

The role of quality function deployment in meeting customers' requirements: A case study on the Egyptian tire manufacturing company

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Keywords

Total Quality Management, Quality Function Deployment, Less Developed countries, Public Sector Organizations, Egypt

Abstract

The purpose of this study is to explore the use of QFD within the Egyptian public sector. Thus, there is a need to examine the role of QFD as an improvement approach within the Egyptian public sector organizations. Where QFD had consistently been claimed in the Western world and Europe. This study aimed to extend the knowledge of choosing an appropriate TQM tool for the Egyptian PSOs. Where it serves as an extension to previous studies carried out in the Western world but within the Egyptian context.

This study is based on two sources of data collection, semi structured interviews from customers which were analyzed using content analysis and focus groups with managers to construct the QFD model. A purposive sample targeting the company's customers and managers were selected who had the requisite information. Semi-structured interviews helped to identify the factors affecting customers' purchase preferences, customers' opinions, perception, requirements, and problems. Moreover, it served the purpose to identify the 'WHATs' that are an essential part of the proposed QFD framework. Two focus group sessions were conducted to construct the QFD model.

The findings of the study indicate that QFD is a generic framework that is appropriate and feasible for application within the public sector tire manufacturing company in Egypt. It was quite a good scientific exercise to demonstrate how customers' requirements were identified, the technical specifications needed and finally constructing the QFD framework to meet customers' requirements.

The current study is a single case study which might limit the ability to generalize the research findings, although it identified powerful context and specific insights into QFD implementation. Yet, generalization of findings could be applied to other public sector companies in Egypt facing almost the same problems and having the same surrounding context and environment. Another limitation of this study is the sample size.

The Egyptian public sector has suffered from different problems and challenges, lack of attention to customers' requirements constituted a major element of such problem. It is suggested that through the use of QFD would help to overcome few challenges facing the public sector. The practical work conducted would help in redirecting and highlighting the important role of QFD. This study aimed to provide insights into the procedures, practices, limitations and constraints faced during QFD development to assist the effective strategic moves for the future.

1. Introduction

In the last decades, the public sector has seen substantial disorder in most developed and developing countries. Rapid changes and globalization in the world caused imperative changes and structuring in public administration. The scope, organization and management of public services have changed dramatically since the 1970s (Turkyilmaz *et al.*, 2011). Public sector organizations that do not embrace the technology will continue to have major problems in achieving efficiencies and delivering the value demanded by the citizen, particularly in the light of shrinking public sector budgets (McIvor *et al.*,

2002). Public sector organizations face restrictions on their ability to generate new revenue and find that they are required to deal with increasing consumer demands whilst operating with reduced budgets (MacIntosh, 2003). Changes in the public sector include changes in expectations with citizens having become more sophisticated and requiring greater focus on choice and quality in the provision of public services (Pekkarinen *et al.*, 2011). During the past two decades, a silent revolution in public sector governance has swept across the globe (Bhuiyan and Amagoh, 2011). Quality management has come to be viewed as the solution to the main criticism of public services, inefficiency, and wastefulness (Magd and Curry, 2003). The basic principles of Total Quality Management (TQM) are applicable in any organization, whether manufacturing, service, public or private (Al Zamany *et al.*, 2002). TQM aims to provide organizations with a template for success through customer satisfaction. The key to competitive advantage is in continuously satisfying customers' needs in a fashion that is superior and more consistent than competitors (Walsh *et al.*, 2002). Marketing scholars and managers have continued to argue that a business which improves its customer orientation will enhance its performance. Building long term relationships with customers is considered an essential precondition for the economic survival and success of most service firms today (Hennig -Thurau, 2004). Yet, the lack of understanding of customer satisfaction issues, the lack of internal drive and motivation to improve processes, make the TQM intervention more difficult in the public sector (Dewhurst *et al.*, 1999). Success in business will continue to depend on how effectively companies meet customers' needs. Many organizations recognize that attaining customer satisfaction through delivery of quality services is a key to their survival and they are well aware that having a loyal base of satisfied customers increases sales, reduce costs and builds market shares (Hennig -Thurau, 2004).

