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Workshop on the Asian Sugar-cane
Industry with Emphasis on
Sugar-cane Diversification*

Islamabad, Pakistan, 5-9 May 1991

REPORT**

19

* Organized by UNIDO in co-operation with the Pakistan Sugar Mills Association (PSMA).

** This document has not been edited.

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INTRODUCTION

1. The Workshop on the Asian Sugar-cane Industry with Emphasis on Sugar-cane Diversification was held in Islamabad, Pakistan, from 5 to 9 May 1991 and was jointly organized by UNIDO and the Pakistan Sugar Mills Association (PSMA). The Meeting was attended by 39 participants from 7 countries. The list of participants is attached as Annex I.

I. ORGANIZATION OF THE MEETING

Opening of the Meeting

2. The Secretary General of the Pakistan Sugar Mills Association, Mr. Aziz Y. Siddiqui, introduced Senator Syed Abbas Shah, Chairman of the Pakistan Sugar Mills Association. In his address, Senator Shah welcomed the Honourable Federal Minister for Food and Agriculture, General Abdul Majid Malik, and depicted the situation of the sugar-cane industry in Pakistan which had been characterized by a noticeable growth in sugar production exceeding 1.8 million tons.
3. Senator Shah emphasized that the average crushing capacity of 3,000 tons/day was becoming uneconomical and that vertical expansion was a must. He requested UNIDO/UNDP assistance in know-how and expertise. He then summarised some developments in the direction of diversification and stressed that the process could be dynamised by assuring long-term viability of the sugar industry, by vertical integration and by having full access to know-how, technology and markets.
4. In his opening address, the Honourable Federal Minister for Food and Agriculture, General Abdul Majid Malik, welcomed the participants on behalf of the Government of Pakistan and mentioned the problem of low agricultural yields due to lack of new varieties. He requested advice from international organizations on how to establish research centres and to increase production by using new equipment and by elaboration of diversification programmes especially in the use of by-products in animal feeding and alcohol production. He finally thanked the Government of France and UNIDO for taking the initiative to arrange the Workshop.
5. The Director of UNIDO's System of Consultations addressed the Meeting and expressed his thanks to the Pakistan Sugar Mills Association for their hospitality in hosting the Meeting and to the Government of France for their generosity and co-operation which had made it possible to convene the Workshop. He pointed out that the Workshop had been organized by the System of Consultations in order to exchange know-how and experience among developed and developing countries so as to increase factory productivity, to make better use of by-products such as molasses, bagasse and derivatives, as well as to examine the potential for elaboration of a sugar-cane diversification programme in Asia.

6. His Excellency, Mr. J.P. Masset, Ambassador of France, thanked the Pakistan Sugar Mills Association and UNIDO for organizing the Workshop and expressed the hope that it would result in concrete results of technical and economic partnership between developed and developing countries in this important sub-sector which links agriculture and industry. He stressed that the French Government was particularly interested in transfer of technology and the creation of joint ventures leading to improvements in the technological and economic status of the developing countries.

7. Mr. M. Akram, Chairman of the Pakistan Sugar Mills Association (Sindh Zone), in his address, pointed out that in order to ensure the sustained progress of the sugar industry, it was imperative to boost supportive measures towards ensuring a vertical growth and diversification of the sugar industry. He emphasized that three major aspects should be borne in mind while preparing for diversification of the sugar industry, namely, access to both raw materials and access to technology, and size of markets.

Election of chairman

8. Mr. Mohammad Awais Qureshi, President of the Pakistan Society of Sugar Technology, was elected Chairperson of the Meeting.

Adoption of the programme

9. The programme adopted is attached as Annex II.

II. PRESENTATION OF UNIDO ACTIVITIES

10. A UNIDO staff member from the Agro-Industries Branch briefed the participants on the difficult market situation that the sugar industry as a whole had been facing in the last decade due to increases in production, the introduction of sweeteners, stagnation of the demand in developing countries due to the low purchasing power, and import restrictions due to shortages in foreign exchange in several countries.

11. This situation had been reflected in the technical co-operation activities of UNIDO which were based on official requests. UNIDO activities had been concentrated on rehabilitation programmes, rational energy utilization, better utilization of by-products and strengthening research and development institutions.

12. Following the recommendations of UNIDO's Interregional Consultation on the Food-processing Industry with Emphasis on Sugar-cane Processing held in Cuba in 1988, UNIDO's technical activities in the sub-sector had been concentrated on the diversification of the sugar industry and on the search for higher levels of productivity.

