Trends in quality management research in higher education institutions

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Abstract

Purpose – The purpose of this paper is to determine the state of research in quality management (QM) in higher education institutions based on a review of the academic literature. The aim is to provide universities with the best evidence for informing their focus and models for quality improvement. Despite quality's role growing in importance as universities strive to compete in an increasingly underfunded market for students and research funds the review shows that current research is limited in volume and scope.

Design/methodology/approach – To ensure the widest coverage in our systematic literature review we use three databases: ScienceDirect, ABI/Inform, and Emerald.

Findings – The findings show that the three most common topics are QM implementation issues, QM models, techniques and tools, and QM dimensions. The key QM enabling dimensions found are: people management, process management and information and analysis, while the results dimension is predominantly focused on an understanding of stakeholders' requirements and feedback on their perceptions of performance. The authors find in this literature that students are discussed as both end customers as graduates and participants in the learning process who have views on their experience. Also provided is an analysis that shows popular journal outlets, research methodologies used and country focus. The paper concludes with recommendations for the development of QM for universities, and a future research agenda.

Originality/value – This paper is the first literature of research in QM in Higher education institutions following the model used in previous literature reviews on QM and operations management.

Keywords Quality improvement, Quality management, Higher education institutions, Quality dimensions, Quality models

Paper type Literature review

1. Introduction

Universities and other higher education institutions (hereafter referred to as HEIs) face financial constraints imposed by governments, as well as pressure to improve their ranking in the performance tables of HEIs produced by newspapers so that they can improve student recruitment (Foskett, 2010; Tambi *et al.*, 2008). These pressures are having a profound impact on the traditional way that educational institutions manage their processes. HEIs are increasingly willing to adopt quality practices and systems (Sohail *et al.*, 2003; Sultan and Wong, 2014), so that they can improve the quality of learning, which it is hoped will improve degree results and student satisfaction (Sahney *et al.*, 2008). These quality practices are similar to those adopted in industry where quality management (QM) is seen as fundamental in achieving improvement in the quality of outcomes while lowering costs (Dick *et al.*, 2008; Lam *et al.*, 2012). This suggests that improving QM in education should be a priority (Sahney *et al.*, 2008).

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In order to improve QM in HEIs, an understanding of the current literature should inform policy and practice. Although findings from the literature do not always reflect practices in the real-world, they can serve as guidelines for decision making. Consequently, the review of the literature presented in this paper can inform practitioners about the trends and issues in managing quality in HEIs. The literature is relevant and provides information that can inform the direction of future research into QM in HEIs.

The primary aim of this study is to analyse published research on QM in HEIs to identify the topics and quality dimensions that are important for HEIs. The secondary aim is to identify the journals that publish the most articles, the countries contributing to research and the research methods used. This paper's contribution is that the review provides a much broader scope than previous literature reviews on QM in HEIs in terms of the breadth of the literature examined in the systematic searches and the range of topics that are analysed in depth. Previous reviews analysed only a few articles (e.g. 14 articles reviewed by Owlia and Aspinwall, 1997, and 18 articles reviewed by Grant *et al.*, 2004), reviewed the literature in a selective way, for example comparing how quality models in HEIs were adapted from business (Becket and Brookes, 2008) or examined how the QM principles are addressed and integrated in HEIs' management systems (Manatos *et al.*, 2014). The review presented here supplements and extends these previous literature reviews to describe improvement in QM practices in HEIs, the dimensions that can be used to manage quality in HEIs and the directions for future research into QM in HEIs. To carry out this review the present paper follows the model used in previous literature reviews on QM and operations management (Machuca *et al.*, 2007; Sila and Ebrahimpour, 2003; Tarí, 2011).

To ensure the widest coverage in this systematic literature review three databases are used: ScienceDirect, ABI/Inform, and Emerald. The sections that follow offer an analysis of earlier relevant reviews and detail the methodology used to conduct the literature review. Then we proceed to analyse the literature and discuss the results. Finally, the paper suggests conclusions, recommendations for HEIs for the development of QM, gaps in the current literature and directions for future research into QM in HEIs.

2. Literature review

To provide a wider theoretical context for our review we start by summarising previous literature reviews that can inform our analysis. We start by examining the operations management field where QM is prime topic followed by reviews of QM in general. Then we look in greater depth at previous reviews on QM in HEIs. Regarding operations management, for example Amoako-Gyampah and Meredith (1989) analyse publications in this field in ten scientific journals over a period from 1982 to 1987 in order to propose a taxonomy of research comprising 17 topics. Similarly, Machuca *et al.* (2007) examine the state of the art in service operations management research in ten of the most relevant journals in the field of operations management, as well as research that is on-going. They analyse the importance of service operations management research within operations management research, possible topics for service operations management research, the methods used in research and the sectors of activity on which the research focuses.

In the field of QM, Sila and Ebrahimpour (2003) analyse and compare the critical QM factors reported by 76 survey-based studies in order to identify the common factors that have been successfully implemented in various countries. For that study, the authors search using 15 keywords and the following databases: Elsevier Science, Emerald, ABI Inform Global and Anbar International Management. They report the number of studies across countries and the most common QM factors: leadership, customer focus,

information and analysis, training, supplier management, strategic management, employee involvement, human resource management, process management, teamwork, product and service design, process control, benchmarking, continuous improvement, employee empowerment, quality assurance, social responsibility, and employee satisfaction. Nair (2006) conducts a meta-analysis of correlations to examine the empirical research in QM and to determine which QM practices are positively related to improved performance. To obtain a sample for this study, Nair uses a computer search of the ABI Inform database using the Boolean expressions total quality management or QM and performance. Molina-Azorín *et al.* (2009) carry out a literature review in order to propose and analyse dimensions for QM, environmental management, quality and environmental management, and firm performance. Regarding QM dimensions, these authors analyse measurement studies and QM-performance studies. In relation to the review of the empirical studies devoted to QM-performance links, these authors conducted a computer search of the ScienceDirect, ABI/Inform, and Emerald databases using the expressions QM, TQM, ISO 9000, or ISO 9001 and performance (results and profitability). Based on this review, the following dimensions can be suggested as the most common for QM: leadership, people management, planning, information and analysis, process management, supplier management, stakeholder focus, and design (Sila and Ebrahimpour, 2003; Nair, 2006; Molina-Azorín *et al.*, 2009).

