

ISO 9001 quality management system on Greek steel construction industry and its impact innovation performance

G. Kampouridis¹, G.I. Giannopoulos, S.A. Tsirkas

Department of Mechanical Engineering, Technological Educational Institute of Western Greece, Megalou Alexandrou 1, 26334 Patras, Greece.

Abstract

Steel construction sector is a very important activity in Greece, however lacks of innovation compared to the rest European countries. Innovation is the process that converts new knowledge into new products and services and may be considered as a fundamental factor for companies' productivity and competitiveness. Standardization of technical specifications of products and processes in Greek construction industry may perhaps contribute to systemizing new knowledge into new constructive procedures. The goal of this research is to investigate at what extent the introduction of ISO 9001 quality management system, which is a common management tool in Greek industrial reality, is indeed supporting the innovation of the local steel construction companies. In order to evaluate the association of ISO 9001 with technological innovation, a survey has been conducted via on-line questionnaires emailed to an efficient number of steel construction firms in Greece. The study is based on a feedback from the year 2014. In order to better correlate the corresponding arisen information with ISO 9001, a proper categorization of these companies is attempted beforehand according to their relation to ISO certification.

Keywords: Quality, standardization, innovation, ISO, steel industry.

¹ Corresponding author. Tel: 00302610 369232. *E-mail address:* gkabou@teipat.gr (G. Kampouridis)

1. Introduction

Total Quality Management (TQM) is an integrative philosophy of management for continuously improving the quality of products and processes. There is an open discussion in the literature regarding the impact of total quality management (TQM) on innovation. Numerous studies have been investigated at what extent companies that implement TQM philosophies and methods tend to be more innovative (Prajogo and Sohal, 2001; Molina *et al.*, 2007; Sá and Abrunhosa, 2007). By exploring studies which analyse the relationship between TQM and innovation (Prajogo and Sohal, 2004 and Singh and Smith, 2004) one may conclude that the main body of the relevant research is not focused on specific industrial sectors. On the contrary, in most cases the presented data and the generic conclusions are arisen via the investigation of firms that belong to different industries. However, both TQM and innovation are strongly dependent on the specificities of the frameworks in which they take place. Furthermore, innovation and TQM are associated with numerous features and thus may be better explored by considering a single industry.

TQM management system in modern reality is frequently implemented by ISO (International Standards Organization) which describes the functions and the actions that are required in order to ensure the desired quality on running organizations and to improve services. The ISO has some basic requirements like strict documentation for audit purposes which allow flexible and simplified monitor of the relevant records. There has been a major push by organizations around the world to seek certification to the ISO quality standard since its introduction in 1987 (Terziovski *et al.*, 1997, Stevenson and Barnes, 2001). ISO standard is adopted by thousands of organizations throughout the world and its impact on operational and business performance has been investigated on numerous works (Henkoff, 1993; Corrigan, 1994; Stephens, 1994; Adler, 1999; Guleretal, 2002; Terziovski *et al.*, 2003; Naveh and Erez, 2004; Corbett *et al.*, 2005; Naveh and Marcus, 2005). However, few are the empirical studies in the open literature which examine the relationship between ISO certification and innovation performance (Henkoff, 1993; Guler *et al.*, 2002; Naveh and Erez, 2004; Corbett *et al.*, 2005; Naveh and Marcus, 2005). Characteristically, Hindo (2007) argues that efficiency programs such as ISO 9000 certification are designed to reduce variation and eliminate waste fact that could potentially stifle innovation.

The new version of ISO (9001:2008) includes a set of guidelines that encompasses the TQM, requires certain documentation on the operational procedures and utilized managerial actions to achieve that the facility can provide products that consistently meet customer and applicable regulatory requirements. A recent European research concerning the companies certified with ISO 9001 standards has indicated that Greek companies are still in the phase of further expanding their quality systems (Franceschini *et al.* 2011). The specific certification due its efficiency and applicability has been adopted by most firms that belong to the Greek steel construction sector. Given the lack of literature evidence concerning the links between ISO and innovation, an attempt to provide new interesting information on this field seems to be very attractive. The aim of the present study is to explore the contribution of ISO 9001 on the innovation by gathering relevant data from a representative industrial sector such as Greek steel construction industry.

