



TQM measurement model for the biotechnology industry in Taiwan

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ABSTRACT

Due to the importance of the growth of biotechnology in Taiwan, the question of how the operation performance of the industry can be upgraded to sustain its competitive advantages has become an important question for Taiwanese biotechnology insiders. Recently, a growing number of organizations have implemented TQM in order to give them a competitive advantage [Chan, T. H., & Quazi, H. A. (2002). Overview of quality management practices in selected Asian countries. *Quality Management Journal*, 9(1), 172–180; Nilsson, L., Johnson, M. D., & Gustafsson, A. (2001). The impact of quality practices on customer satisfaction and business results: Product versus service organizations. *Journal of Quality Management*, 6, 5–27]. Meanwhile, quality related awards are also appearing for examining and identifying whether or not the overall quality of a firm is high. Each award, however, focuses only on examining certain items. It is impossible for a firm to make each examined item perfect. In addition to this, since the overall quality of the technology and products of some Taiwanese biotechnology corporations has been decreasing, the prestige of the Taiwanese biotechnology industry as a whole has decreased in the global market. Thus, in order to solve the above difficulties, this study attempts to find the most suitable measurement model for the biotechnology industry to enact quality improvement. The study first reviews a substantial body of literature on total quality management and categorizes measurement criteria. The study then proceeds with in-depth interviews with relevant background experts in order to extract and verify the most suitable measurement criteria. In addition to this, a FANP is utilized in order to analyze the weights of different measurement dimensions and criteria. The value of this study is its construction of a TQM measurement model for the Taiwanese biotechnology industry that can be used to improve its quality as well as to regain a higher market share of the global market.

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1. Introduction

Industries have come to understand that, in order to stay competitive globally, a continuous improvement in organizational quality performance is a necessity (Mele & Colucio, 2006; Sitalakshmi, 2007). Thus, a body of organizations started to implement total quality management (TQM) in order to generate a competitive advantage (Chan & Quazi, 2002; Nilsson, Johnson, & Gustafsson, 2001). In Taiwan, the importance and growth of the biotechnology industry has, in recent years, increased dramatically; it is now Taiwan's second most profitable industry, the high-tech industry being the highest. Moreover, with the large amount of capital investment by the Taiwanese government, biotechnology related corporations are flourishing; nevertheless, due to the poor quality of products and technology from some of them, both the prestige and market share of Taiwanese biotechnology corporations are decreasing in

the global market. In this regard, a precise and effective way to measure and operate quality improvement is necessary today.

Measuring overall quality is complex. A great number of quality awards exist, such as the European Quality Award, the Malcolm Baldrige National Quality Award, the Asia-Pacific Business Excellence Standard, the Vietnam Quality Award, QS 9000, and IS 9000 (Dinh, Barbara, & Tritos, 2006), all of which are trying to play a role in standardizing the overall quality of an organization. Each award, however, focuses on certain examined items. It is impossible for a firm to make each item perfect. Although the national quality award (NQA) is widely used in different industries in Taiwan, there is little evidence that it can improve a specific industry's overall quality, due to each industry's different features.

In light of this, a literature summarizing method is adapted in order to integrate related measurement criteria. A fuzzy analytic network process (FANP) was used to overcome the problem of dependence and feedback among dimensions or criteria. This is a general form of the FAHP that relieves hierarchical structural restrictions (Liou, Tzeng, & Chang, 2007). In this study, a literature summarizing method that is based on the NQA is utilized by combining it with FANP to create a new TQM measurement model.

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2. Total quality management

The definition of quality, in the past, was the degree of conformance to a standard (Sitalakshmi, 2007). Sallis (1993) defined quality as that which best satisfies and exceeds customer needs and wants. Typically, quality has a variety of meanings (Sitalakshmi, 2007) and its range of meanings causes confusion as each individual's perception of quality differs (Shields, 1999). Since quality is proven to contribute to greater market share and return on investment (Cole, 1992; Philips, Chang, & Buzzell, 1983), lower manufacturing costs, improved productivity (Garvin, 1983) and improved strategic performance (Zhang, 2000), there are more and more organizations emphasizing the importance of increasing the quality of their service and products.

Within the field of quality improvement, total quality management (TQM) is the most referred as well as most used criterion for enhancing organizational quality (Chan & Quazi, 2002; Nilsson et al., 2001). Recent studies have defined TQM as an holistic management philosophy that strives for continuous organizational improvement (Kaynak, 2003). Furthermore, TQM can be seen as a management style based on producing quality service as defined by the customer, or based on achieving an organizational strategic imperative through continuous process improvement (Tseng, Lin, Chiu, & Liao, 2007). Additionally, TQM is also an integrated management philosophy aimed at continuously improving the performance of products, processes, and services in order to achieve and surpass customer expectations (Ozden & Birsan, 2006). To summarize the above literature, TQM can be defined as a managerial method both for improving an organization's core competitive ability and for gaining the maximization of market share within the industry in which it belongs.

