

THE INTEGRATION OF TOTAL QUALITY MANAGEMENT (TQM)
AND THEORY OF CONSTRAINTS (TOC) IMPLEMENTATION IN
MALAYSIAN AUTOMOTIVE SUPPLIERS

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*Specially dedicated to my beloved Mother and
Father, beautiful Sister, dashing Brother, and
Sweetheart*

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ABSTRACT

The automotive industry is one of the most important and strategic industries in the Malaysian manufacturing sector. It supports a large number of Small and Medium Enterprises (SMEs). The Malaysian automotive industry, especially the suppliers, must be able to stay competitive and be in business. In order to be able to achieve the above goals, suppliers should apply Total Quality Management (TQM) to improve the quality of products and services in satisfying the customers. Theory of Constraints (TOC) is a systems methodology that has been developed to assist people and organizations to think about their problems, develop breakthrough solutions and implement those solutions successfully. This study has attempted to integrate TQM and TOC in enhancing the implementation of TQM. There has not been any well research about the integration of TQM and TOC implementation, especially in Malaysia. So, it is hoped that this study can help Malaysian SMEs, especially automotive suppliers, to implement TQM better. Survey methodology and case study have been conducted to determine the extent of TQM and TOC implementation in Malaysian automotive suppliers. The TOC Thinking Process (TP) tools were used to analyze data from survey and case study to find out and reduce some of the problems of TQM implementation in Malaysian automotive suppliers. It was found that Malaysian automotive suppliers have achieved quite a high level of their quality implementation programs, although most of them are still in the early stage of implementing TQM. There were also still problems in their implementation of TQM. By using TOC TP tools, it was found that the core problem of the TQM implementation in Malaysian automotive suppliers was lack of management leadership and commitment to TQM. The main contribution of this study is a proposed framework for the integration of TQM and TOC in assisting companies for the implementation of TQM.

ABSTRAK

Industri automotif merupakan salah satu industri yang penting dan strategik dalam sektor perkilangan Malaysia. Ia menyokong sejumlah besar industri kecil dan sederhana. Industri automotif Malaysia, terutama para pembekalnya, hendaklah mampu mengekalkan diri mereka dalam persaingan bisnis. Oleh itu, para pembekal hendaklah mengaplikasikan Pengurusan Kualiti Menyeluruh (TQM) untuk meningkatkan kualiti produk dan perkhidmatan secara berterusan dalam memuaskan hati pengguna. *Theory of Constraints* (TOC) adalah sistem metodologi untuk membantu individu dan organisasi memikirkan masalah, membangun penyelesaiannya, dan melaksanakan penyelesaian tersebut dengan berkesan. Kajian ini bertujuan untuk mengintegrasikan pelaksanaan TQM dan TOC, dan menggunakannya sebagai satu mekanisme untuk menilai dan meningkatkan pelaksanaan TQM. Penyelidikan dan laporan mengenai integrasi TQM dan TOC sangat kurang, terutamanya di Malaysia. Oleh itu diharapkan kajian ini dapat membantu industri kecil dan sederhana Malaysia, terutamanya para pembekal automotif, melaksanakan TQM secara berkesan untuk kekal dalam persaingan perniagaan. Kaedah soal selidik dan kajian kes dijalankan untuk menentukan tahap pelaksanaan TQM dan TOC di kalangan para pembekal automotif Malaysia. Alatan *Thinking Process* (TP) digunakan untuk menganalisis data yang diperoleh dari soal selidik dan kajian kes untuk mengenal pasti dan mengurangkan masalah utama pelaksanaan TQM di kalangan para pembekal Malaysia. Ditemukan bahawa para pembekal automotif Malaysia telah mencapai tingkat yang cukup tinggi dalam pelaksanaan program kualiti mereka, meskipun kebanyakan daripada mereka masih dalam tahap awal melaksanakan TQM. Ditemukan pula masalah dalam pelaksanaan TQM mereka. Alatan TOC TP menemukan bahawa punca utama masalah dalam pelaksanaan TQM di kalangan para pembekal automotif Malaysia adalah kurangnya kepemimpinan dan komitmen pihak manajemen kepada pelaksanaan TQM. Sumbangan utama kajian ini adalah satu cadangan rangka kerja yang mengintegrasikan TQM dan TOC dalam membantu syarikat melaksanakan TQM.