13. A staff member outlined the activities of UNIDO's Industrial Investment Division, which were aimed at promoting business-oriented industrial co-operation between national and foreign investors. Foreign investment resources were, inter alia, finance, equity participation and expertise. The latter included equipment, know-how, licenses, etc.

14. He described all the steps necessary to promote and achieve a successful partnership investment, as well as the instruments UNIDO used for that purpose.

15. He pointed out that proof of success could be found in the number of agreements concluded between the foreign partners and local investors with the assistance of UNIDO. For example, in 1989, 143 industrial investment projects were concluded amounting to more than 550 million US dollars and in 1990, 170 projects were concluded amounting to 699 million US dollars. He stressed that other non-quantifiable objectives such as the number of young staff from developing countries being trained in investment promotion were also extremely important for the future.

16. A participant from Pakistan described the difficult situation in which the sugar mills in Pakistan found themselves due to shortage of raw materials. Low agricultural productivity and lack of adequate sugar-cane varieties were negatively affecting the agricultural output. He emphasized that exchange of germoplasm as well as the development of new varieties should be top priority areas of international co-operation.

17. The participants welcomed UNIDO's technical assistance and investment promotion programmes in the area of sugar-cane processing especially those private sector action-oriented plans.

III. PRESENTATION OF BACKGROUND PAPERS AND DISCUSSIONS

Techno-economic aspects of sugar-cane processing in Asia

18. A UNIDO consultant presented the techno-economic aspects of sugar-cane processing and the development possibilities of the thirteen main producing countries of Asia. He analysed the agricultural sector in each country, drawing attention to the areas dedicated to sugar-cane cultivation, cultivation techniques, average yields, problems of variety, contractual arrangements between farmers and the factories and stressed the importance of paying farmers according to the quality of the sugar cane.

19. Data on mill sizes in each country were also presented as was information on technical yields, production, structure of factories, uses of by-products, production costs, etc. Based on these data, a brief techno-economic evaluation was presented as well as the prospects for industrial co-operation to improve factories' profitability using diversification programmes.

20. A participant from Pakistan described some unsuccessful experiences in the direct use of sugar molasses as cattle feed. He said that the small size of most Pakistan sugar mills could be a handicap for diversification programmes.

21. Another participant described a system whereby the sugar content could be assessed in order that the amount due to the sugar-cane grower could be ascertained. The benefits of using different sugar-cane varieties in order to scale deliveries, allowing better and longer use of existing processing capacities were also listed.

22. One of the participants from Indonesia described the situation of the sugar-cane industry in his country and pointed out the decline of sugar-cane production caused by the increased use of irrigated land for rice growing. Among the diversification programmes developed in Indonesia he cited the processing of alcohol and pulp as well as monosodium glutamate.

23. A participant from India stressed the importance of the sugar industry in India which came second after the textile industry. India also had a chemical industry producing acetic acid and a complete range of chemicals from acetaldehyde. A paper plant also produced paper from bagasse. More than 200,000 tons of by-products from small decentralized plants were used for animal feed. The investment costs of these small plants were estimated at approximately three million rupees.

24. Another participant from the Philippines pointed out the importance of the sugar industry in the Philippines which sustains 4-5 million people and provides direct employment to over 363,000 people involved in the operation of 38 sugar mills.

25. He gave a comparison of the relatively low performance of the Philippine sugar mills with that of other countries and cited deficiencies in cane preparation, imbibition and short milling as the main factors leading to an insufficient sucrose recovery. Lack of purity of mixed juices was also mentioned as an explanation for the high percentage of molasses produced.

26. He informed the participants that out of 38 operating sugar mills only six had diffusion-type mills. He said, the country had 20 alcohol distilleries using 48% of molasses produced of which 1% was used directly as animal feed. An example of co-generation through biogas production was also given as well as an outline of research which had been undertaken in the use of by-products for animal feeding and bagasse as fertilizer.

27. A participant from Thailand stated that his country exported sugar to Europe during the first half of the nineteenth century. Now, more than 46 sugar mills were processing about 39 million tons of sugar-cane. One mill was co-generating power purchased by a public utilities company. Molasses were used as cattle feed and bagasse for the production of medium density fiberboard.

28. The participant from Viet Nam outlined the situation in Viet Nam where 10 sugar mills existed with capacities ranging from 500 to 2000 tons of cane per day; only one of the mills, with a capacity of 2000 tons per day, used diffusion to extract the juice. In general terms half of the sugar mills were obsolete.