Few studies report a literature review of QM specifically in HEIs. Among those, Owlia and Aspinwall (1997) conduct a review of papers related to QM initiatives in the USA and the UK to identify QM dimensions. Based on ten QM success factors, the authors indicate which success factors appear in each of the cases analysed in the articles reviewed in the USA (14 cases) and in the UK (six cases): top management commitment, strategic planning, organisations for quality, employee involvement and team working, training for quality, design management, process management, supplier QM, and information and analysis. Grant *et al.* (2004) analyse 18 papers (nine USA and nine international) to investigate the state of affairs in QM. They evaluate the university QM initiatives discussed in the 18 papers. Becket and Brookes (2008) present a review of current QM practices in HEIs. They analyse several studies that show quality models (e.g. excellence models, performance measures, internal audits, ISO standards, etc.) adopted by HEIs. Manatos *et al.* (2014) examine how the literature has approached QM in HE and how the QM principles are addressed and integrated. They use Elsevier's Scopus database using the term "QM" and "HE" and analyse 58 articles. They categorise the articles that they identify on the basis of their methodological approach and also identify the main QM principles (customer focus, leadership, involvement of people, process approach, system approach, continuous improvement, factual approach and supplier relationships). Collectively, these papers provide a literature review of QM in HEIs that analyses a set of papers related to QM in HEIs in order to describe QM dimensions and models used by HEIs. The QM dimensions identified by these papers are similar to those examined by studies on reviews in the field of QM. With the exception of the work of Manatos *et al.* (2014), these papers on reviews on QM in HEIs do not use a systematic computer search to elucidate, amongst other things, the topics analysed, the research methods used, the countries studied, and QM dimensions, as several papers in the operations management and QM fields have done. Consequently, a study based on a literature review, similar to those carried out by various authors in the operations management and QM fields, will be a valuable addition to the literature and will provide information about current QM approaches in HEIs.

3. Methodology

This paper presents a systematic literature review of the literature on QM in HEIs. Previous studies have carried out systematic literature reviews in the QM field (e.g. Heras-Saizarbitoria and Boiral, 2013), in service management (e.g. Galvagno and Dalli, 2014) and in QM in HEIs (Manatos *et al.*, 2014). Many previous papers on reviews have been based on the principles of a systematic review provided by Tranfield *et al.* (2003) and Denyer and Tranfield (2009) (Jones and Gatrell, 2014). Here we undertake a systematic literature review of QM in HEI's following the methodology suggested by Tranfield *et al.* (2003) and used later by other scholars (e.g. Tarí, 2011; Thorpe *et al.*, 2005):

(1) planning the review (objective and protocol);

(2) conducting the review (identification of research, selection of studies, assessment of article quality, data extraction and data synthesis); and

(3) reporting and dissemination (descriptive analysis and thematic analysis).

3.1 Planning the review

In planning the review the paper follows the model used in previous literature reviews on QM (e.g. Sila and Ebrahimpour, 2003) and operations management (e.g. Machuca *et al.*, 2007). It uses a dual approach following the methodology suggested by Tarí (2011). This method uses both internet searches of relevant journal databases following the methods used in a rigorous literature reviews on operations management and QM (e.g. Sila and Ebrahimpour, 2003) combined with a detailed search in each relevant journal (e.g. Amoako-Gyampah and Meredith, 1989). The criteria used for inclusion is that articles are in peer reviewed academic journal articles that analysed QM in HEIs in teaching, research or administrative services from a managerial perspective. The methodology used in each article was assessed in order to exclude articles where the methods used were unclear. This procedure reduced the risk of including findings based on conjecture. The research focuses on academic papers and does not consider works in the trade press or popular press.

We anticipated that papers found would fall into two journal subject groups: business and management journals (B), and education management journals (E). These two groups of journals were targeted for analysis and comparison of articles. Previous literature reviews in the operational and QM fields focused on different areas to carry out their analyses of literature, covering such areas as topics, dimensions, journals, countries and methods (Lockett *et al.*, 2006; Machuca *et al.*, 2007; Nair, 2006; Sila and Ebrahimpour, 2003; Tarí, 2011). Similarly, Manatos *et al.* (2014) examine QM dimensions in their review of articles on QM in HE. Based on these ideas the plan for analysis is to extract information on the following five areas:

(1) Topics in QM: As there is no a standard classification, as there is in other areas (e.g. Machuca *et al.*, 2007), these topics will emerge through content analysis.

(2) QM dimensions: Based on those most commonly cited in the articles analysed.

(3) Journals: By frequency of articles published (Tarí, 2011).

(4) Countries contributing to research: Sila and Ebrahimpour (2003) analyse QM dimensions in survey studies that sampled companies located in 23 groups of countries. Most of the studies surveyed companies only from only one country. If a study reports measures for different countries, the authors consider these studies as separate studies for the purpose of grouping QM

dimensions for each country. Accordingly, the present paper considers, for theoretical studies, the country where the authors were working as identified by their institutional affiliation. For empirical studies the country is the one where the empirical study was carried out.

(5) Methods: classified into theoretical studies (separated into conceptual frameworks/models and literature reviews), and empirical studies (separated into qualitative, quantitative, or mixed methods). This method of classification combines some of the most widely used ideas found in the research methods literature on classification where there is a wide range of approaches but little agreement (e.g. Lockett *et al.*, 2006; Machuca *et al.*, 2007).

3.2 Conducting the review

The initial search examined ScienceDirect, ABI/Inform, and Emerald databases as these have been widely used in previous literature reviews (e.g. Heras-Saizarbitoria and Boiral, 2013; Tarí, 2011). We searched article abstracts using the search expressions – Education and "TQM" (total quality management) or "quality management" or "quality assurance" or "ISO 9000" or "ISO 9001" or "EFQM" or "excellence model" or "six sigma". These expressions were chosen as these are QM methods and philosophies applied by business and HEIs as well as common themes examined in the QM field (Linderman *et al.*, 2003; Molina-Azorín *et al.*, 2009).

Altogether, the searches yielded 745 articles – 19 articles in ScienceDirect, 452 in ABI/Inform, and 274 in Emerald. Of these 745 articles we identified 103 duplicate articles reducing the total to 638 articles. These were then scrutinised to ensure that their contents are relevant to the aims of the review. First, the abstracts of the articles were read; if these are not sufficiently clear on any aspect, the full version of the paper was reviewed. This resulted in the exclusion of 450 articles (because they do not fulfil the criteria for inclusion) leaving 188 papers for detailed analysis against our assessment criteria.

