

# Integrating Outcome Based Accreditation (OBA) with ISO 9001 Compliant Quality Management System (QMS): A Case Study

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## ABSTRACT

The objective of introducing Outcome Based Education (OBE) is to improve the quality of engineering education so that the education is aligned with the expectations of the stakeholders and is making continuous improvement. The accreditation process is based on the Outcome Based Accreditation (OBA) criteria and is conducted at every Accreditation cycle (e.g., 2 years or 5 years). It is important that the institution requires a system that implements processes that are followed on a day-to-day basis so that it ensures on a regular basis (i.e for every 6 months or 1 year) that the OBA criteria is met and it takes steps to make continuous improvement. To achieve this objective, this paper proposes a Quality Management System (QMS) which is compliant to an International Standard namely ISO 9001. The paper presents a case study in an institution where the ISO 9001 compliant QMS is integrated to the OBA criteria and hence the OBE is achieved effectively.

**Keywords:** Outcome Based Accreditation, Quality of Engineering Education.

## INTRODUCTION

The objective of introducing Outcome Based Education (OBE) is to improve the quality of engineering education so that the education is aligned with the expectations of the stakeholders and is making continuous improvement. The accreditation process is based on the Outcome Based Accreditation (OBA) criteria and is conducted at every Accreditation cycle (e.g., 2 years or 5 years). It is important that the institution requires a system that implements processes that are followed on a day-to-day basis so that it ensures on a regular basis (i.e for every 6 months or 1 year) that the OBA criteria is met and it takes steps to make continuous improvement. To achieve this objective, this paper proposes a Quality Management System (QMS) which is compliant to an International Standard namely ISO 9001. The paper presents a case study in an institution where the ISO 9001 compliant QMS is integrated to the OBA criteria and hence the OBE is achieved effectively.

## OUTCOME BASED ACCREDITATION PROCESS

As a part of implementing OBE, the Accreditation agencies (eg Accreditation Board for Engineering and Technology (ABET) in USA [1], National Board of Accreditation (NBA) in India, etc.) [2]

lay down the Accreditation procedure for the agency to award the accreditation status to the institutions. The procedure of OBA requires that the institution does a self assessment and prepares a report based on the criteria. It is called Self-Study Report in the case of ABET [3] and Self Assessment Report (SAR) in NBA [4]. The criteria covers various academic and administrative processes and results like the institution's Vision, Mission and Program Educational Objectives, Mapping of the PEOs to the curriculum, Students Performance and Faculty Contributions, Facilities and Support Systems, Governance etc. The Self Study Report or SAR report is submitted to the Accreditation agency (eg ABET in USA, NBA in India). Based on the review and evaluation of the SAR report and subsequent site visit by Expert Team, the accreditation is awarded. This process is done for each Institution or Program in every accreditation cycle (i.e. every 2 years or 5 years as applicable).

### **QMS BASED ON INTERNATIONAL STANDARDS ISO 9001**

International Standards Organization (ISO) has published standards for various types of products and services and has defined the procedures for certifying the products and services as ISO standard compliant. ISO has published the ISO 9001 standard [5] for meeting Quality in all product and service organizations. Currently ISO 9001: 2008 version is in use and ISO 9001: 2015 has been published. Authorized ISO certification agencies can award ISO certification and periodically recertify the institutions and/or products and services. Such agencies in turn are accredited by the ISO periodically. The institution has to prepare a QMS document defining all the institutional level processes and relevant forms meeting the clauses defined in the ISO 9001 standard. Such QMS covers areas of Management responsibility, Resource planning, Design and delivery of Products and Measurement, Analysis and Continuous Improvement. As required by ISO, each institution should have a Management Representative (MR) who implements the QMS across the institution.

### **INTEGRATING THE OBA CRITERIA WITH THE QMS**

In order to integrate OBA and QMS, the institution should prepare the QMS in accordance with the ISO 9001 requirement but at the same time ensure that all the processes are included to measure and improve OBA criteria on an going basis. When using the forms for the QMS processes, the institution should try to include the forms in the OBA criteria to enable the collection of the data for accreditation.

### **BENEFITS OF THE INTEGRATION**

Some of the benefits of integrating the QMS with the OBA criteria are as follows:

- **Vision and Mission:** The QMS requires that the Management is responsible to set the Vision and Mission and continuously revise it. This will ensure that the institution and the individual departments/programs also set the Vision, Mission, Program Educational Objectives (PEO) and Program Specific Objectives (PSO).
- **Teaching and Learning:** The QMS will enforce that a document is made to detail the processes involved in the teaching and learning and various other supporting processes which are required to implement the OBE and meet the OBA criteria.

