Integrated Quality Management System at Tomsk Polytechnic University

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Abstract

For the time being, institutional quality management systems and systems for academic programme quality assurance are not appropriately integrated at the majority of Russian and European universities. As a result, the efficiency and effectiveness of institutional quality management systems are very much limited. The solution to the problem could be putting together all quality assurance tools applied by a university to a complex system aimed at achievement of a principal target – high quality of education and graduates' competitiveness on national and international labour markets by means of necessary competencies acquisition.

The suggested approach is being adapted at Tomsk Polytechnic University by means of the development of an integrated quality management system (QMS). The subsystems of the presented integrated QMS are a competency-based standard for academic programmes, evaluation and accreditation criteria and procedures, HEI's processes management and strategic management of a university.

Introduction

Intention of Russia to foster knowledge-based economy implies the idea that national universities pay more considerable attention to the quality of academic programmes, improvement of tools for quality assurance of the HEIs main processes.

However, there is no concept of quality management system covering all HEI's activities in Russia. In Russia, unlike UK or Ireland, state accreditation is the main type of evaluation for a higher education quality assurance system. Only some indicators of HEI's activities are verified during state accreditation and licensing conducted by the Federal Agency for Education and Science Supervision of the Russian Federation. Russian universities, guided by their own principles and experience, unsystematically elaborate and implement tools for quality assurance, i.e. their own standards for academic programmes, quality management systems based on different models, and apply procedures of external evaluation of academic programmes through implementation of accreditation criteria.

As a result, institutional quality management systems and systems for academic programme quality assurance are not appropriately integrated. It leads to efficiency decrease in quality assurance of education, comparatively low competitiveness of graduates on the international labour market and insufficient attractiveness of the Russian higher education.

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Following world trends in quality assurance, Tomsk Polytechnic University (TPU) is developing its quality management system in accordance with the Federal Agency's requirements, the ISO 9001:2000 standard, ESG and EUR-ACE standards used by the European Network for Accreditation of Engineering Education (ENAEE) for evaluation of engineering programmes.

Starting 2005, a number of universities have been involved in the national project 'Education' for high school modernisation. In the framework of this project 57 RF higher education institutions including TPU were provided with substantial additional state funding. The main goal of the Innovative Programme in Education of TPU carried out within the project is elaboration of new academic programmes with novel methods of programme development and implementation, aimed at providing graduates with competences, which are keystones for their competitiveness on the labour market. A principal guiding tool for development of such academic programmes is a new Standard of Educational Programme (SEP) of TPU.

Integrated approach to development of quality system

Tomsk Polytechnic University practices an integrated approach to quality management. Its feature is consideration of all main quality assurance tools applied by a HEI as a complex system aimed at achievement of the main goal – assurance of high quality of education and graduates' competitiveness on national and international labour markets by means of necessary competencies acquisition.

The subsystems of the integrated QMS can be presented as a famous Russian nested doll ('Matryoshka') (Fig. 1).
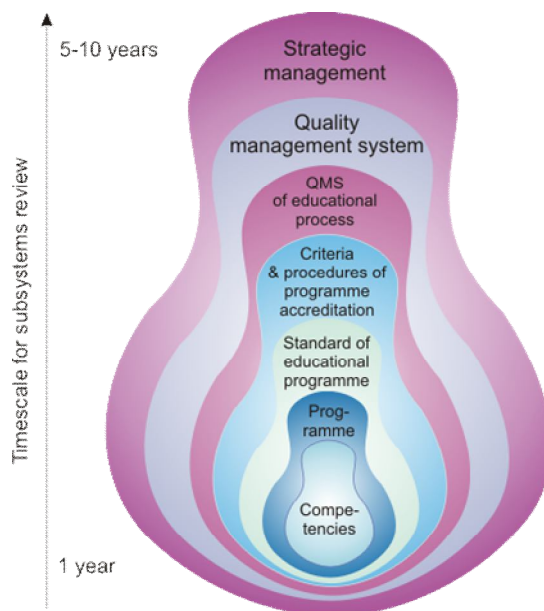

Fig. 1. Concept of HEI's integrated QMS

The competency-based approach to evaluation of higher education quality is gaining popularity worldwide. Graduates' competency implies 'readiness (including motivation and personality traits) to demonstrate abilities (knowledge, skills and experience) for successful professional activity when possible (problem and availability of resources)'.