As QM is an important topic in the operations management field, we expanded the search terms in three operations management journals in the Social Science Citation Index (SSCI) management category: *Journal of Operation Management*, *OMEGA*, and *International Journal of Operations & Production Management*. They are top ranking journals that are known to publish articles on QM. In this search, we use the keywords "education" or "educational". This search found eight articles in the *Journal of Operations Management*, 40 articles in *OMEGA*, and 30 articles in the *International Journal of Operations & Production Management*. Using the inclusion criteria described earlier we evaluated the abstracts of these 78 articles to ensure that they fulfilled the criteria for inclusion. Only six were found to meet the aims of the study making a total of 194 articles to be read and analysed. During the reading of the 194 articles we checked for references that could be relevant to our research aims, and in this way found some new articles. These new articles were then read to see if they meet the inclusion criteria. Eight articles were added, giving a total sample of 202 articles from 45 journals to analyse in detail.

3.3 Reporting and dissemination

To record the evaluation of each article we used a database with fields for: details of topics, QM dimensions, journal, year, country, and methodology and from this data developed tables and figures that were designed to summarise the topics, QM dimensions, journal, year, country, and methods. Based on the database of the whole

202 articles we develop thematic analyses and used SPSS to analyse the frequency of the set of categories examined (journals, years, topics, methods, countries and QM dimensions) and employed χ^2 tests or Mann-Whitney U tests to test if there are statistically significant differences between groups.

4. Results

4.1 Topics

Table I shows the numbers of articles dealing with each topic and the percentage of the total that they represent. Taking all the journals together, the topics that have been most frequently discussed in QM in HEI studies are those referring to QM implementation (42 per cent), followed by the implementation of quality models, techniques and tools (24 per cent) and QM dimensions (10 per cent). These first three topics clearly stand out from the rest; the Mann-Whitney U test shows that there are significant differences ($p = 0.014$), and these groups include 76 per cent of the articles. In business journals there are also differences between the first three topics and the rest ($p = 0.013$), whereas in education journals the differences are noticeable between the first two topics and the rest ($p = 0.032$). This means that the most examined topics in QM in HEIs studies are about QM implementation, QM models, techniques and tools, and QM dimensions for HE. Business journal cover all three of these while education journals tend to focus more on QM implementation and QM models, techniques and tools and less on QM dimensions.

Business journals reflect the ranking found for all the articles, with QM implementation (36 per cent), the adoption of models, techniques and tools (e.g. ISO 9000, SERVQUAL, etc.) (25 per cent), followed by issues related to QM dimensions in HEIs (17 per cent). For education journals QM implementation represents an even higher percentage (48 per cent), with models/techniques and tools (23 per cent) being similar to business journal. Education journals are different in ranking quality assurance collaboration in third place (6 per cent) and barriers to QM (4 per cent) in fourth place, followed by QM dimensions (3 per cent).

Table I shows the topic of QM dimensions is important in business journals, but not so common in education journals. This is probably due to the fact that QM has its origins in industrial practices that have been extensively researched in management

	Theoretical		Empirical		Total			Percentage		
	B	E	B	E	B	E	Total	B	E	Total
QM implementation	22	34	18	21	40	55	95	36	48	42
Models, techniques and tools	8	8	19	19	27	27	54	25	23	24
QM dimensions	3	2	16	2	19	4	23	17	3	10
Barriers to QM	3	4	4	1	7	5	12	6	4	5
Status and/or effectiveness of QM			7	3	7	3	10	6	3	4
Quality assurance collaboration	1	4		3	1	7	8	1	6	4
Definition of customer/stakeholders	5	2			5	2	7	5	2	3
Quality assurance in countries	1	3	1	1	2	4	6	2	3	3
Quality assurance requirements	1	4			1	4	5	1	3	2
Role of governing board/bodies in QM		2		1	0	3	3	0	3	1
Definition of QM	1	1			1	1	2	1	1	1
	45	64	65	51	110	115	225			

Table I.
Topics in QM in HEIs studies

Notes: B, business articles; E, education articles

journals where the QM literature analyses how to introduce and measure QM, QM dimensions and their measurement and QM and business performance.

This review also shows some similarities and differences between QM literature in the business and education areas. The most common topics about QM in HEIs in Table I reflect those found in the general QM literature (Curkovic *et al.*, 2000; Flynn *et al.*, 1994; Molina Fernández *et al.*, 2003; Saraph *et al.*, 1989). Similarly, these topics support the review by Harvey and Williams (2010) of contributions to the journal *Quality in Higher Education*. They indicate that the key issues in this journal are the definition of quality, external quality assurance processes, quality models (e.g. audit, accreditation), international and national framework and systems, industrial models, performance vs financial funding, improvement and accountability and specific dimensions critical for HE such as management and leadership. This means that the issues investigated from the educational QM perspective are similar to those analysed in studies of QM in HEIs from management journals. The main divergence is that accountability is more prominent in the education field.

In addition, comparing the findings in Table I to the topics that are found in the literature on QM in industry we note other issues that need to be discussed. First, although the review indicates some attempts have been made regarding QM in HEIs, more research is needed on QM dimensions in HEIs to clarify in greater detail the aspects managers should focus on when introducing QM. Second, an important issue in research published on industry is the analysis of the effects of QM practices on business performance (e.g. Kaynak, 2003; Psomas *et al.*, 2013). In contrast for HEI we find little focus on QM and HEI performance in the articles we examined apart from those on research performance. This gap indicates an important future field for QM research in HEIs. In spite of this fact, the evidence found also show that QM practices can have positive effects on outputs, such as teaching and research performance (e.g. Bayraktar *et al.*, 2013).

Clarifying the role of QM implementation is important and here we find a wide range of articles on the topic of QM implementation and studies of the critical factors for the development of QM (e.g. leadership, culture and organisational issues), QM practices (e.g. leadership, customer focus, people management, etc.), and the steps to implement QM in HEIs in general (mainly theoretical articles) while empirical articles focus on a specific programme, an administrative function, or an academic department.

Articles related to the topic of dimensions of QM tend to approach the topic through analysis of the quality models used in HEIs. Very few theoretical papers identify these dimensions and but there are more papers that use empirical methods to compare and identify the dimensions or in addition propose a measurement instrument and analyse the instrument's validity and reliability. In the next section we examine QM dimensions in greater detail.

