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Issue Paper II

IMPROVEMENT OF THE PRODUCTIVITY IN THE SUGAR-CANE SECTOR*

Prepared by the
UNIDO Secretariat

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SUMMARY

The objectives of this paper are to evaluate the principal issues affecting productivity in the sugar-cane processing industry. Although, the search for a higher efficiency of the sector might be considered in a purely technical sense, measures taken to develop the industry must be tailored to the social and economic situation in the sugar-producing countries and analysed in terms of its linkage to the general performance of the economy.

In many developing countries the cultivation of sugar cane and the manufacture of sugar including the plant milling process, systems of sowing, harvesting and transportation have been carried out without major technological changes for decades. In the past, the absence of a strong demand for innovations and at the same time, in a situation of relatively high prices and stable international market, the sugar industry followed the inevitable course to technological stagnation and a steady decline in productivity in comparison with other sectors of economy.

In view of the current economic situation of the industry and consequent commodity crisis, the search for alternative supplementary activities within the sector is a real desirable objective. This calls for measures aimed at overcoming the serious problems caused by oversupply in the world market and a drop in prices. One of the ways to deal with this problem is the diversification of the sugar industry and improvements in its productivity to make producers more competitive through a viable production process. It has become evident that it is necessary to improve existing technologies and introduce new ones in the sugar-cane industry with the aim of reducing production costs. Raising production efficiency presupposes the rational utilization of energy, improvements in product design, provision of appropriate infrastructures, and increasing yields.

The approach to the issue of productivity in the sugar industry may be subdivided into several subprogrammes due to the complexity of the problem and diversity of country situations and regional disparities. Within the industry, developing countries should deal with the technological prospects for the agricultural sector itself, innovations and restructuring of the "industrial" sector or processing activities including plant maintenance, infrastructure and increase in added value. The use of biotechnology, optimum use of processes, improvements in energy balances and a growing use of computers as well as managerial emphasis are also a few of the means to tackle the problem and attain the desired objectives.

Success in expanding the international trade in sugar and its by-products depends on the productivity of the sector. The situation where there is abundance of out-dated technology and lack of investment capital for restructuring and renovating existing mills and by-products processing lines hinders the development of the industry and prevents it from competing effectively on the international market. Many producers have come to the conclusion that new regulations and measures should be adopted at the national and regional levels to stimulate the flow of capital for the rehabilitation and restructuring of the sector. Changes in depreciation rates, employment regulations and general improvement of management should also be considered as ways and means to solve existing problems of the technological underdevelopment of the industry.

Because of the complexity of the situation in the sector and the evident predominance of the economic and financial factors in the way of attracting new equipment, technology, know-how, management and qualified manpower into the industry, international co-operation could play an important role by encouraging and supporting activities and programmes by which the developing countries would receive an adequate package of assistance from the developed ones that would enable them to set up productive co-operation and exchange of information on a South-South basis. National and regional efforts to improve the productivity of the sugar-cane industry could also benefit greatly from multilateral assistance as well as from specialized institutions such as GEPLACEA (Group of Latin American and Caribbean Sugar Exporting Countries) and ISO.

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I. INTRODUCTION

1. The low price of sugar and its decline as an export product in the international market compels the sugar-producing countries to look for alternatives to compensate for the losses caused by the situation as well as to develop new products for export. Apart from the process of diversification and the introduction of derivatives, there is an evident need for a comprehensive and broad understanding of the necessity of drastic changes and improvements in the productivity of the sugar-cane industry. The critical issue is how to maintain production levels to meet domestic and export demand while at the same time minimizing costs.

2. The complexity of the present "commodity" crisis has been further compounded by the fact that for several decades, sugar has been a product with high price fluctuations and an erratic international market. These circumstances have been aggravated by a combination of negative factors which have caused the consumption figures to fall and the prices to stay below the profitability limits over a long period of time. Urgent measures are required to offset the negative effects in production costs and market prices to guarantee profitability even under unfavourable conditions.

3. Introduction of new technologies and materials improvements in utilization of energy, further development of infrastructure and a steady search for better efficiency and management of the industry in general are now the focal points of national policies in the sugar-producing countries. Changes are envisaged in the field of investment and tax regulations, role of foreign capital and international co-operation. In general terms, the situation prevailing in the sector up until now is on the verge of transformation.

II. TECHNOLOGY BALANCE IN THE SUGAR-CANE INDUSTRY

4. The production of sugar as a product both for export and internal consumption is a branch of the economy of strategic importance for many developing countries. It has been growing for decades giving a stimulus to national economies but without necessary technological changes and innovations because of the then existing relatively stable demand and prices. Although some periods of the sugar-cane industry's history coincided with attempts to improve the production technology, quality and quantity of sugar produced as well as its derivatives and by-products, nevertheless the general trend has reflected a constant lag in productivity growth rates in comparison with other branches of economy or even agriculture.

