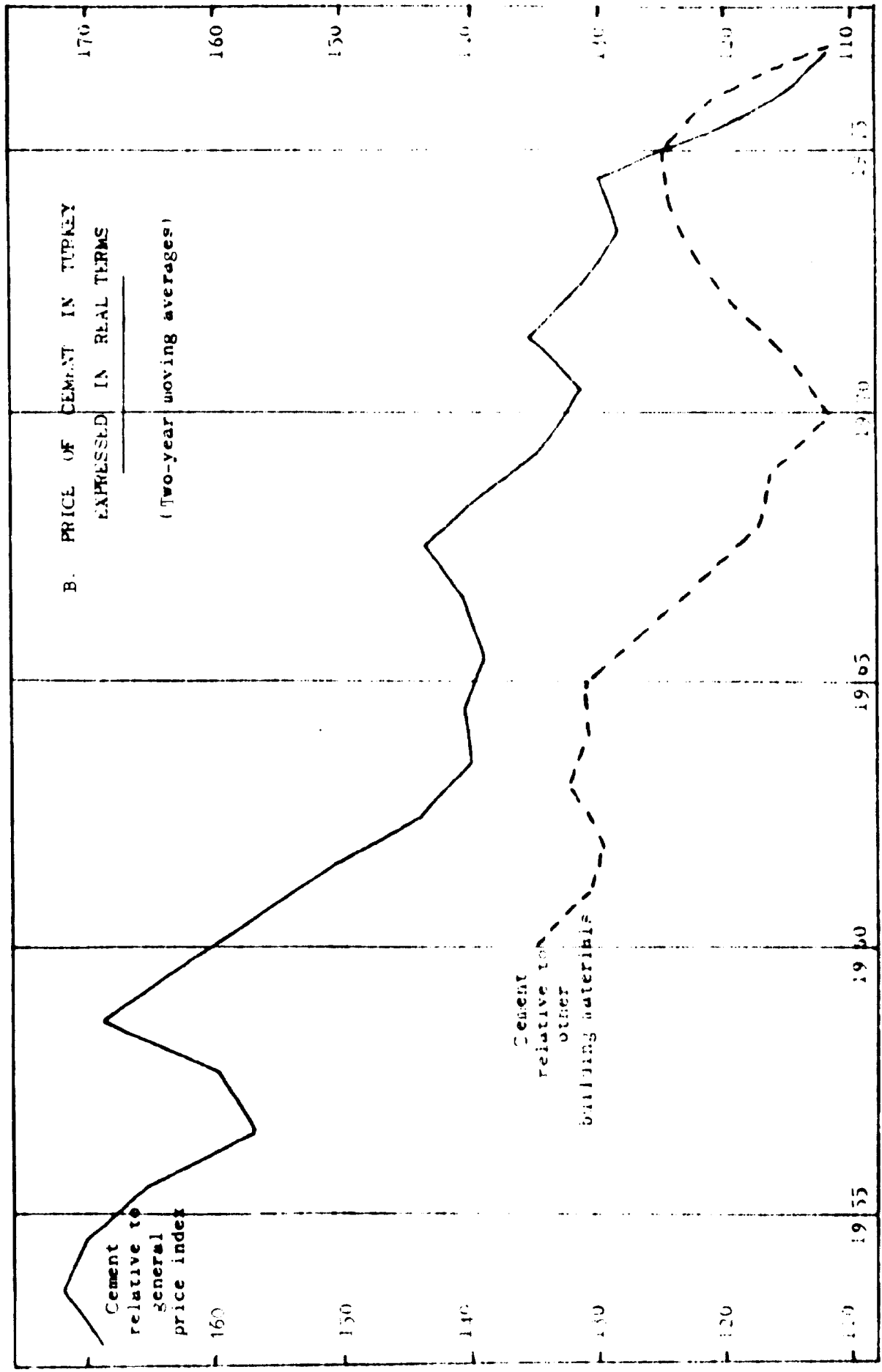THE RATE OF RETURN DESIRED[a]/

The step-by-step description that follows assumes that a projection of the project's operating accounts is already available.
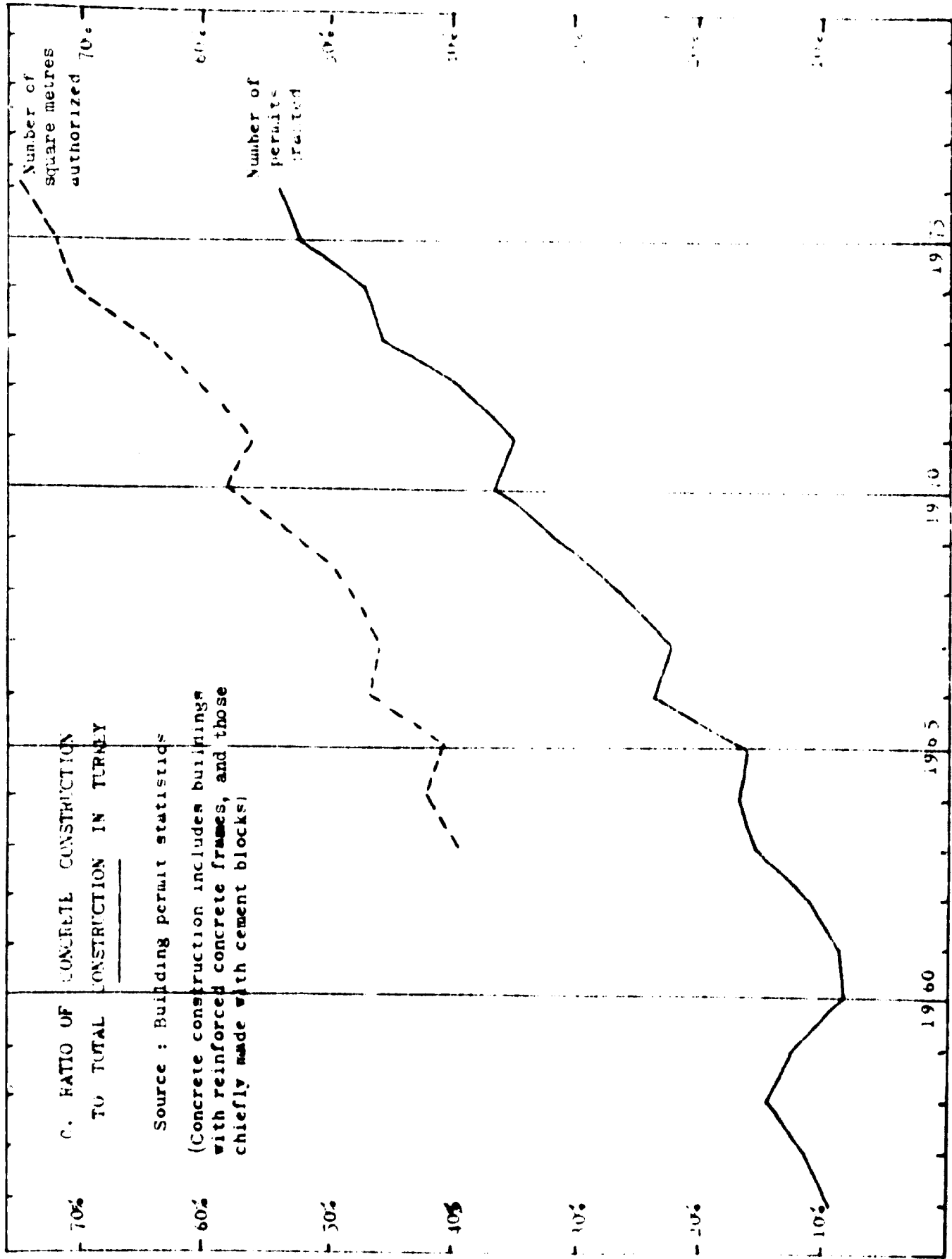
1. Start from the cash flow of the project at the previously assumed sales price, which will be refered to as the original cash flow.

2. Adjust the resale value of the plant or business (liquidation value) to take into account assumed increased profitability (for example from LT 300 million to LT 600 million).

3. Calculate the series of discounting factors applicable to the cash flow on the basis of the desired rate of return (for example 16%/year).

4. Calculate the average discounting factor (for example 0.3095) applicable to the cash flow over the entire operating period of, say, 20 years. If the expected volume of sales is not constant, a weighted average of the successive discounting factors must be calculated.

5. Calculate the present value of the original cash flow on the basis of the discounting factors referred to above (that is, those that correspond to the rate of 16%/year). The present value of this discounted cash flow is presumably a negative quantity, which will be refered to as $\underline{x}$.

6. Calculate the amount to be added to the riginal cash flow so that its present value becomes zero. This will be obtained by dividing - $\underline{x}$ by the average discounting factor applicable to the operating period (for example, $\frac{1}{0.3095} \underline{x}$).

7. The result of the above calculation can then be compared to the cumulated amount of sales at the originally assumed sales price over the total period of operation. The ratio between the two figures will indicate the required increase in sales price, thus giving the answer to the problem.

8. As a check on the above calculations, it is advisable to calculate the revised cash flow resulting from the sales price obtained as above. The present value of this revised cash flow, on the basis of the desired rate of discount (that is, 16%/year), should be approximately zero.