2. ISO 9001 and innovation

ISO 9001 is an international standard that gives requirements for an organization's quality management system (QMS). It is part of a family of standards published by the International Organization for Standardization often referred to collectively as the "ISO 9000 family". ISO 9001 is the only standard in the ISO 9000 family that can be utilized for the purpose of conformity assessment. The aim of ISO 9001 is to provide a number of requirements that, if efficiently applied, will provide confidence that the supplier can consistently provide goods and services that meet the customer requirements and satisfy regulations. The requirements involve numerous aspects such as supplier's top management commitment to quality, customer focus, adequacy resources, employee competence, process management (for production, service delivery and relevant administrative and support processes), quality planning, product design, review of incoming orders, purchasing, monitoring and measurement of processes and products, calibration of measuring equipment, processes to resolve customer complaints, corrective/preventive actions, continual improvement of the QMS and monitoring of customer perceptions about the provided quality.

On the other hand, innovation within industrial firms is evidently as well focused on two main objectives: product and process. A product innovation is the act of offering something novel to the market place that improves the quality of products. A process innovation is a new method of manufacturing products or offering services. Many definitions of innovation have been proposed, since it is a complex and multidimensional concept (Goswami and Mathew, 2005). Rogers (1995) considers innovation as "An idea, practice, or object that is perceived as new by an individual or other unit of adoption". In a similar point of view innovation can be defined as "the adoption of an idea or behaviour- whether a product, device, system, process, policy, program or service – that is new to the adopting organization" (Aiken and Hage, 1971; Damanpour, 1988). In addition, an innovation may be a new idea or an old idea in a new context (Firth, 1996) since organisations may have been aware of an innovation for some time before adopting it (Rogers, 1995). Despite the fact that product innovation may be easily identified, process innovation which is vital for an organization to increase its competitiveness is more difficult to be described (Schilling, 2008). Most of process innovation is focused on achieving continuously better business operations, quality and productivity within all activities and processes of the organization (Gopalakrishnan et al., 1999; Damanpour & Gopalakrishnan, 2001).

ISO standards spread knowledge and propagate innovative advances in technology. The characteristics of innovation, characteristics of the external environment and organisational characteristics are significantly associated with the adoption of ISO standards by manufacturing companies (Hashem and Tann, 2007). Furthermore ISO tends to have a long-term economic added value because it helps its users create improvements, inventions and innovations by requisite holism (Pivka and Mulej, 2004).

3. Innovation in Greece

Greece may be characterized as a moderate innovator in comparisons with the rest countries of EU. However, innovation performance of Greece is constantly improving over time as **Figure 1** depicts. It should be noted that the country showed an important drop in 2010. Since then, innovation performance has been increasing and a peak concerning innovation index has been observed in 2013. Nevertheless, **Figure 1** clearly illustrates that the observed growth is below that of the EU.

