1.0 Introduction

Education can be considered as a “network of interdependent components that work together to try to accomplish the aim of the system” (Deming, 1993), where the system consists of inputs, process and outputs. The inputs of the system are its resources which in higher education represent students, information and various other learning resources. Through the educational processes these inputs produce its outputs; the graduates (Becket and Brooks, 2006). Education quality can be considered as a system that “constitutes the input, process and output of education and provides services that satisfy both the internal and external strategic constituencies by meeting their explicit and implicit expectations” (Cheng and Tam, 1997). According to the United Kingdom body called “Quality Assurance Agency for Higher Education (QAA)”, “Academic quality is a way of describing how well the learning opportunities available to students help them to achieve their award.

2.0 Higher Education Institutions’ challenges to develop quality in their operations

The main challenge to adapt the principles of TQM in Higher Education is the need to deal with the intangibility of educational processes. TQM need to accommodate the intangible aspects of student learning which have direct effects in teaching and learning quality in higher education (Venkatraman, 2007). Moreover, in the age of increasing competitive pressure and finite individual and institutional resources the educational institutions have started to feel the pressure to change and reform (Koslowski III, 2006). The rapid change of technology (Venkatraman, 2007), the continuous changes taking place in the economic and social environment, the increasingly diverse student population as a demand for universal access (Becket & Brooks, 2006), the greater teaching and learning expectation of students as paying customers and the optimisation of
university scarce monetary, information, infrastructure and technological resources (Calvo-Mora et al, 2006) are catalysts to customer orientation adoption in Higher Education and consider TQM as a process-oriented approach which has the ability to improve quality of service and process effectiveness (Kanji et al, 1999).

3.0 Higher Education Institutions’ engagement of quality principles and criteria

The facilitation of change and innovation in the academic institutions in order to implement successfully quality management encompasses the management of quality perspectives of both internal and external education stakeholders (Becket & Brooks, 2006). According to Venkatraman (1997) the authors Srikanthan and Dalrymple consider “courseware as products, the current prospective students as users of products and the graduates as output with employers as their users”. The customer focus, process orientation and continuous process improvement quality principles are very much applicable in Higher Education (Lundquist, 1998). Spanbauer (1995) refers to students as primary customers not knowing what they need to learn and considers faculty as the balance bar between students and employers’ needs. As far as continuous improvement concerns self-University-improvement, academic work improvement and society improvement depend on TQM issues’ implementation (Venkatraman, 2007). Process management is affected by the efficiency with which resources and alliances are managed (EFQM, 2003).

4.0 Universities’ needs and process quality problems

There is still no universal consensus about the best way of quality improvement initiatives management within higher education institutions (Becket & Brookes, 2006). There is a disparity between TQM techniques and educational processes and also lack of shared vision within academic institutions or educational fields (Srikanthan & Dalrymple, 2005). Venkatraman (2007) supports Bringham’s conclusion that TQM’s success in Higher Education field depends on the lessons drawn from industry TQM application results.

So failure to identify the customer, to diminish academic employees’ culture to resist to change, to optimise resources, to gain leadership and senior management commitment towards achieving quality and dealing effectively with providing full commitment of TQM implementation towards all educational processes, to produce sufficient curriculum design or course delivery, to measure, monitor and improve product characteristics and academic processes performance, to control the variability of the teaching process and to achieve positive TQM return on investment has its origins to industry field (Venkatraman, 2007; Calvo-Mora et al, 2006; Sirvanci, 2004; Cruickshank, 2003; Kanji et al, 1999). “Higher Education may borrow ideas and methods from business to improve the output of their students” (Sirvanci, 2004).

5.0 TQM benefits for Higher Education

According to Venkatraman (2007), Schmoker and Wilson have stressed that the adaptation of TQM in the education context provide an excellent opportunity for success.
Academic people need to acquire, through TQM, concepts, practices and “system thinking” in order to acknowledge the way that their actions or initiatives affect the other people (Detert & Jenny, 2000). Also the “system thinking” of process and organisational improvement which concern quality assurance and quality enhancement correspondingly reflect highly developed academic learning quality (Avdjieva & Wilson, 2002). Moreover, the realisation of university mission leads continuous processes improvement to educational quality (Cruickshank, 2003). These processes are described in the quality criteria of European Business Excellence Model of EFQM. This model helps organisations to diagnose the state of processes’ performance health providing an indication of the way to achieve business excellence and a holistic way to ensure long-term success (Dale, 1999). This holistic way presupposes the coordination of EFQM enablers to define what organisations must do in order to achieve excellence and to establish the way that policy and strategy must be put into practice through a key process group (Calvo-Mora et al. 2006; Eskildsen & Dahlgaard 2000).

