Implementation of Egyptian Competitive Projects for Higher Education Enhancement: A Case Study

By

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Abstract

This paper demonstrates the salient features of the implementation process of the projects funded through the Egyptian competitive mechanism of the Higher Education Enhancement Project Fund (HEEPF). A case study has been considered as a model of the 160 projects funded by HEEPF in its first phase 2003-2007. A synopsis about the project and needs analysis are deliberately outlined. The selection of the project for granting, the management process, risk management, monitoring and evaluation, quality control, outputs, outcomes and impact assessment of the project are briefly elaborated. Some special characteristics of the project including collaboration with other funded projects, pros and cons are also marked out. This model has been successfully implemented and incorporated in the on-going institutional educational process and some fruitful impact on capacity building and collaboration with industry.

1. The Project Selected as Case Study

HEEPF aims at supporting attempts to enhance quality, relevance and efficiency in higher education within public universities and technical colleges through competitive mechanism [1]. During the first phase, HEEPF had announced four requests for proposals. The case study is the funded project by HEEPF entitled "Developing a center and educational program in renewable energy at Egyptian universities". This project was among 160 projects approved for funding out of 565 submitted proposals.

The candidate institution was the Faculty of Agriculture, Alexandria University as a grant holder as a representative for three institutions [2]. It is worth mentioning that Alexandria University includes three higher agricultural institutions and encountered the problem of disinterest of students to join this track [4, 7]. That is why an urgent need to provide new disciplines that attract admission and access to this viable field [6] and the selected project as case study served within that scope.

2. About the Project

The current agricultural programs in Egypt were diversified but, unfortunately, inadequate mainly due to the nonexistence of Renewable Energy (RE) educational program and E-Learning environment. Thus three Egyptian Universities (Alexandria University, AU; Mansoura University, MU and Zagazig University, ZU) collaborated to develop a renewable energy centers at Alexandria University and e-learning program in renewable energy (RE). Five RE E-learning courses were developed to be shared by the three Universities via distance education. The project was funded by the higher education Enhancement project fund (HEEPF) in its first cycle and further sponsored in the fourth cycle on competitive basis. The main objectives of this project were: development of RE center and RE courses, enhance teaching/ training using E-learning and increase the awareness of RE systems. The present project, therefore, developed an educational center and program for the agricultural applications of renewable energy at the Egyptian Universities by utilizing both conventional and E- learning environment. The program was designed to suit graduate and undergraduate students in the

Agricultural Engineering Departments and other departments in the Faculty of Agriculture. The university graduates working in the field of agriculture that lack training in renewable energy is also one of the main targets of this program through continuing education. Achieving the above stated objectives accomplished the following: improve the quality of education in agriculture at Egyptian Universities and make it compatible to that of other advanced universities; provide students with hands on experiences, provide graduates with specific competencies in job-market demands, standardize the agriculture education in Egypt by teaching the same course at all universities at the same time through E-learning and introduce E-learning as a new tool for education and training for students and trainees far from the university and outside Egypt. This paper describes how the project was developed, the output and outcome of the project, the procedure and infrastructure that were created to achieve the objectives and finally the dissemination and sustainability measure that were taken to insure the sustainability of the project.

3. Practical Motivation of the Project

Energy is a critical commodity since it functions as a factor of production, as a process feedstock and as consumer goods. It determines the shape of the life of individuals and that of the total economy. In addition there is a positive association between per capita income and per capita energy consumption. Energy is central to concern about sustainable development and poverty reduction. It affects practically all aspects of social and economic development, including livelihood, water, agriculture population, health, education, job creation, and gender-related issues. Current patterns of energy production and consumption have direct negative impacts on the environment and natural resources at the local, regional and global level. Energy is not an end in itself, but an important entry point for achieving the goals of all three of the pillars of sustainable development: social equity, economic growth and environmental protection.