- **Continuous Improvement based on the attainment:** The QMS will enforce a well defined measurement, analysis and improvement process in place. This requires that the results are analysed, gap analysis is done using various Total Quality Management (TQM) tools and steps are taken for improvement. This will ensure that results analysis of the attainment of the Program Educational Objectives (PEO) and continuous improvement planning are done on a periodic basis multiple times before the next cycle of accreditation. The findings from ISO Internal and External Audits and corrective actions taken as responses can be reported as 'Academic audit and actions taken' as a part of OBA.
- **Stakeholder feedback and achieving Outcomes:** The ISO also requires that feedback is taken from all internal and external stakeholders and they are addressed and improvements are achieved. This enables the institution to achieve the outcomes.
- **Completion and consistency:** While the institution is free to define its QMS, as a part of the auditing, the ISO External Auditor of the certifying agency will audit the institution's Management Representative (MR) and ensure that the QMS is satisfying all the ISO 9001 clauses.
- **Common Processes across programs:** As the processes are defined at institution level in QMS, different Programs within the institution can report as their processes in the OBA and then add suitable program specific processes in the report. QMS is flexible that it allows the institution to have processes as best suitable for the institution as long as the requirements are met.
- **Periodic Audits:** The QMS will enforce the process of periodic Internal Audits and External Audits by certified and qualified auditors. This will ensure that the various processes of OBE are being practiced and are showing the results in attaining the targeted PEOs and PSOs.

## CASE STUDY OF THE QMS IN RMKEC

### Establishing the Organizational Structure for QMS and OBA

In line with the above, a QMS system has been implemented in our institution RMK Engineering College. The institution established an organizational structure with clear roles and responsibilities for the implementation of the QMS. A Management Representative (MR), a Professor in one of the Departments, has been appointed to be responsible for the complete development and implementation of the QMS. The MR reports to Principal and coordinates with all Departments. The ISO 9001 requirements mandate that an MR has to be appointed for implementation of QMS. It had defined the roles and responsibilities clearly. On the advice of the Principal, each Head of the Department has appointed an ISO QMS Coordinator for the respective Department. In addition, each Department has nominated one or more ISO QMS Internal Auditors who may also be the ISO QMS coordinator of the Department. The MR, under the guidance of the Principal, conducts Internal Audit once every 6 months and coordinated with the external agency for External Audit once a year.

### Training in QMS and OBA/OBE

The ISO QMS Coordinator is trained in ISO 9001 QMS and is responsible for creating the awareness and implementation of the QMS in the department. The MR has coordinated the formal training of the designated ISO QMS Internal Auditors by the authorized agencies and for the certification of the ISO QMS Internal Auditors.

In each Department, all the senior members have been formally trained in the Outcome Based Accreditation Education (OBE) and Outcome Based Accreditation (OBA). In view of this, the knowledge of OBE/OBA and ISO 9001 is made available in each department.

## Development of QMS

The MR coordinated the development of QMS documents by involving various faculty members in the department. Each such faculty member, who has been experienced in the processes, has developed one or more sections of the QMS. So the faculty members have been designated as process owners and co-authors of the QMS. From time to time, they also contribute towards the revision of the QMS in the respective sections.

The RMKEC QMS system has directly mapped the ISO 9001: 2008 requirements to the OBA criteria and has used the OBA forms wherever applicable. The RMK Engineering College comes under the Tier II category. The mapping of ISO requirements to OBA criteria are as follows:

No	ISO Requirements	OBA Criteria
1	Management Responsibility	<b>Criteria 1:</b> Vision, Mission and Programme Educational Objectives (Institution and Program levels)
		<b>Criteria 10:</b> Governance, Institutional Support and Financial Resources
2	Resource Management	<b>Criteria 5:</b> Faculty Information and Contributions
		<b>Criteria 6:</b> Facilities and Technical Support
3	Product Realization	<b>Criteria 2:</b> Programme Curriculum and Teaching – Learning Processes
		<b>Criteria 3:</b> Programme Outcomes and Course Outcomes
		<b>Criteria 4:</b> Students' Performance
		<b>Criteria 8:</b> First Year Academics
		<b>Criteria 9:</b> Student Support Systems
4	Measurement, Analysis and Improvement	<b>Criteria 7:</b> Continuous Improvement

## Examples of the Benefits Achieved

To illustrate the benefits achieved by RMK Engineering College of integrating the QMS with the OBA criteria, following examples can be given:

- **Academic Performance reporting and result analysis:** As a part of the Teaching & Learning Process as defined in the QMS, the academic performance is reported every semester with all relevant data as required in OBA and results analysis is done and improvements are planned.
  - **Findings from external sources:** In the External Audit conducted by Certified ISO Auditors, the auditors recorded the findings that the Quality Management System was found to be in compliance with the ISO 9001 standard and the institution's procedures. As examples, they recorded the findings that College students secured more than 100 Ranks in the University including Gold Medals in Civil, Mech and Post Graduation. In the

accreditation by NBA Expert team, expert team members recorded the findings as 'good success rate and placement' as a strength.