In the articles that featured the models, techniques and tools, we found that in both business and education journals, theoretical articles typically analyse the quality assessment procedure, whereas empirical articles analyse the adoption of well-known quality models (e.g. ISO 9000, EFQM, MBNQA, etc.) in the HEI as a whole institution, or in a service or a faculty. However, some authors suggest new models designed for academic institutions (e.g. Owlia and Aspinwall, 1998; Srikanthan and Dalrymple, 2007) or suggest methods for the measurement of administrative quality in universities (Waugh, 2002). Others discuss the models created specifically for measuring education institutions, such as the Malcolm Baldrige criteria for performance excellence for education or for the accreditation of academic institutions by quality award bodies (e.g. AACSB, EQUIS). Alongside these models, several academic studies develop instruments for measuring QM

that are applicable to both manufacturing and service organisations and which can be used as a guide by HEIs (Ahire *et al.*, 1996; Conca *et al.*, 2004; Flynn *et al.*, 1994; Saraph *et al.*, 1989).

Next we discuss the papers that identify the barriers to QM and the perceptions of those affected. The research indicates a range of outcomes from the implementation of QM practices. On the negative side, academics have new time-consuming administrative tasks (e.g. evaluations of their teaching) and are under greater managerial control (e.g. measurement of research output against targets) (Teelken, 2012). Many lecturers think that these activities do not increase the quality of teaching and research. However, others suggest positive effects, (e.g. greater transparency of how their research is measured and judged) and they feel that in principle assessment of performance is not undesirable (Teelken, 2012). Overall, lecturers do not oppose the aims of QM but often they do not like how QM practices are implemented (Teelken and Lomas, 2009). Other papers suggest that HEIs can apply QM in teaching and research activities, and that industry QM practices may be successfully adopted across the institution with intelligent adaptation (Voss *et al.*, 2005) to overcome difficulties in implementing QM in teaching and learning areas (Harvey and Williams, 2010).

The barriers to implementation are similar to those found in industry: resistance to change, inadequate resources to employ QM, and employee training (Bhat and Rajashekhar, 2009). Some of the articles that cover this topic indicate other barriers specific to the HEIs context (Cruickshank, 2003; Koch, 2003; Meirovich and Romar, 2006; Srikanthan and Dalrymple, 2007):

- the difficulty of determining the product of HEIs, specifying who the customers are and measuring core learning processes;
- an absence of standards that reflect customer requirements;
- a lack of managerial responsibility for quality and lack of empowerment of staff for quality improvement;
- the difficulty of controlling teaching in HEIs due to the variety of programmes, sites of delivery, delivery modes, processes and personnel to be controlled; and
- erosion of academic freedom and the conflict with research responsibilities.

Overall, the coverage of topics in HEI in the business and educational journals suggests that the implementation of QM in university service departments is similar to that in any other service sector, whereas several papers in the education journals indicate that their application is more difficult in teaching and learning.

The topic status/effectiveness of QM in Table I includes articles measuring the level of implementation of QM practices and/or the success of the implementation of such practices. We can see there are more publications in business journals than in education journals. Measures discussed in the articles ignore the financial metrics used in industry in favour of those specific to the educational context (e.g. number of students enroled, student satisfaction, research output).

The discussion presented above covers 86 per cent of the articles analysed covering topics in QM, which is the bulk of those identified. We now move on to discuss the dimensions of quality in more detail.

4.2 QM dimensions in HEIs

Table II lists the articles that discuss/research dimensions of quality by their year of publication, together with a brief summary of their content. Business journals are the

Study	QM dimensions	Performance dimensions
1. Theoretical studies		
Business journals		
Sakthivel and Raju (2006)	Commitment to top management and leadership; customer focus; course delivery, communication; campus facilities; continuous assessment and improvement; congenial learning environment	Customer value; customer satisfaction
Mergen *et al.* (2000)	Quality of design; quality of conformance and quality of performance	Quality performance
Owlia and Aspinwall (1997)	Top management commitment; strategic planning; organisations for quality; employee involvement and team working; training for quality; design management; process management; supplier quality management; information and analysis	Customer focus and satisfaction
Education area		
Venkatraman (2007)	Leadership; educational management; human resource management; information management; customer focus and satisfaction; partnership development and management	
2. Empirical studies		
Business journals		
Ali *et al.* (2010)	Quality team working; customer-focus orientation; visionary leadership; staff selection and competency; education and training; innovation and creativity; recognition and motivation; effective communication	
Bayraktar *et al.* (2008)	Leadership; vision; measurement and evaluation; process control and improvement; programme design; quality system improvement; employee involvement; recognition and reward; education and training; stakeholder focus; other stakeholders' focus	
Sahney *et al.* (2008)	Effective and efficient leadership; clear and well-defined policies and procedures; strategic and operational planning; budget priorities-proactive and objective driven; emphasis on continuous improvement; management by fact; instructional competence; differentiation-adaptive service for customers; customer focus; well-defined channels of communication	
Tambi *et al.* (2008)	Leadership; delight the customer; customer focus; management by fact; process performance; people-based management; people performance; continuous improvement; improvement culture	
Osseo-Asare *et al.* (2007)	Mission, policy, strategy, objectives; internal communications infrastructure; staff empowerment and motivation; staff support and encouragement; stakeholder needs and expectations; process ownership and improvement; data, information, intelligence, knowledge management; maintaining a framework of core processes	
Badri *et al.* (2006)	Leadership; strategic development; student, stakeholder, and market focus; measurement, analysis and knowledge management; faculty and staff focus; process management	Organisational performance results
Calvo-Mora *et al.* (2005)	Leadership and commitment; policy and strategy; people management; partnership and resources; process management (educational, research and administrative processes)	People results (people NCI reduction, people

(*continued*)

Table II.
QM dimensions in HEIs from the literature

Study	QM dimensions	Performance dimensions
		satisfactions, people skills and knowledge); student results (student NCI reduction, student satisfaction); centre results; Society results (society satisfaction, environmental protection activities)
Sakthivel *et al.* (2005)	Commitment of top management; course delivery; campus facilities; courtesy; customer feedback and improvement	Students' satisfaction of academic performance
Detert *et al.* (2003)	Shared vision; customer focus; long-term focus; continuous improvement; teacher involvement; collaboration; data-based decision making; systems focus; quality at same cost	
Rosa *et al.* (2003)	External regulation; leadership; policy, strategy and culture; structure and organisation; partnerships; actors; resources; processes	Results
Borahan and Ziarati (2002)	Programme management and operation; curriculum design and structure; teaching, learning and assessment; student support and guidance; learning resources; quality assurance and enhancement	Student progression and achievement
Hills and Steward-David (2001)	Leadership; policy and strategy; people management; resources; processes	People satisfaction; impact upon society; financial results
McCarthy and Keefe (1999)	Planning (mission, strategic planning); culture (customer satisfaction, quality improvement leadership); management of the workforce (workforce quality and training, support for work and personal life quality, workforce motivation, rewards/ recognition, participative leadership); system processes (with-unit coordination, between-unit coordination, fairness and treatment of others); performance measurement and feedback	Outcomes (job satisfaction, organisational commitment, locus of control-empowerment-)
Kanji and Tambi (1999)	Leadership; delight the customer; customer satisfaction; internal customer are real; management by fact; all work is process; measurement; people-based management; teamwork; people make quality; continuous improvement; continuous improvement cycle; prevention	Business excellence index
Owlia and Aspinwall (1998)	Academic resources; competence; attitude; content	
Education area		
Calvo-Mora *et al.* (2006)	Leadership; policy and strategy; people management; partnership and resources; process management (educational processes, research processes, administrative processes)	
Lagrosen *et al.* (2004)	Corporate collaboration; information and responsiveness; courses offered; campus facilities; teaching practices; internal evaluations; external evaluations; computer facilities; collaboration and comparisons; post-study factors; library resources	

