

Issues and Challenges of the Surveying Engineering Education in Morocco Present and future

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Key words: Surveying engineering, geo-information, education, curriculum

SUMMARY

The Surveying Engineering Branch of the Institute of Agronomy and Veterinary medicine Hassan II (in short IAV Hassan II) was created in 1970. Up to know more than 800 surveying engineers have been graduated, about 10% from them are from Africa.

In order to improve the quality of the academic programs, follow the advanced technologies and answer the needs of several potential users, this Branch has known important adjustments and progress that can be summarized in three periods.

- 1- From 1970 to 1988 the education program was reserved to engineers of application (four-year program)
- 2- From 1988 to 2004 the education program concerned engineers in surveying (six-year program)
- 3- In 2004-2005 starts the new program of engineers in surveying based on five-year program.

The most important factors behind the third reform are:

- The reform of the university based on the law 01-00
- The recommendations of the Project of establishment of the IAV Hassan II
- The demand and opportunities of employment by private and public sectors
- The evolution of new technologies of information and communication
- The adoption by the ministry of higher education of a global educational architecture similar to that of the European countries (LMD system: License , Master, Doctorate)

The new curricula will emphasize to provide the surveying engineer a polyvalent education considering the practical and theoretical components of the profession such as:

- Professional courses (Geodesy, Cartography, Remote sensing, Surveying, Photogrammetry, GIS, Adjustment computation, Astronomy)
- Professional connected courses (land consolidation, land management, hydraulics, urban and rural management, road networks, purification network, allotment projects...)
- General courses (law, marketing, management, economy, finance, communication).
- Practical works (laboratories, practical project works, field training works, seminars, thesis...)

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1. INTRODUCTION

The Institute of Agronomy and Veterinary medicine Hassan II (in short IAV Hassan II) is an education and research institution constituted of six big branches (Filières) of formation of engineers and veterinary doctors (surveying engineers, engineers in agronomy, agro-food engineers, engineers in farming equipment, veterinary doctors, and horticultural engineers).

The Engineering surveying education started within the IAV Hassan II (short for Institut Agronomique et Veterinaire Hassan II) in the early 1970's. In a first time, it was dedicated to graduate surveying engineers based on four-year program ((ingénieurs d'application) to carry out the needs of the agriculture Ministry, mainly the Administration of the Land registration, Cadastre and Cartography.

In 1988, and in order to answer new needs of the professional users and because of the extremely rapid technological developments, the Direction of the IAV Hassan II decided to extend the educational program to the teaching of the advanced technologies in the domain of Geodetic Science and Geo-information.

In 1994, the surveying profession was organized by the law 30-93. These texts legalize the exercise of the profession of a Surveying Geometer Engineer (Ingénieur Geomètre Topographe).

Today, the various mutations and reforms of the university's educational system, as well as the constraints and employment opportunities, challenge us to review the curriculum of the surveying engineering education.

The present article presents an overview of the present Moroccan experience with the education of surveying engineering and highlights the future new educational program.

2. HISTORICAL OVERVIEW

Until 2004, the surveying branch of IAV Hassan II has qualified more than 800 surveying engineers. From 1970 to 1988, there was 437 surveyors formed ((ingénieurs d'application), from 1988 to 2004, about 385 surveying engineers of state (ingénieurs d'Etat) graduated in this branch. It is necessary to note that the laureates from African countries represent about 10% of the total number of qualified engineers.

The graduated surveying engineers are enrolled in a large variety of activities, either in public and semi-public sectors (agriculture, interior, habitat and urbanism, equipment, tourism, finances, etc.). In addition, several of these engineers are working within the private sectors

(private surveying societies, constructional societies, society of highways, development of software, telecommunication, etc.).

3. THE PRESENT EDUCATIONAL PROGRAM

3.1 Admission

The actual system is a basic six-year program, divided into three cycles of two years each. The first year (called APESA) is common to all the six branches of the IAV Hassan II. About 70% of students coming to surveying branch are recruited directly from this APESA. The other 30% are candidates who have succeeded the common national competition of the preparatory years to engineering schools (Math.Sup. & Math.Spe.), and candidates titular of CUES or DEUG (option Mathematics Physics).