To establish the subsystem 'competencies' of the integrated QMS, a HEI should be guided with standards of professional societies or governmental bodies responsible for higher education or criteria of accreditation agencies. Development of this subsystem needs continuous observation of the chosen reference points for timely amendments and updates diagnosis. Tomsk Polytechnic University defines competencies of its graduates in compliance with the requirements of the European Qualification Framework [1], the 'EUR-ACE Framework Standards for the Accreditation of Engineering programmes' [2] and the 'Graduate Attributes and Professional Competencies' agreed by bodies, which regulate recognition of results of engineering programme accreditation and international engineers mobility [3], as far as the TPU Mission is aimed at becoming an internationally-recognised University of high-level education.

A set of necessary competencies, conditions for their acquisition and assessment procedures are prescribed within an academic programme. An academic programme includes a curriculum, syllabi of courses (modules), introductory and industrial practice, a calendar plan, teaching and other support materials. It is a variety of academic programmes which meets current requirements of the labour market and society, as well as detailed published information on them that mainly determine competitiveness of a HEI. The main recommendations for this element of the integrated QMS are benchmarking for academic programmes development and annual review of academic programmes based on internal monitoring results.

TPU elaborated its own Standard of Educational Programme that covers design, approval, implementation, monitoring and improvement of academic programmes, which comply with the contemporary world trends and satisfy the needs of all stakeholders. It is worth mentioning that the way of SEP development in Russia is prescribed by the requirements of the Federal State Educational Standard of Higher Education. Foreign HEIs wishing to establish this component of the integrated QMS should be guided by the national law or analysis of similar regulations of leading world universities. A SEP should be periodically revised to assure its topical nature.

The TPU SEP consistent with the requirements of the world professional community (EUR-ACE Standards, ESG, accreditation criteria of the Washington Accord signatories and the Russian Association for Engineering Education (RAEE)) imposes conditions for academic programmes leading to various degrees/qualification (first cycle degree: Bachelor (four year programme), second cycle degree and qualification: Master (two year programme upon four-year Bachelor programme), Specialist (five-year integrated programme)) in different disciplines. Following the TPU SEP provides the basis for efficient design and implementation of 25 new Master programmes in the framework of the University innovative project 'Advanced Education for Elite Specialists in Engineering and Technology'. Seven Double Degree programmes are being developed in cooperation with European universities in prospective areas of science and engineering.

Programme accreditation, its criteria and procedures updated upon current trends in industry, science and education are one of the main elements of HEI's quality assurance. It takes effect during preparation for the accreditation procedures (revision of the objectives, outcomes, curriculum, teaching materials for an academic programme), thorough analysis of auditors' reports, planning and implementation of preventive measures taken.

To decide what particular accreditation criteria will be used for integrated QMS development, leaders in the domain should be determined upon analysis of the accreditation services market. Cooperation with accreditation agencies is a long-term partnership which should be established upon thorough consideration of probable benefits and restrictions including those covering requirements for competencies of graduates. Criteria and procedures of accreditation are modified from time to time, so higher educational institutions should be aware of all changes introduced.

TPU has been regularly submitting its academic programmes for national and international accreditation since 1995. In 1995 the University applied for external programme evaluation to the Independent Engineering Accreditation Center (Russia) and 11 TPU programmes successfully underwent accreditation procedures. In 2000, invited examiners of the Global Alliance for Transnational Education (GATE) from the USA, Australia and New Zealand scrutinised four TPU academic programmes for international students delivered in English. The audit confirmed that the University is guided by the main international principles for transnational education and the programmes were certified by the GATE for the first time in Russia [4].