5. This persistent technological lag did not enable the industry to face the deterioration of the international market, decline in sugar consumption and prices and the appearance of new and highly efficient producers of beet varieties. Changes in eating habits and diets, introduction of artificial sweeteners, raising of tariff and non-tariff barriers and import quotas and the tendency towards reaching the upper limit of the average world's yearly consumption rate have put the cane-sugar producers and especially exporters in a position where purely market factors could provide an explanation to the acute supply/demand situation.

6. It was only on account of some external forces that new technologies on ad-hoc and irregular basis began to be introduced. It occurred in the sectors consuming primary energy (thermal, mechanical and electrical power) i.e. steam generation and the co-production of electricity in the mill primarily due to the oil crisis of 1974 and a drastic increase in prices of imported oil. These sectors were modernized both in terms of engineering and process technology; with regard to the other sectors, there have been some changes involving optimization and modernization of the processing techniques, manpower training, introduction of new managerial approaches. But the scale of these innovations have not been sufficient to guarantee the orderly development of the industry and to prevent the negative effects of the international market. Moreover, most of them took place only in a few countries like Brazil, Mexico, Thailand, the Philippines, which possess more or less advanced and relatively competitive sugar-cane processing industries. But the great majority of countries of Latin America, the Caribbean, Asia and the Pacific possess obsolete and inefficient facilities for the efficient production of sugar.

7. The backwardness of the technology and productivity levels of the sugar industry in developing countries create a serious problem. Any delay in the process of restructuring and modernization of the industry means additional losses in export revenues, inability to compete effectively and successfully, and the preservation of the old-fashioned style of management. That is why the tilt towards the diversification and production of by-products should be also viewed in a broad sense of industry renovation and rehabilitation in all its aspects.

III. PACE OF INNOVATIONS

8. In principle, the restructuring process in the sugar industry with the aim to improve its productivity and maximize the efficiency may be subdivided into three principal groupings namely: diversification; improvements in cane production; and sugar processing. The prospects of the sugar industry are predominantly dependent on achieving success in these fields. Their close inter-relationships also presuppose the need for comprehensive and integrated approaches.

9. Cane production can be improved by introducing high yielding varieties, increased usage of fertilizers, improved land farming and preparation methods, proper pest and disease management and through expanded use of irrigation and drainage systems. The cost of growing sugar cane is one of the determining factors for the cost of final products and thus the revenues of the industry in general. Nevertheless, the transfer of technology and the introduction of the necessary methods and techniques mentioned above have been much slower despite the fact of the steady trend towards lower prices on the international market and the appearance of new highly efficient and aggressive competitors. Mechanization of the cultivation and harvesting of cane has had relatively successful experiences in the Louisiana, Hawaiian and Australian systems.

10. Generally, however, the pace of innovations has been slow. It has become obvious that in-depth market and economic analysis should be made before the purchase and application of modern technology and equipment under local conditions. The need for training of personnel, steady supply of maintenance parts and repair services, total compliance with all pre-harvesting equipment and its proper territorial distribution forced many producers to be more patient and careful on the way towards modern mechanization.

11. The introduction of new varieties of cane sugar also faced similar problems. To be able to obtain suitable varieties, producers need to analyse the climatic conditions and soil characteristics to locate suitable prototypes to meet the future demand for sugar cane. Moreover, countries which do not have a genetic improvement programme will have difficulty in continuing as sugar-cane producers since they will not be in a position to grow it efficiently. The potentials of genetic engineering are enormous and they could become a decisive factor in developing sugar-cane varieties. Efforts would need to be directed to confronting sugar-cane diseases, increasing sanitary control, reduction of entry of new pathogenic agents, etc.

12. The bulk of efforts in the way of innovations in the sugar industry has been recently concentrated on the "industrial corner" of the sector. This comprises stages of sugar cane processing line as cutting, collection, transportation, extraction, etc. Data processing as a resource for computerized programming and control of such operations (including the control of the saccharose content) has become one of the technologies most successfully applied in a number of more developed sugar-producing countries. Another stage of the process where the introduction of new technologies helps to improve efficiency is the extraction of saccharose: this involves better preparation of the cane, increased milling capacity of the mills and an effective feed system. Good results have been gained by introducing sugar-cane diffusers which make better extraction with a smaller power consumption at a lower maintenance cost. The only problem in this case has been the lack of adequate investments to replace mills by diffusers.