Quality Function Deployment (QFD) can be viewed as an application of the TQM philosophy to new product development (Sweet *et al.*, 2010). It is with QFD that companies will be able to accomplish future challenges (Delano *et al.*, 2000). QFD is an ideal opportunity to move away from we know best what the customers' wants to a new culture of let's hear the voice of the customer. In a sense that enables the organization to become very much proactive to quality problems rather than being reactive to them by waiting for customers' complaints (Herrmann *et al.*, 2006). It is argued that quality problems could be reduced by including customers' requirements in the new product and design stage by understanding customers' needs (Macintosh, 2007). TQM implementation in Less Developed Countries (LDCs) is likely to encounter several roadblocks; political uncertainties are likely to make TQM long term orientation untenable to many governments and industry leaders. The notion of worker involvement and empowerment could be seen with cynicism and suspicion by managers and government leaders who are used to autocratic and even dictatorial ways of decision making. In LDCs, the impediments to successful TQM implementation are: the insufficiency of the required infrastructure, scarce domestic capital, economic problems, foreign exchange shortage, the political environment in is unstable, and the democratic culture is generally lacking. On the other side studies have shown that successful implementation of TQM can help to alleviate the typical problems encountered in LDCs (Mersha, 1997). Most management research in Egypt has focused on the public sector (Elbanna, 2008). The successful implementation of TQM strategy in the Egyptian industrial sector would help to improve the quality of goods and services, enhance corporate performance, improve workers skills and quality consciousness and may boost the demand of Egyptian products in international markets (Bhuiyan and Amagoh, 2011).

Previous studies have been conducted concerning QFD as an improvement approach derived from TQM; Bellou (2010) conducted a comprehensive review of TQM literature and reported that customer focus and satisfaction receive the widest coverage in TQM survey literature. Where a customer driven quality is a key strategic business issue which should be considered an integral part of overall business strategy at the organization level. While Jiang *et al.* (2007) in his study on QFD in contract manufacturing mentioned that for QFD to succeed it needs top management commitment to QFD, facilitate worker-supervisor collaboration in QFD efforts, institute internal processes and strategies for QFD, establish effective use of information and data to support QFD actions, build relationships with customers, enable employees to develop and utilize their capacity to deliver value to customers, and enhance QFD team-

building. Ghobadian and Terry (1995) showed how Alitalia improved service quality through QFD, to apply the QFD technique successfully the service organization should: be market driven and customer oriented, rely on teamwork and multidisciplinary team approach, create an environment which regards everyone downstream as a customer, attempt to eliminate bureaucracy, develop a culture aimed at delighting the customer, internalize the QFD technique and use it as a matter of course. In general QFD has been used in different fields as to improve the quality of teaching (Lam and Zhao, 1998), in electronic banking (González *et al.*, 2004), designing information technology systems (Tan *et al.*, 1998), new product design (Lockamy and Khurana, 1995), resolve customer satisfaction strategy decisions (Chien and Su, 2003), in educational setting (Pitman *et al.*, 1995), in food safety management (Sweet *et al.*, 2010), and pump manufacturing environment (Devadasan *et al.*, 2006).

The Egyptian public sector is far in terms of TQM implementation. Literature and studies have showed that there are several impediments to successful TQM implementation in Egypt. Adopting TQM within the Egyptian public sector would lead to improvements in performance. Yet, there is a lack of understanding of customer requirements which could be achieved through the use of QFD. Thus, there is a need to evaluate the role of QFD as an improvement approach within the Egyptian public sector organizations. The whole of the Egyptian public sector organization is too wide in scope to be manageable, the decision was made to select a certain industry to represent this sector. Thus, the tire manufacturing industry has been chosen. Having only one company in the public sector in the tire manufacturing industry made it a good candidate for the study. This study represented a case study on Egyptian public sector exemplified by the public sector tire manufacturing company.

2. Literature Review

Total quality management

Recent years have witnessed major changes in public sector management. Increased productivity, reduced costs, satisfied customers and employee empowerment are some of the major terminologies associated with quality implementation and continuous improvement tools and strategies (Fryer *et al.*, 2009). Implementing and sustaining quality management in the public sector is a challenge (Willcocks, 2002). To improve TQM implementation in public enterprises a concerted effort is required to market the TQM approach not only to top managers but also to influential government leaders. Creating awareness among top government leaders by articulating the benefits of improved quality for economic development, and by highlighting the political implications of achieving such improvements, would help to earn support for TQM. This would facilitate TQM implementation in public enterprises (Mersha, 1997). TQM is a philosophy which aims to provide organizations with a template for success through customer satisfaction. TQM seeks constant attainment of customer satisfaction through an integrated system of tools, techniques and training. The key to competitive advantage is in continuously satisfying your customers' needs in a fashion that is superior and more consistent than competitors (Walsh *et al.*, 2002). Due to the dynamic global competition providing customers with quality products and services is essential. To maintain a competitive edge in the marketplace, many managers undertake the concept of total quality management (Cai, 2009).