Today's world is facing two major problems with respect to energy: the first is the continuing depletion of fossil fuel reserves and the second is the dramatic increase in global pollution. In the face of these two problems, renewable energy would seem to be the most suitable solution, since it is a clean and abundant energy source.

Renewable energy technologies produce marketable energy by converting natural phenomena into useful forms of energy. These technologies use the solar energy and its direct and indirect effects on the earth (solar radiation, wind, falling water, and biomass), gravitational forces (tides), and the heat of the earth's core (geothermal) as the resources form which energy is produced. These resources have massive energy potential, however, they are generally diffused and not fully accessible, most of them are intermittent, and have distinct regional variabilities. These characteristics give rise to difficult, but solvable, technical and economical challenges. Nowadays, significant progress is made by improving the collection and conversion efficiencies, lowering the initial and maintenance costs, and increasing the reliability and applicability.

Nonetheless, it is rarely chosen because of cost and lack of pertinent experience.

Agriculture is the main source for life conservation and national independence in Egypt. It is a dominant sector in the Egyptian economy. Egyptian agriculture contributes more than 20% of the GDP of the country and more than 50% of the workforce population is involved directly or indirectly in agriculture sector.

Egypt has been going through a dynamic agricultural transformation, highlighted by the expansion in desert agriculture, protected intensified agriculture, organic farming, large integrated agricultural enterprises, modern food industries and agricultural export. All

these activities required more energy sources to support these expansions that represent major expenses for agricultural producers and processors. The increases in the prices of traditional energy sources such as natural gas, diesel and electricity can cause economic hardship for farmers and processors, particularly if these increases are unanticipated. Therefore, those farmers and processors have been concerned with maximizing the utilization of renewable energy. Although several research works have shown that renewable energy is cost effective in Egypt, the lack of trained personal to design, install and maintain the complete system presents the principal barrier to their development. The Lack of information and awareness is also one of the most important barriers towards RE utilization.

4. Needs Analysis

The need for education in renewable energy (RE) at Egyptian University cannot be overemphasized. Egypt is one of the solar belt countries and it has excellent climatic conditions for direct solar energy applications such as water heating, space heating and cooling, grain drying, water pumping and electric generation. Egypt enjoys excellent radiation and wind characteristics including long period of sunshine throughout the year. Furthermore, renewable energy systems can have a beneficial impact on the environmental, economic, and political issues of the Egyptian socity. The benefits arising from the installation and operation of renewable energy systems can be distinguished into three categories; energy saving, generation of new working posts, and the decrease of environmental pollution. There are two wind regimes in Egypt that make the utilization of wind energy economically feasible. Pollution from burning residues of rice and other crops represents a major health hazard and pollution problem facing Egypt. Thus, renewable energy in Egypt is considered adequate if not optimum and its use is highly needed for the following reasons:

1- Abundant renewable energy everywhere in the country (solar, wind and agricultural residues)
2- Public interest
3- Need to develop remote and vast desert areas that require huge investments for infrastructure and utilities, and in which renewable energy can play a vital role by minimizing the cost of required utilities.
4- Use of inexhaustible, renewable energy supplies, especially crop residues can reduce pollution.
5- Renewable energy processes can have low operating costs, especially using available cheap labor.

Yet, renewable energy is rarely chosen for lack of pertinent experience. In agriculture, energy is a major expense for agricultural producers and processors with important cost and profitability implications. Increased cost of traditional energy sources such as natural gas, diesel and electricity can cause economic hardship for farmers and processors, particularly if these increases are unanticipated. Renewable energy offers a reliable and environmentally–sound alternative. Nonetheless, it is rarely chosen for lack of pertinent knowledge and experience.

Although several research reports have stated renewable energy can be used cost effectively in Egypt, the lack of trained personal to design, install and maintain complete systems presents a major barrier to their development. We believe that in addition to research and development, know-how is crucial to the success of renewable energy technology in Egypt. Needed know-how can primarily be obtained through training and education. Indeed, there is a need for an educational program in renewable to remove the knowledge barriers to the spread of renewable energy, provide student

with hands on experience and provide graduates with specific competencies in job-market demands.