Table II.

dominant source for these as education journals contribute only three articles (one theoretical and two empirical). The four theoretical studies identify QM dimensions from a literature review and apply them to higher education as an institution (two articles) or to programmes or courses (two articles). Among the empirical studies (17 articles) some discuss dimensions for the institution as a whole while others examine dimensions for programmes, courses or services. Six of these empirical articles present scales for measurement of QM dimensions with the associated tests for reliability and validity. These articles use QM dimensions adjusted to the HE context based on the QM literature and quality models (e.g. MBNQA model, EFQM model).

We next examine in more detail the 15 empirical works that propose QM dimensions for higher education, in order to identify the most common QM dimensions proposed by the literature. These are summarised in Table III.

The six most frequently mentioned QM dimensions are:

(1) people management (involvement, training, recognition of staff, professional development);

(2) information and analysis (measurement, data from student learning, daily operations, complaints, academic results);

(3) process management (design of the learning process, mapping processes);

(4) stakeholder focus (aspects related to students, staff, society and other stakeholders relationships);

(5) planning (definition, communication and review of objectives and plans); and

(6) leadership (top management commitment).

Finally, three other dimensions are mentioned, but less frequently that those listed above: continuous improvement, programme design (involvement of all affected departments in design reviews, clarity of specifications and emphasis on quality), and supplier management (relational practices associated with suppliers). Not included in Table III are dimensions that appear in only one or two studies (channels of communication, external regulation, structured organization and partnership) because they have not been widely used in HEIs. Nevertheless, they could be included in future studies if researchers consider them appropriate for their particular sample.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
People management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	15
Information and analysis		X	X	X	X	X	X	X	X	X	X	X	X	X	X	13
Process management		X	X	X	X	X	X	X	X	X	X	X	X	X	X	13
Stakeholder focus	X	X	X	X	X	X	X	X	X			X	X	X	X	13
Planning	X	X	X		X	X	X	X	X		X	X	X	X		12
Leadership		X	X	X		X	X	X		X	X		X	X		10
Continuous improvement	X	X	X	X					X					X		6
Programme design		X										X			X	3
Supplier management							X	X					X			3

Sources: 1. Ali *et al.* (2010); 2. Bayraktar *et al.* (2008); 3. Sahney *et al.* (2008); 4. Tambi *et al.* (2008); 5. Osseo-Asare *et al.* (2007); 6. Badri *et al.* (2006); 7. Calvo-Mora *et al.* (2006); 8. Calvo-Mora *et al.* (2005); 9. Detert *et al.* (2003); 10. Sakthivel *et al.* (2005); 11. Rosa *et al.* (2003); 12. Borahan and Ziarati (2002); 13. Hills and Steward-David (2001); 14. Kanji and Tambi (1999); 15. Owlia and Aspinwall (1998)

Table III. Common QM dimensions in HEIs

We can see that there are similarities between these dimensions identified for HEIs and those suggested for the field of quality in industry/commerce. In three articles reviewing the literature on QM in industry (Molina-Azorín *et al.*, 2009; Nair, 2006; Sila and Ebrahimpour, 2003) the most common dimensions for QM were almost identical to the eight found in Table III (the exception being the continuous improvement dimension, which the wider quality literature considers an effect rather than a quality dimension). However, in the literature on industry the dimensions design and supplier management that are the least frequent in HEIs are found to be much more frequent. That supplier management is of less relevance to HEIs is understandable, but design is an important issue in higher education because programmes need to be designed to fulfil the quality requirement established by employers, institutions, government, and quality bodies. Therefore, future research on QM in HEIs should give greater prominence to this design dimension.

Notwithstanding the differences, in general terms the review shows that QM practices in HEIs are not so different from those experienced in manufacturing or service organisations (Lagrosen *et al.*, 2004; Owlia and Aspinwall, 1997). In addition, experts in quality in education suggest that many core QM principles are also critical for HE, such as the participation of academic staff, students and administrative staff, stakeholder satisfaction, and so on (Rosa and Amaral, 2007). These articles demonstrate how the QM dimensions can be adapted by HEIs to meet the characteristics of education and be implemented successfully. All these eight dimensions (leadership, people management, information and analysis, process management, stakeholder focus, planning, supplier management and design) give a focus for QM development and evaluation of QM systems in institutions which can be used to create a continuous improvement ethos to improve institutional and educational performance outcomes. In the recommendations we provide details of how this can be achieved.

4.3 Journals analysed

We found the articles we analyse in 45 journals. The journal *Quality Assurance in Education* is by far the most common outlet for QM in HEI articles (32 per cent), followed at some distance by *Total Quality Management & Business Excellence* (11 per cent), *The TQM Journal* (10 per cent) and *Tertiary Education and Management* (7 per cent). These four journals account for 60 per cent of all articles published (Mann-Whitney U test; $p = 0.000$), with empirical articles dominant in *Total Quality Management & Business Excellence* while theoretical articles are more prominent in *Quality Assurance in Education* and dominant in *Tertiary Education and Management*. We found no substantial difference between the number of articles published in education compared with business journals (Mann-Whitney U test; $p = 0.146$).

For business, the journals most likely to publish papers on quality in HEIs are *Total Quality Management & Business Excellence* and *The TQM Journal*. In education, the most likely journals are, *Quality Assurance in Education* and *Tertiary Education and Management*. The other business/education journals where it is possible to publish are the *International Journal of Quality & Reliability Management*, *Managing Service Quality* and the *International Journal of Educational Management*.