TQM implementation in LDCs

Egypt, like most LDCs, strives to diagnose and find solutions for the severe problems that are obstructing the growth and development of its industrial sectors. Problems like losing market shares, high levels of inventory, poor quality of products, long lead times and the existence of many sources of waste in production processes (Salaheldin, 2005). The successful implementation of TQM in the Egyptian industrial sector would help to improve the quality of goods and services, enhance corporate performance and may boost the demand of Egyptian products in international markets, improving workers' skills and quality consciousness (Salaheldin, 2003). It also leads to increased export capability, improve foreign exchange earnings for LDCs which can be used to purchase capital goods needed for economic development projects. If successfully implemented, it would thus contribute to increased trade between LDCs and the

industrialized nations (Mersha, 1997). Salaheldin (2003) explored the major problems that faced the application of TQM were lack of strong leadership, lack of strategic quality planning, ineffective human resources development and management, incapability of managing quality process, and less concern about customer satisfaction and quality results. Moreover, organizational culture, unskilled employees, and uncommitted top management were found to be some of the barriers that hinder the application of TQM in the Egyptian PSOs. Added to the above, some other problems were related to the ambiguity of training, poor individual performance appraisal, weakness of financial and information systems, the long period of time needed for the application of TQM, and above all most employees were driven without being convinced to participate in the TQM implementation which could be reflected on their poor performance and the organization overall outcomes.

TQM and QFD

Quality Function Deployment focuses on quality management and product development. Through focusing on listening to the voice of the customer, it ensures that quality can be built into new products or new versions of existing products at an early design stage, where QFD can be viewed as a main pillar for successful TQM (Bosch and Enriquez, 2005). QFD is the implementation vehicle for TQM. The effective use of QFD for integrating TQM into new products results in strategic market advantages due to improved customer satisfaction. TQM practices provide a basis for QFD which in turn helps to break down organizational barriers and solve quality problems in key market segments (Thakkar *et al.*, 2006). QFD is an important product/service development methodology which provides a way for practitioners to understand customer needs and demands for a product or service, and transform this information into required or desirable technical attributes. The main goal in implementing QFD is to improve the quality of the product or service based on customer defined requirements and expectations (Iqbal *et al.*, 2014). It is one of the quantitative tools and techniques of total quality management that could be used to translate customer requirements into appropriate technical or service requirements (Durga *et al.*, 2014). QFD is used in defining how to understand the quality that customers expect and make it happen in a dynamic way. It is a successful technique for helping product design and development groups in interpreting customer requirements into technical requirements (Shahin *et al.*, 2016). Moreover, consumers are becoming better organized, are well informed and are; on the whole, more demanding. It is not surprising that many firms have instituted formal activities to improve the value of services delivered, and to promote a renewed emphasis on serving the customer (Berthon *et al.*, 2004). QFD can be viewed as an application of the TQM philosophy to new product development. It requires a TQM philosophy to be successful. Using QFD ensures that nothing falls through the cracks with regard to the needs of the customer (Sweet *et al.*, 2010).

Due to QFD numerous benefits, it has been successfully applied in construction companies, education, software developments, hotels and airlines (Ginn and Zairi, 2005). It has been widely used at some of the world's largest and most successful companies including Ford, Hewlett Packard, General Motors, Proctor and Gamble (Han *et al.*, 2001). It is deeply integrated in the world of the West (Politis, 2003). Although manufacturing industries were the first to adopt QFD, service and government organizations are also using it in their efforts to improve performance (Vonderembse and Raghunathan, 1997). QFD can help companies to make key tradeoffs between what the customers' wants and what the company can afford to build. By concentrating efforts on what will satisfy the customer and the company most, less time will be spent on redesign and modification of the product (Bouchereau and Rowlands, 2000). It is with QFD that companies will be able to accomplish future challenges (Delano *et al.*, 2000). QFD is a method for product or service planning and development that enables a development team to specify clearly customer's wants and needs, and then evaluate each proposed product or service capability systematically in terms of its impact on meeting those needs (Lam and Dai, 2013). QFD is an ideal opportunity to move away from we know best what the customers' wants to a new culture of let's hear the voice of the customer. In a sense it enables the organization to become very much proactive to quality problems rather than being reactive to them by waiting for customers' complaints (Vonderembse and Raghunathan, 1997; Zairi and Youssef, 1995). To respond to the needs of customers and stay at the edge

of competitive advantage, a decision-making tool was developed that can integrate technology, organizational policies and customers' requirements all into a product that is manageable, attractive, useable, and profitable. This decision-making technology is nothing but quality function deployment (Vinayak and Kodali, 2013). In countries such as Japan, the USA, the UK and Canada, QFD has become a tool for translating customer requirements into objectives and targets through quality of thought, quality of processes and quality of action. In these developed countries, QFD is seen as a pro-active customer driven planning process that enables problems to be identified and solved at the very beginning (John *et al.*, 2014).

