

**The role of quality management in improving engineering education outcomes in LIBYA****دور إدارة الجودة في تحسين مخرجات التعليم الهندسي في ليبيا****Dr. Al-Mehdi Ibrahim<sup>1</sup>**

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*Received: 29/09/2023**Accepted: 03/11/2023**Published: 31/12/2023***Summary:**

This paper aims to analyze engineering education system in Libya for sustainability, and to suggest how does quality education management could pointed to required development needed to achieve sustainability. The paper stressed that quality assurance management in higher education has a significant role on evaluating teaching process, and providing affective outcomes of values and qualifications.

Quality assurance activities include assessing outcomes and evaluating courses, providing academic credit for affective outcomes, and designing realistic and acceptable learning outcomes. Furthermore, the main objective is to investigate factors that lead to provide effective outcomes; a survey was conducted on the engineering education system at the collage of engineering, at the University of Gharyan, Libya; the main goal is to improve engineering knowledge, technical skills, and research skills of the graduates.

Therefore, providing high quality outcomes, and building trust between society and higher education institutions. Results showed that management commitment have a crucial role in successes of engineering education to achieve the noble goals to improve the engineering outcomes, and to achieve a sustainable future.

**Keywords:** Quality Education Management; Sustainability Development; Engineering Education.

**المخلص:**

تستعرض هذه الورقة البحثية تحليل النظام التعليمي الهندسي بدولة ليبيا بهدف المساهمة في تحقيق أهداف التنمية المستدامة من خلال تقديم مخرجات عالية الجودة. كما تساهم الدراسة في توضيح دور نظم إدارة الجودة في دراسة العمليات التعليمية المختلفة بمؤسسات التعليم الهندسي بليبيا. وتشمل أنشطة إدارة ضمان الجودة بالمؤسسات التعليمية على تقييم العمليات التعليمية ومقارنتها بالمقاييس العالمية ومراجعة المواد الدراسية وتطويرها بما يتماشى والتغيير المستمر في التقنيات الحديثة، وكذلك اعتماد البرامج التعليمية لكي تساهم بشكل فعال في خدمة المجتمع وتحسين مخرجات مؤسسات التعليم الهندسي. تقوم الدراسة على تقييم وتحليل النظام التعليمي بكلية الهندسة جامعة غريان بهدف الارتقاء بمستوى مخرجات التعليم الهندسي، ورسم السياسات الكفيلة بتحقيق أهداف التنمية المستدامة. وقد أظهرت النتائج أن الإدارة العليا لها دور بارز في نجاح العملية التعليمية وتبني البرامج والخطط التصحيحية اللازمة لتحسين جودة مخرجات التعليم الهندسي.

**الكلمات المفتاحية:** إدارة ضمان جودة التعليم، التنمية المستدامة، التعليم الهندسي.

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## 1. INTRODUCTION

There is no doubt that universities in general and engineering departments in specific play an important role in society as a whole not only in educating members of society, but also in contributing to research and the development of society. These noble goals could be achieved if and only if institutions produce highly qualified graduates, who are effective in providing valuable consultations, very good researches, competent in solving technical problems, and creating new Technologies.

One way to ensure that graduates coming out of educational institutions armed with such high qualifications, is by introducing the Quality Assurance system program which produces a generic statement that represents general expectations including the objectives and standards that used to evaluate the academic performance of teaching process, and deciding whether the outcomes will be according to that specifications or not. It also assists the higher education institutions; in designing and validating plans of study, academic reviewers and external examiner, and comparing standards. The objective of this paper is to measure the education performance in engineering collage to improve the abilities, technical skills and ensure the optimum utilization of the resources i.e. providing high quality outcomes, and build the trust between the society and the organization.

