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EDITED BY
Benito Yáñez-Araque,
University of Castilla-La Mancha,
Spain

REVIEWED BY
Ciprian Marius Ceobanu,
Alexandru Ioan Cuza University,
Romania

*CORRESPONDENCE
Nilüfer Ülker
✉ ulkern@itu.edu.tr

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Total quality management in the context of University 4.0: New game new rules

Nilüfer Ülker*

Istanbul Technical University (ITU), Istanbul, Türkiye

There have been many changes in the field of higher education in accordance with the advancements brought by the new industrial era, which is defined as Industry 4.0. Introduction of Industry 4.0 has definitely influenced ongoing practices requiring alignment and adaptations in many spheres of higher education including but not limited to Total Quality Management (TQM). As a TQM system, ISO 21001 has been specifically designed and developed to serve to the needs of educational institutions, in this particular case universities. Considering the rate of advancements in the context of Industry 4.0 where previously defined rules and policies no longer apply, universities have an important role in revising and improving their current practices in TQM accordingly to maintain their quality in this competitive environment. To be successful in the new game with new rules, this paper will provide a framework for higher education institutions for successful implementation of TQM, particularly ISO 21001, in line with the essentials of University 4.0 through alignment of ISO 21001 principles with University 4.0 practices to contribute to quality and competitive advantage of universities under current circumstances.

KEYWORDS

University 4.0, quality 4.0, TQM, TQM for universities, ISO 21001

1. Introduction

Industry 4.0 has led to numerous changes, the most prominent developments taking part in technology and the traditional education system is facing difficulty to simply overtake those changes. As the agents of change and due to their responsibility to lead change and innovation through raising individuals equipped with skills and competencies of the current era, higher education institutions have been in the spotlight of this transformation process. According to Gueye and Exposito (2020) the evolution of education in accordance with industrial revolutions can be summarized as below:

⇒ Industry 1.0 was characterized by limitations and accordingly in University 1.0, university education was limited to a few elites

⇒ Industry 2.0 was marked by massification of production, which was reflected as massification of higher education by means of access adjustments in University 2.0.

⇒ Industry 3.0 changed the shift of focus to innovation technologies, which enabled integration of digital technologies as teaching and learning tools as part of University 3.0 practices

⇒ Industry 4.0 is identified by digitalization and automation of production processes through advanced Technologies, which led to emergence of University 4.0

University 4.0 is a new form of educational institution where, in its broadest sense, learning opportunities are provided through blended, online or traditional ways; short-term education and certificate programs are offered to equip the learners with a variety of professional competencies;

learners' career management skills are developed and there are permanent connection and support programs between learners, researchers and the industry (Dewar, 2017). Flexibility can be considered as the central concept brought by industry 4.0 to higher education 4.0, which requires provision of more flexible education standards due to ambiguities accompanying technology (Kulik et al., 2020). Also, University 4.0 puts special emphasis on co-creation of influential remedies for tackling societal challenges including sustainable development (Giesenbauer and Müller-Christ, 2020).

In accordance with the framework of University 4.0, a new paradigm has come to the forefront where different constituents are redefined in line with the requirements of the current era. Pawawimol (2017) has categorized the new paradigm in the scope of University 4.0 under four headings: Learning, research and innovation, public-private community partnership and digital higher education, essential features of which can be summarized as follows: *Learning* is purposeful, generative, mindful and results-based; *Research and innovation* is experiential and demand-led featuring multidisciplinary infrastructure; *Public-private community partnerships* is considered a key strategy to enhance the efficacy of academic services offered; *Digital higher education* constitutes such offerings as MOOCs, open lectures, flipped learning and digital content accessible by students and academics.