Benefits of implementing QFD

Various applications and studies have shown many benefits of QFD, it brings efficiency to companies because misinterpretation and need for changes are minimized. Better understanding of customers' needs, increased quality of communication, and faster decision making are achieved. QFD leads to superior product quality and design, shorter design cycles with fewer engineering changes, higher potential for radical innovations, and more satisfied customers, more customer orientation, reduction of implementation time, better promotion of teamwork, and higher customer satisfaction (Hermann *et al.*, 2006). Toyota also offers impressive data on how useful QFD could be. Toyota reported the following benefits: engineering changes cut by 30 to 50 per cent, design cycles are shortened by 30 to 50 per cent, start up costs was trimmed by 20 to 60 per cent, and warranty claims were reduced by 20 to 50 per cent (Kathawala and Motwani, 1994). Benefits reported by Japanese manufacturers using QFD include: reductions in number of engineering changes (up to 50 per cent), squeezing of design cycle time (up to 50 per cent) increased customer satisfaction and reductions in warranty claims (up to 50 per cent) (Zairi and Youssef, 1995).

Problems of implementing QFD

QFD needs to input and analyze a large amount of subjective data, QFD analysis often stops after the first QFD, so links between QFD phases are broken. It is very complex and time consuming process to develop the QFD charts. Complexities of the chart, vagueness in the data collected and the analysis is performed in a subjective basis (Bouchereau and Rowlands, 2000). QFD is a very time consuming process. Any attempt to get instant results will probably be disappointing. The most frequent QFD mistakes committed by organizations are making charts that are too big, mixing engineering elements with customers' demands, and completing QFD late so that no changes can be implemented (Kathawala and Motwani, 1994). The use of special symbols for constructing the House of Quality (HOQ) makes it difficult for a person who is not exposed to the QFD process to interpret it (Devadasan *et al.*, 2006). Several problems can be encountered during the implementation of QFD. Bias can be easily injected into any stage of QFD implementation. To a high degree, the QFD method depends on serial processing, therefore errors introduced at one stage will propagate to successive stages. QFD is complex and time consuming process requiring a lot of details. Performing QFD manually within a large matrix can lead to errors. Thus simplification and computerization of the QFD process have become important research issues in QFD (Han *et al.*, 2001). Many attempts to QFD fail because not enough time is given to the team concerned to learn the technique and pilot it on simple projects to start with. QFD tends to work better if there is a strong total quality program (Zairi and Youssef, 1995).

Why use QFD

For sustainable increases in market share and profitability, companies are focusing on improving product development practices. These efforts allow firms to design products that better meet customers' requirements and, at the same time, can be produced economically and quickly (Vonderembse and Raghunathan, 1997). QFD has been heralded as an important part of the product development process, it uses a cross functional team to determine customers' requirements and translate them into product designs and specifications through highly structured and well documented methods. It enables an

organization to measure customer 'WHATs' and map them against the engineering 'HOWs' in a way that highlights tradeoffs and drives the products design towards customers' requirements (González *et al.*, 2004). QFD facilitates the growth and prosperity of a firm by developing an array of products that are attractive to existing and new customers. Through QFD the voice of customer aligns the company's resources to focus on maximizing customer satisfaction (Vonderembse and Raghunathan, 1997). Products designed with QFD will have lower production cost, shorter development time, and higher quality than products developed without QFD. These benefits are attracting an increasing number of product development practitioners to the QFD methodology. Although manufacturing industries were the first to adopt QFD, service and government organizations are also using it in their efforts to improve performance (Killen *et al.*, 2005).

3. Research methodology

This study represented a case study on Egyptian public sector exemplified by the public sector tire manufacturing company. An exploratory research was used to define the problem more precisely, identify relevant course of action and gain additional insights. A purposive sample was used to identify and question customers who had past experience with the company's products and the company's managers because the researcher was interested in their experience, knowledge and opinions.