One definition of quality states that "Quality is a dynamic state associated with products, services, people, processes, and environments that meets or exceeding expectations" (David L. et al 2006). Another definition is that of G. Taguchi, who states that "quality of a product/service is the loss imparted by the product/service to society from the time the product is shipped (if it is related to a product) or from the time the service is rendered to the customer" (Jiju Antony et al 2003).

Quality Assurance provides the basis for introducing product that consistently meets expectations. It identifies appropriate quality characteristics of final products, the factors that contribute to these characteristics, and procedures for evaluating and controlling these factors (James R et al, 1996). Quality Assurance (QA) is defined as information systems that collect, process, store, and disseminate information to support decision-making, control, analysis, and visualization in an organization. QA assists in comparing the performance of an organization against internal standards (process control) and external standards (benchmarking).

## 2.LITERATURE REVIEW

For any organization to survive over a long term, performance must begin to be measured by the improvements seen by the customers (John S. et al 1996)The measurement of system performance must be designed, planed, and implemented to reflect the customer requirements, gives visibility to the processes, and the progress made, communicate the total quality effort and engage the never ending improvement cycle. The role of quality education for sustainable development goals (SDGs) is explored by (Nazar et al., 2018), they concluded that the best thing that the government can do to stimulate progress is to provide the nation with the best minds to help the nation tackle future challenges. (Molaodi Tshelane and Sechaba Mahlomaholo, 2015) Presented a strategy or framework for technology integration in the school under the theme of collaboration and network. (Sung et al., 2019) reported that mobilelearning research suffered from methodological limitations such as a lack of baseline equivalence between the experimental and control groups, poor quality of outcome assessment tools, and insufficient statistical powers. Quality assurance has also become a generic term for external quality monitoring and accreditation (Lucander and Christersson, 2020). The perceived need for external quality assurance reflects a demand for accountability by stake- holders as well as a global, contemporary decline in trust of public service institutions.

QA analyzes the actual performance and mapping the strategy and guiding the organization to ensure customers requirements and needs are met; address a sensible objectives; provide standards for establishing comparisons; identify and prioritize quality problems; and provide feedback for improvement purposes.

The Quality Assurance Agency efforts in the Libyan higher education system seeks to build the quality culture to see whether they provide a qualified graduates or not according to the standards of the quality assurance agency for higher education in UK [5]. The main objective during this study is to measure the performance of engineering education and put forward areas which quality assurance efforts should concentrate on to improve the overall performance of the Engineering collage in Libya, and built the trust with the community that it will produce a high quality outcomes in terms of graduates, researches, solving engineering problems, adapting new technologies, and effective consultations.

QA in general aims to produce "generic statements which represent general expectations aboutstandards for the award of degrees in Engineering" . QA in Libya

are not any different than those adapted in other institutions. These include assisting higher education institutions in designing and validating study programs, provide academic reviewers (internal or external) to ensure that the program compares to the international standards. The QA procedure by which the Libyan education system was evaluated is shown in Figure 1.

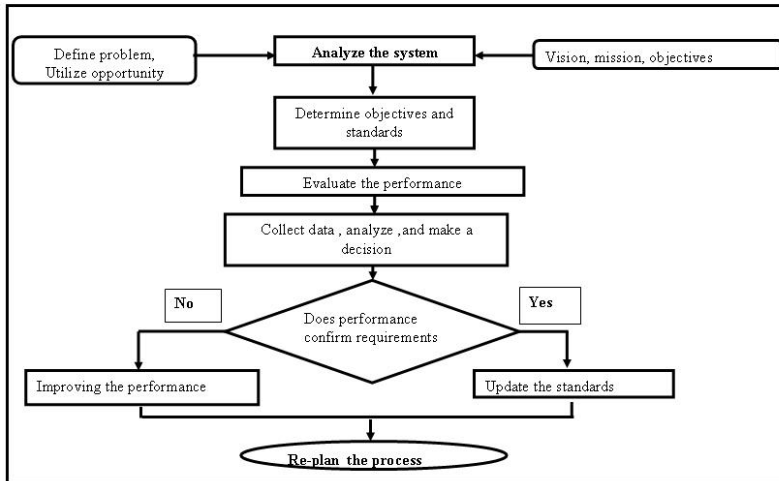


Fig.1: The QA procedure to improve the education process.