- **Faculty performance appraisal:** This is done every year for each faculty member as self-appraisal, then appraisal by HOD and then by Principal. The appraisal is based on a well defined format which includes various faculty contributions as defined by OBA and the activities required to enable such contribution. Examples include papers published, research and consultancy activities, academic results of subjects taken, students' feedback etc with due weightage for each item.
  - *Findings from external sources:* In the accreditation by NBA Expert team, the data and the process of faculty development had been reviewed extensively and the expert team members recorded the findings as 'well qualified and dedicated faculty' as a strength.
- **Placement and new initiatives:** As a part of placement, the data is collected on placement of students and steps taken for yet-to-be placed students like special training etc. Based on feedback from stakeholders from industry, employer / recruiters etc, new initiatives are taken up as continuous improvement eg Value Added Courses, etc.
  - *Findings from external sources:* In the External Audit conducted by Certified ISO Auditors, the auditors recorded the findings that the process improvements implemented in the Placement have produced results like Placement above 95% and the Technoconnect Program introduced had fetched placement for more than 100 students in addition to regular placement.
- **Auditing as a means of Continuous Improvement:** As mentioned above, periodic audits are conducted by Internal Auditors once every 6 months and by External Auditor once a year. This has been found to be very useful as a thorough auditing of the academic activities have brought out any discrepancies (non-conformances) in the implementation of the current processes and opportunities for improvement in the current processes. Such findings are taken as inputs for improving the processes for continuous improvements. As the Internal Auditors, conduct audit departments other than their own, the auditors acquire knowledge of best practices of other departments resulting in knowledge sharing and implementing processes for continuous improvement in their own departments.

## CONCLUSION

Integrating OBA Criteria and the ISO compliant QMS enables implementing the OBE as a part of the institutional processes and continuous improvement. It also integrates the 2 activities into one and avoids duplication of work and improves productivity.

## REFERENCES

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- [4] <http://www.nbaind.org/En/1064-current-accreditation-documents.aspx>
- [5] [http://www.iso.org/iso/home/standards/management-standards/iso\\_9000.htm](http://www.iso.org/iso/home/standards/management-standards/iso_9000.htm)

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**Prof. M. Somasundaram** was graduated from Madras University in Electronics and Communication Engineering and he had done his Master of Technology in Electrical Engineering in IIT Kanpur. He has worked in the Information Technology (IT) industry for over 28 years and is currently working in RMK Engineering College for over 6 years as the Professor in the Department of Computer Science and Engineering (CSE). He started his career in DCM Data Products, New Delhi where he has worked in the R&D Division for over 5 years. He has been the Senior Design Engineer working in the area of Process Control and real time software systems. He later worked in Tata Consultancy Services (TCS) for over 23 years in various roles in Project Management, Software Engineering Tools Group, Innovation Lab, Customer Relationship Management, Capability Maturity Model (CMM) Implementation, Tata Business Excellence Model (TBEM) Implementation and Academic Interface Program. He has been the Principal Consultant in TCS.

His areas of interest include Software Engineering, Total Quality Management, Wireless Communication and Mobile Computing. He is the ISO QMS Management Representative (MR) for the RMK Engineering College.

### **Dr. Elwin Chandra Monie**

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**Dr. Elwin Chandra Monie** was graduated from Madras University in Electronics and Communication Engineering and he had done his Masters in Applied Electronics from Bharathiar University and Ph.D. from Indian Institute of Technology-Madras. He started his teaching career at Alagappa College of Engineering and Technology, Karaikudi and served in Government Engineering Colleges at various capacities. He was appointed as Principal of Thanthai Periyar Government Institute of Technology, Vellore and served there for six years. Elevated to the post of Additional Director of Technical Education, he was looking after the examination process of all the Polytechnic Colleges in Tamil Nadu for two years. He is serving as Principal in R.M.K. Engineering College since 2010.

He was awarded the 'Bharatiya Vidya Bhavan National Award for the Best Engineering College Principal' by Indian Society for Technical Education in the year 2012.

His areas of research are Image Processing and VLSI Design. Three Ph.D. candidates have completed their work under him. He has published over 35 technical papers in Journals/Conferences. He served as member of various committees constituted by Anna University, Directorate of Technical Education, Tamil Nadu, AICTE and UGC.