29. He pointed out that bagasse was being used as fuel to operate factories and that molasses were either exported or fermented into alcohol for consumption. He mentioned that local production of sugar was not sufficient to cope with demand and that Viet Nam was a net sugar importer. As a result, the Government was calling for overseas investment in the sugar sub-sector.

30. A French international expert presented some facts and figures of sugar-cane processing in the French Department of La Réunion. The average yield was 7 tons of sugar per hectare but due to payment rates for manpower, costs of production were high. Steps were being taken to reduce those production costs by introducing the Hawaiian long-cycle system and irrigation. Competitiveness of the processing industry had been achieved by scale economies, increased preparatory index and optimization of the extraction process by upgrading milling efficiency.

31. A 24 Mw power plant, the largest in the world using bagasse, had been operating since 1983 and selling power to the local utility company. A new coal/bagasse plant was being erected and another one planned to be in operation by 1995. The plants would operate 130 tons/hour boilers and two 30 Mw condensing turbines.

Diversification as a strategy for the sugar-cane sector

32. A UNIDO consultant presented a background paper on diversification as a strategy for the sugar-cane sector. He summarized some of the features of international sugar activities in terms of production, consumption, preferential markets and the international market. He pointed out that sugar had a long history of protectionism and stressed the importance of diversification as a strategy to share production costs among a large number of products, as well as to create vertical integration, to increase productivity and to restructure the present sugar industry through integrated industrial multiproduct complexes.

33. The presentation included a list of diversification opportunities as well as the development of diversification programmes in Latin America and in the Caribbean.

34. A general discussion took place on the issue of alcohol from sugar cane. It was pointed out that there were three main uses of alcohol: alcohol-chemistry which had to be competitive with petro-chemistry, alcohol as fuel which had to compete with oil prices and alcohol as an environmental-friendly octane enhancer which although more expensive than lead tetraethyl was non-pollutive. A consultant pointed out that some concern had emerged on the possible damage by alcohol to the ozone layer. This concern, however, had not been supported by any scientific evidence.

35. A participant pointed out the importance of monosodium glutamate in Indonesia where more than 600,000 tons of molasses were used for its production and which was almost totally exported.

36. Another participant stressed the importance of alcohol chemistry in India which was producing a wide range of chemicals from acetic acid to PVC.

37. A participant from a developing country enquired about the technology for making citric acid from sugar-cane molasses. He was informed that India was running a plant with technology acquired several years ago and that UNIDO was implementing a citric acid pilot plant project in Viet Nam with promising results.

Utilization of sugar-cane by-products in animal feeding

38. A UNIDO consultant presented a background paper on the utilization of sugar cane and its by-products for animal feeding. The consultant stated that the objective of the study was to present a series of alternatives for animal feeding based on the experience gained in the Latin American and Asian region.

39. The consultant further emphasized the high photosynthesis efficiency and biomass production of sugar-cane and outlined its direct utilization for feeding purposes and use of sugar-cane juice and sugar as animal feed.

40. Particular attention was drawn to the uses of molasses and derivatives such as Torula yeast, biofermel, lysine, molasses-urea-pitch, multinutritional blocks and zacamel.

41. Uses of bagasse and bagasse derivatives like pre-digested bagasse and hydrolyzed bagasse as well as vinasse and filter mud were also presented in light of Latin American and Caribbean experience where more than 300 industrial plants were in production.

42. A participant enquired about the possibilities of sugar-cane derivatives in the production of feeds for aquaculture. The issue of small plants which could be decentralized and erected close to the consumer markets, was also discussed.

43. A participant from a developed country informed the Meeting that more than 120 bagasse pre-digesters had been ordered by Brazil.

44. Another participant from an Asian country requested UNIDO to examine the possibilities of convening a workshop on this subject.

IV. FRENCH OFFER FOR TECHNICAL AND INDUSTRIAL OPERATIONS

45. The French experts in sugar technology outlined their experience in this area and formulated offers for technical and industrial co-operation. The evolution of the French sugar-beet industry was illustrated by the fact that in 1960 one hectare of beet yielded 5 tons of white sugar; today, the same area yields 10 tons of white sugar. The beet industry now needs 1/7 of the time and 50% less energy to process the same quantity of beet than 25 years previously.

