

## The Design and Implementation of Quality Decision Support System (QDSS) Accordance with NCAAA Framework for Higher Education

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**Abstract:** Quality management system implementation has become a must for institutions in Arab countries to be able to enter tenders. One of the most common quality standards is the NCAAA quality management standard and many institutions seek NCAAA standards accreditation in today's highly competitive market. However, in getting this accreditation, most institutions face difficulties such as the huge amount of paperwork, improper documentation, poor communication among employees and low employee morale as a consequence of lack of motivation. The study presents a higher education Quality Decision Support System (QDSS) that integrates the quality tools as well as the process quality information. In a development type of research, researchers must identify the constraints imposed by the environment, state the objectives of the development effects (i.e., the focus of the research) and define the functionalities of the resulting system to achieve the stated objectives. The results shows that the application of QDSS can optimize the process of design academic program, shorten the cycle time of quality, reduce the cost and realize quality improvement continuously.

**Key words:** QDSS, NCAAA, quality assurance, quality management, improvement continuously, optimize

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### INTRODUCTION

In recent years, the attention is increasingly being centered on quality management in higher education institutions throughout Arab community.

In fact, a quality oriented service requires perfection in the design and planning of service activities as well as during its conveying and furthermore for the embraced service performance evaluation method.

The administrators of institutions are responsible for making decisions and set up plans so that they could make use of the limited resources as effectively as possible (Lari, 2002).

Institutions of higher education were being criticized due to the higher costs to students and the demands for increased financial support from the government. Accreditation was the primary tool used by the government to determine whether or not institution for higher education are qualified. A search of over two dozen databases revealed that no research focused on quality management theory and higher education. Researchers indicated that administrators in higher education struggle to identify useful models to manage and monitor the quality processes (Early, 1991; Forza, 1995).

The evaluation of student learning has become a hot topic in higher education as business school educators become increasingly more accountable for what students learn. Whether it is an accrediting agency or any of the other constituent bodies that a university is accountable to, they want to know that graduating students have the skills to succeed (Anglin *et al.*, 2008).

The most of information system for quality management and assurance is typically utilized in documentation. That is only aimed to automate traditional paper-based processes to improve response times, reduce errors and costs. Therefore, there is a need for a decision tool for managers to track quality performances that can help managers to decide the proper corrective and preventive actions (Lari, 2002).

Decision support system is intended to serve as a tool for the senior executives. DSS includes information about both internal and external factors, e.g., targets, strategy, policy, tactics, problems and control, etc. for the administrators to manage quality assurance. Thus, the motivations to develop the Quality Decision Support System (QDSS) for higher education as a tool to support the quality management process so that the administrators could set up plans and make real time decisions more efficiently.

This research proposes a conceptual model for a Quality Decision Support System (QDSS). The objective of QDSS is to monitor quality and bring managers closer to quality operations. Here, the term service quality refers to the student's evaluations about the services they have received.

The objective of this research developing a QDSS compatible to National Commission for Academic Accreditation and Assessment (NCAAA) standards.

This study analyzes the requirements of NCAAA standard. Further, it proposes a conceptual model for Quality DSS (QDSS) then it explains approach to the system development by empirically testing the prototype model on Islamic University at Medina Mnoura. The proposed system will provide the conceptual structure for a quality assurance information system within higher education's organization.

**Literature review:** Quality and corporate information systems are inextricably linked. The need for information systems for quality management has been argued convincingly by Garvin (1983) in his comparative study of the American and Japanese manufacturing industries. "Clearly, timely, specific and detailed information is needed to decide the cause of quality problems to be able to follow the related quality problems and their impact anywhere in the organization to react quickly to these and to use related information in all planning problems company wide".

**The role of IS on quality management:** Information systems play in achieving total quality management in the service industry. According to Fuld (1992), examination of six critical quality factors and their information links can help us understand why information systems are so important in quality management in the service industry. With information systems a service company can stay close to the customer and do more than just make monthly visits. This means the company can also listen to what the customer is not saying as well as to what the customer is saying. As a result, the company can maintain a constant information flow on its market place and its customers.

If no standard for identifying services is established and each department serves customers its own way, then it will be extremely difficult to come to any conclusions about how the company should do to improve its service. In order to ensure that services are continually improved, data should be collected and analyzed on a continuing basis with particular attention given to variations in service. Information systems can help monitor the causes of service variation and improve cost-effectiveness and accuracy.