The TPU second-cycle integrated programme in Computer Engineering passed the substantial equivalent evaluation procedure run by the Canadian Engineering Accreditation Board (CEAB) in 2005 [5]. Re-evaluation of the programme by the CEAB examiners was successfully carried out in 2008. The B.Sc. programme in Electrical Engineering was evaluated by the Accreditation Board for Engineering and Technology (ABET, USA) in 2006 [6]. As a result, the programme (content and quality) was acknowledged to be equivalent to the ABET accredited B.Sc. programmes in Electrical Engineering of the USA HEIs. Over ten TPU engineering programmes were accredited by the RAEE in 2003-2007 [7]. Examiners from the EC[UK] (UK) and ASIIN (Germany) took part in the on-site visits to TPU within the RAEE accreditation process in 2007. According to the results of these visits, four TPU engineering programmes were granted the EUR-ACE quality label and were put on the registers of the ENAEE and the European Federation of National Engineering Association (FEANI).

Designed in 2007, TPU and TU Berlin Double Degree programme 'High Technology Physics in Mechanical Engineering' (M.Sc.) will be submitted to accreditation by the RAEE and the ASIIN (Germany) in 2008.

The results of accreditation audits and auditors' recommendations are available for programme directors and can be an additional aspect for improvement of accredited programmes as well as other academic programmes.

Such mechanism as the 'European Standards and Guidelines for Quality Assurance in the European Higher Education Area' (ESG) is an integrated QMS element focused on academic programme quality assurance (see Fig. 1) [8]. These standards and guidelines developed as an essential component of a HEI's internal quality assurance system within the Bologna process, cover academic programme implementation placing special emphasis on quality assurance of an educational process at a university level. Although implementation of the ESG assumes working out large number of regulations, the standards and guidelines provide the opportunity to arrange and enhance efficiency, process transparency and attractiveness of educational activities at a HEI.

Taking into account that the ESG do not provide tools for the standards application and they need certain adaptation as an element of the integrated QMS, TPU approved a programme on normative papers adjustment in compliance with the ESG requirements and started its implementation. For example, the SEP of TPU highlights profoundly programme monitoring and improvement. TPU Department of corporate web-server development, in cooperation with other TPU offices, is elaborating a new version of the web-server, which will allow not only to publish detailed impartial qualitative and quantitative information on academic programmes and awarded degrees / qualifications and provide feedback from students and faculty, but also will improve communication between students and faculty and contain databases necessary to assure process transparency and supervision by stakeholders.

Each two or three years, to improve the stage of educational process QMS, a HEI should analyse regulations on the educational process in other countries (e.g. guidelines by the QAA (UK) and FINHEEC (Finland) in Europe or guidelines by the U.S. regional accrediting commissions (NWCCU, SACS, WASC-ACCJC etc.)) to detect best practices.

In spite of the key role of the educational process, sufficient attention should be paid to support processes which influence the educational process significantly; and, as a result, it might impact competencies acquisition by graduates. Quality assurance mechanisms of such processes are traditionally based on the Total Quality Management (TQM) principles using the ISO 9001:2000 model [9]. Moreover, at the QMS level, the guidelines IWA 2:2007 on ISO 9001:2000 standards application in education are taken into consideration. The second version of these guidelines was elaborated at the workshops of the International Organisation for Standardisation (ISO) in 2006. IWA 2:2007 guidelines interpret the ISO 9001:2000 standards for HEI faculty and propose additional principles to sustain university successful development. Guidelines IWA 2:2007 provides a form for self-assessment with instructions for application, examples of common educational processes, measures for educational processes assessment, tools for analysis and improvement of the educational process, etc.

The TQM concept, standard ISO 9001:2000 and guidelines IWA 2:2007 imply the process approach to HEI's activities. Permanent monitoring of the processes is an advantage of this

approach as it allows to reveal and eliminate shortcomings at the initial stage and prevent delivering of sub-quality services to the customers.