University 4.0 has been the cause and motive for improvements taking place within different realms of higher education, including but not limited to those in quality management systems. Within this scope, it can be mentioned that the emergence and progression of University 4.0 has advanced almost contemporaneously with the development of ISO 21001, which, as indicated by Camilleri (2017), "provides a common management tool for organizations providing educational products and services capable of meeting the needs of learners as well as of other beneficiaries and stakeholders in education" (2017, p. 2). It can be stated that the primary objective of ISO 21001 is to establish efficient intercommunication between educational institutions and consumers of education services and improve the quality of educational services (Vorobyova et al., 2022). ISO 21001 was created in accordance with PDCA (Plan-Do-Control-Act) principles, which supports educational organizations to evaluate fundamental components of the standardization process with a specific emphasis on social responsibility and such other specific features (International Organization for Standardization-ISO, 2018). According to Syahrullah et al., establishing internal audit of academic quality standards at the university level is of particular importance for successful implementation of ISO 21001: 2018 (2022). ISO 21001 can increase the satisfaction levels of all stakeholders including the students *via* implementation of its basic principles (Benz-Camino et al., 2022). Being two focus points in the field of higher education recently, Total Quality Management System 21001 and University 4.0 have been examined individually in their own contexts but still to a limited extent; however, how principles of ISO 21001 should be implemented in the context of University 4.0 has not been explored, which will be the primary objective of this particular study.

2. TQM principles in the context of University 4.0

According to ISO 21001 document released in 2018 (International Organization for Standardization-ISO, 2018), quality management systems for educational organizations comprise 11 basic principles, which are focus on learners and other beneficiaries, visionary leadership, engagement of people, process approach, improvement, evidence-based decisions, relationship management, social responsibility, accessibility and equity, ethical conduct in education and data security and protection. As Kovalenko et al. (2020) assert, while some principles form the foundation for both ISO 21001: 2018 and ISO 9001: 2015 (International Organization for Standardization-ISO, 2015), there are certain principles that refer entirely to educational organizations, which are social responsibility, accessibility and equity, ethical conduct in education and data security and protection.

2.1. Focus on learners and other beneficiaries

Learners should be actively involved in their own learning; needs of the society, mission of the institution and course goals and learning outcomes should be scrutinized to facilitate the learning process. In the circumstances of the 4th industrial era, there is a need for a shift toward innovation, technology and services providing high value to customers (Kankaev, 2019), which is reflected in education as the necessity of equipping students with skills that will help them adapt rapidly to changing socio-economic needs and challenges (Kulik et al., 2020). Sader et al. (2017) emphasize in this respect that industry 4.0 initiated production that is tailored for customer needs in a more elaborate way, which applies to higher education in terms of the focus on meeting the articulated needs of the learners and other stakeholders of the education process. In line with this perspective, in addition to meeting the needs of the students, as also highlighted by Chitkara et al. (2020) designing curriculum in accordance with needs of the industry to cater for the needs of external stakeholders is of utmost importance.

2.2. Visionary leadership

Learners and other stakeholders should be included in the leadership through engagement in the establishment and employment of the vision and mission. The transformation required by industry 4.0 necessitates proper competencies and skills, and a need for management systems, which can be achieved through relevant leadership skills in the scope of University 4.0 (Fonseca et al., 2021). Therefore, strategies should be employed to create knowledge and skills in line with educational objectives (Latif et al., 2019). Leadership should focus on working toward the same goal among employees, arranging resources, processes and policies and provision of effective communication between members of administration (Sader et al., 2017). Technology knowledge is the fundamental blueprint for competition in industry era 4.0 (Lukita et al., 2020); hence, as an integral part of this principle, instructors must be equipped with technological competencies to contribute to their innovation and creativity ability to compete in 4.0 environment (Buasuwan, 2018). Also, there must be new educational programs and specialties for digital personnel (Cheglakova et al., 2019) and new expertise should be developed using AI, AR, VR (Alzahrani et al., 2021) pursuant to visionary leadership.

2.3. Engagement of people

All stakeholders should be appreciated; their qualifications and individual contributions should be acknowledged and embellished.

According to Giesenbauer and Müller-Christ (2020), inter-organizational collaboration is the key regulatory component of University 4.0. In this scope, based on the importance of collaboration, knowledge sharing and continuous professional development, professional communities as a way of learning networks as defined by Buasuwan, occupy an important place in University 4.0 (2018). Also, the digitalization of the economy is on the growth and this brings the requirement of reorganizing the education and training of professionals so that they can perform to their highest potential (Kulik et al., 2020). As part of this principle, relevant stakeholders of university education should be informed accurately about university processes and practices (Polkinghorne et al., 2017) so that they can contribute to its sustained achievement.