There is a stream of recent literature showing that if a firm implements TQM, it will gain many advantages, such as helping companies to improve their performance (Chase, Jacobs, & Aquilano, 2006; Han, Chen, & Ebrahimpour, 2007; Knod & Schonberger, 2001; Wadsworth, Stephens, & Godfrey, 2002), reducing rework, a

reduction in the costs related to poor quality (e.g., scrap, rework, late deliveries, warranty, replacement, etc.) (Antony, Leung, Knowles, & Gosh, 2002), and generating more unique competitive advantages (Reed, Lemak, & Mero, 2000). Hence, many quality related awards have arisen, such as the European Quality Award, the Malcolm Baldrige National Quality Award, the Asia-Pacific Business Excellent Standard, the Vietnam Quality Award, QS 9000, and IS 9000 (Dinh et al., 2006; Uzumeri, 1997). The purpose of each of these awards is to examine the performance of each firm's operating TQM. Each award, however, has its own examination items. It is difficult for a firm to focus on every item while trying to improve. Consequently, it is important for firms to be able to discover which criteria are most critical for them to engage.

3. Measurement criteria of TQM

The criteria for measuring TQM are various from one author to another (Ozden & Birsan, 2006). One of the early research works defining what constitutes TQM practice was conducted by Saraph et al. in 1989 (Joo & Yong, 2006). Since then, numerous related studies have been conducted by authors including Flynn, Schroeder, and Sakakibara (1994), Black and Porter (1996), Choi and Eboch (1998), Samson and Terziovski (1999) and Kaynak (2003). This study summarizes the different criteria proposed by related researchers in Table 1.

Based on the above literature, TQM criteria can be categorized into the following five dimensions: leaders, employees, customers, IT, and operating process. In Taiwan, the National Quality Award (NQA) is the most frequently utilized in some industries. It contains seven measurement dimensions: leadership and operation ideals, strategy management, the development of customers and a market, human resources and knowledge management, the applications and management of information strategy, process management, and operation performance. Because the measurement dimensions of NQA are similar to the above dimensions, the research structure in this study is based on NQA, with fixed

Table 1
Measurement criteria based on TQM.

Authors	TQM factors
Brah, Wong, and Rao (2000)	Top management support, customer focus, employee involvement, employee training, employee empowerment, supplier quality management, process improvement, service design, quality improvement rewards, benchmarking, and cleanliness and organization, customer satisfaction
Antony et al. (2002)	Management commitment, role of the quality department, training and education, employee involvement, continuous improvement, supplier partnership, product/service design, quality policies, quality data and reporting, communication to improve quality, and customer satisfaction orientation
Sila and Ebrahimpour (2002)	Top management commitment, employee involvement, employee empowerment, education and training, teamwork, customer focus, process management, information and analysis systems, strategic planning, open organization, a service culture, and especially process management
Shieh and Wu (2002)	Leadership, human resource management, process management, supply chain management and information management
Sureshchandar, Rajendran, and Anantharaman, (2002)	Top management commitment and visionary leadership, human resource management, technical systems, information and analysis systems, benchmarking, continuous improvement, customer focus, employee satisfaction, union intervention, social responsibility, services capes, and service culture
Besterfield (2003)	Quality culture, the quality chain, quality assurance, commitment to continuous improvement, and the support of top management
Prajogo and Sohal (2003)	Product innovation impacts the performance of total quality management
Jacqueline, Coyle, and Paula (2003)	Statistical process control, the commitment of top management, empowerment, and appropriate culture
Wanger and Schaltegger (2004)	Leadership
Escrig-Tena (2004) and Kenneth and Cynthia (2004)	Financial performance
Ozden and Birsan (2006)	Customer focus, continuous improvement, and teamwork
Nusrah, Ramayah, and Norizan (2006)	Employee empowerment, information and communication, customer focus, and continuous improvement
Ismail (2006)	Leadership, strategic planning, customer focus, information and analysis, human resource management, process management, supplier management, human resource results, customer results, and organizational effectiveness
Dinh et al., (2006)	Strategic planning
Keng, Nooh, Veeri, Lorraine, and Loke (2007)	Teamwork, reward and recognition, customer focus, organizational trust, extensive training, high level of communication, management commitment at all levels, employee involvement, empowerment and organizational culture
Han et al. (2007)	Supplier relationship, customer involvement, training, top management commitment, and product design

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