Employee empowerment is one of the paramount interests to all organizations who want to achieve total quality goals. Providing information to employees makes goals explicit and helps direct researchers behavior, since the decision maker is more informed about the structure of the task. Information also provides workers with quick feedback and encourages learning which facilitates a quick identification of solutions by those who are most knowledgeable. Employees need informational tools if they are to make decisions along the way. Information systems can and do improve employee involvement by forcing the information flow to move in many directions throughout a company.

Organizations must recognize the need to constantly enhance and fine-tune all activities in order to maintain total quality standards. They must also constantly watch the ever-changing business environment. Information becomes distinctly vital for coordinating activities in a continuous improvement environment that maintains a tight relation between institution goals and current operations. Here, information systems are also critical. A company must have the most current and reliable information upon which to base its decisions. If that information is poor, out of date or just plain wrong, the company will be doing its total quality problem a disservice.

Some situations require that the company make a drastic change in its processes for the sake of quality. Information systems can provide continuous information assisting the company in making the drastic changes.

**Quality management systems:** Quality is regarded as a multidimensional, value-laden construct (Davis and Vollmann, 1990) so, it is not surprising to observe in the literature wide differences regarding its conceptualization and subsequent operationalization.

Effective quality management requires some measures of quality (i.e., quantifiable standards or indicators of performance) which can be monitored to tell a company how well it is doing (Cheng and Ngai, 1994). As Early (1991) says, "quality improvement without measurement is like hunting ducks at midnight without moon-lots of squawking and shooting with only random results and with a high probability of damage". A quality management theory is a system-focused perspective to management, based on principles such as leadership, factual approach to decision making, customer satisfaction and continuous improvement (Lari, 2002).

Higher education institution should be more effective and efficient when they integrate quality management principles such as customer satisfaction and factual approach to decision making. Fact-based decision making

is a means of making decisions with data, facts and information and not making decisions using gut feelings. Researchers concluded that quality management was important for performance improvement and development of organization (Garvin, 1983; Lau *et al.*, 2009) the improvement of this performance positively affects all aspects of an organization. Hence, there is a clear need for more research to determine if a quality management system are making processes more effective and efficient at universities (Marchand and Raymond, 2008).

Measurement, analysis and knowledge management is a quality management principle that determining how the institution improves its performance based on the analysis of key measures (Bititci *et al.*, 2002). Most importantly it is about how systematic process is established to manage and improve data, information and knowledge.

Management professionals have been using information systems for more than five decades. Particularly, managers started to use computer-based information systems which today are known as Management Information Systems (MIS). Since, then the scope of MIS (O'Brien and Montazemi, 2003; Oz, 2002) has been increasing and widening (Laudon and Laudon, 2013). In coincidence to MIS development, the world has been attempting to achieve continuous quality improvement in organizations. Yet, there has been no concrete effort by management professionals toward integrating continuous quality improvement projects with information systems (Forza, 1995).

In fact, no major discussions have taken place in managerial conferences and seminars about extending support to enhance the effectiveness of continuous quality improvement projects through the application of MIS concepts (Anglin *et al.*, 2008). At this juncture, it should be noted that a large number of companies have been benefitted by implementing Total Quality Management (TQM) (Themistocleous *et al.*, 2001) and Enterprise Resource Planning (ERP) systems (Waldman, 1994).

The most noticeable is the contribution of Juran and Gryna (1995) who coined the term "Quality Information System (QIS)". After they advocated the use of QIS, some researchers worked in the direction of developing QIS during the 1980's (Forza, 1995). Without appropriate management tools it would be nearly impossible for administrators and evaluators to know how well the institution, department or program is performing.

Lack of proper links between information systems and quality measurement systems is highlighted in different studies (Bititci *et al.*, 2002) they stated that advances in information technology such as data warehousing can support performance assessment

systems to achieve enhanced efficiency and effectiveness. Laitinen (2009) emphasize the role of information systems in delivering information to managers. The contributions of this study can be summarized as follows:

- Examination of the relationship between universities quality management and the role of information systems
- Avoidance of delayed decisions stemming from misinterpretation and delayed processing of information because delayed decisions may lead to gaps in service quality
- Monitoring of quality performance in higher education organizations in a timely fashion
- Development of the process for designing the infrastructure of a quality management information system for universities

**NCAAA standards:** The NCAAA (National Commission for Academic Accreditation and Assessment, 2009) has obligation under its by laws for setting up standards and for accreditation of all institutions and all programs. Its duty identifies with both institutions as a whole and to the individual programs they offer.