2.4. Process approach

Comprehension of how outcomes are achieved through complementary procedures will contribute to escalation of the system and institution's accomplishment. This approach suggests description and operation of processes and the interaction between them in a standardized manner so that expected outcomes could be accomplished in line with defined policies and strategic plan of the educational organization (Kovalenko et al., 2020). In accordance with process approach, industry 4.0 "will provide accurate information about processes (time, risks, resources, critical constraints) thus, it will help the planning level of key-processes to maintain continuity and efficiency" (Sader et al., 2017, p. 5). University 4.0 is expected to put emphasis on constituent elements of education process to contribute to success at a wider perspective. Pursuant to process approach in University 4.0, as illustrated by Chitkara et al. (2020), troubleshooting technologies and technology skills sets must be emphasized in the curriculum. For example, in line with the requirements of the current era, the latest information and communication technologies must be used in the education process (Kulik et al., 2020), all of which will influence the success of the whole system while focusing on isolated processes.

2.5. Improvement

There should be an ongoing emphasis on improvement to preserve existing extent of performance, to be responsive to changes and to generate additional opportunities. Alzahrani et al. (2021, p. 1) defines quality 4.0 as "the digitalization of traditional quality approaches and the focus on the use of digital tools to improve an organization's ability to meet customers' requirements with high quality." An institution-wide culture advancing quality by using latest technologies will be required for effective implementation of quality 4.0. As making changes in the culture of an institution necessitates a long-term committment, universities will need to instill the quality culture inside the institution in a strategic way (Sony et al., 2020). Universities need to trigger continuous improvement especially leading to positive change and contributing to quality of education (Benz-Camino et al., 2022). Accordingly, it is very important that there is a mechanism of continuous and systematic feedback collection from stakeholders (Ramirez, 2018), like gathering data from students and lecturers on their perceived education quality, ongoing issues and possible solutions (Nabokikh et al., 2019). Also, that quality discussions take place with the participation of colleagues; with the participation of students and staff together (Stensaker et al., 2019) is of prime importance.

2.6. Evidence-based decisions

Curriculum should be designed and related decisions should be made depending on examination and interpretation of information and data. Universities should be able to demonstrate valid and reliable data concerning all aspects of the system including teaching quality (Polkinghorne et al., 2017). Decision making is a complex process and quality management systems require providing evidence for quality claims. To form the basis for evidence-based decisions to demonstrate data regarding different constituents of the education process, as suggested by Sader et al. (2017), data collected from stakeholders of the education process should be analyzed using appropriate methods. Consequently, as asserted by Fonseca et al., data should be converted into knowledge and information; and outcomes should be used to determine potential opportunities to create additional sustainable value (2021). When decisions are made based on evidence, it is much easier to provide proof for compliance with quality standards as well as using evidence to form the basis for new policies and practices.

2.7. Relationship management

Communication with stakeholders should be effectively operated to maintain accomplishment and improve performance. As an integral part of this principle in the scope of University 4.0, there should be systems in place for knowledge exchange and knowledge sharing among the university, public organizations, NGOs and the community (Buasuwan, 2018). It is important to note that in this context universities should enhance their services to their stakeholders within the institution while sufficiently meeting the needs of their external stakeholders (Hansen et al., 2019) integrating their articulated requirements into the design of quality assurance. Relevant tools should be used for provision of effective communication among members of the institution (Sader et al., 2017) so that knowledge sharing and collaborative work could be enhanced (Fonseca et al., 2021). In addition to knowledge exchange and collaboration, there should be appropriate infrastructure and transparency among departments to contribute to transformation to quality 4.0 (Alzahrani et al., 2021). Managing relationships effectively with internal and external stakeholders will be the key for the empowerment of relevant people to embrace the principles of University 4.0 in general terms.