3.2 Current curriculum

The education curriculum programs are conceived in order to answer the requirements of the professional needs. The first and second years are restricted to fundamental sciences. The third, fourth and fifth years are reserved to the development of the basic, fundamental and professional educational courses. The first two months of the sixth year are reserved to a training in a private society, public or semi-public establishment. During the lasting months of this year students are involved into a theoretical and practical research topic, at the end of which they are asked to prepare a thesis on the chosen research topic (mémoire de fin d'études). We emphasize on the fact that the practical projects and trainings occupy more than 40% of the educational program.

The programs of the six degree curriculum could be summarized in 5 fundamental components as follow:

Fundamental Sciences: Mathematics, physics, computer science, statistics, probability...etc.

Basic Education: This part is divided into three categories:

Professional education: Geodesy, Surveying, Photogrammetry, Cartography, land regulation, cadastre

Professional connected education: Road network, Consolidation, Purification, urban and rural planning, allotment, hydraulics

General education: Civil law, Economy, Communication, Marketing, Management, Languages, sports

Advanced Techniques: Global Positioning System (GPS), numerical surveying methods, analytical and digital Photogrammetry, Numerical cartography, Remote sensing and satellite imagery, Geographic Information Systems

Practical projects and field trainings: Laboratories, field trainings, cadastre and training in professional and private societies.

Research: choice of a research topic, study theoretical and practical aspects, seminars, thesis preparation and presentation in an oral examination.

3.3 Field Trainings

Field trainings of the current education system concern the six years of the curriculum. During the first year students participate to a practical initiation field training in France for a period of 10 weeks. This training is common to all students who successfully past the exams of the first year (APESA). The second year terminates with a second training in the rural (Ruralisme) which lasts for 4 weeks.

In the third year of the surveying education program students are initiated to prepare a project of surveying for 2 weeks. During the fourth year the training consists in establishing a synthesis field practical project that combines geodesy, surveying, photogrammetry and cartography. This training lasts for 4 weeks. In the fifth year the training in cadastre takes 2 weeks.

At the end of their educational program, students should leave about 2 months in a private society, public or semi-public administration to practice the daily management and practical problems of the institution.

4. HUMAN AND MATERIAL RESSOURCES

The permanent faculty staff of the surveying branch is composed of 16 assistant professors and professors. Most of them obtained Master degree and/or Doctorate degree from European or North American universities (France, Belgium, Netherlands, Switzerland, Japan, Canada, USA) and also from Morocco. This staff is supported by an auxiliary staff composed of engineers, technicians and secretaries.

On the other hand, about 34% of courses are instructed by several professors from other IAV Hassan II departments. The professionals, national and foreign associate lecturers are also participating at about 15% of the courses of the educational program.

The surveying branch possesses some laboratories and research facilities with a sufficient number of conventional technical instruments being acquired during the years 70 and 80.

In the 1980's the instrumental park was enriched by the acquisition of several equipments for data acquisition and processing. Hence, the laboratories are equipped by electronic total stations and levels, GPS receivers, analytical and digital photogrammetric instruments, stations of satellite imagery processing. In addition, our laboratories are equipped by several personal computers and a variety of software of photogrammetry, remote sensing, digital cartography, GIS, geodesy and surveying.

5. CHALLENGES OF THE FUTURE EDUCATIONAL PROGRAM

The challenges our educational program is in front of are due to the following factors:

- The attributions of a surveying engineer as defined by law 30-93
- The reform of the Moroccan university system based on the law 01-00
- The recommendations of the Project of establishment of the IAV Hassan II
- The demand and opportunities of employment by private and public sectors
- The evolution of new technologies of information and communication
- The adoption by the ministry of higher education of a global educational architecture similar to that of the European countries (LMD system: License , Master, Doctorate)

In 2004, the direction of the IAV Hassan II decided to shorten the educational program to five years instead of six. The new curriculum will emphasize to provide the surveying engineer a professional polyvalent education as it will be explained in the following paragraphs.