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CHAPTER 1

INTRODUCTION

1.1 Background of the Research

Since the implementation of ASEAN Free Trade Area (AFTA) agreement in 1992, competition has become intense between ASEAN countries. AFTA has the objective of increasing the ASEAN region's competitive advantage as a production based geared for the world market. This activity has begun to serve as a catalyst for greater efficiency in production and long-term competitiveness.

The automotive industry is one of the most important and strategic industries in the Malaysian manufacturing sector. It is an important driver of industrial development, the provider of technological capability and the generator of inter-industry linkages, because it brings together various components, which are manufactured by suppliers in other industries. This also means that the automotive industry actually supports a large number of Small and Medium Enterprises (SMEs) supplying components, subassemblies to the car manufacturers.

Facing the implementation of AFTA, the Malaysian automotive industry especially the suppliers must be able to stay competitive and be in business. In an increasingly competitive market place, businesses with a strong continuous improvement culture and external focus are more likely to survive and prosper. They should also produce products with better quality, cheaper price, faster delivery and better service to customers compared to competitors. Total Quality Management

(TQM) is considered an important catalyst in this context (Ghobadian and Gallear, 1996). TQM has the objective of improving the quality of products and services continuously to satisfy the customers. So, in order to be able to achieve the above goals, suppliers can adopt Total Quality Management (TQM).

The adoption of TQM involves a fundamental change in the way business is conducted: customer needs and expectations are fully focused, employees are wholly empowered, a set of effective management techniques is adopted, and each part of the organization is able to contribute to continuous improvement (Garvin, 1991; Bounds *et al.*, 1994). Although much literature promotes TQM as a potent strategy for firms to gain long-term competitive advantages, this claim was contradicted by general opinion surveys. A number of studies reveal that a large percentage of companies have found that their TQM efforts have failed to live up to their expectations (Martins and de Toledo, 2000; Huarng and Chen, 2002). Hansson and Klefsjo (2003) suggested that many of the failures of TQM are related to bad implementation strategies and processes.

Almost all of those studies were identified and developed for large firms. For SMEs, the problem in implementing TQM compared with large organizations was SMEs have been slow to adopt TQM (Ghobadian and Gallear, 1996). In Malaysia, the concepts of TQM are relatively new to Malaysian SMEs (Agus and Abdullah, 2000 and Abd. Rahman, 2002). Only a small number of Malaysian SMEs have reached a stage of development where they are able to apply TQM effectively (Idris *et al.*, 1996).

Is TQM really over? No. Quality and the customer satisfaction that it implies is still a necessary condition for success. However, it is no more than a necessary condition, which means other factors must be considered in planning to succeed. This brings up the question, "How do you integrate quality with the other elements of business success? The answer lies in finding a way to focus attention on the system as a whole, rather than on its component processes. If that is done, all the necessary conditions are afforded the attention they merit, not just service or production quality (Weis, 2001). TQM divides the system into processes, then optimizing the quality of each process. TQM doesn't address how to manage the system as a whole, only

focusing in improving processes (Dettmer, 1995). The question is how to solve those problems. One of the ways is by applying the tools and methodology of Theory of Constraints (TOC).

TOC was first presented in 1986 by Eliyahu M. Goldratt (Goldratt and Cox, 1984) through his revolutionary book, *The Goal*. TOC provides the methodology to define what to change, what should be changed to, and how to effect the change to continuously improve the performance of an entire system. TOC, like TQM, treats improvement as an ongoing process. But instead of focusing on localized improvements in all areas, it attacks the one constraint or bottleneck that limits the systems performance.

1.2 Statement of the Problem

As explained above, Total Quality Management (TQM) has been recognized and used during the last few decades by organizations all over the world to develop a quality focus and improve organizational performance. In spite of this, TQM implementation is still problematic for many organizations. Especially for Malaysian SMEs, they have been slow to adopt and implement TQM.

So, this study has focused on using TOC as a mechanism to assist TQM. It is not to replace TQM, but TOC can help TQM to find out problems in its implementation and focus TQM toward the organization's goal. TOC is a good approach in continuous improvement, but not much has been studied in Malaysia. There is also no research about the use of TOC as a mechanism to assist TQM in Malaysia, especially the automotive suppliers that have an important role in Malaysian industry and economy.