Egyptian scientific and institutional support of agriculture is very high. There are 18 Faculties of Agriculture provide 4500 graduates each year. Yet, there was no available training or any educational program in renewable energy. The Faculties of Agriculture in Egypt are all seeking to strengthen their existing bases and to improve teaching programs in order to meet challenges of the next millennium. It is concluded that the existing Egyptian educational programs in Agriculture will benefit from the development of training and educational programs in renewable energy, and that the programs will be strengthened by the development of an E-Learning environment. We believe education in renewable energy and dissemination via E-learning are critical to the improvement of educational offerings. Education in the area of renewable energy in Egypt is certainly a field where almost all still needed to be accomplished. The present project therefore, introduced a RE practical training and E-Learning environment into the university education through the development of RE center at Alexandria University. A University education and practical training package in RE technologies were developed.

Online teaching programs are becoming more important for Universities as the workforce continues to transition in Egypt and elsewhere. Today, employees are seeking educational opportunities while continuing full time careers.

E-learning offers more flexibility and efficiency for trainees and students using the program. E-Learning saves time, money, and resources of both users and university. E-Learning help reduce the cost to students and trainees especially travel time and expenses. E-learning provides more flexibility for students to choose online instructor-led courses or interactive self-paced courses, and can take advantage of an extensive online virtual library. E-learning further delivers knowledge on-demand, with up-to the-minute information. Students and trainees can access learning and training courses instantly at home, at the office, twenty-four hours a day, and seven days a week. E-learning also widen the range of trainees and students using, benefiting from and participating in the program in Egypt and the surrounding Arab countries. The development of the E-learning environment is divided into three parts: development of a course delivery platform, online course material, and interactive process simulations.

A courses delivery platform is an application that forms the foundation for an E-learning environment and coordinates its function and databases, providing a user interface that enables interaction for students, instructors and administrators. A Tutor as a course platform has been selected among several alternatives, supplemented and implemented on five courses in the Renewable Energy center at Alexandria University.

Development of courses material, specifically designed for use on the Website, has been accomplished. The online course material is made for five renewable energy courses. Each course material is produced using HTML and Flash technology for enabling hypertext and multimedia contents.

One of the aims of this project was to create online renewable energy educational program and courses, or in other words a virtual program for the renewable energy center at Alexandria University. The development of the virtual program focused on improving the quality of the education produced and easing the workload for the teachers and assistants in the RE center.

5. Awareness and Dissemination

In addition to the regular awareness within the institutions of the three universities, dissemination activities of the project included as authoring five textbooks and

developing website, conducting several lectures as well as holding specialized workshops at several Egyptian universities. Several other workshops and lectures were also given to the beneficiaries in one of the ministry of Agriculture project (IFAD project) to raise the awareness about renewable energy among farmers and agricultural Engineers.

Other part of the dissemination activities of this project was presenting two research papers about renewable energy and the project at national and international conferences. The title of the first paper is "Date Palm as a renewable energy sources" which was presented at the fourth date Palm symposium held at King Faisal University, Saudi Arabia. The other paper entitled "The need for Renewable energy educational program at the Egyptian Universities". This paper was presented at the International Meeting for the American society of Agricultural and Biological Engineers (ASABE), which was held in Minnesota, USA.

6. Management Methodology

A management committee consisted of five professors (headed by project manager) was formed to meet once a month. The main duty of the committee is to review the activities and achievements of the project in a monthly basis, suggest any correction action if needed and assign the tasks for each team member. The duty of the management committee is also the approval of all expenses related to equipments, staff cost and implementation. Writing all types of reports was the responsibility of the project manager. The daily management activity was the responsibility of the project manager.