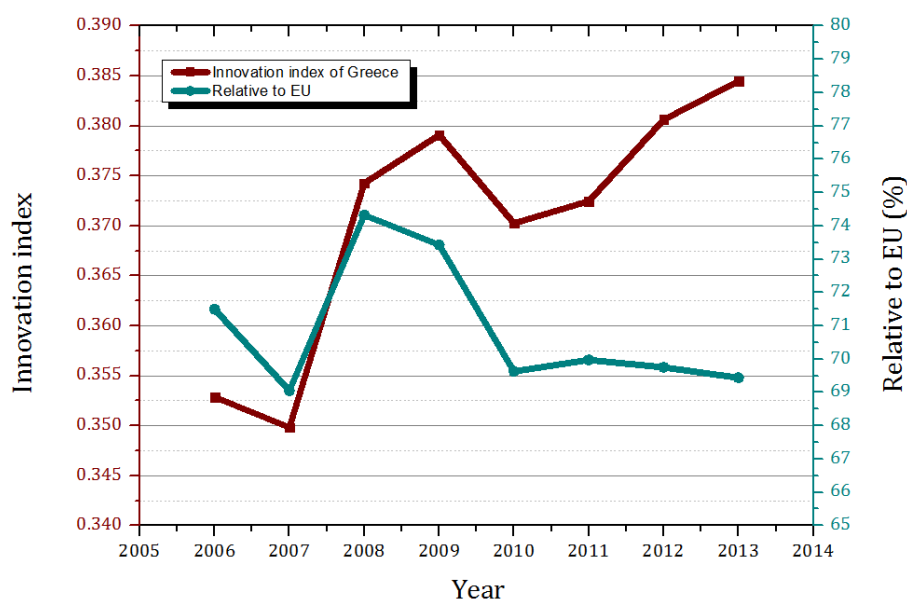
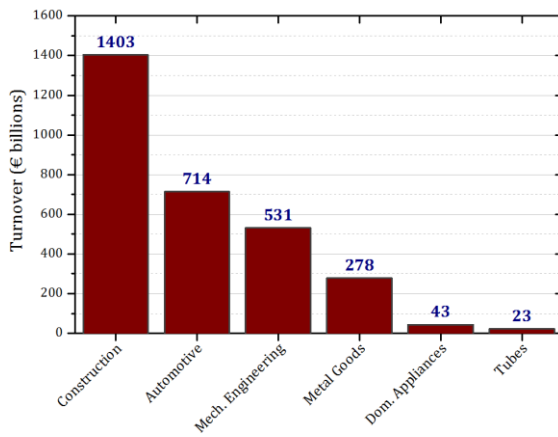
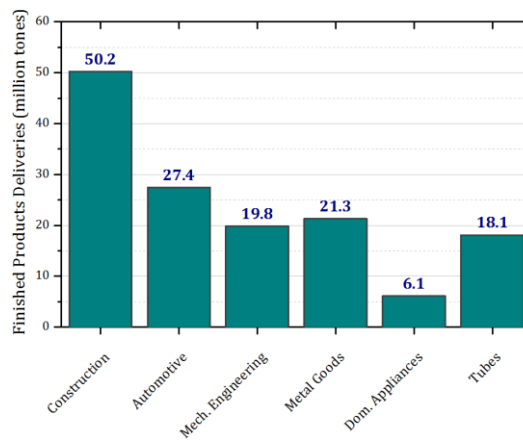


Figure 1. Innovation index of Greece versus time (Source: *European Commission 2014*).

The relative performance to the EU has been decreased from 74% in 2008 to almost 69% in 2013 probably due to the economic crisis. According to European Commission and concerning most relevant indicators, Greece performs lower than EU average, mainly for non-EU doctorate students, community designs, venture capital investments and R&D expenditures in the business sector. On the other hand, innovation indicators of Greece are higher in comparison with those of EU regarding international scientific co-publications, sales share of new innovations and small and medium enterprises with marketing and/or organisational innovations. However, almost constant growth may be observed for most indicators in Greece. Highest growth indicators are observed for community designs, community trademarks, sales share of new innovations and international scientific co-publications. Finally, growth has been delayed regarding non-R&D innovation expenditures and venture capital investments.

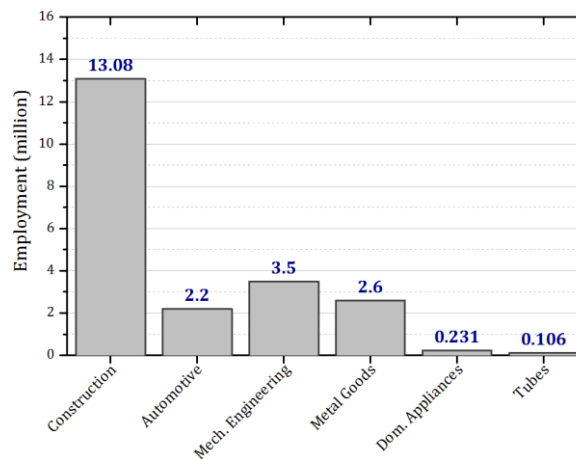
4. European Steel Construction Sector and innovation challenges

Steel market is very important for Europe's economy and competitiveness. Generally, The European steel industry is a world leader in the production of steel and the corresponding production methods. The European steel industry has a real competitive advantage compared to its main trading partners due to its continuous collaborative research efforts. The main characteristics such as productivity, profitability and employment ability of European steel industry concerning year 2007 are clearly illustrated in **Figure 2**. It becomes evident that steel construction sector remains the leader sector in the steel market.



