

# COORDINATION IN THE TEACHING OF SANITARY ENGINEERING <sup>1</sup>

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*Intelligent and effective coordination of efforts is one of the aspects of modern public administration most essential to the successful outcome of programs, and one that, while easy to understand and accept, is often hard to put into practice because of its implications for human behavior and relations.*

The subject is complex, but broached with enthusiasm and comprehension, it can result in conclusions that will lead to better understanding between the institutions that train sanitary engineers and the official and private organizations that employ them in the production of goods and services.

The doctrine that education is a social instrument for bringing progress and well-being to the community is universally known and accepted. A hundred years ago, when the Republic was restored, Juárez and his colleagues unhesitatingly introduced the reforms needed in higher education to transform it, in line with the liberal thought of the times, into a suitable means of opening the way to progress for Mexico. It was in this spirit that a number of institutions were established, including the National School of Engineering, which was to become the present School of Engineering of the National University of Mexico. Although further advances have been made since then, the action programs carried out have not always responded to the principle of assigning to the technical training of professionals the importance of a strategic measure basic to national development.

Dr. Gonzalo Aguirre Beltrán, former Rector of the University of Veracruz, de-

scribed the situation very clearly when he said that "university education has traditionally evolved under a liberal philosophy that places a high value on the individual and relegates the community to a secondary position." After referring to the social changes of 1910 and describing the establishment of the Technological Institutes as "a heroic remedy in the face of university inertia," Dr. Aguirre stressed that "it is not enough to produce good physicians and highly trained engineers if they lack an orientation that will enable them to grasp our social and cultural realities."<sup>3</sup>

More recently, the Rector of the National University of Mexico, Javier Barros Sierra, speaking before the Fifth Assembly of the Union of Latin American Universities, said that the Latin American universities are aware of their proper role in training the competent and social-minded technicians and leaders needed for economic development. He also noted that the possibility of change would be lessened if higher education were not attuned to the needs of society, that such harmonization would require a change in teaching methods and systems to adapt them to the requirements of a constantly changing labor market, and that in a more advanced phase higher education should seek not only to adjust to reality but also to become a dynamic factor in the

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<sup>3</sup> Aguirre Beltrán, Gonzalo. *La Universidad Latina Americana*. Universidad Veracruzana, Jalapa, Veracruz, 1961.

social and economic transformation of the countries. He concluded by predicting that the success of university modernization would depend on the interest shown by authorities, professors, and students.

### Sanitary Engineering in Latin America

In the Latin American countries sanitary engineering was developed in response to the demands of urban progress but actually evolved as a reflection of the progress taking place in countries with an advanced level of industrial and technological development. It was the recipients of fellowships in the 1930's and 1940's who brought back to the Latin American countries new concepts that prompted civil engineers to delve into biology, statistics, chemistry, and epidemiology and to give the profession the new dimension that was required to solve the environmental health problems of the Latin American communities.

In certain aspects, specialization rapidly became "superspecialization" with the improvement of teaching methods and the emergence of new courses and procedures that are changing the traditional patterns of schools of engineering. As a consequence, a modern type of engineer is now being trained; while not always clearly aware that his activities bring about cultural as well as physical change, he has a precise understanding of the new instruments at his disposal.

The objective of economic growth, according to its classical definition, is the improvement of conditions for the masses. While considerable progress has undoubtedly been made in this regard, it must be admitted that much remains to be done in environmental sanitation. Suffice it to say that more than 30 million people in Mexico and 170 million in Latin America as a whole, or two out of every three persons, do not enjoy the fundamental right to home water connections or, even less, to proper sewage disposal facilities.

The dramatic picture of a rural existence marked by deprivation and wholly inadequate public services extends to the marginal areas of the major cities, the so-called "poverty belts" where the most serious economic and social maladjustments are in evidence and where urban culture and technological progress have failed to resolve the serious conflict between the growth of the population and its well-being.

### Education and Coordination

This discouraging picture is made even worse by the deficiencies of a still inadequate educational structure and by the inability of official action to maintain a rate of production of goods and services on a scale that will meet the demands of the community. To overcome this situation it is generally accepted that efforts must be joined through *coordination*.

An initial and very important step is communication. The establishment of channels of mutual communication can lead to better understanding between teachers and those responsible for program execution, replacing the mutual disinterest that frequently marks their relations. Among program officials, the prevailing sentiment is that universities carry on their activities according to rigid academic criteria that are not conducive to practical approaches; on the other hand, those in the schools feel that the governmental and entrepreneurial sectors are guided most often by administrative procedures based on empirical formulas and experiences of limited value.

Actually, it has been found that both attitudes have some foundation in truth and might even be considered inevitable, but the common objective requires greater understanding and cooperation between these two groups. The promotion of meetings such as the Second National Meeting on the Teaching of Sanitary Engineering, and scientific and professional activities such as those of the Mexican Sanitary Engineering

Society and the Inter-American Association of Sanitary Engineering (AIDIS), have special significance for the development of such relations. But an even greater opportunity to achieve the required coordination is afforded by direct contact between institutions of higher learning and organizations responsible for the production of goods and services.

Short courses for technical personnel now in service and programs of applied research on matters basic to the development of action plans are forms of contact that are already in effect; they have proved useful for both institutions and have permitted a start to be made in coordination. It is gratifying to note that the Ministry of Hydraulic Resources of Mexico, through its Division of Water Supply and Sewerage, has established excellent coordination with the National University of Mexico and the University of Nuevo León in this kind of activity.

It is possible, however, to have an even more profound impact on the teaching of sanitary engineering at the professional level through coordination, which promotes closer ties and enables educational activities to formulate approaches better attuned to the technical needs and requirements of the country's development plans.