2.8. Social responsibility

Institutions should be aware of their liability for influences of their actions on public, environment and economy and thus should adopt a sheer and moral attitude. Social responsibility is one of the TQM principles that applies directly to educational context. In this scope, Fonseca et al. (2021) discuss, quality management could be mentioned as having a considerable influence on social sustainability, which refers to the organization's influence on and its functions in society. According to this principle in the context of University 4.0, universities must welcome open and interconnected environments to meet social challenges and tackle with

complicatedness, which could be realized through focusing on research on hot topics concerning the society (Giesenbauer and Müller-Christ, 2020) such as sustainable development. As part of social responsibility, universities are also expected to conduct activities demonstrating their interest in finding solutions to societal issues, like producing sustainability reports as suggested by Ramirez (2018) to raise awareness in public regarding practices and research carried out institution-wide concerning the society.

2.9. Accessibility and equity

To cater for learners' needs, institution's resources should be available for everyone to be accessed in an unbiased manner. In its broadest form, this principle requires that access to education is expanded with regards to institutional framework (Dubey et al., 2019). It is important that programs should be created to support the students with special needs so that they can accomplish their best potential (Syahrullah et al., 2018), which requires access to information and education resources in any place in the network (Kulik et al., 2020). To facilitate equity, students should be given the chance to choose the tools and techniques of their choice in accordance with learner-centered pedagogy adopted (Chitkara et al., 2020) as an integral part of University 4.0, which requires providing students with opportunities to contribute to their development as autonomous learners (Polkinghorne et al., 2017). Also, in addition to internship and voluntary services for provision of international mobility opportunities (Aybek, 2017), students should be provided with personal tutor scheme, academic, library and study support (Dicker et al., 2019) to optimize accessibility and equity of educational offerings to contribute to student autonomy and success on the whole.

2.10. Ethical conduct in education

The institution should create an environment where professionalism is at the core of its regular practices and staff attitudes. Quality of professional exposure can be considered one of the most important features of University 4.0 (Ramirez, 2018). Digital transformation required by industry 4.0 necessitates development of proper competencies and skills as well as work ethics and the United Nations Sustainable Development Goals and European values supporting business ethics are integrated into principles of latest quality management systems (Fonseca et al., 2021). In addition to professionalism expected from colleagues in the workplace, as underlined by Kankaev (2019), students should be assigned volunteer projects to help others and to create networks of students and society, and improve empathy, ethics and teamwork.

2.11. Data security and protection

Institutions should create an atmosphere where staff are ensured of confidentiality, accessibility and careful treatment of their individual data. Data shifts from traditional to big data as applied in quality 4.0, which is used in higher education for such purposes as security, risk mitigation, and performance evaluation (Alzahrani et al., 2021). In addition to big data, suggested quality 4.0 tools are deep learning, machine learning and data science (Dovleac, 2021). As a requirement of this principle, it should be ensured that ethical values are prioritised while treating and using data, knowledge and information, showing respect to the rights of individuals that provide the data, information, and knowledge. Also, unique knowledge such as intellectual property should be secured, protected, and maximized (Fonseca et al., 2021). Data, processes and people in the higher education institution should be working together to enhance quality as a whole (Alzahrani et al., 2021). In line with the increased utilization of digital tools, data security and protection cannot be compromised as one of the requirements of Total Quality Management in the context of University 4.0.

3. Conclusion

Times have changed and new trends have emerged in line with the needs of the society as a whole. Undoubtedly, due to changing circumstances as a consequence of the fourth industrial revolution, there have been adaptations in every realm of higher education including but not limited to quality management systems. This paper argues that implementation of ISO 21001 in the context of University 4.0 requires major alterations in different constituents of the system as a whole. Among many modifications suggested to align ISO 21001 principles with policies and practices of University 4.0, the following implications prevail: The students must be equipped with skills that will help them achieve in a rapidly changing environment being responsive and socially responsible to emerging circumstances in their surroundings and deal with complications in the best way possible. Students, academic and administrative staff must be equipped with technical competencies to be able to compete under new circumstances. Also, university-community-industry partnership must be at the core of design of educational offerings to contribute to knowledge and experience sharing between stakeholders to form the basis for continuous quality improvement. Last but not least, the university should create an environment in which professionalism and ethical conduct are supported and appreciated while increasing awareness concerning the significance of respecting the confidentiality and unique knowledge of others.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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