The management team of the project meets every month to review the completed activities and take any necessary correction actions. The management team from the beginning of the project believed that developing a center, the educational program and E-learning program required more than 18 month and more than the allocated budget. Therefore, most of the management efforts oriented towards managing the activities in an efficient and cost effective ways. To compliance with the allocated budget, all alternative market for purchasing equipment for the project was considered.

7. Risk Management

The main risk faced the project was to comply with time frame and allocated budget because the conception of the project was relatively new to many parties. The high cost of some of the equipments and no dealer in Egypt of some other equipment were other risks faced the management team. To face the fund limitation for some of the equipment, the project manager under the approval of HEEPF collaborated and integrated with other projects to share funding of these equipments such as the PC server and weather station. Without these integration activities, the project would be in a risky situation. To overcome the no dealer situation and to comply with time frame, the team members increased their efforts in implementation and in searching for alternative dealers in the international market.

8. Monitoring and Evaluation Activities

Monitoring and Evaluation (M&E) was the guide to keep track along with the planned project schedule, allocated budget and quality work [5]. The M&E system was carried out within the project team, through the university projects' management unit and through the funding body HEEPF. Quarterly progress reports, site visits, financial auditing and coordination meetings constituted the major framework of the system. Specialized experts were hired by HEEPF to evaluate the technical constituents of the

development. Performance indicators were checked such that criteria of completion, success and impact are traced. In addition, co-finance by institutions and entrepreneurial partners of more than 15% of the allocated budget by the donor was remarkable.

9. Quality Control Process

Quality control was an essential phase to ensure the technical quality of the deliverables of the project and was carried out at four levels:

- Evaluation by the team member,
- Evaluation from the educational institute,
- Evaluation from expert in the field and
- Evaluation from beneficiaries of the project.

Quality control was carried out internally by a committee composed of the vice dean for graduate studies, vice dean for educational affairs and the head of the Agricultural Engineering Department and headed by the project manager. The committee reviewed the activities and the outputs of the project.

Some experts namely Dean of the University of Mansoura, Vice dean for graduate studies at Mansoura University, the head of the Agricultural, Engineering departments at Alexandria University, Zagazig University and Suez Canal University invited to attend the various workshops carried out by the project. Those experts reviewed the deliverable of the project and wrote their comments and suggestions.

10. Outcomes and Outputs

The activities of the project started in October 2005. In the beginning of the project the team developed a plan or guideline to strengthen RE education in Egypt to include the following points:-

- Energy education programs must offer a mix of academic as well as hands-on skills training to the student. The latter can be accomplished by conducting laboratory experiments, practical demonstrations of operational systems, field visits and field installation of an actual working system.
- Preparation of textbooks, laboratory manuals, teacher's guides and other teaching learning aids for all levels and modes of education in the field of renewable energy is very important for successful implementation of the teaching/training programs.
- The E-learning programs, courses and models must be added to the program and the center to offer a way for continuing learning
- E-learning infrastructure should also be developed in the center
- Modern techniques of communication and information processing as well as computer-aided instruction techniques should be used for this purpose.
- Dissemination and sustainability steps must be effectively implemented.
- The teaching/training programs should be designed to provide ample job opportunities and/or should be capable of providing self-employment.

Taking the above point into account the outputs/outcomes of the project were as follows:

1- The developed RE program consisted of five renewable energy courses. These courses were developed to be taught by both face to face (F2F) and E-learning methods. The developed courses are: introduction to renewable energy, agricultural applications of renewable energy, photovoltaic, solar thermal systems and energy from biomass.

These courses were added to the curriculum of the agriculture engineering department and taught at the three universities in trial basis.

Most of the available references are in English which is not the native language. The five textbooks, shown in Fig.(1), on RE were developed and written in Arabic language as a demand for the fact that most of the agricultural courses in most departments are in Arabic.

Fig.(1): The developed textbooks (in Arabic).