The quality management system at TPU was certified by the NQA Global Assurance (UK) against the ISO 9001:2000 requirements in 2001, first among the Russian HEIs [10]. A generalised pyramid of the TPU QMS processes and documents is presented in the Fig. 2.
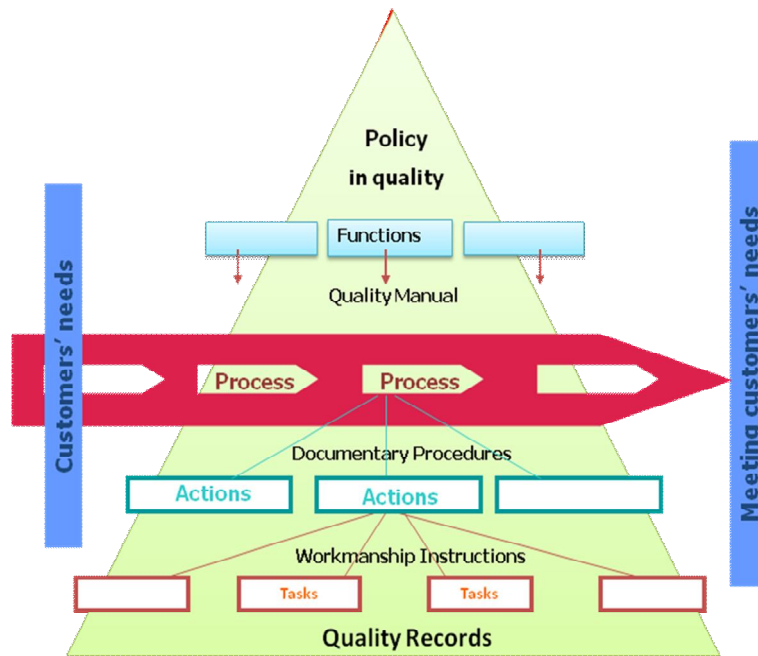

Fig. 2. Pyramid of TPU QMS processes and documents

In 2007 the TPU QMS was successfully recertified by the NQA Global Assurance. So, 27 University departments and TPU on the whole were granted ISO 9001:2000 certificates till 2010.

The integrated approach assumes that the university QMS is a tool for gaining HEI strategic goals. Formulation of these goals and decision on the ways for their achievement are made in the framework of strategic management. The University Mission and Quality policy assign long-term goals of the University. A five-year Complex Development Plan (CDP) defines mid-term lines of TPU development with indicators of its activities, and some key dimensions are provided with resources on a priority basis. Parameters of a CDP are widely discussed by TPU faculty and administration.

The objective of the first TPU CDP for 1991-1995 was transition to education of new generation specialists due to the transformation of Polytechnic Institute into a University. The main idea of the second TPU CDP (1996-2000) was to provide stable dynamic development of the University in the framework of market economy development in Russia. The third TPU CDP (2001-2005) was aimed at the University integration into the international scientific and educational community.

According to the current CDP-4, the objective of TPU is development of innovative nature of the University, which conducts top-rate research and educates highly qualified specialists able to make positive changes in their occupation and hence in economy and social life of Russia. The current

CDP (2006-2010) consists of five projects on the main aspects of the University development, ten target programmes and over twenty development programmes for TPU departments (institutes, faculties, centers, etc.) as presented in Fig. 3.
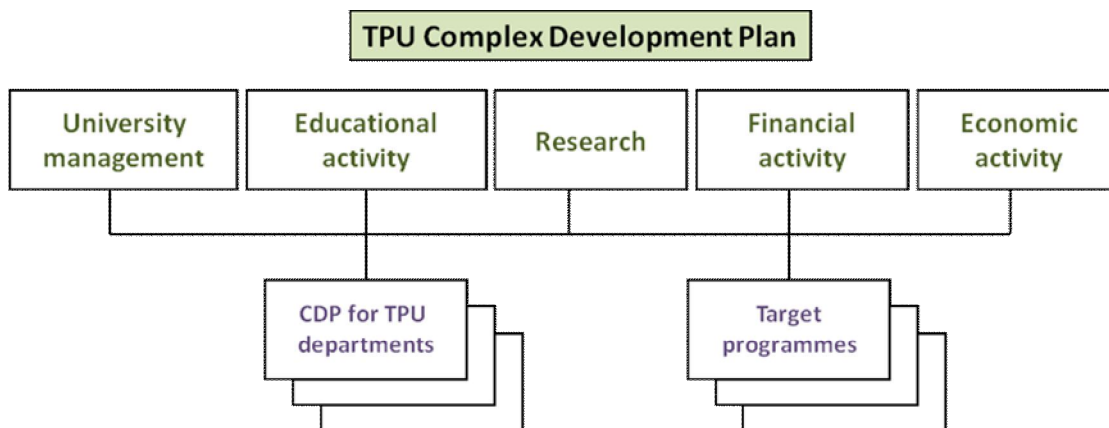