Data collection

Semi-structured interviews with the company's customers were carried out to identify their requirements, problems, perceptions, and opinions, followed by themed analysis. Then two focus groups were conducted with the company's managers to construct the QFD model.

Semi structured interviews with the company's customers

The semi-structured interviews with the company customers had been conducted in advance of the focus groups with the company managers to develop the 'WHATs' which is the input to QFD framework. Interview questions were designed to elicit, probe participants responses based on expectations, perception, attitudes and experience. They were asked in a loose format to establish rapport, confidence and probe in-depth information from the interviewees. It was conducted in a relaxed atmosphere at the tire retail store. The semi-structured interview started by the assumption that participants were meaningful and knowable and their perspectives affected the success of the research. The spontaneous responses were expected to reflect genuine opinions, ideas and feelings. The semi-structured interviews helped in capturing customers' perception in their words. The semi-structured interviews with customers were stopped when any added customer opinion, perception or requirement will not add new ideas to the ones that have been already obtained. This shows that saturation was achieved. One hundred and fifty customers who intended to buy tires produced by Egyptian public sector tire manufacturing company were asked if they could participate in the semi-structured interview. Only one hundred and thirty customers agreed to participate to know their requirements, problems, perceptions, and opinions, thus leading to a response rate of about 87%, the sampling time frame of the semi-structured interviews were three months. The semi-structured interview addressed the customers shown in table 1.

The data obtained from the semi-structured interviews were analyzed using themed analysis, an approach used in the analysis of documents and texts that seek to quantify contents in a systematic and reliable manner (Bryman, 2012; Tantawi, 2008). Themed analysis helped to determine interests, attitudes, and current concerns of customers towards the company products. During the interviews the researcher was keen to record direct quotes from the interviewees and display them within the research. The semi-structured interviews revealed that customers stressed on the following points which could be summarized as follows: tires wear out fast, poor wet handling performance of the tires, frequent wheel alignment of tires, poor customer service, not all the required tire sizes were available, tires could not tolerate high speed, tire air pressure should be checked frequently, dull appearance of tread pattern, and the company stopped credit sales and bonuses given to the distributors and retailers.

Customers	Number of interviewees
Private cars	40
Taxi	35
Vans	10
Light weight pickup	8
Trucks	10
Buses	12
Retailers	15

Table (1) sample of interviewed customers
 Source: own Focus groups with managers

Two focus group sessions were conducted, the main aim of the first focus group was to present to the company's managers the results derived from the semi-structured interviews conducted with the company's customers; known as the 'WHATs' part of the QFD framework. Then, the role of the company's managers was to come out with answers and ways; known as the 'HOWs' part of the QFD framework and construct the QFD framework to meet customers' requirements. The aim of the second focus group was to study how to meet customers' requirements through design specifications that were extracted during the first focus group where the QFD framework was constructed. The managers who attended the workshops were in different managerial posts with strong knowledge about the company performance. The sessions started by an introduction, followed by a discussion of the purpose and scope of the session.