13. Among the technological innovations introduced into the boiler sector, the general improvements in the efficiency of the equipment and its energy saving characteristics enables the boilers to act as heat economizers (heat de-aeraters, bagasse driers, air pre-heating). Their productivity has been also improved by installation of automatic control devices with electronics and computers.

14. Great efforts have also been devoted to the rational energy utilization, efficient use of electricity and electrical energy produced within the sector. Given the deficient electricity supply in some countries, there is a definite case for the mills to be self-sufficient and to generate surplus amounts for the other production units or even for transmission to the national grid at commercial prices. At the same time co-generation of electricity involves energy efficiency measures to reach the optimum energy balance of a given plant or even a chain of mills. But in spite of the obvious positive factors associated with this process, it involves capital intensive measures such as replacement of the heaters by other high-pressure devices, more thorough water treatment and the training of personnel. Economy

of scale is also important. Small plants are obviously less energy efficient, the quality of sugar is lower, investments are small and employment per ton of sugar produced is higher. Such plants may operate economically provided that labour wages are kept low. Large-scale operations no doubt are more energy efficient, but require very skilled operators for running and maintenance of plant equipment. In general, optimization of the sugar-cane industry in terms of energy requires substantial investments which are highly profitable and quickly recoverable in relative terms.

15. New elements that have improved process of technology have been introduced in the area of the purification and concentration of juice, flotation process, acquiring better quality saccharose crystals during the final stage of concentration, etc., for example, hydrocyclones for removing mineral impurities, use of calcium saccharate in the clarification process, introduction of filtered juice floats, modification of vaporizers to gain a greater volume of less concentrated juice. Plans have been made for straight vertical plans with a "calandria" of the same diameter and consistency to reduce the stagnation zones. The installation of magnetic equipment, faster centrifugers have also contributed to raising productivity. Furthermore, packaging, storage and dispatch have made progress with the implementation of bulk sugar handling systems and been considerably simplified as compared with traditional methods.

16. A set of measures to improve the quality of intermediate and final products have been introduced in many leading sugar-exporting countries. Chemical control of the mills and quality control systems allow to observe operational conditions prevailing in different areas, to check the level within the parameters conditioned by the capacity of existing equipment and the process employed. But in a broader sense such kind of measures in the industry call for standardized methodologies and qualified technical and management staff.

17. New opportunities have been discussed during the recent years in improving repair services, maintenance and rehabilitation of sugar mills and processing lines. The proper "treatment" of existing facilities has proved effective in extending the life-span of the equipment under use. "Preventive services" instead of repetitive "repair services" may also make their contribution in diminishing the volume of investments needed for unjustified or unexpected maintenance. It is also possible to recover components or spare parts worn out by continual use, or to protect them before initial installation by coating them with metal or plastic powders. In principle, all these new methods may be transferred to the sugar-cane industry from other branches of economy and their wide-spread application would not be capital intensive because of the already existing practice and relatively cheap know-how. Moreover, in the sugar-producing countries experiencing financial difficulties and with the abundance of obsolete technology and sugar plants this might be one of the ways of gaining extra time for the accumulation of investment capital.

18. Meeting manpower requirements has always been the keystone for the successful development of any industry. Changes needed for the process of diversification, production of by-products and general improvements in the

sector now force the producers to look for more qualified and professionally trained personnel able to deal with modern technology and processing methods. Because new plants and equipment are usually imported from developed nations it is important to see that when acquiring new technologies they should include as far as possible the installation, start-up and operation for a certain period by specialized staff from suppliers and at the same time to train local personnel and provide the technical assistance needed.

IV. ECONOMIC AND INTERNATIONAL ASPECTS

19. As in the case of the diversification and by-products production, the principal problem for the development of the sugar industry and productivity improvements is the availability of financial resources for purchasing new technology and equipment, rehabilitation of plants, building-up modern infrastructure, etc. The chronic budgetary difficulties experienced by the majority of developing countries pose serious obstacles in the way of comprehensive introduction of all these remedies to modernize the sector. Heavy indebtedness, a striving for a balanced budget and the abundance of other socio-economic problems seriously limit the public sector ability to finance the process of restructuring of the sugar industry at the expense of other national priorities. The private sector is more flexible and mobile in this sense, but its financial resources are not sufficient to provide the rapid changes in a short period of time. At the same time the lack of government investment and loan guarantees becomes an impediment for any initiatives in capital areas.

20. In this connection, the issue of a sound and effective national economic stimulus policy arises and poses a number of questions for the administrative and regulatory institutions. Tax breaks, loan guarantees, attractive credit terms, tariff exemptions for imported equipment and other measures may be considered to stimulate the flow of capital and investment into the sugar processing industry. Of particular value is to promote and facilitate the transfer and application of new technologies able to improve processing, diversify production, reduce costs and improve the quality of products. In general, the sugar industry should be put in a special economic environment to be provided with necessary resources indispensable for its restructuring and further development.