There are 38 other journals not mentioned above but most of these have only one relevant article (full listing available from the authors). In the full listing there are nine journals that are in the SSCI with *Total Quality Management & Business Excellence* publishing 11 per cent and remainder publishing 7 per cent of

the 202 articles considered in the study. These articles are mainly empirical, suggesting that it is more difficult to publish theoretical articles on QM in HEIs in SSCI journals.

4.4 Countries

Next we analyse how prolific each country is in producing articles. Overall there were 36 countries involved, covering all five continents. The UK ranks top (33 per cent) with the USA (24 per cent), followed at some distance behind by Australia (7 per cent). The Mann-Whitney U test shows that there are significant differences between these three countries (UK, USA, Australia) and the rest ($p = 0.003$). This is also true when examining business ($p = 0.003$) and education ($p = 0.003$) journals separately. Therefore, there is considerable scope for extending research on Quality in HEIs to countries other than the UK, the USA and Australia (full listing available from authors).

In contrast with industry, where QM literature reviews by country show China to be prominent (Dereli *et al.*, 2011; Sila and Ebrahimpour, 2003), we found only one paper for China. The review also found different regional preferences on where QM in HEIs articles are published. UK and European scholars usually publish in education journals, while USA and other American scholars are much more likely to publish in business journals.

4.5 Evolution and research methodologies

Figure 1 shows graphically the number of articles published over time. The earliest article dates back to 1991. These earlier papers tended to favour a theoretical approach but after 2002 the trend was downwards with empirical papers becoming more popular. The trend reflects the normal scientific paradigm whereby works shifts from theoretical studies to empirical studies to test theory as a field develops (Kuhn, 1962).

Table IV details the research methodologies used. Half of the articles are empirical studies, while the others are theoretical studies, among which are six (3 per cent) literature reviews. Business journals represent a higher percentage of empirical studies (61 per cent) than theoretical ones, while the opposite is true for education journals, where theoretical papers (61 per cent) are the majority.

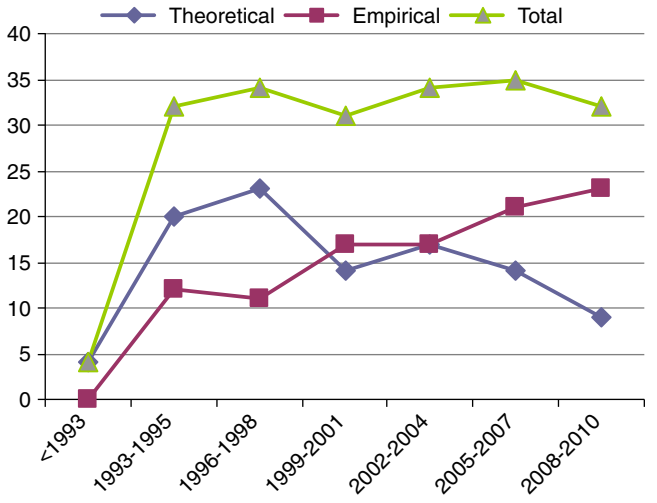

Figure 1.
Evolution of QM research

Research method	No. of papers Business journals	Education journals	Total	Percentage Business	Education journals	Total
Theoretical studies						
Theoretical	36	59	95	35	59	47
Literature review	4	2	6	4	2	3
Empirical studies						
Qualitative	26	26	52	25	26	26
Quantitative	16	3	19	16	3	9
Mixed-method	20	10	30	20	10	15
Total	102	100	202			

Table IV. Distribution of research methods

These differences are statistically significant. Whereas in education journals there is a predominance of theoretical articles, in business journals empirical articles form a majority (χ^2 test: $\chi^2 = 10.48$, $p = 0.001$). Amongst the empirical articles, most use only one methodology, either quantitative or qualitative, with no significant differences between the use of methodologies and the type of journal (χ^2 test: $\chi^2 = 0.33$, $p = 0.563$). However, the data in Table IV show that among the empirical articles, education journals publish mostly qualitative studies, whereas there are no important differences between the number of qualitative and quantitative methods for the business journals.

In the field of education in general the use of qualitative methods is dominant and Table IV shows this is also true for articles in the education journals and to a lesser extent is true for the business journals. In contrast to industry-based QM research (Dereli *et al.*, 2011), in the studies of HEIs mixed methods are well represented.

One explanation for the prominence of theoretical studies, qualitative methods and mixed methods over quantitative methods may be the relative immaturity of QM research in HEIs. In a new field of research, new ideas that inform theory building are grounded on qualitative studies and refined through mixed methods. Quantitative methods then emerge as dominant, to test and extend theory (Malhotra and Grover, 1998). Therefore, we can predict that, based on the pattern seen in Table IV, the trend in the future is likely to be towards more articles using mixed methods and quantitative methods along with a decline in theoretical and qualitative studies (Malhotra and Grover, 1998).

We are not suggesting that any particular methodology is better than another (Galán Zazo, 2006) but, at this stage of development of research into HEIs, mixed methods offer the necessary insights and knowledge of priorities. This can then inform the development of sound quantitative methods that have the advantage of allowing generalisation of new knowledge (Malhotra and Grover, 1998; Higón *et al.*, 2010).

5. Conclusions

The purpose of this study is to analyse published research on the QM of organisations delivering higher education (HEIs) to determine what topics have emerged as most important and how quality is categorised into dimensions. This study provides insights into the focus needed to improve quality in academic institutions. In addition, an analysis of journals, countries and methods used has been carried out. The paper shows convergence between the approaches to QM in industry and HEIs and explores the divergences in approaches to the topic of quality and research methodologies in HEIs between business journals and education journals.

Previous literature reviews of QM in HEIs propose QM dimensions and models used by HEIs (Owlia and Aspinwall, 1997; Grant *et al.*, 2004; Becket and Brookes, 2008). They do not use a computer search to elucidate other issues such as the topics analysed, research methods, and countries, as several papers in the operations management and QM fields have done. Accordingly this study supplements these previous studies on QM in HEIs using methods followed by previous literature reviews in the operations management and QM fields. This study also supplements the literature review on QM in HE by Manatos *et al.* (2014) supporting the QM dimensions identified and expanding their review including new ideas about topics, journals, countries and methods.

This paper's contribution is that the review has a much broader scope than previous literature reviews on QM in HEIs in terms of the breadth of literature examined and the range of topics that are analysed in depth. This review supplements and extends these previous literature reviews on QM in HEIs identifying trends and issues for future research. This makes it possible to inform improvement in QM practices in HEIs, the dimensions that can be used to manage quality in HEIs and the directions for future research into QM in HEIs.