2- Several RE systems were added to the center to include vacuum tube solar collectors, Biogas unit, Gasifier unit and hydrogen/fuel cell unit as shown in Fig.(2). These systems and other existed in the center were used in lab periods of the courses.

Fig.(2): Several Renewable Energy systems developed and added to the center

3- A website (www.areac-agr.com) and an E-learning program were developed to include five courses and several modules and lessons. The E-learning program utilized the a-tutor as a learning content management system. Fig.(3) shows a snap shout for the website and one of the lessons.

Fig.(3): Snap shot for the website and the e-learning program

4- E-learning lab contains 10PCs and server was also developed. Fig.(4) shows a photo for the E-learning lab and server.

Fig.(4): The E-learning lab and the server

11. Training and Capacity Building

Students in this program acquired the knowledge and skills to develop and implement new methods of renewable energy utilization [3]. Fig.(5) shows the training cession where student is gaining the skill to build RE systems.

Fig.(5): Students at lecture and lab sessions

The project made a stress on training and capacity building of staff members. The PM attended an E-learning course at the American University in Cairo. A similar training offered to other staff member at the center.

Five graduate students are know working towards their Ph. D and M. Sc. Degree program in RE at the center, two of these students is about to get their degree in the fall semester.

A staff member also got his Ph. D in wind energy from Germany; His efforts will enhance the activities of the center.

12. Collaboration with the Industry

The project was carried out in collaboration with surveying Systems Company. The company maintained the measuring equipments in the project during the project period and offered a training program for maintenance of the measuring equipment in the project for young staff member. The company collaborated with one of the Non Governmental Organizations (NGO), and Fulbright to invite an expert, Dr. Larson from Arizona University, to work as a consultant for the project. Dr. Larson also reviewed all project achievements.

13. Integration with other Funded Projects

One of the most important achievements of this project is the integration with other HEEPF projects; several HEEPF projects collaborated in purchasing a large server for implementing the E-learning program of the project as well as other developed E-learning courses at the faculty of Agriculture.

Several Agricultural Engineering undergraduate renewable energy courses were developed by the project and shared by another HEEPF project at another institution. These courses were developed to be a part of the Agricultural Engineering new curriculum. In addition, a protocol for cooperation between this project and another HEEPF project at the Faculty of Engineering, Alexandria University to use the center, labs, courses, textbooks, websites developed by the two projects.

14. Sustainability Measures

The most important impact of the project is its sustainability measures. The HEEPF required some measure to insure the sustainability of the project. The project team submitted several proposals to several local and international funding agencies to support the activity of the center after the termination of the project. The result of these efforts is wining one of the European Union project. It is one of the FP6 project. The project title is "Hybrid Renewable Energy Systems for supplying of Services in Rural Settlements of Mediterranean partner Countries, HYRESS". The budget of the project is 1250000 Euros. The project started in October 2006 and will last for three years. The purpose of the project is to develop three hybrid renewable energy systems one of them is in Egypt and the others in Tunisia and Monaco to generate electricity for rural remote villages and use the system as a show case to remove the knowledge barrier against RE installation.

The project manager in collaboration with a consortium of 12 countries submitted a proposal to FP7. The project title is " Jatropha Curcas Network in South European, North African and Chineese Regions:Adaptation, Productivity, Improvement and Environmental, Socio-Economic, Market Assessment, JATROPHANET". The project was submitted in the first call for FP7 (Call fp7-kbbe-2007).

Including the RE course in the curriculum of the Agricultural Engineering Department and developing the center, the textbooks and the website are all ways that aid in making the center sustain its activities.