(a)

(b)



(c)

Figure 2. Basic characteristics of European steel industry and specifically steel construction sector: (a) Productivity, (b) turnover (c) employment, (Source: *EUROFER 04/2007*).

Most of the countries in the EU had a decrease in steel usage after year 2008 and especially after 2012. It was not only the debt-ridden countries, such as Spain, Italy and Greece that experienced a decline in steel consumption, but also strong countries such as Germany. The a steel use in Spain and Italy in 2012 has been decreased by 11.9% and 12.6%, respectively, while in Germany a decline of 4.7% has been observed. Despite the current uncertain economic environment in Europe, small improvement has been observed after 2013. Sectors such as mechanical engineering, domestic appliance and metal goods are expected to contribute positively to EU steel demand, whereas the main steel sectors such as construction and automotive, which have the main contribution to steel consumption, continue to shrink even after 2013.

Steel continues to offer strong, durable, beautiful, flexible, adaptive and recyclable solutions for constructions which are always open to novel ideas. Innovation should and may play a very significant role on steel construction sector recovery and growth. There are numerous fields for new innovations within steel construction industry. The world market demands lighter, stronger and more sustainable steel materials and structures. In order to produce these materials and structures, a number of complex processes should be utilized. New steel grades of enhanced quality and properties are developed while new production processes are continuously proposed. Advanced and modern constructions require the creation of customised materials and combination of techniques and methods. Energy efficiency and environmental responsibility in recent times require the development of innovative solutions. New targets and areas for investigation and research arise every day in the field of steel construction in the effort to find and develop new methods of manufacturing products or offering services.

5. Research study on Greek steel industry

The research of the present study is based on the year 2014, during a period in which a slight recovery of the Greek economy has been observed. Crucial data has been collected by distributing online questionnaires to about 50 rather small and medium sized Greek companies in the field of steel construction. Many of these companies are fully complying with ISO 9001:2008 since 2008. However, some others have much later been certified with such a standardization system. It should be mentioned that very small companies of the industry under consideration have been excluded from the research.

Figure 3 shows the categorization of the analysed organizations with respect to their certification status. It becomes clear that the companies of the present survey belong to two main categories i.e., those that are certified with ISO for about six years and those that have been members of ISO system for about three years. It is evident that most of the companies that took part in the present study belong to the first category.

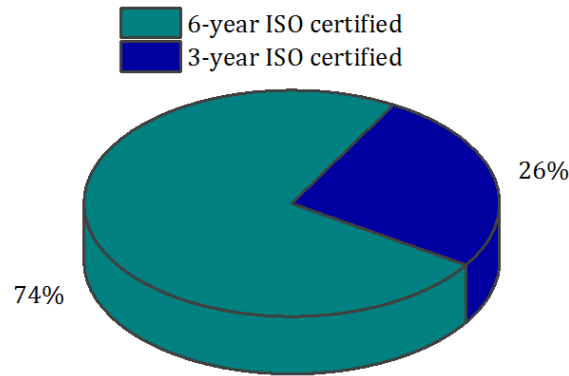


Figure 3. Categorization of Greek steel construction companies according to ISO participation.

In order to exploit the implications of ISO 9001:2008 in the innovation characteristics of the sector under investigation, some targeting questions have been asked to representative managers involving of their companies' strategy (Figure 4), research activity (Figure 5), education activity (Figure 6) and investments to novel developments (Figure 7).

Figure 4 makes evident that 6-year ISO 9001:2008 certified companies present a more focused strategy on the development of new processes as well as on the incorporation of the modern technological advances.