5.1 The nature of quality in HEIs

The most common topics (representing 76 per cent of articles) are "QM implementation", "Models, techniques and tools", and "QM dimensions". These results are consistent with the most popular topics found in the industry QM literature (Lo and Chai, 2012; Molina Fernández *et al.*, 2003) with one exception. The effects of QM on organisational performance (see Table I) have not been examined in any depth in HEIs compared to its prominence in the general QM literature (Dereli *et al.*, 2011).

The most important QM dimensions for HEI management are people management, information and analysis, process management, stakeholder focus, planning, leadership, design, and supplier management. The application of these dimensions to all aspects of HE will enable continuous improvement and performance improvement. Although some differences between industry and HEIs exist, the QM dimensions are similar but HEIs need to implement with appropriate adaptation to the education context. These dimensions may be used by HE managers as the main focus for the development and measurement of quality in non-academic departments and with adaptation also in academic areas. For researchers these quality dimensions indicate those which can be fruitfully used to examine and measure QM in HEIs in future studies. In particular a gap exists for comparative research that considers these dimensions alongside measures of performance such as student learning outcomes and other stakeholder measures.

There was no consensus on which QM models best suit HEIs. In practice, any of the QM models can be used as a way of developing the QM dimensions identified in this review. Overall the techniques and tools of QM which have been successful in industry can be relevant to HEIs across different geographic areas, and can be adapted to the needs of different national agencies. The literature review shows that HEIs can successfully utilise QM dimensions in the implementation of QM (e.g. Avdjieva and Wilson, 2002; Chen, 2012; Manatos *et al.*, 2014).

5.2 Publications on QM in HEI, geographical focus and methods

The review considers the number of publications on QM in HEIs grouped by business journals and education journals. There are several journals, such as *Total Quality Management & Business Excellence*, *Managing Service Quality*, *The TQM Journal* and

International Journal of Quality & Reliability Management among the business journals and *Quality Assurance in Education*, *International Journal of Educational Management* and *Tertiary Education and Management* among the education journals, which are more likely to publish this type of article. For journals that are in the SSCI or Science Citation Index, the review found that empirical articles on QM in HEI are dominant. The findings show there is prevalence for empirical articles in business journals. In contrast, theoretical articles predominate in education journals where even amongst the few empirical articles, qualitative studies prevail. For countries, the literature on QM in HEIs indicates that the USA, the UK, and Australia are those most extensively analysed by academics. This finding is similar to that found in the literature on QM in industry.

5.3 Recommendations for HEIs for the development of QM

Synthesising the content of the articles reviewed we can say that QM can be applied in all areas in HEIs, such as non-academic functions, the administration of academic functions and learning processes. In industry firms mainly implement a QM philosophy due to marketing motives while motives for HEIs were to improve efficiency or reduce costs as a way to face funding constraints, and/or government demands. Thus, improved QM can be beneficial in matters of curriculum, teaching, and research, and can help in designing more effective educational processes and systems, although intelligent adaptation is required, as several scholars have advocated (Voss *et al.*, 2005).

With higher education increasingly under pressure due to squeezed funding, competition for improved rankings, and other pressures, the potential of QM practices and systems that have served industry well in reducing costs and improving internal and external quality, has never been greater. Given the economic imperatives, we suggest that at the national-level governments need to encourage the national bodies responsible for HEIs to consider these QM dimensions as a general way of managing HEIs and then allow national bodies to publish guidelines for QM that serve as a flexible template for the development of quality in administrative and academic processes to achieve improvement in the learning process and environment. This implies the development of performance measures to evaluate improvement from the perspective of external and internal stakeholders.

These QM practices may be adopted in the university administrative services in the same way as in the service sector. In the case of teaching and research activities these practices should be implemented but face additional barriers such as the difficulty of measuring core learning processes, the difficulty of controlling teaching in HEIs due to the variety of programmes, delivery modes, delivery sites, processes and personnel, and academic freedom. However, increasing managerialism in higher education has removed some of these barriers through the modularization of teaching programmes and the adoption of standardised processes across the institution (Deem, 2004). In addition metrics are increasingly being used to measure the outputs of academic and research staff in the quest for teaching excellence, research excellence and generation of income from working with industry (Cuthbert, 2011).

It is evident from the review that leadership is a key element for the development of the other QM dimensions. Therefore, senior managers need to consult with all stakeholders to establish quality policies and objectives that will act as a guide for QM activities to meet other quality dimensions (Chen, 2012). The stakeholder focus dimension is important for HEIs as they have a wider range of stakeholders than

business organisations. Therefore, it is important to collect information from all stakeholders and analyse these needs to best inform QM objectives, measurement of teaching and learning activities and to define improvement actions (Loukkola and Zhang, 2010). This requires that managers consider different stakeholders (e.g. students, graduates, employers) and that student plays different roles, as customers and as active participants in the processes they experience. For example, recent graduates and employers may assess academic quality as customers and, for non-academic departments, students may evaluate the service quality they receive as customers.

To meet these objectives it is essential that efforts focus on incorporating continuous improvement in academic areas (Rosa and Amaral, 2007) and that evaluations include measures for core education processes. If quality efforts are focused only on ensuring accountability and external control (Harvey and Newton, 2007) then it becomes difficult to develop improvement in core education processes. This then results in academic staff showing resistance to the QM system as they do not see any improvement that aids their activities. Instead the see bureaucracy and interference with professionals' efforts (Harvey and Williams, 2010, Stensaker *et al.*, 2007). In other words, staff in HEIs will have a positive perception about the effects of QM in terms of improvement but a negative perception about the effects in terms of control (Kleijnen *et al.*, 2011).

These negative perceptions of control from QM (Kanji and Tambi, 1999) bust be overcome by QM implementation having a clear focus on improvement actions. QM leads improvement when an HEI identifies indicators of performance improvement, framed around educational aims and values that are seen as relevant criteria for assessing learning processes and outcomes. Here the quality planning-dimension can serve to define targets related to teaching and research activities and clarify designation of responsibility for quality issues (e.g. teaching quality) at the institutional level.