6.0 Role of model combination in the educational process improvement

The first move towards educational quality is the identification of the role play of processes in the educational system (Owlia & Apinwall, 1996). The introduction of process-oriented approaches, which reflect organisational and individual commitment to continuous quality and process improvement, integrating all aspects of the core issues of higher education institutions (Grant et al, 2004; Marshall, 1998) will increase capability of meeting students requirements, awareness of student problems, satisfaction of needs and expectations of the faculty, the students, the academic staff, the professional bodies and the community and improvement of process baseline results through the evaluation of the effectiveness of process improvement programmes and total quality initiatives (Osseo-Asare & Longbottom, 2002).

Literature review has acknowledged the need to combine TQM models with academic ones undertaking a synthesis of features in order to develop a holistic model or an integrated educational quality management system which will be able to address educational processes and manage quality in Higher Education (Sakthivel & Raju, 2006; Srikanthan & Dalrymple, 2005).

This holistic model or the integrated educational quality management system is designed to determine current and future customer requirements, to focus on what and how students are learning and on how student learning can be improved (Trigwell & Prosser, 1991), to use the assessment of student learning not as test method of their learning but as a part of the overall academic strategy towards real student learning, to encourage academic authorities to deliver value to students through the enhancement of their career prospects and through the presentation of innovative and creative skills of lecturers and administration personnel and to help academic institutions to tailor their own processes to different educational requirements (Srikanthan & Dalrymple, 2005).

Moreover, the spring of the correlation between higher educational TQM models and commercial models (Becket & Brooks, 2006) comes, as mentioned before, from the inability of academic institutions to incorporate TQM techniques into educational processes (Srikanthan & Dalrymple, 2005).
7.0 CMMI concept in Higher Education

Such a commercial model which can be combined with TQM principles is suggested to be CMMI, the Capability Maturity Model Integrated, which was developed by both U.S. Department of Defence and Software Engineering Institute at Carnegie Mellon University. Its first release was in 1991 and was known as “Capability Maturity Model”. The staged representation version of the model represents an integrated framework for software process improvement which consists of five maturity levels of process assessment. Maturity level is the degree of process improvement after the attainment of all of the goals of a predefined set of process areas which supports this improvement (Humphrey, 1989; SEI, 2006).

There is a commonality between software and teaching and learning process improvement (Lutteroth et al, 2007; Thompson, 2006; Marshall & Mitchell, 2004; Haigh, 2004; Neuhauser, 2004). The capability of the organisation to develop software product from processes which are tailored to specific customer requirements and are institutionalised repeating their successful results (Chrissis et al, 2006) is translated in the context of the maturity of the higher educational learning activities as a definition of the extent to which an academic individual, the student, has developed its capability to achieve learning outcomes, to fully understand the subject under study requirements with a repeated and reliable manner (Thompson, 2006). In other words, the leaning maturity of the student depends on his capability to select the appropriate learning strategy that meets the subject under study requirements and his understanding objectives (Thompson, 2006).

On the other hand, the maturity of the higher educational teaching process can be described as a definition of the extent to which an academic individual, the lecturer, has developed the capability to achieve teaching outcomes, to fully understand the subject under study requirements with a repeated and reliable manner and also to define teaching performance in a way that enhance student learning outcomes (Thompson, 2006; Robins et al, 2003).

Many authors generate and cultivate the idea to adopt CMMI in education, like Marshall & Mitchell (2004) analysing the e-learning maturity model, Thompson (2006) analysing the learning maturity process, White et al. (2003) analysing the information systems maturity process, Neuhauser (2004) analysing the online course design maturity process, Lutteroth et al. (2007) analysing the teaching maturity process in course delivering, conclude that “Unlike CMM, the maturity levels are used for the evaluation of each practice and not just the whole organisation” (Lutteroth et al, 2007).