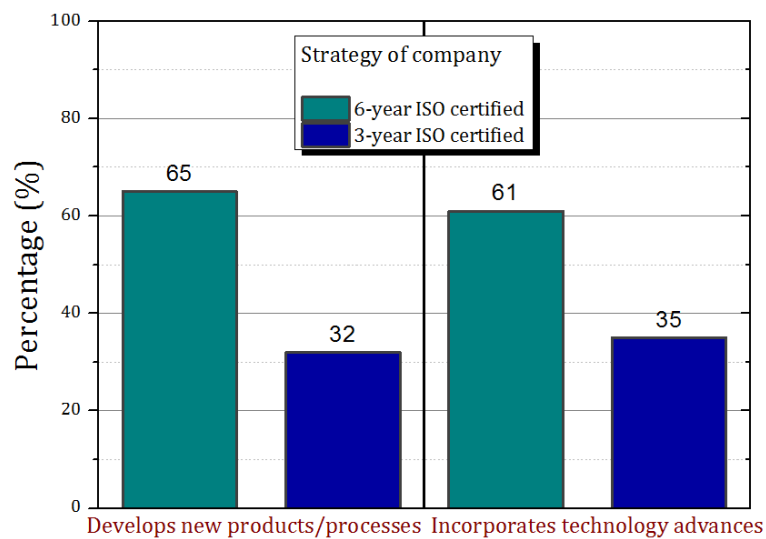


Figure 4. Strategy of 6-year vs 3-year ISO certified steel construction companies involving their tendency for new product/process development and technology advances incorporation.

Comparing the interest for research of 6-year and 3-year ISO certified companies, a clear advantage of the first ones may be observed in Figure 5. Characteristically, companies that are not familiar for many years with ISO 9001:2008 show an almost negligible concern for participating in research activities within or out of the company.

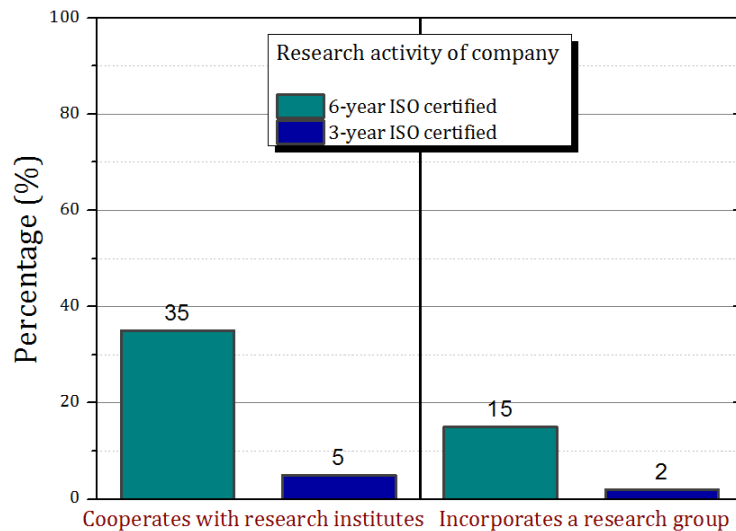


Figure 5. Research activity of 6-year vs 3-year ISO certified steel construction companies involving their tendency for research institutes cooperation and research group incorporation.

According to the managers' answers which are summarized in **Figure 6**, 6-year ISO 9001:2008 compliant companies give special attention on educating their employees via frequent training programs and seminars in comparison with the 3-year ISO certified companies.