21. In the course of the analysis of the external factors, it would be reasonable to stress the role of the international organizations such as UN system, UNIDO, ISO, GEPLACEA which could assist national governments in the task of promoting interregional investments among sugar-producing developing countries as well as multinational investments at the same time and exploring the possibilities of funding for specific projects, guiding these countries and facilitating their access to such sources. The international institutions might also serve as clearing house not only in terms of technology transfer and know-how but informing the member states among the sugar producers about investment prospects and potential donors.

22. In an interdependent world, the role of international co-operation could be seen to be one of the positive factors of the development of the sugar-cane industry. International co-operation may advantageously be focused on encouraging and supporting activities and programmes by means of which developing countries would receive technical assistance and financial aid for the introduction of new technologies; modernization of industry; improvement of productivity; and manpower training including management.

23. Emphasis should be placed on the importance of the exchange of information, experiences and knowledge on South-South basis because it has become evident that even within a given region the existing interregional disparities and differences in levels of development are pronounced. This process might stimulate the flow of data and know-how for the benefit not only of the least developed sugar producers but also to the leading exporters. As mentioned in Issue Paper I, regional advisory and consultancy services on the basis of existing institutions could contribute to the development of projects and investments. The main objective of these regional industrial research and development centers would be to conduct studies on subjects related to processing, production and productivity improvements in the sugar industry as well as to contribute to a better exchange of information.

24. In general, co-operation should be carried out on a comprehensive scale and at different levels to achieve the best results for the sugar-cane industry in developing countries. Different versions of joint activities may be considered and recommended for concrete cases: bilateral or multilateral assistance, intra-regional and interregional activities, between developing sugar-producing countries in which the evolution of the sugar cane agro-industry has been different enough to allow complementarity between them and the combination of resources for common aims. Active and productive participation of the international bodies such as the UN system, GEPLACEA, ISO, GATT, etc, could be highly instrumental in terms of a co-ordinating role as mentioned above.

V. PROSPECTS FOR THE FUTURE

25. Changes have to be deliberately sought if the complexity of the problems facing the sugar-cane processing industry are to be effectively tackled. This can be brought about through a process of rapid restructuring, diversification and improvements in productivity, in accordance with well-conceived strategic plans for the future development of the sugar-cane industry as one of the principal branches of the economies of many developing countries in Latin America, the Caribbean, Asia and the Pacific, and Africa.

26. At present, productivity in the sector depends largely on technologies which do not accord to precepts of technological progress in general and in the sector in particular. Developing countries will have to make full use of technological advances and launch programmes of rehabilitation of their plants. The introduction of new processing techniques, equipment and know-how should be considered not as a costly and capital intensive action for a short period of time but as an investment for the long-term development of the sector.

27. In addition to technological innovations, rational energy utilization, quality control, proper maintenance and preventive services network should be encouraged and introduced to use the already existing potential of the sugar industry and to reduce the costs of production. Adequate and professionally oriented training of manpower and personnel could also contribute to the better utilization of available resources. It is also necessary to overcome the obstacles in the way of information flows so as to provide producers with the basic data and statistics on technological developments, market situation and research results.

28. The restructuring of the industry, its diversification and improvements in productivity inevitably require substantial flows of investments. There is a need to develop new mechanisms for attracting domestic and foreign capital to attain the aims outlined above. In this connection it is becoming obvious that the majority of the national economic and fiscal policies in sugar producing countries should be adjusted to effectively stimulate the flow of capital into priority programmes of investment. This is the case where international exchange of experience and consultancy services of the leading research centers might play a positive role in changing the economic environment of the sugar industry at least cost.

29. The issue of raising productivity and efficiency is essentially a national enterprise responsibility. The public and private sectors could also benefit from external technical assistance in their efforts. The very fact of the present Consultation meeting reflects the growing international recognition of the necessity to co-ordinate world-wide initiatives for the restructuring of the sector.

30. Bearing in mind the acute problems facing the sugar industry in developing countries and the complexity of the problems faced in regard to the future development of the international sugar market, a thorough analysis of the situation and constructive recommendations would be of a great value. The prompt application of some of the solutions offered so far to offset the seriousness of the crisis, would be one positive contribution to solving problems besetting the sugar cane agro-industry at present.

31. In this context, the purpose of the Consultation meeting is to evaluate and recommend the policies at national, international and governmental levels aimed at improving the productivities in the sector, to discuss possibilities and measures for transfer of technology, define investment ideas and joint programmes for rehabilitation of the sugar industry in developing countries.