15. Pros of the project

- Improve the quality of education in agriculture at Egyptian Universities and make it compatible to that of other advanced universities;
- Provide the agricultural students with practical training, hands on experience and the know-how in renewable energy technologies and applications in agriculture.
- Develop an awareness of the importance of using renewable energy in desert and remote locations in Egypt.
- Contribute to narrow the time and technology lag between developed and underdeveloped countries and between scientific Research and Development (R & D) in RE technology and engineering utilization in agriculture.
- Standardize the agriculture education in Egypt by teaching the same course at all universities at the same time;
- Agricultural problematic areas such as limited low-cost-energy irrigation means may be overcome by providing more knowledgeable agriculture graduate in the field of Renewable energy.
- Demonstrate the technical suitability and economic viability of using RE systems in agriculture and identify the conditions required for their dissemination.
- Provide graduates with specific competencies in job-market demands.

- Dissemination of the latest information on know- how and applications of renewable energy technologies in food and agriculture systems in Egypt.
- Introduce E-learning as a new tool for education and training for students and trainees far from the university and outside Egypt.
- Encourage other university staff and training centers to use and benefit from the program and center.
- Develop a continuing education program in RE

16. **Cons of the project**

- Late delivery of some equipments, components or training aids to the center delayed the center activities.
- The unawareness of the important of RE makes some professors at the University disagree with the project.
- No enough advertisement about the activities and the training program among the public.

17. Impact assessment of the Project

The project has two types of impacts, impacts on the students and impacts on the educational institute. The impact on the students can be summarized as follows:

1- The project increased the awareness of Renewable energy among students. Students realized that the use of RE in the Egyptian desert is not just on option it rather a necessity for sustainable development for remote desert location in Egypt.
2- Increase of the awareness of students and staff at other Universities with the achievements of the project.
3- Students gained hand on experience about RE systems and gained the experience necessary to compete in job fair.
4- Students realized that utilizing RE in Egypt conserve and protect the environment.

The second impact is on the educational instituted which can be summarized in the following points:

1- The project improved the teaching methods through using the data show in delivering lectures.
2- The E-learning program and the website will certainly close the Gab between educations in the developed countries and education in Egypt.
3- RE center and program will be used by other departments in the faculty in their educational program and it will be used by students in summer training program.
4- Here again introducing the RE in the student summer training will improve summer training program at the faculty of Agriculture and will make the students aware of the RE technologies and its agricultural applications.
5- Graduate students and young staff members in their research program will also use the facilities in the center. Certainly, this will enhance the research programs at AU.

The project beneficiaries believed that without the help and support of such a project such a new center and RE educational program never existed. The program closed the gap created due to nonexistent of RE training in our educational system. The project played and will continue to play a role in removing the barriers of utilizing RE and increasing the awareness about RE.

Though the greatest impact of this program is environmental protection, it will also impact two other critical needs, sustainable energy supplies and employment. Graduates trained in renewable energy can expect to pursue careers with rural power utilities, solar

energy manufacturing and installation companies, international aid organizations, government departments, energy efficiency and environmental consulting companies, universities and private companies.
Through its sustainability activities, the project forced the manger of the project to form a consortium with several Mediterranean and European partners. This increases the cooperation between Egyptian and the European researchers and certainly will help in knowledge and technology transfer. The program provided an opportunity to a number of experts in the field of renewable energy and educationists nationally and internationally to work together and focus on course work in the field of renewable energy education.
Introducing the E-learning program in RE is a great success to the project. The need for RE e-learning education cannot be overemphasized. The greatest impact of the project is environmental protection.

18. Conclusions

The rationale of implementing HEEPF projects has led to appropriate fulfillment of the proposed main objectives. Competitiveness of projects provided new ideas to enhance the educational process such as that of the RE. More emphases deserve to be devoted to such type of indirect funding to the institutions. New era of electronic courses are expected to be incorporated within the conventional system in a hybrid manner.

19. Acknowledgements

The authors are indebted to the support of the Ministry of Higher Education to conduct this research. Thanks are due to the entire HEEPF team and sub-projects managers who contributed to adopting such a dynamic management system. The contribution of Dr. M. E. Said, Director of the Project Management Unit (PMU) through the implementation process is highly appreciated.

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