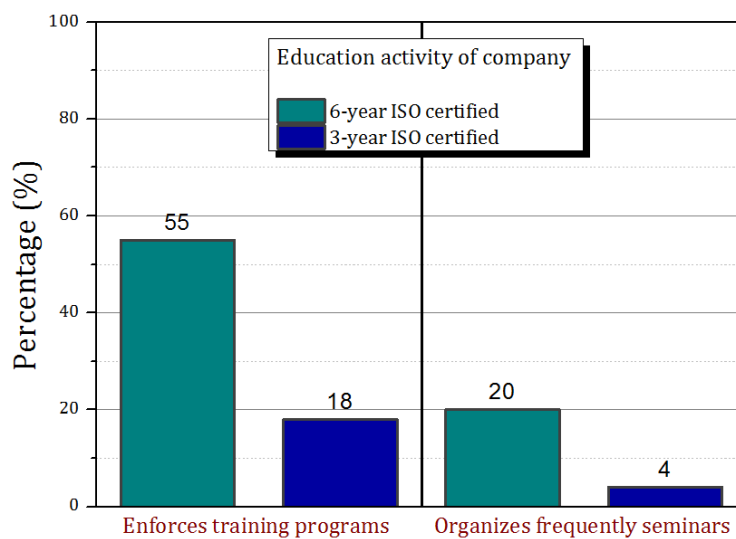


Figure 6. Education activity of 6-year vs 3-year ISO certified steel construction companies involving their tendency for training programs enforcement and frequent seminar organization.

Finally, the higher interest that 6-year ISO certified steel construction industries show for investment on innovative materials, equipment or patents may be concluded by observing **Figure 7**. Organizations that do not follow ISO 9001:2008 system for more than 3 years seem to be rather reluctant to spend on innovative tools or ideas.

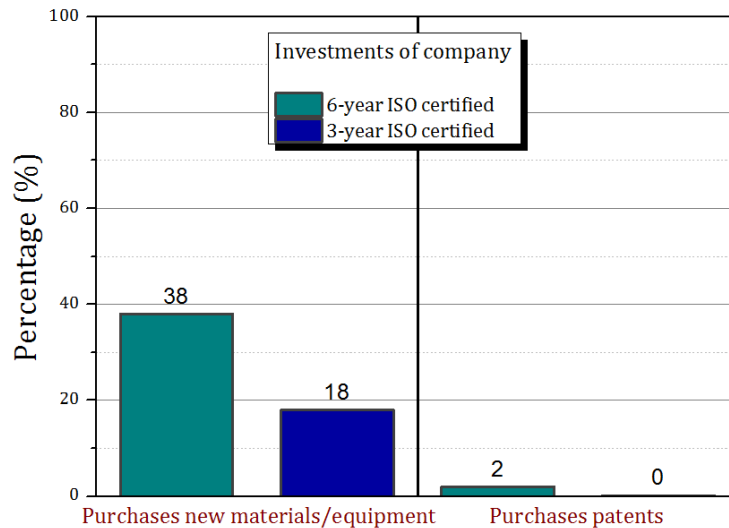


Figure 7. Investment activity of 6-year vs 3-year ISO certified steel construction companies involving new materials/equipment and patent purchase.

6. Conclusions

The present study has been concentrated on the investigation of the relation between ISO 9001:2008 and innovation performance in Greek steel construction industry. A comprehensive discussion has been made on ISO 9001, innovation and their inter-links according to the literature while special attention has been paid for the innovation in Greece during the last few years. The profile of the European steel sector and especially the profile of the steel construction industry and its innovation perspectives have been analysed.

A significant sample of representative ISO 9001:2008 certified companies which belong to the Greek steel construction sector have been investigated. According to the statements and answers of numerous managers, several illustrative data have been arisen concerning the innovative actions of the companies that they represent. The analysis showed that organizations which have adopted earlier ISO 9001:2008 presented notable tendency for adopting innovations. Specifically, the companies that are certified with ISO 9001:2008 for a longer period of time showed a higher interest for new products, equipment and technological advances, research conduction and collaborations, training programs and seminars as well as investments for new equipment and patents. However, it should be noted that quick ISO 9001:2008 adoption by some organizations could possibly be related as well with their higher efficiency and competitive positioning before-hand in comparison with other corresponding companies which are compliant with ISO for less years. This fact alone may be associated with higher innovation performance. Thus, future research is recommended which would examine the relationship between ISO 9001:2008 with innovation performance by studying same sized companies which share similar productivity characteristics.

Acknowledgements

This research has been co-financed by the European Union (European Social Fund - ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) - Research Funding Program: ARCHIMEDES III. Investing in knowledge society through the European Social Fund.

References

Adler, P.S. (1999), Building better bureaucracies, *The Academy of Management Executive* 12(4): 1–36.

Aiken, M., Hage, J. (1971), The organic organization and innovation, *Sociology* 5:63–82.