The standards to be applied in judgments about accreditation are based on what are generally considered good practices in institutions. These "good practices" must be understood so that institutions can refer to them in their internal quality processes and external reviewers can use them as criteria in their evaluations. The practices are summarized in eleven broad statements of standards and described in two documents, standards for quality assurance and accreditation in higher education institutions and standards for quality assurance and accreditation of higher education programs. He eleven broad standards apply to both institutions and programs though there are differences in how they are applied for these different kinds of evaluation. The standards are presented in five groups.

**Institutional context:**

- Mission and objectives
- Governance and administration
- Management of quality assurance and improvement

**Quality of learning and teaching:**

- Learning and teaching:

**Support for student learning:**

- Student administration and support services
- Learning resource

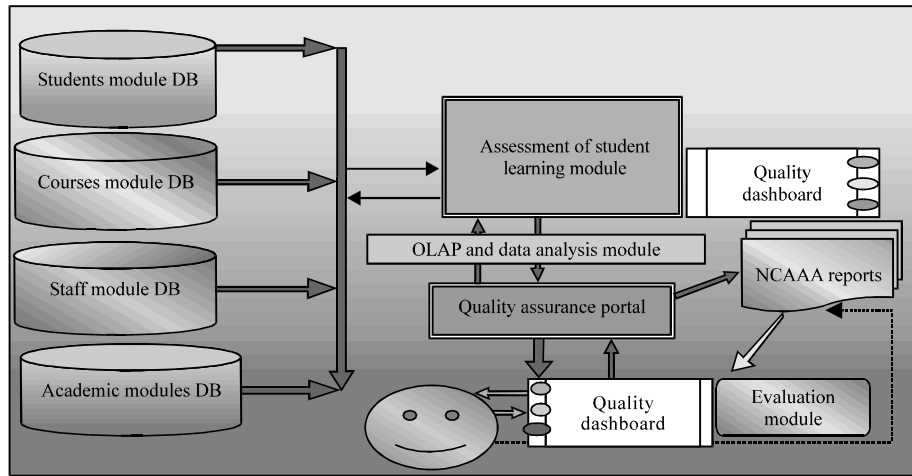


Fig. 1: QDSS conceptual model architecture

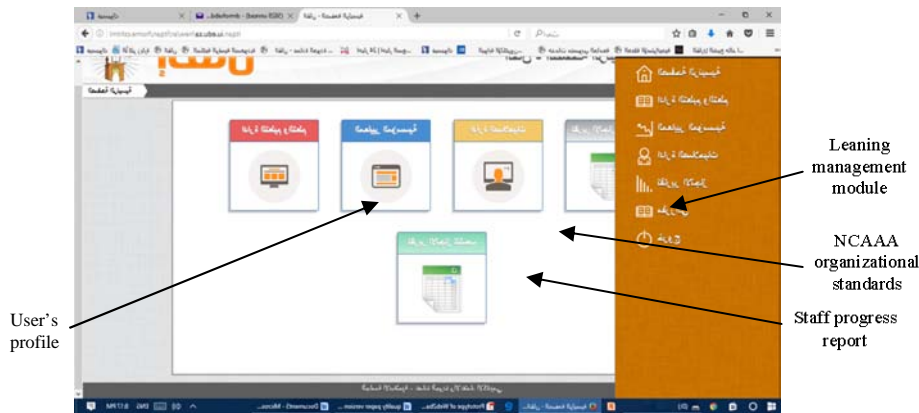


Fig. 2: QDSS main screenshot

**Supporting infrastructure:**

- Facilities and equipment
- Financial planning and management
- Employment processes

**Community contributions:**

- Research
- Institutional relationships with the community

A decision support system for quality management is designed to supply the data that help to define NCAA standards to assist in the development of quality improvement programs to monitor performance to enable more effective and efficient activities and to enhance the services provided to customers.

QDSS is a straightforward, easy to understand, user-friendly query management information system that is designed to fill a void associated with TQM in the universities.

**QDSS conceptual model architecture:** Universities contain of faculties and each faculty have academic program. Each academic program consists of courses. Quality assurance on NCAA consists of procedures and polices necessary to ensure that quality is being maintained and enhanced. QDSS modules (Fig. 1 and 2) is applied to the courses, the academic program, the staff, learning methods, students assessment module and technology.

**Course management module:** This module manage course map and course specification, course learning outcomes and teaching methods in Fig. 3.

**Academic program management module:** This module manage academic program data such as learning outcomes and KPI (Key Performance Indicator).

