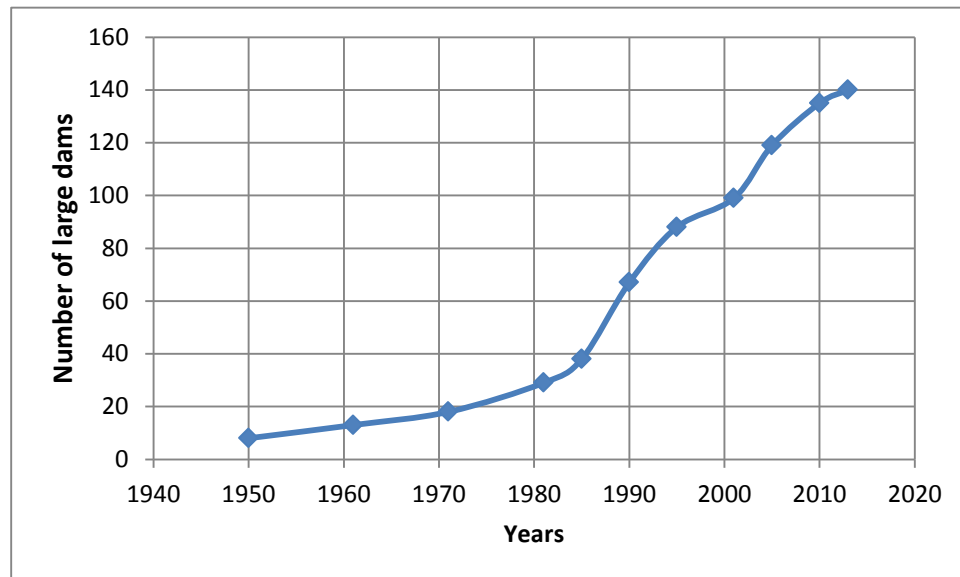


Capacity Building in Morocco

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Introduction

The first Moroccan large dam has been constructed in 1918, for Casablanca domestic water supply. At the end of the seventies, Morocco counted only 25 large dams, among them Bin El Ouidane completed in 1952, which was, at 135m height, the largest arch dam in Africa. At the beginning of the eighties, it was decided to build one large dam a year, and later on speeding up gradually to 3 to 4 a year. That was a far-sighted policy, aiming at providing the population with drinking water and developing irrigated agriculture. The following graph shows the variation of number of dams with time.



In 2013 Morocco counts 140 operating large dams, 21 under construction and 15 under design. Among them there are 30 RCC, 23 operating and 7 under construction. Morocco is ranking 5th in the world and 1st in Africa as far as large RCC dams are concerned.

Along with launching the policy of dam construction, Morocco targeted acquiring locally the knowhow for dams design, construction and maintenance. An almost 15 years strategy was built to achieve this goal.

It was based on a tacit agreement with two or three international highly experienced consulting engineers committing themselves to collaborate in "technology transfer" through:

- Building up a collaboration with a local consulting engineering company where native and expatriates work together,
- Receiving in their offices Moroccan engineers for at least 6 months immersing them within their teams,

In compensation, the government granted to each consulting engineering company a continuous work during all over the period, through mutual agreement contracts. However, the local part in the contract increased with time from 20% in the beginning to 80% at the end of the period, before passing to 100%.

The strategy relies on the assumption that, for a country like Morocco, the number of local consulting engineering companies to operate in dams should be limited to two or three.

Furthermore, the government agency in charge of dams rejected all kinds of donation, loan or aid conditioned with the obligation to hire a consulting engineer from the founding country. The liberty to conduct its strategy was essential.

On jobsites, construction supervision was placed under the responsibility of local engineers, assisted with expatriate, experienced ones. Holding the responsibility is the best way to learn, provided being aware of its own competences limits.

In parallel, Morocco launched a vast program of small dam construction. Corresponding design was mainly entrusted to local consulting engineers. A cross check control was organised to prevent any incorrect design.

For all projects (large dam with bi-national team, or small dam) the team in charge of the design was also entrusted for the construction supervision and the behaviour evaluation, mainly during the first operating years. This is very important as construction supervision and behaviour assessment enable the design engineer to overlook "all" the stages of the dam's life and be aware of corresponding difficulties. Having in mind that an average of 10 years are needed to go through design, construction and first operating years, keeping an engineer on the same project during all this period, assumes that he remains fully occupied in dam engineering. He should therefore be involved in more than one project taking into account dead periods for investigations, owner design review and tender process. Thus the dam construction program should be sustained and design companies limited to a maximum of 3 in order to constitute in each one a team of geologist, hydrologist, geotechnical, hydromechanical, hydraulic, structural, dam design engineers, draughtsman... having different ages in each speciality.

Continuity and involvement in all stages while assuming an increasing responsibility are the cornerstone and the foundation of the strategy. The continuity of the staff is an essential element, either in the government agency or in the consulting engineers.

While the government agency in charge of dams was encouraging local consulting engineers, it conducted a program related to its own staff and to the promotion of local contractors:

- In the early seventies more than 90% of the staff of the agency was made of expatriate engineers and technicians. Young graduated Moroccans were recruited massively and given interesting wages to replace gradually expatriates. It took more than 10 years to reduce the latter importance to 30% and then almost 15 years to get almost 100% locals. However high level international experts remains involved, mainly in dam design review and complex construction projects.
- For local contractors, they begun working on small project and gradually got the responsibility of larger ones. No relevant experience in dam construction was required in the beginning, but strong government staffs was dedicated to construction supervision to prevent any defect. Furthermore, all final design and workshop drawing are prepared by the consulting engineer. This is still the case

This voluntarist strategy was indeed fruitful as in the end of the nineties Morocco became self-sufficient in dam engineering technology. Nowadays, there are almost 500 engineers and more than a thousand technicians working in dam engineering as owners, consulting or contractors. All of them acquired their knowledge after their graduation.

This experience is unique in the region. Morocco is now exporting its knowhow and receiving each year engineers form African countries for practicing either at the government agencies, consulting companies or job sites.