46. A French expert presented methods to increase factory productivity through better energy management. The methods were based on an analysis of internal and external constraints allowing savings in bagasse consumption. Several simple procedures such as flashes control and blow-downs could enable economies of up to 35 kg of steam per ton of sugar-cane.

47. Those measures, as well as improvements in monitoring crystallization units - particularly working with solutions at 75 degrees Brix - and the installation of five effect evaporators, could result in steam consumption figures of as low as 250 kg per ton of processed sugar-cane.

48. A presentation made by another French expert compared methods and practices among sugar factories in Hawaii and in the French Department of La Réunion. In La Réunion, an agreement between a factory and the public utilities company resulted in a particular co-generation programme, whereby bagasse was given free to the power company and in return the sugar factory received 25 Mw and all its needs in steam at 2 bars.

49. Data were given by another French expert on reducing losses in condensers, methods to compensate evaporation loss as well as ways to decrease steam consumption and keep the temperature gap between first and fourth effect.

50. Software for computerized energy management developed by a French company requiring a factory diagnosis in order to feed the proper data, was also detailed.

51. New commercially-available technologies for production of alcohol were also presented. Particular attention was focused on a continuous fermentation process where yeast was recycled and protected against bacterial contamination. In that process, yeast as well as diffusion water were treated by acid and molasses injected directly into fermentation tanks specially designed to avoid yeast deposits.

52. Techniques to improve energy efficiency in alcohol distillation, to reduce impurities (off flavours) and to concentrate vinasses, were also outlined, and new process for alcohol dehydration using prevaporation techniques were discussed.

V. FINDINGS AND CONCLUSIONS

General

53. Participants recognized the usefulness of the Workshop for exchange of technical experience, updating knowledge on existing technologies in sugar-cane processing, as well as for diversification. They agreed that the Workshop and the contact with the participants were valuable tools towards developing new processing and diversification technologies.

54. In that context, participants from Indonesia requested UNIDO to consider the possibilities of convening a similar workshop at the national level, with participation of international experts, consulting firms, research institutions and suppliers of equipment.

Agronomy

55. All participants recognized that agricultural aspects were the main reservoir of future productivity gains in the sugar-cane industry and that efforts to develop new varieties were not always adequate at either a national or international level. Participants welcomed the fusion of the French International Cooperation Center for Agronomic Research and Development (CIRAD) with the cane breeding station in the French Department of La Réunion. As a result of this fusion, the French Institute for Cane and Sugar (IFCS) was created.

56. The development and dissemination of short- and long-cycle new varieties developed at La Réunion as well as those developed at the Sugarcane Breeding Institute of Coimbatore (India) could be a very significant contribution to international co-operation and to productivity increase of the world sugar-cane industry.

57. The Workshop recognized the urgent need for reassessing factors of productivity affecting sugar-cane production. Evaluation of a varietal improvement programme must be undertaken by the countries through national, regional and international co-operation and exchange.

Diversification

58. The participants agreed that diversification programmes could be a valuable tool for restructuring the present sugar-cane industry through integrated industrial multi-product complexes sharing production costs among a large number of products.

59. Use of sugar-cane processing by-products for animal feeding was seen as a relatively low cost diversification programme that could improve factory profitability and promote national wealth by increasing meat and milk production. Latin American and Caribbean experience in this area was described and the participants took note of the significant number of bagasse pre-digesters being erected. However, as farms were much smaller in Asia, the feasibility of that approach needed to be studied and tested. International co-operation on the issue was requested by all participants.

60. Participants took note of the necessity for technical improvement of alcohol production - particularly in the area of fermentation improvement of alcohol quality, effluent disposal, recycling of the nutrients, and of energy-saving systems.

61. Participants stressed the importance of diversification programmes in power co-generation and the significance of negotiating with public utilities on the price of Kwh purchased.

62. Versatile new power plants fed by either coal or bagasse could solve the problem of seasonal irregularity in generated power. However, in view of the investment required there was no universal solution, and each factory should study co-generation feasibility taking into account local circumstances.

63. The importance of research in new uses of sugar-cane by-products was fully recognized. Participants laid special importance on the developments of bagasse steam cracking followed by enzymatic hydrolysis, as well as on the production of special biochemicals like citric acid and antibiotics from sugar-cane molasses.

Factory productivity

64. Supply/demand imbalances and unfavourable fluctuations in market forces including increased production cost in field and factory, called for renewed efforts at improving field and factory productivity, both for exporting and non-exporting sugar-producing countries of Asia. Concrete measures towards that end should be identified and implemented by the countries.

