



# EDUCATION AND RESEARCH WORK AT THE INSTITUTE OF WATER MANAGEMENT AND HYDRAULIC ENGINEERING OF THE TECHNICAL UNIVERSITY, BUDAPEST

by

I. V. NAGY

Institute of Water Management and Hydraulic Engineering, Technical University, Budapest

(Received February 8, 1972)

This issue of the *Periodica Polytechnica* is a synthesis of recent results of the development of the research and educational activity at the Institute of Water Management and Hydraulic Engineering of the Technical University, Budapest, and, at the same time, gives a survey on the main trends of research, on the development of teaching work. The papers presented are intended to reflect the evolution which took place in recent decade in the field of methods of investigation of natural and influenced hydraulic and hydrological phenomena.

The initial phase of development of the hydrology is known to have been characterized by the descriptive way and the effort to establish bare laws and concepts, and in many cases, to explain insignificant hypotheses. Decisions concerning certain quantitative values were then based essentially only on the judgement of much experienced experts and, therefore, hydrology and hydraulics could hardly be regarded as sciences.

The success of the physical, mathematical and economic sciences, and especially the rapid evolution of computerized mathematical procedures have led, by necessity, to the abandonment of the deterministic aspect and methods in favour of the *stochastic* approach. The introduction into practice of the new methods requires rather wearisome explanatory and instruction work. Anyhow, it is clear that the task to be solved requires first the *change of mind*, the more so as research and teaching of new relations and in new fields has led to the development of a *new system of concepts*.

The methods of analysis developed for studying (mainly statistically) the behaviour of hydrologic and hydraulic systems motivated, first of all, by the insufficient knowledge of the physical system in question, are intended to interpret the hydrologic records and observations as well as the relations explored.

Our objective is to formulate mathematically and physically the laws underlying the observed phenomena, and then to verify that the exactly formulated laws produce all that has been experienced.

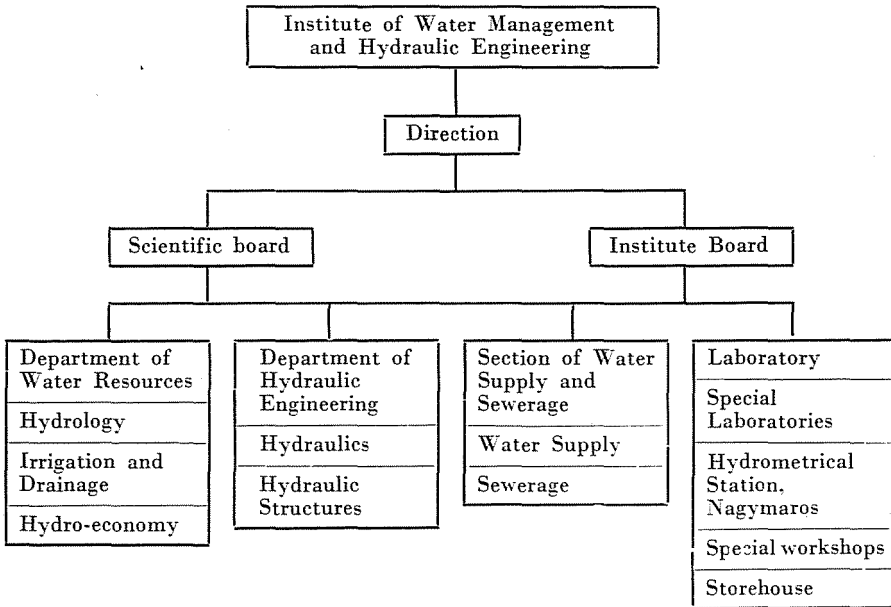
It is of fundamental importance for every procedure and method to clarify what practical results can be expected from the given procedure or, whether economy of its application (for example on a computer) fits the result sought for, or not. One must be aware that hydrological statistics — rather than to be based on axiomatic mathematical theory — tends towards physical theories, in fact, permits to describe the states of *physical systems*, for the sake of reproducibility and thus, also its correctness can only be verified by observations. The science of statistics, alongside with computer methods, developed mostly so as to offer a great help in studying the major part of the hydrologic and hydraulic problems. In fact, for the solution of a wide range of new problems of water management, the application of stochastic methods should be considered as a criterion of scientific treatment.

Nevertheless, application and formulation of empiric relationships of well-defined validity must not be renounced either — especially for closed hydraulic systems — because they provide very useful information on the present level of our knowledge of the given phenomenon.

It is hoped that the papers here published will contribute to the development of the up-to-date hydrologic approach and, at the same time, the new computation methods make engineering work more exact and easy.

As a result of the recent significant development in Hungary, water management has become an independent branch of national economy with a responsibility beyond its own strictly meant field and extending to water resources problems of other branches of the national economy, as well as to those of the reasonable utilisation of natural resources and of the protection of the human environment. In order to satisfy the increasing requirements of national economy for hydraulic engineering, to make hydraulic engineering education at the university more efficient and uniform, as well as to foster the research work in hydraulics, the foundation of this Institute became imperative. The scheme of organization of the Institute is illustrated in the table annexed.