5.1 Methodology

The methodology adopted for the development of the new programs is based on the five steps proposed by Ayeni (2000):

- Definition of the objectives of the curriculum taking into account the new technology developments
- Definition of the contents of the programs
- Identification of methods and strategies for their application
- Identification of evaluation methods
- Get back the users reactions concerning the programs

The contents of the new programs are being established while taking into account the following factors

- The professional requirements
- The advances in the new technology
- The necessities of the employment opportunities
- The available hardware resources in the institution
- The available human resources to dispense these contents
- The existing curriculum

5.2. General architecture of the new curriculum

In the new structure, it is proposed that the IAV Hassan II will be transformed into a Polytechnic Institute which will contain 8 schools of engineering (agronomy, surveying, veterinary medicine, horticulture....) substituting the old branches. Therefore, the future

educational curriculum studies will last for 5 years (instead of 6) two of which are devoted to preparatory studies in basic courses. Throughout this reform, it is proposed that the new name of the branch of surveying will be the **school of engineering surveying and Geo-information**, but this proposition is not official yet.

In the first preparatory year students follow a common program, then they can choose between the eight different schools of the IAV. The second preparatory year is devoted to specific basic courses specific to each school (figure 1).

Concerning the surveying engineering school, this second year is devoted to several basic courses in mathematics, physics, statistics, probability, electronics, optics, computer science, programming languages...etc.

5.3 New curriculum

The new curriculum emphasizes to provide the surveying engineer a polyvalent formation considering the practical and theoretical components of the profession such as:

- Professional courses (Geodesy, Cartography, Remote sensing, Surveying, Photogrammetry, GIS, spatial analysis, geospatial databases, Adjustment computation, Astronomy)
- Professional connected courses (land consolidation, hydraulics, land management, hydraulics, urban and rural management, road networks, purification network, allotment projects...)
- General courses (law, marketing, management, economy, finance, communication, ecology, environment, etc).
- Practical works (laboratories, practical project works, field training works, seminars, thesis...)

Indeed, the new programs that are under development would be conceived to privilege an education that would allow the surveying engineer to be able to assimilate the fast technology changing.

The new curriculum is based on a system of semesters (two semesters per year). Each semester is composed of 14 to 16 weeks, the average total credit hours of a semester is around 400 hours. The last two weeks of a semester are reserved to evaluation and exams. Courses are grouped into modules, the maximum total credit hours of a module is 120 hours (figure 1).

5.4 Trainings and projects

The new vision of the education in surveying engineering aims to give a particular attention to the professional education. This part of the curriculum is composed of four parts:

- Field trainings
- Synthesis practical projects
- Studying visits
- Professional seminars.