After defining the problem in light of the vision, mission and objectives of the organization, the system is analyzed to determine the objectives of the QA and the standards to be measured against. The performance of the system is then evaluated by analyzing the collected data to reach a decision. Depending on whether the performance confirms the requirements or not, either the standards are updated or improving the performance is recommended.

### 3.METHODOLOGY

In order to evaluate the system, we need to make clear of some educational expectations of the engineering profession. The UK Engineering Council [4], sets out its definition of Engineering: "Engineering is a profession directed towards the skilled application of a distinctive body of knowledge based on mathematics, science and technology, integrated with business and management, which is acquired through education and professional formation in a particular engineering discipline. Engineering is directed to developing, providing and maintaining infrastructure, goods and services for industry and the community". The outcome of Engineering is a product, or perhaps a process or service.

### 3.1 The benchmark statement (student attainment)

In this section, we present the benchmark statements an engineering program aims to achieve. These benchmarks range from threshold at the lower end to excellent when the program meets its objectives. Each component of the educational process has a benchmark statement associated with it. In the remainder of this section we list the benchmarks for each component of the educational objectives.

The benchmark statements were translated into to three categories, which measure the intellectual, practical and general transferable skills. These reflect the real performance and map the planned performance. The question is then now, how does the Libyan educational system score in light of these benchmark statements. The statistical methodology (quantitative and qualitative) used in terms of designing the questioners that reflect the actual performance, determine the performance gap, and how to improve it (Re-plan the process).

Table 1: The benchmarking statements categorized into three skills, which include intellectual, practical and general transferable skills [\*].

| Intellectual Abilities                                                                                                                                                                                                                                                                                                                                                                             | Practical skills                                                                                                                                                                                                                                                           | General transferable skills                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Solve engineering problems, often on the basis of limited and possibly contradictory information;</li> <li>• Analyze and interpret data and, when necessary, design experiments to gain new data;</li> <li>• Design a system, component or process to meet a need;</li> <li>• Evaluate designs, processes and products, and make improvements;</li> </ul> | <p>Use a wide range of tools, techniques and equipment, including pertinent software;</p> <ul style="list-style-type: none"> <li>• Use laboratory and workshop equipment to generate valuable data;</li> <li>• Develop, promote and apply safe systems of work.</li> </ul> | <ul style="list-style-type: none"> <li>• Communicate effectively with colleagues and others, using both written and oral methods;</li> <li>• Use IT effectively;</li> <li>• Manage resources and time;</li> <li>• Work in a multi disciplinary team;</li> <li>• Undertake lifelong learning, particularly for continuing professional development;</li> <li>• effective communication.</li> </ul> |

## 4. RESULTS AND DISSCUSION

In this study, a sample consist of 50 applicant is used in investigating the engineering qualification during interviews and questionnaires. Data is collected and analyzed using Minitab software. Results showed that there is a strong indication that most the students possess the knowledge and understanding of the material in terms of science, but students failed miserably when it came to problem solving skills, initiate ideas or work independently. This means that the quality of the

educational system did not deliver nor achieved the goals it meant to achieve. Therefore, management should review their teaching process and specify the reason behind such huge failure. The factors contributing to the failure of the education system in Libya to produce qualified engineers are tabulate in Table 2. The results of the QAS pointed to the reasons behind the poor education system in Libya into five categories; management, Standards, resources, Teaching activities, and inputs.