3. The QFD constructed framework

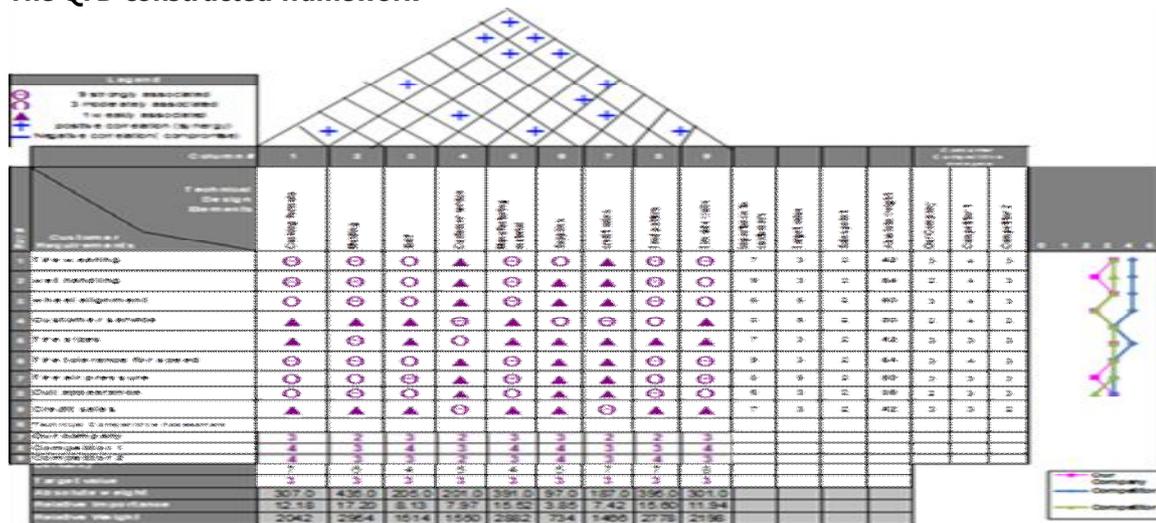


Figure (1) The QFD constructed framework
 Source: own

5. Findings and discussion

The public sector in Egypt is left to face drastic problems that affected its performance, the investment regimen in Egypt, its associated constraints, and the privatization process that the Egyptian PSOs are subject to, which prohibits any new capital investments in the PSOs set up for privatization. This shows that any appropriate improvement approach should not rely on the use of capital investment approaches such as new production machines, knowhow, processes or systems. Although decisions should not be made based on numeric numbers, the company needs to take into consideration the constraints, restrictions faced by the company and its impact on decision making. Most customers' requirements extracted from QFD framework needed modifying the knowhow, investments, capital, updated technology and machines, infrastructure, paying royalties, changing the existing line of production, contacting new

suppliers, trained and skilled employees, in addition to improving the customer service and applying customer relationship management to respond to customers' complaints and problems. Putting into consideration all above mentioned constraints, after two hours of talking, debating and negotiating between the focus group attendees, the group came into a consensus based on the QFD constructed framework where it would focus on few technical specifications to meet customers' requirements within the constraints of the company and short time frame.

6. Conclusion

QFD is a generic framework that is appropriate and feasible for application within the public sector tire manufacturing company in Egypt. It was quite a good scientific exercise to demonstrate how customers' requirements were identified, the technical specifications needed and finally constructing the QFD framework to meet customers' requirements. Evidence from the literature and studies indicated that TQM had become a major strategy to boost manufacturing and service firms whether in developed or developing countries. In the last decade many studies had appeared in the literature regarding the use of QFD. The QFD framework had been tested in different case studies and had shown that it was an integral tool for strategic planning. This study contributed to the body of knowledge through introducing a comprehensive technical framework of QFD application within the Egyptian public sector organizations to fill a gap not being addressed by the literature. There appeared to be a gap in the literature and a lack of QFD application within the Egyptian context. This study could be a considerable contribution to the academic literature trying to bridge and close this gap. It is hoped that it would add knowledge in the field of quality management within the context of developing countries and give particular focus on Egypt, where QFD had consistently been claimed in the Western world and Europe. This study aimed to extend the knowledge of choosing an appropriate TQM tool for the Egyptian PSOs. This study has been an extension to previous studies carried out in the Western world but within the Egyptian context. The findings of the study provided empirical evidence and proved to be feasible when applied in Egypt. The methodology used in the study helped to clarify the applicability and the importance of QFD within the Egyptian context, and would stimulate more research within the Egyptian PSOs.

Although benchmarking Egyptian public sector organizations is applied with the aim of maintaining a competitive advantage, increasing profitability and achieving continuous improvement, yet the Egyptian public sector has suffered from different problems and challenges, lack of attention to customers' requirements constituted a major element of such problem. It is suggested that through the use of QFD would help to overcome few challenges facing the public sector. The practical work conducted would help in redirecting and highlighting the important role of QFD. This study aimed to provide insights into the procedures, practices, limitations and constraints faced during QFD development to assist the effective strategic moves for the future. For QFD to succeed it requires adopting a QFD methodology within the company, where it needs to improve the quality of customer service provided through spreading a culture of quality commitment. Conducting regular meetings to spread QFD awareness between employees, educating employees about QFD and giving them time to put QFD into practice. Conducting regular meetings and seminars to identify the obstacles facing the company when implementing QFD and determining how to overcome it. Training, monitoring and evaluation of employees offers a path for learning, continual improvement and development. In future research, more attention should be devoted to the role of QFD within the Egyptian public sector and the vital role that social media plays to respond to customers. It was pointed out that there are significant lacks of research concerning this issue. This study is a qualitative research, where it should be followed by quantitative research to further explore the role of QFD within the Egyptian PSOs and provide venues for future research. Future research should be extended and supported by a number of case studies considering other public sectors whether manufacturing or service, also it would be beneficial to conduct similar research to other PSOs in different countries in the Arab world as well, as a new area of interest.

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