**Students management module:** This module contains of student's data and his academic tables.



Fig. 3: Academic programs

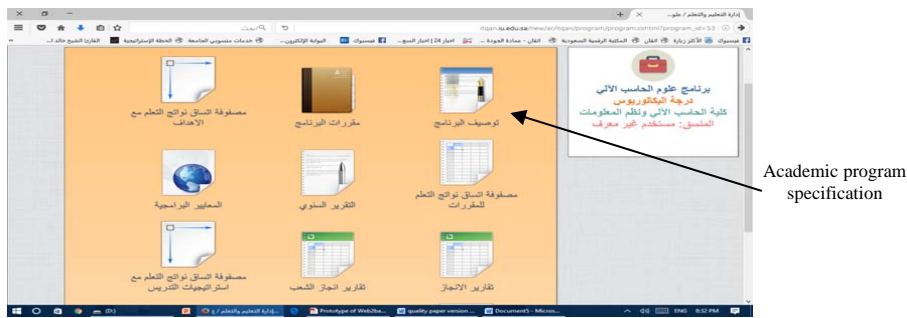


Fig. 4: Academic program NCAA requirement

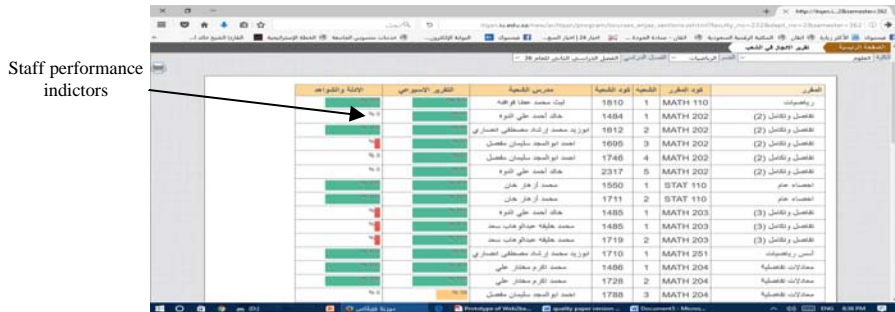


Fig. 5: Staff progress report dashboard

**Staff management module:** This module consists of staff's courses and courses map (Fig. 4).

**Assessment of student learning module:** This module assess the student learning by examining samples of student work directly related to a program learning objective and analyze the students feedback that is related to the course (Fig. 5 and 6).

**Quality assurance portal:** A quality assurance portal contains suitable reports and data to show the trends and exceptions of system qualities. Towards monitoring different quality assurance goals, users can have their quality assurance portal customized with particular graphs

and reports to make their analysis on the quality data more efficient. This module generate the NCAA documents such as academic program specification, academic program report, course specification and course reports (Fig. 3 and 4).

**OLAP and data analysis module:** By providing OLAP functions in reports, users can sort, filter, aggregate quality data and drill up/down in dimensions which candramatically reduce the efforts to notice quality exceptions and to investigate and determine the cause of those exceptions. Based on data mart models in the QDSS package a number of quality assurance reports are created using QDSS functions.



Fig. 6: Course learning outcomes assessment dashboard



Fig. 7: NCAAA organizational standards dashboard

**Evaluation module:** This interface that provides us staff performance and course states also that permits the reviewer and auditor to review and audit the academic program and recommendation (Fig. 5).

**Quality dashboard:** Dashboards conceptually resemble dashboards used in automobiles by simplistically representing the current and past key performance metrics of the a company in forms, e.g., gauges, table and the charts show in Fig. 7.

### MATERIALS AND METHODS

The methodology was based on developing a web-based system for quality measurement using a dashboard technique. The developed system consists of three major parts including databases, user interfaces and web applications. Microsoft visual studio 2010 was used to develop the main structure of the system. Microsoft visual studio is an Integrated Development Environment

(IDE) from Microsoft which can be used to develop graphical user interface applications along with web sites and web applications. The database of the system was created using the Microsoft SQL Server 2008 which is a Relational Database Management System (RDBMS). User interfaces and web pages of the system were designed and developed using ASP. NET which is used to build dynamic web sites and web services. C# (C Sharp) was used to connect database, user interfaces and web applications.

The users can access the system through an authentication page. Different departments and their related data will then be defined.

**QDSS environment:** QDSS can be accessed through the internet by different web browsers such as Mozilla Firefox, Microsoft Internet Explorer, Google Chrome, Opera, etc. Users of the system can be anyone who is the assigned a username and a password. The system consists of the following the parts.