Corrigan, J. (1994), Is ISO 9000 the path to TQM? *Quality Progress* 23:33–36.

Corbett, C.J., Montes-Sancho, M.J., Kirsch, D.A. (2005), The financial impact of ISO 9000 certification in the United States: an empirical analysis, *Management Science* 51(7): 1046–1059.

Damanpour, F. (1988), Innovation type, radicalness, and the adoption process, *Communication Research* 15(5): 545–567.

Damanpour, F., Gopalakrishnan, S. (2001), The dynamics of the adoption of product and process innovations in organizations, *Journal of Management Studies* 38(1):65–84.

Franceschini, F., Galetto, M., Maisano, D. and Mastrogiacomo, L. (2011), A proposal of a new paradigm for national quality certification systems, *International Journal of Quality & Reliability Management* 28(4): 364–382.

Firth, M. (1996), The diffusion of managerial accounting procedures in People's Republic of China and the influence of foreign partnered joint ventures, *Accounting, Organizations and Society* 21(7/8): 629–654.

Gopalakrishnan, S., Bierly, P., Kessler, E.H. (1999), A reexamination of product and process innovations using a knowledge-based view, *Journal of High Technology Management Research* 10(1): 147–166.

Goswami, S., Mathew, M. (2005), Definition of innovation revisited: an empirical study on Indian information technology industry, *International Journal of Innovation Management* 9(3): 371–383.

Guler, I., Guillen, M.F., Macpherson, J.M. (2002), Global competition, institutions, and the diffusion of organizational practices: the international spread of ISO9000 quality certificates, *Administrative Science Quarterly* 47(2): 207–232.

Hashem, G., Tann, J. (2007), The adoption of ISO 9000 standards within the Egyptian context: A diffusion of innovation approach, *Total Quality Management and Business Excellence* 18(6): 631–652.

Henkoff, R. (1993), The hot new seal of quality, *Fortune* 28:68–71.

Hindo, B. (2007), At 3M, a struggle between efficiency and creativity, *Business Week* 11: 8–16.

- Molina, L.M., Lloréns-Montes, J., Ruiz-Moreno, A. (2007), Relationship between quality management practices and knowledge transfer, *Journal of Operations Management* 25(3): 682–701.
- Naveh, E., Erez, M. (2004), Innovation and attention to detail in the quality improvement paradigm, *Management Science* 50(11): 1576–1586.
- Naveh, E., Marcus, A. (2005), Achieving competitive advantage through implementing a replicable management standard: Installing and using ISO9000, *Journal of Operations Management* 24(1): 1–26.
- Pivka, M., Mulej, M. (2004), Requisitely holistic ISO 9000 audit leads to continuous innovation/improvement, *Cybernetics and Systems* 35(4): 363–378.
- Prajogo, D., Sohal, A. (2001), TQM and innovation: a literature review and research framework, *Technovation* 21(9): 539–558.
- Rogers, E. M. (1995), *Diffusion of Innovations*, 4th ed., New York: The Free Press.
- Sá, P., Abrunhosa, A. (2007), The role of TQM practices in technological innovation: the Portuguese footwear industry case, *Total Quality Management & Business Excellence* 18(1–2): 57–66.
- Singh, P.J., Smith, A. (2004), Relationship between TQM and innovation: an empirical study, *Journal of Manufacturing Technology Management* 15(5): 394–401.
- Schilling, M. A. (2008). *Strategic management of technological innovation*, 2nd ed., New York: McGraw Hill Education.
- Stephens, K.S. (1994), ISO 9000 and total quality. *Quality Management Journal* 2(1): 57–71.
- Stevenson, T.H., Barnes, F.C. (2001), Fourteen years of ISO9000: impacts, criticisms, costs and benefits, *Business Horizons* 44: 45–51.
- Terziovski, M. (2010), Innovation practice and its performance implications in small to medium enterprises (SMEs): are source-based view, *Strategic Management Journal* 31(8): 892–902.
- Terziovski, M., Samson, D., Dow, D. (1997), The business value of quality management systems certification: evidence from Australia and NZ, *Journal of Operations Management* 15:1–18.