The questionnaire sent out by the Organizing Committee of the Second National Meeting on the Teaching of Sanitary Engineering was answered by 16 of the 27 schools in Mexico in which civil engineering is taught. The replies showed that 10 institutions were coordinating their activities with the Ministry of Hydraulic Resources, five with the Ministry of Health and Welfare, three with the government of the Federal District, seven with the governments of their respective states, three with private institutions, and six with other agencies. Two of the educational institutions replied that they had no ties with any official or private organization. Moreover, although the mechanisms of coordination were not

clearly specified, it is assumed that these were not sufficiently broad and continuous.

### Practical Aspects of Coordination

Faced with this situation, the Ministry of Hydraulic Resources is giving special attention to the possibility of strengthening its ties with teaching institutions as regards the practical aspects of sanitary engineering instruction. There are four specific fields in which coordination could be given a broader base and facilities might be offered: (1) field work; (2) preparation of water supply and sewerage projects; (3) social service that must be completed by students; and (4) preparation of theses.

With respect to field work; some means might be found for providing transportation and technical guidance facilities for visits to water supply and sewerage works under construction. It would also be possible to take advantage of field work in topography to do something of this kind in large or small communities where the Ministry is conducting studies requested by the communities themselves, which generally offer to pay all or part of their costs.

In regard to sanitary engineering projects, the Ministry could make available the designs and basic data required for their preparation, thus permitting the application of a variety of solutions to the practical problems arising in the projects and lending greater instructional value to this type of teaching. As in the previous case, the educational institutions could count on the help of specialized personnel from the Ministry itself, stationed in the place or region where construction is under way.

As for social service and thesis preparation, activities which are usually closely related, the Ministry could assign temporary positions on its staff to those students completing the engineering course who show the greatest interest, affording them the opportunity to meet their requirements and, above all, giving them the technical super-

vision they require. In this way the preparation of theses, which is becoming increasingly valuable as bibliographic research, would be done under the supervision of a professor and would have a more objective foundation, based on the student's contact with actual problems through field research.

The Ministry has the necessary organizational and technical resources to carry on this basic work of coordination. In Mexico City the Division of Water Supply and Sewerage has technical personnel, laboratories, and such highly specialized services as hydrology, geology, and chemistry. Moreover, the Division of Promotion and Education was established to handle just this kind of coordination.

For the field work, the Ministry has at least one General Manager's office in each state and territory; these branch offices have training facilities in the fields of study, planning, construction, and operation of water supply and sewerage systems, each manned by widely experienced professional staff. The General Manager's offices, similar in structure to the Central Offices, give cohesion to the national water resources policy, the primary objectives of which are the study and measurement of such resources and their multiple uses, flood control projects, and control and prevention of water pollution.

Through these agencies, students would have the opportunity, as part of their practical training in sanitary engineering, to establish ties with related areas of civil engineering, which is bound to broaden their vision and influence their future professional activities.

There is no question that in a coordinated effort such as the one described the mutual advantages would outweigh the difficulties, and early contact with actual national problems would not only make the teaching of sanitary engineering more purposeful but would also orient the professional career of the student and better enable him to assume and exercise the social function of the engi-

neer, of which so much is heard. Moreover, instruction along these lines would give balance to the underlying motivations of the student by stressing the acquisition of knowledge and lessening the importance of positions of status and the marked tendency to seek at all costs, and as quickly as possible, a privileged financial situation in which everything seems to center around the securing of construction contracts.

In Mexico, as in other Latin American countries, one may see a situation that has been noted by a number of persons who have studied problems related to technical and human resources: ever-widening opportunities present themselves to new graduates of schools of engineering to occupy executive positions with substantial technical and administrative responsibilities. The student's contact with reality and his direct knowledge of the problems that must be solved gives him valuable experience for performing the duties thrust upon him, often prematurely, by the dynamic evolution of the Latin American countries.

In summary, an attempt has been made to provide a brief description of the possibilities and scope of institutional coordination in the teaching of sanitary engineering, a coordination adjudged extremely helpful both for those who plan and execute programs in sanitary engineering and for those responsible for training professionals in this field.

Perhaps what has been noted here can serve as a point of departure for the discussion of this matter with a view to the adoption of coordination policies that will be useful not only for the teaching of sanitary engineering, but also in other areas of civil engineering.

In any case, the foregoing is an attempt to convey—although necessarily in limited fashion—the experience of a former professor and the concern of one responsible for an action program dealing primarily with the field of engineering; one who seeks only the mutual benefit and strengthening of two

institutions linked by a common aim, which is to create the kind of sanitary engineer desired for the future, a man endowed with the characteristics described by that great educator Dr. Jaime Torres Bodet: interest in the progress of his country and ability to perceive its needs and help to meet them in the fullest possible measure through intensive, foresighted, and intelligent use of its resources.

### Summary

The role of environmental sanitation agencies in Mexico is of key importance at this stage in the development of the country. In the order of priorities that is being followed in Mexico to improve the living standards of the population as rapidly as possible, a considerable part of the effort is at present being borne by such agencies. Consequently, they require financial, administrative, and technical support at this point. It is also essential for them to

increase both the coordination of their activities and their relations with the institutions training the sanitary engineers who will carry out the plans.

To facilitate this coordination it is proposed to open new channels of communication among the agencies responsible for project execution and between the agencies and schools of sanitary engineering.

The Ministry of Hydraulic Resources of Mexico is endeavoring to strengthen its ties with teaching institutions in the following respects: (1) field work; (2) preparation of water supply and sewage disposal projects; (3) social service that must be completed by students; and (4) preparation of theses.

To promote coordination the Ministry has a complete organization and the necessary technical resources to enable sanitary engineering students to acquire practical experience and to make contacts with other related fields of civil engineering, a development that will help them to broaden their view of problems in their own field as well as to orient their future professional activities.