The setup and installation authority is given to the institution's administrator to define the institution organization structure. Among the different organizational structures a functional organizational structure is used in QDSS. Administrators can delegate his authority to other personnel such as head of the academic department or head of quality department to be able to create, define or modify quality operations. Other users have only access to the data for their research.

**QDSS reports:** QDSS can extract the data from different department; use them to provide various reports. The reports are online and updated automatically as any change occurs in the research and database. The difference between receiving and reading times of all received messages will be calculated and accumulated for each person. These delays could be shown both in tabular format and graphically. Course reports, annual academic program reports, course learning outcomes assessment report (Fig. 6) staff performance report (Fig. 5) and many other types of reports could also be retrieved based on need.

## RESULTS AND DISCUSSION

**QDSS evaluation:** As stated by Laitinen (2009) IS can provide several benefits such as improved productivity, innovation, market share and cost saving. The evaluation of an IS can be viewed as an assessing in determining its implementation success. Implementation success refers to different factors to be achieved, thus evaluation is a multidimensional concept (Palvia *et al.*, 2001) these factors vary according to different group (users, developers, managers), perspectives and the type of information system to be evaluated.

The primary feedbacks attested that QDSS will provide a competitive environment among employees and thus can help Institutions to overcome the difficulties of quality management system implementation and NCAAA certification. Managers pointed out some benefits provided by QDSS including time saving, cost and expense reduction (as a result of decreased paperwork, reduction of administrative staff, accuracy increase, easier and faster performance measurement and calculation and communication improvement.

**QDSS benefits:** Less paperwork, appropriate documentation and archiving and easier communication were also emphasized by managers as a result of QDSS usage. He claimed that using a system like QDSS would help intuitions prevent such extra expense and effort. On the other hand, an important issue for a manager is fast and easy accesses to necessary information which can be

achieved easily by utilizing a system like QDSS. Managers and staff can be monitoring of quality performance in higher education organizations in a timely fashion and measuring the course learning outcomes. Managers also revealed that more accuracy would be attained by using QDSS. Almost, 100% accuracy would be provided, compared with 15-20% human errors faced by companies as stated by some managers.

**QDSS application difficulties:** The only difficulty of QDSS application was believed to be the resistance of personnel. Clearly, every new system faces some resistance and adaptation difficulties. Management commitment and ability would encourage staff to accept the new system and procedures. Long-term feedback was expected to be obtained after longer time usage of QDSS. The researchers expect to receive both managers and employees feedback after at least one year of the QDSS practical implementation. As short-term feedback demonstrated the practicality and advantages of QDSS, together with the positive perspective of the managers it is foreseen that long term feedback will also prove its appropriateness and ease of use. Motivation cannot be measured yet, since it requires employee performance to be observed and evaluated after at least 6 months of QDSS implementation.

**Practical and managerial implications of QDSS:** Quality measurement systems and information systems receive considerable attention now a days, thus it is expected that QDSS with both characteristics will provide numerous and important advantages for its users. Although, QDSS is still running in islamic university at Medina Mnoura KSA and long-term feedback has not yet been received, it is believed and somehow proved by short-term feedback results that some main practical and managerial implications of QDSS are:

- Positive effects on working behavior of employees and managers
- Provision of a decision tool for managers to have quick access to employee performance and to monitor the overall performance of their organization
- To encourage institutions seeking NCAAA certification or QDSS deployment to start and continue the process and overcome implementation difficulties

## CONCLUSION

Institutions seeking quality management system deployment, like NCAAA standards, face numerous discouraging difficulties. Major difficulties are paperwork,

documentation, communication and lack of motivation. Using a web-based quality management system, called (QDSS) managers would be promptly provided with accurate information about their business. In this study, the Quality Decision Support System (QDSS) that has been designed by referring to NCAAA standards has been reported. After designing this QDSS, its development in real-time environment was examined by conducting a study at an NCAAA standards certified high technology-oriented institution. Also, a validation study was conducted by gathering assessment of the managing partner of the institution on QDSS. These studies revealed the feasibility and possibility of implementing QDSS in NCAAA standards accredited universities. QDSS reduces paperwork through appropriate IT utilization decreases documentation problems by the use of a QDSS, overcomes communication problems by using internet and mobile phone facilities and finally assists faculty in getting NCAAA certification as a part of its quality management system. On the other hand, QDSS encourages staff to perform their tasks in the possible shortest time with the lowest cost and at the highest quality level to gain higher Performance.

QDSS further studies can be conducted on the quantitative data. It would be interesting for future research to deal with unstructured information sources.

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