65. The issue of energy savings was considered extremely important for improving factory efficiency. In that context, a methodology for direct and indirect energy savings, bagasse drying, thermo-compression and software for energy management, among others, was presented to and commented upon by the participants.

66. It was agreed that factory increase in productivity could successfully be achieved through an integrated plan of action based on a detailed factory diagnosis.

67. The Workshop attached importance to greater regional co-operation in all spheres of sugar-cane, sugar and by-products production. Exchange of experience, information and initiation of joint regional action would be of help to the Asian countries. Establishment of a regional association of the sugar industry in Asia, based on world experience, needed serious consideration. In that context, GEPLACEA offered assistance to the sugar producers of Asia.

Follow-up

68. UNIDO, in co-operation with other international organizations, interested governments, financial and non-governmental institutions, was requested to:

- (i) Develop technical co-operation programmes with the Asian producers in priority areas identified during the Workshop, including inter-alia:
 - (a) Proper fermentation techniques;
 - (b) Energy-saving devices and processes in sugar and alcohol manufacturing;
 - (c) Production of special chemicals;
 - (d) Technological quality of sugar crops for processing;
 - (e) Production of animal feeds including protein-rich components;
 - (f) Development of human resources.
- (ii) Co-ordinate development and exchange of sugar-cane germplasm and varietal improvement programmes.
- (iii) Explore the feasibility of establishing development centres for the sugar industry in selected Asian countries.
- (iv) Promote further co-operation among Workshop participants in partnership, and in co-investment in areas of mutual interest.

69. Interaction between UNIDO and agencies/associations of producers and technicians in Asia should be further widened, contributing, among other things, to greater awareness of the useful work carried out by UNIDO in the sugar-cane processing industry.

Annex I

LIST OF PARTICIPANTS

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S. Miranda da Cruz, IDO, Agro-based Industries Branch, Industrial Operations Technology Division, Department of Industrial Operations

Annex II

PROGRAMME

Sunday, 5 May

- 9:00 Registration
- 9:30 Formal opening of the meeting:
- Address by the Pakistan Minister of Agriculture and Food
- Address by Pakistan Sugar Mills Association
- Address by Mr. G.R. Latortue, Director, System of Consultations Division, UNIDO
- 9:30 - 10:00 Introduction of participants
Election of Chairman
Adoption of agenda and organization of work
- 10:30 - 12:30 Presentation of UNIDO activities
- Technical assistance: Mr. S. Miranda da Cruz
Agro-based Industries Branch, DIO
- Investment promotion: Mr. M.O. Abdelmoneim
Industrial Investment Division, DIPCT
- 14:30 - 15:45 Presentation by UNIDO consultant, Mr. P. du Genestoux, of Background Paper I:
- Techno-economic aspects of sugar-cane processing in the main producing countries of Asia: Development possibilities
- Technologies and methods to improve efficiency and profitability of the sugar-cane industry including integrated management of production, energy and quality control
- General discussion of Background Paper I
- 16:00 - 17:30 Continuation of general discussion

Monday, 6 May

- 9:00 - 10:00 Continuation of general discussion on Background Paper I
- 10:15 - 12:30 Presentation by UNIDO consultant, Mr. J.A. Cerro, of Background Paper II:
- Diversification as a strategy for the sugar cane sector
- 14:30 - 15:45 Presentation by UNIDO consultant, Mrs. Herly Noa, of Background Paper III:
- Utilization of sugar cane and by-products of its agro-industry for animal feed
- 16:00 - 17:30 General discussion on Issue Paper III

Tuesday, 7 May

- 9:30 - 12:30 Presentation of offers and requests for technical and industrial operations
Contacts among participants
- 15:00 - 18:00 Continuation of contacts among participants

Wednesday, 8 May

- 9:30 Departure by bus for industrial visits to sugar-cane processing enterprises

Thursday, 9 May

- 9:30 - 10:00 Presentation of conclusions by the UNIDO Secretariat
- 10:00 - 10:30 Official closure of the workshop

Annex III

LIST OF DOCUMENTS

Background Papers

Diversification as a strategy for the sugar-cane sector	ID/WG.513/1(SPEC.)
Evolution and present situation of the sugar industries of Asia	ID/WG.513/2(SPEC.)
Utilization of sugar-cane and by-products of its agro-industry for animal feed	ID/WG.513/3(SPEC.) & ID/WG.513/3/Corr.1(SPEC.)