Table 2: Summary of the results of the survey

| Reason                 | Percent % |
|------------------------|-----------|
| Management (M)         | 72        |
| Resources (R)          | 13        |
| Teaching processes (T) | 3         |
| Standards (S)          | 2         |
| Weakness in inputs (I) | 10        |

As shown in Figure 2 illustrates the influence of management and other factors on the education system; management does not have commitment for making changes and adopts the improvements whereby it plays the main role during this process. The unavailability of resources reduce the probability to gain the optimum use of instruments needed to produce qualified graduates, effective consultants, proper designs for conducting investigations, and good climate for innovation and creation new technologies. The teaching process was not performed as expected due lack of the experienced staff, including teachers, technicians, and support staff. The selection of appropriate standards to measure the system performance also has a considered effect on the evaluation process. And finally the inputs (students) should be able to receive and communicate the teaching process.

#### 4.1 Factors influencing the success and failure of QA in Libyan Education Systems:

The term system failure is used when a specific system does not perform as expected, is not operational at specified time, or can't provide the intended functions (Kenneth C. et al 1995). Among the factors contributing to failure of QA to meet its objective are summarized in table 3.

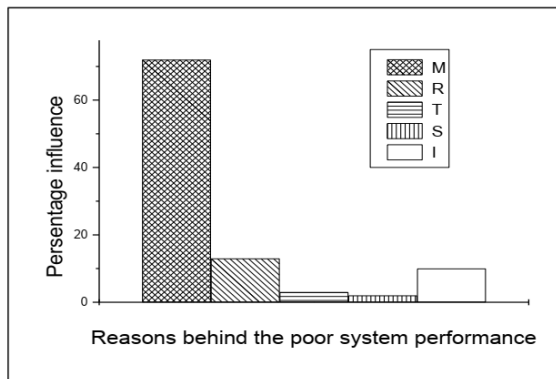


Fig.2: the percentage influence of management (M), resources (R), teaching process (T), standard (S), and inputs (I) on the education system in Libyan Education System.

| Factors contributing to the failure of QAS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Factors contributing to the success of QAS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• They do not define the performance operationally</li> <li>• They do not relate performance to the teaching process</li> <li>• The boundary of the processes are not define</li> <li>• There is no distinction between control and improvement</li> <li>• It seen as an extra burden in terms of time and reporting</li> <li>• There is a fear of the introduction a tight management controls</li> <li>• The data collection and analyzing is not relevant and efficient</li> </ul> | <ul style="list-style-type: none"> <li>• Management commitment for measuring system performance</li> <li>• Management awareness with the significant role of the Quality system in Engineering education</li> <li>• Recognition of the importance of quality culture and assist the change</li> <li>• Selecting the measurable and achievable objectives</li> <li>• Confirm the standards with customer requirements</li> <li>• Student involvement and influence in system evaluation</li> <li>• Achieving the objectives and making the improvement;</li> <li>• Discommendation and never ending cycle</li> </ul> |

## 5.CONCLUSIONS

Evaluating the system performance for any organization is needed to pointed out the actual performance and specify the opportunities, threats, and therefore improving the competitiveness. Also, providing a high quality product highly dependent on its long term objective, which is to exhibit consistency performance and assure their quality. Therefore organizations must assist in the adaptation of Quality Assurance programs, and create a climate that promotes the introduction of

high quality culture. Engineering education rapidly changing to live up to technological advances, hence the teaching processes must also be continuously updated. Statistical theorems and concepts are necessary for analyzing education systems and that is why a lot of concern must be taken.

The investigation conclude that there is a huge gap in the Engineering education system in Libya and recommended to the top management to make a strategic plan to overcome these threats in the system, and committed to adopt the required changes;

- Update the teaching process (introduce new courses, technologies) and concentrate on building and supporting the quality sense in all process;
- Awareness with the new students and refresh their knowledge to receive the teaching processes
- Ensure that students have the minimum acceptable standard (performing the basic task)
- Provide technical training to improve the technical skills
- Provide qualified requirements for teaching processes (e.g. experts, instruments)
- Motivation and rewards play a significant role in improving education systems

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