The main objective of the Institute is to impart theoretical and practical knowledge in water management, by the mastering of which the students become qualified for science-based theoretical and practical engineering work, to the application and improvement of their professional knowledge, to acquire and make use continuously of the relevant new results. The activity of the Institute involves the training and post-graduate education of hydraulic engineers. Its existence permits the decentralization and a more efficient administration of the Faculty of Civil Engineering, the co-ordination of education and professional training as well as a more efficient utilization of material and intellectual resources of the Institute in education and research work.



Responsibilities of the Institute include:

- working out and continuously developing curricula, programs and syllabuses for the professional subjects, keeping the academic staff up-to-date in ideology and pedagogy; ideological, professional training and moral education of the students;
- specialized training of hydraulic engineers to meet demands of the national economy, training of industrial managers;
- training scientific workers working for post-graduate degrees and assisting students with scientific aspirations by involving them into research work at the institute as well as by organizing students' research groups;
- assistance given to the College of Water Management Engineering in training production engineers, granting a close collaboration.

Other responsibilities of the Institute are connected with the participation in tasks of water engineering at the level of national economy, with the maintenance of systematic professional relations to the engineering practice and with scientific development affecting in its turn the standard of training work. These are:

- systematic, co-ordinated research work developed in collaboration with the competent government authorities, and with institutions engaged in research, design and construction;
- establishment of research schools, organization of research teams involving university and extra-mural experts;

- development of inland and foreign professional relations and common research programs;
- organization of professional discussions and
- conferences on actual problems of theoretical and technical development.

Experience shows the outlined tasks cannot be perfectly fulfilled without the modernization and substantial development of the teachers' way of thinking. In our days, age of the second scientific-technical revolution and comprehensive building of socialism, the future of society and economy depends much on the experts trained at our Institute.

From this point of view, the technical sciences, as they are offered at this Institute, are extremely instructive for the youth by presenting them a certain standard of truth and objectivity; they provide a pattern for a given system of ideas. This is why concept and practice of professional training and socialist education must not be separated, and their unity defines the requirements for education. Our present curriculum, even after a number of reforms, is not suitable in every respect to meet the requirements concerning the development of way of thinking and forming the personality of the student. Often methods are encountered relying on memorizing, giving merely factual information. This fact coupled with the *overdimensioning of the subject-matter* inhibits to find general correlations, to establish parallelisms and antagonisms and to enforce the development of consciousness.

Therefore, much stress is laid on the revision of the subject-matter based on the specialized branches of science in respect to the contents, amount, build-up and — last but not least — to the methodology of knowledge transfer.

The early development of our speciality had a descriptive character and it was endeavoured at that time to establish bare rules, often insignificant hypotheses and empiric relations of limited validity. Alongside with the evolution of water management, as an independent branch of national economy, analytic methods of physics, mathematics and economics got into the foreground. Besides the *deterministic approach*, the probabilistic one came to the front involving the *systems approach* for solving its problems by simultaneously taking the technical — economical — social factors into account, making use of the potentialities afforded by the *computers* and up-to-date statistical procedures.

The departments of the Institute did also hitherto pioneering work in forming up-to-date scientific views and thus, a basis for further development is available. The activity of the departments is marked out by results in the fields of investigation of hydrological systems, mathematical modelling, analysis of stochastic processes, introduction of computer design methods into the amelioration, water supply and river hydraulics, by the introduction of analytic methods based on chemical—biological—hydraulic processes in the lecturing on the subject matter of water supply and sewerage.

In view of the *practical and theoretical requirements resulting from tasks entrusted by national economy to water management*, the improvement of training in the following major fields seems to be necessary:

1. enhanced teaching of up-to-date methods of automation, telerecording, remote control, new procedures of observation and measurement;

2. modernization of the subject-matters on the mechanization, design and construction of hydraulic engineering structures as well as on methods for testing building materials used in hydraulic engineering. Further, the fact has to be taken into account that, first of all, *minor hydraulic structures* are and will be built in this country. Training, therefore, has to be concentrated on this scope, while lecturing on major hydraulic engineering structures may be left to specialist and post-graduate engineering courses;

3. in spite of the recent significant development in the curricula of water supply, sewerage, water and sewage treatment technologies, more comprehensive education and research in procedures of *water supply and sewage treatment* are needed to meet increasing requirements of the national economy;

4. further modernization of the already high-standard training in amelioration and in analytic procedures of *control technique*, mechanization and *mathematical statistics*;

5. introduction of hydro-economical education involving *optimization methods* represents a significant modernization also by its effect on specialized subjects. This process should, however, be accelerated to help uniformity of economic and technical approaches crucial in teaching the special subject;

6. training in recent computer methods should be developed; new procedures should be worked out corresponding to the actual demands of design and operation.

### Summary

Establishment of the Institute of Water Management and Hydraulic Engineering at the Faculty of Civil Engineering has created the organizational framework for the realization of the outlined objectives. Concentration of the material and intellectual resources, evolution of initiative ability, intensifying the connections between students and staff and — last but not least — assistance and support from superior authorities of higher education and water management will contribute to achieve our objectives.

Prof. Dr. Imre V. NAGY, 1111 Budapest, Műgyetem rkp. 3, Hungary