CMMI represents the capability of the organisation as a whole to manage process improvement through certain process maturity levels. In the field of software development “most existing software process improvement research concentrates on -what- activities to implement rather than -how- to implement them” (Niazi et al. 2005). CMMI as a model, which identifies strengths and weaknesses in an organisation’s software development processes building a consensus around fundamental software development problems, does not focus on “how” the organisations should do the “whats” but provides the tools to understand “what to do” in order to enforce best practices or confront process problems (Jiang et al., 2004).

The interpretation of educational process improvement in the basis of a technological oriented model like CMMI will offer alignment opportunities of higher
educational institutional priorities with information technology best practices (Nelson, 2005). These practices will enable academic institutions’ process agility towards the improvement of the speed of their response to environmental change. The good use of the CMMI tools towards educational process improvement starts from the understanding of the identification factors of the process that helps academic people to design its implementation policy and strategy. The role of total quality management frameworks which guide the integration of process improvement policies and strategies to academic quality management system is critical. Moreover, the adoption of an academic process improvement implementation maturity model will help the institutions to effectively implement their educational process improvement initiatives after CMMI process assessment.

Diagram:
Model combination issues towards academic process improvement

8.0 Example of CMMI dynamic towards best practice process enhancement

The first step towards the understanding of educational process improvement correlation with CMMI issues is the acquaintance of Higher Education environment with them. Twenty two certain key process areas are correlated in order to support the roadmap, in order to provide the tools for process improvement or enhancement (Chrissis et al, 2006). Grant’s et al (2004) reference of a TQM best practice called “benchmarking” and based on Kock & Fisher work, produces the basic process building block which is called “review of the best practices of other academic institutions in order to design quality more effectively”. According to the first maturity level this specific benchmarking process is neither understood nor reflected upon. The university environment in this level is chaotic, unstable and unpredictable. The quality management system which supports
the specific process is non-existent or does not work properly and the success of the process depends on the heroic efforts of the academic people who intuitively or self-motivating manage to monitor the quality initiatives of the other academic institutions.

During the second maturity level, planning and implementation of the specific process, namely of the other academic institutions’ best practice review, are based on previous experience of the academic authorities and process progress is tracked. The academic organisation through the establishment and incorporation of its policy and strategy into the important aspects of this specific process develops procedures to implement the process. During the third maturity level the benchmarking process is controlled systematically producing not only repeatable results through the implementation of its well documentation, which reviews successfully the best practices of other academic institutions, but also the necessary mechanisms to adopt the results of these reviews configuring the academic quality goals and educational priorities ensuring continuous competitive advantage of the institution against the others.

The fourth maturity level is the level of the establishment of process measurement programmes. The development of a database system is used to store all the benchmarking process evaluation results which come from the specific benchmarking process statistic measures. These measures control the benchmarking process ability to meet its design requirements and the objectives of its use. During the fifth maturity level the common causes of benchmarking process variation are understandable meaning that the process can be changed statistically achieving the established quantitative process improvement objectives, reflecting best practice and also reflecting changing academic objectives. The main reasons of non-conformances of benchmarking process towards meeting certain academic quality goals are identified, analysed and successfully confronted.

9.0 Conclusion

The quality journey of the contemporary academic institutions and academic research centres meets barriers which have their origins in manufacturing industry. The suggestion of this paper is the combination of TQM quality principles with CMMI model in order to provide a roadmap for the academic institutions to use CMMI tools ensuring the effectiveness of process improvement or enhancement. The alignment of higher educational priorities and TQM educational benefits with information technology best practices may enable their process agility towards the improvement of the speed of their response to environmental change. Further research is going to study the contribution of the higher educational process implementation strategy methodologies to higher educational process improvement or enhancement after being assessed according to CMMI requirements.

10.0 References


EFQM (European Foundation Quality Model), 2003, [http://www.efqm.org](http://www.efqm.org)


SEI-Software Engineering Institute, (2006), *CMMI (Capability Maturity Model Integrated) for Development, Version 1.2, Staged Representation*