[a] For example, 16%/year.

Annex V

SELECTED STATISTICAL CHARTS ON FACTORS THAT AFFECT THE DEMAND FOR CEMENT IN TURKEY (1956-1976)
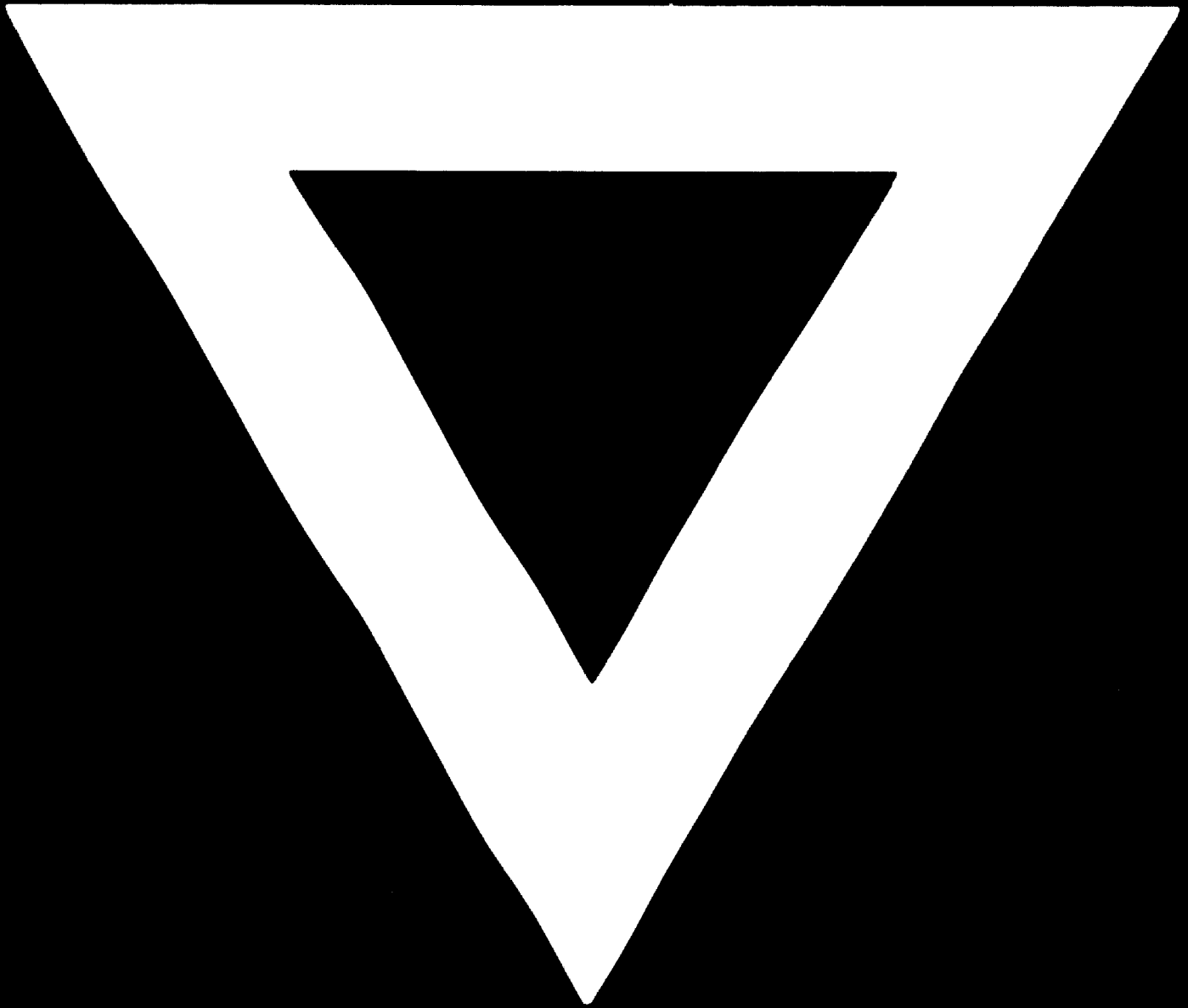
- 38 -

B. PRICE OF CEMENT IN TURKEY EXPRESSED IN REAL TERMS
(Two-year moving averages)

C. RATIO OF CONCRETE CONSTRUCTION
TO TOTAL CONSTRUCTION IN TURKEY

Source : Building permit statistics

(Concrete construction includes buildings
with reinforced concrete frames, and those
chiefly made with cement blocks)

Number of
square metres
authorized

Number of
permits
granted

C-700

78.12.12