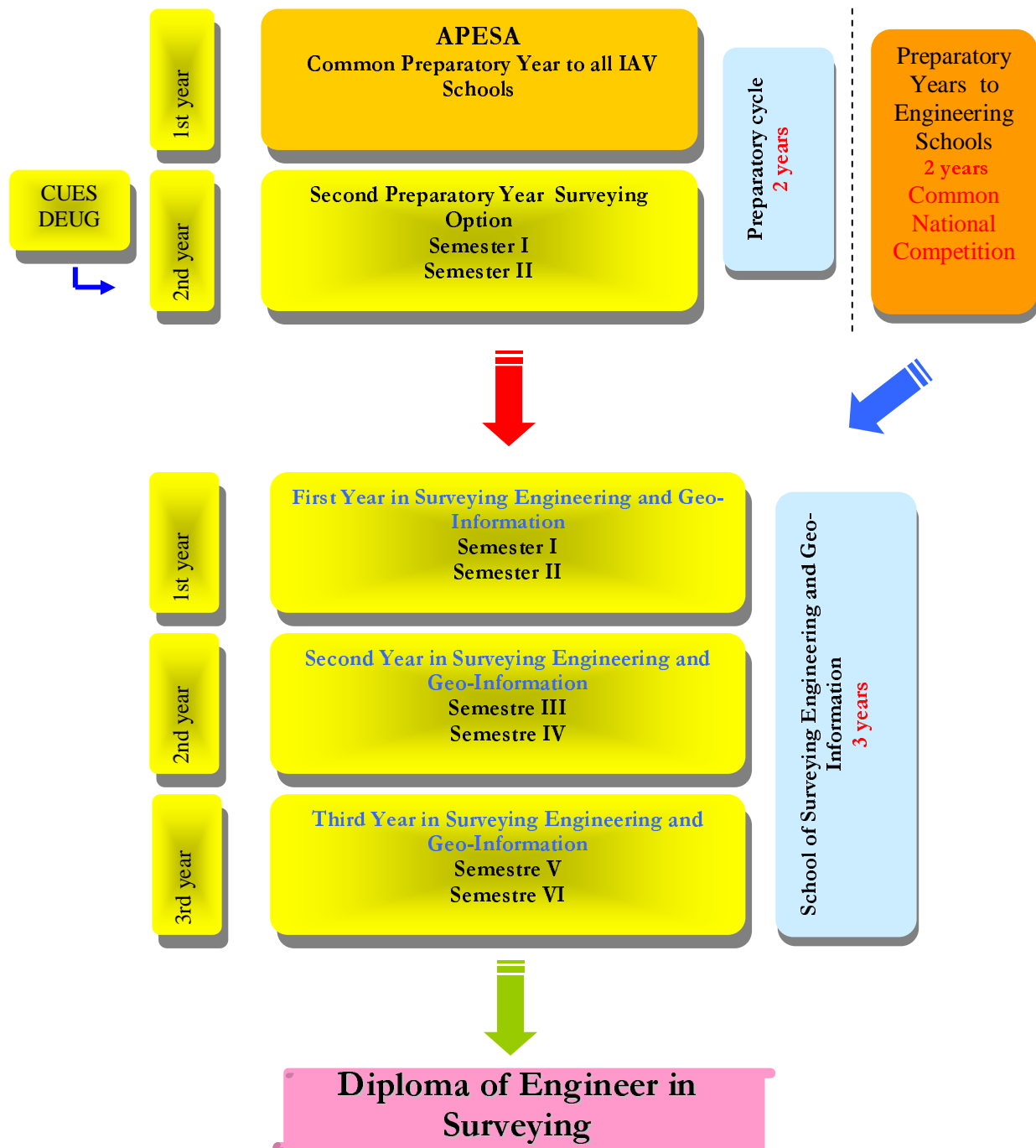


Figure 1. General architecture of the new educational system

Field trainings

The objective of field trainings and practical projects is the acquirement of a professional experience and to strengthen the theoretical and practical knowledge acquired during the theoretical courses. These trainings are conceived to allow the student to:

- show his knowledge and professional competences
- conceive and prepare real projects in geodesy, photogrammetry, cartography and surveying
- assure the execution of these works on the field
- integrate in a multidisciplinary team works
- practice both conventional techniques of measurements and numerical techniques as well
- learn to develop human relations in the professional activities
- know the role and responsibilities that the future engineer must assure
- start learning the management problems that a private society must assure.

These field trainings are distributed over the last three years of the new educational program:

First year of engineering surveying:

- Project of surveying
- Training in cadastre

Second year of engineering surveying:

- Practical project in surveying, geodesy, photogrammetry and GPS
- Project of digital cartography
- Training in a private society, public or semi-public administration
- Studying visits
- Professional seminars

Third year of engineering surveying:

- Project of geomatic
- Studying visits
- Professional seminars

Studying visits

The objective of these visits is to show to students the works of different professional laboratories, and follow-up the works achieved by public institutions and national agencies.

Professionals Seminars

Professional Seminars will be presented by members of the National Order of Surveyors (ONIGT) and also by the engineers from the private sector. The aim of these seminars is to

present to students the law that governs the profession and the activities that the future engineer will exercise. Some other aspects related to some specific topics will be discussed (management problems, marketing, land expertise, environment, land regulation...)

6. RESEARCH ACTIVITIES

Actually, the surveying branch is involved into three kinds of research activities:

- the activities of the end of studies research thesis;
- the activities of doctoral research;
- the contractual research.

These activities are governed by the following axis of research:

- Assessment and development of methods and techniques concerning data collection and data processing
- analysis and presentation of the geographical information;
- contribution of the new technologies in various studies and applications,
- adaptation and improvement of the procedures of the existing software, by developing users' interfaces

7. CONCLUSION

The purpose of this paper has been to give an idea for understanding the issues and challenges of the educational surveying system in Morocco and the improvements achieved since 1970. Ultimately, several efforts have been made to elevate and develop professional competences. The strategies followed to make these developments coincide and take into account the needs of the professionals, the employment market and the reform of the Moroccan university as well.

ACKNOWLEDGMENTS

The authors would like to thank the faculty staff of the branch of surveying of the IAV Hassan II for their contribution to enrich this document through the different meetings and the document established in consequence.

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