Knowledge of existing processes is essential if the process dimension is to be used by HEIs to map their processes to understand potential failure points that need monitoring and how processes can be redesigned to reduce complexity and improve quality. Improvement against objectives requires standards to be set and measured. For learning, existing measures can provide a starting point (e.g. proportion of employed among graduates, average duration of study, student evaluations, student drop-out rate, added value). Measurement in other areas will require the identification of performance indicators (e.g. number of publications, ranking of journal publications, and participation in faculty development activities) that are agreed as the best way to assess organisational success in research and non-academic activities. To avoid extra workload for faculty members these measurements should be developed and monitored by the QM function of the institution using a range of tools (e.g. teaching and learning audits, students' surveys, focus groups of students, etc.) to analyse the data. For this, it is crucial to use a database to help in the analysis of strengths, weaknesses, and success in making improvements. For the people-dimension of quality, reward and promotion systems should emphasise compensation for improvements in research quality, teaching quality, and, in non-academic departments, meeting of quality improvement targets. These improvements should be measured using the quality information and analysis-dimension, based on internal and external measures. For example, surveys of students can assess every course and teacher (Meirovich and Romar, 2006), while surveys of graduates can evaluate the

quality of the education experience as a whole. Finally, formal oversight structures need to be established for evaluating performance (Chen, 2012) to identify improvement actions in academic areas.

To summarise we believe that QM concepts from industry can help HEIs using these quality dimensions. Managers can define targets, measure teaching and research activities and have as a result data to make better decisions. These informed decisions will help focus attention on continuous improvement activities which eliminate wastes and so reduce costs. Thus, the QM dimensions we suggest can be a route to improve efficiency in HEIs while at the same time improving academic results and quality for stakeholders.

In contrast we warn against HEI managers focusing only on satisfying the demands of national bodies and accreditation bodies as this usually leads to a symbolic adoption of QM rather than an embedded quality improvement system. Likewise, only applying quality concepts in administrative areas will not achieve a real culture of continuous improvement as the changes will be decoupled from the core educational objective of HEIs.

We acknowledge that QM is not the sole contributor to HEI success and that there is no guarantee that QM will satisfy all stakeholders in HEIs, but it is a framework that increases the likelihood of success, as it allows managers to manage more effectively and systematically than before, to achieve their aims.

There remains the question of academic freedom. To some extent any change upsets the status quo, but all institutions have to establish goals and policies to guide actions and processes and individuals need to accommodate the constraints of corporate obligation that allow them the academic freedom to pursue individual ways of achieving goals. So a balance between control and autonomy must exist in any organisation. In particular lecturers must understand the roles of students, as customers as well as participants in the learning process (Meirovich and Romar, 2006) and the institution needs to provide a quality learning environment and support for students so that they have the opportunity to achieve their potential, using QM dimensions as a way to continuously improve learning and the educational environment.

5.4 Gaps and directions for future research for QM in HEI

This review of QM in HEIs will help academics by providing a starting point for understanding what has already been done and an appreciation of the gaps that exist in research on QM in HEIs (Table V). The findings indicate the QM dimensions that may be used by future researchers in order to measure and assess QM developments in HEIs. The paper shows researchers the journals that have preferences for empirical and theoretic approaches and those that have published the greatest number of papers. It also suggests that trends indicate that at this stage of development the field would benefit from mixed methods.

The results expose many gaps in the literature that can guide the direction of future research. In Table V the gaps in the literature are noted along with suggestions for future research. First, there is an opportunity to look more deeply at the opinions of academics and managers in HEIs to understand more about the needs of these key stakeholders. This might be formalized in comparative surveys of HEI academics, managers and national funding bodies to find out the role played by national bodies in encouraging HEIs to develop QM practices.

Second, future research needs to formalize measurements for each quality dimension and analyse their validity and scale reliability across different institutions. This would make it possible to conduct comparative analysis of quality to indicate

Knowledge gaps	Directions for future research
Identification of QM and performance dimensions in the HE context	Empirical studies to analyse the opinions of managers and other stakeholders (lecturers, national bodies, etc.) using comparative surveys
Effects of QM dimensions on different performance outcomes	Quantitative and mixed studies to analyse QM and performance dimensions
How QM dimensions help accountability	Empirical studies to assess the effects of QM on different performance dimensions (stakeholder performance, social impact, etc.)
How to apply QM in HE to achieve continuous improvement	Empirical studies to examine the relationship of QM practices with accountability and continuous improvement using views from managers and other stakeholders
Barriers to QM and drivers to successful QM	Empirical studies to investigate the barriers and the drivers of successful QM
Quality models used by HEIs	Cluster analysis to identify different levels of implementation of QM in HE
The adoption of QM models in HEIs	Empirical studies to examine the importance of QM practices for stakeholders using interviews with stakeholders to evaluate the extent of symbolic adoption of QM in HEIs
Measuring the depth of adoption of QM in HE	Studies to examine the role of national bodies in encouraging a quality culture in HEIs
Symbolic adaptation of QM	Studies on how to instill QM practices at all levels using views from managers and lecturers
Cost and benefits of QM adoption	Studies in other countries and cross-country comparative studies on QM implementation
Scarcity in the usage of quantitative and mixed methods	
Scarcity of research that examines the opinions of different stakeholders (e.g. lecturer, management, national bodies)	
How national bodies can help HE to develop QM	
How to develop QM at all level in the HEIs	
Studies in countries different than USA/UK/ Australia	
Why are HEIs in some countries more proactive in the adoption of QM?	

Table V.
Gaps and directions for future research for QM in HEIs

which practices are more successful in a HEI environment and evaluate which barriers and drivers affect QM implementation.

Third, in contrast to the industrial literature, we found few studies in HEIs that use measures of performance (see Table II) and a lack of studies in HEIs that analyse the impact of QM on improving the quality of learning for students and the effects of quality initiatives on academic engagement and commitment. There is also an absence of research on how QM dimensions help managers to facilitate continuous improvement and accountability.

Fourth, new studies are needed to examine different levels of implementation of dimensions of QM in HEIs and the effect on a higher or lower internalisation of QM practices. This can distinguish those HEIs adopting a symbolic QM from those implementing a continuous improvement culture. Here contrasting the opinions of managers and lecturers may provide insights into how to increase the probability of instilling QM at all levels of HE.

Fifth, there is lack of research in regions that have new economic importance, to understand their perspective on quality in HEIs. Are their practices differentiated or based on western ideas? Can their practices provide new insights on QM improvement in HE that may have the impact that Japanese industrial quality improvement methods had for the West?

Finally, and regarding limitations, like other reviews, this paper uses a computer search based on three databases. Other ways of mapping the academic knowledge on

QM in HEIs could exist. For example, although some authors have developed literature reviews using the same databases, others have carried out the review differently. Similarly, the study considers common terms in the QM field for search but other terms could also expand the search. Despite these limitations, reviews such as the present one are necessary to identify key themes in a field and attempt to identify gaps and propose future research.

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Further reading

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