Fig. 3. General TPU CDP structure

It is obvious that the integrated QMS cannot be subject to external evaluation because there are no criteria of an independent body which cover all elements of the suggested integrated QMS. At the same time, a distinctive feature of any modern system is its internal and/or external monitoring. Customers' satisfaction and internal audits are used for internal monitoring. External evaluation of some system components according to the international rules and procedures serves as external monitoring.

Monitoring of customers' satisfaction is performed regularly by the Center for Information Analysis of TPU. The main instruments of monitoring are special questionnaires and tests. Reports on the monitoring results are submitted to the Quality Representative of TPU to make decisions on processes improvement. Persons and departments interested in monitoring findings are also provided with the relevant information.

Internal audits are run according to an approved plan to evaluate efficiency of the quality system, quality of education and science. Remarks made during an annual audit are put down in an audit report, which is submitted to the Quality Representative of TPU and a head of a department under the audit. Performance and efficiency of corrective actions aimed at elimination of revealed shortcomings are also analysed.

Elements of the integrated QMS are subjects to periodic external evaluation: the QMS of TPU is assessed against the provisions of BS EN ISO 9001:2000 by the NQA (UK) and academic programmes are under the accreditation of the ABET (USA), CEAB (Canada), ENAEE (EU) and RAEE (Russia). External evaluation is a regular procedure that allows improving particular components of the integrated QMS as well as the integrated quality management system as a whole.

Assurance of QMS components integrity

It is important to arrange management process and links among subsystems of an integrated QMS taking into consideration the level hierarchy. Developers of the integrated system should keep in mind a 'core' of the system – graduates' competencies. The main problem is not to neglect assurance of competencies' acquisition providing operation and improvement of particular components of the system.

Correlation of the integrated QMS elements is provided by processes running according to by-laws covering several subsystems such as a Complex Development Plan of the University, the Quality Manual and the Standard of Educational Problem.

Statement of main indicators of any CDP is to be consistent with the University Mission and Policy. If required, elimination of contradictions is undertaken at meetings of the Quality Council of TPU and the Academic Board of TPU by adjustment of the Mission and/or the Policy. Operation of the described subsystems 'competencies', 'quality management system' and 'strategic management' is interdependent: developers of an academic programme have to provide compliance of goals of the programme with the University Mission and Policy defining graduates' competencies. At the same time, if modifications of competencies in an academic programme have iterative nature due to substantial changes in main stakeholders' demand, they are reflected in a Complex Development Plan, the Policy or even in the Mission, providing integration of all levels of management hierarchy.

Requirements of five "lower" subsystems are incorporated into the SEP. All educational departments and faculties of TPU must be guided with the SEP with internal audits regularly checking its execution.

Conclusion

The integrated QMS joins different management hierarchic levels from strategic management to a particular academic programme and competencies. That is acknowledged with regular monitoring of customers' satisfaction, findings of internal audits against organization requirements, external evaluation of some system's elements against the standard ISO 9001:2000, and criteria for academic programmes accreditation of national and foreign accreditation agencies. It is expected that integrated QMS should improve the quality of education and research at University as well as competitiveness of its graduates on the national and international labour market.

Reference

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Suggested questions for the follow-up discussion

1. What are the strong and the weak points of the integrated QMS adaptation?

2. Is the strategic management a part of the subsystem 'quality management system' or the independent top-level part?

3. How is the ESG essential for the proposed integrated QMS concept?