1.3 Research Questions

Some of the key questions addressed during this research were:

- a. How is the implementation of TQM in Malaysian automotive suppliers?
- b. How is the level practice and understanding of TOC in Malaysian automotive suppliers?
- c. How to identify problems in the implementation of TQM by using TOC?
- d. How to focus the implementation of TQM by using TOC?

1.4 Objectives of the Study

The objectives of this study:

- a. To identify the problems of TQM implementation in Malaysian automotive suppliers.
- b. To devise a framework for the integration of TQM and TOC implementation in Malaysian automotive suppliers.

1.5 Importance of the Study

The research on the integration of TQM and TOC implementation is very important and useful. TOC can help the companies to appreciate the effect of local actions and decisions on overall system performance. TOC can also find the core problem that hampers the companies in achieving their goal.

Therefore, this research has merit in the sense that it can help the Malaysian automotive suppliers to implement TQM better and improve their performance continuously. It influences the ability of Malaysian automotive industry to stay competitive and be in business.

1.6 Scope of the Study

The scopes of this study:

1. The Malaysian automotive suppliers are the focus of this research.
2. The research to find out the problems of TQM implementation in Malaysian automotive suppliers was confined to the top managers: Quality Control Manager, Production Manager, Human Resources and Development Manager, etc., in Malaysian automotive suppliers.

1.7 Assumptions of the Study

The study was based on the following assumptions:

1. The managers selected to respond to the questionnaires had sufficient knowledge about the quality practices in their companies
2. The managers selected to respond to the questionnaires about the quality practices provided honest answers to all of the questions.

1.8 Layout of the Thesis

This report is organized into 7 chapters. The first chapter provided an introduction to the research. It also describes the background of the problem, statement of the problem, purpose, importance, and scope of the study. Chapter 2 presents a critical review of the Malaysian automotive industry, Small and Medium Enterprises (SMEs), quality, Total Quality Management (TQM), Theory of Constraints (TOC), and definition, characteristics, and types of framework.

The methodology employed in conducting the study is described in the Chapter 3. The research adopted survey methodology by using postal questionnaire and the case study methodology. The questionnaire was designed to capture information about the level of TQM implementation and the practice and

understanding of TOC in Malaysian automotive suppliers. Conducting the case study was the next step after collecting data through questionnaire. Data from survey and case study was analyzed by using the TOC Thinking Process tools to find out the core problem in TQM implementation and suggest solutions in solving it. The outcomes and inputs from the survey and case study were used to develop the integrated TQM and TOC implementation framework (TOC-based TQM framework) in Malaysian automotive suppliers.

Chapter 4 presents the survey results and analysis. The survey method was investigated to know the level of TQM implementation and the practice and understanding of TOC in Malaysian automotive suppliers. The case study results and analysis, and the use of TOC Thinking Process tools were described in Chapter 5. The tools were used to find the core problem of TQM implementation and solve it. They identify Undesirable Effects (UDEs) and implement the Current Reality Tree (CRT), Conflict Resolution Diagram (CRD), Future Reality Tree (FRT), Prerequisite Tree (PRT), and Transition Tree (TT).

Chapter 6 presents the integrated TQM and TOC implementation framework in Malaysian automotive suppliers. This chapter provides a detailed description of the framework's working mechanisms. So, it can guide the companies how to integrate TQM and TOC implementation in the organization.

The last chapter is the culmination of this report. It aggregates all the findings of research: the main outcomes and the contribution to the field. It also outlines possible areas for future research because there are still the limitations of this study.

REFERENCES

- Aalbregtse, R. J., Hejka, J. A., and McNeley, P. K. (1991). TQM: How Do You Do It? *Automation*. 38(8). 30-32.
- Abd. Rahman, M. N., Tannock, J. J. D. T., and Idris, M. A. (2002). A Survey Findings on Quality Management Practices in Malaysian SMEs. *Standards and Quality*. 9(5). 2-7.
- Agus, A. and Abdullah, M. (2000). Total Quality Management Practices in Manufacturing Companies in Malaysia: An Exploratory Analysis. *Total Quality Management and Business Excellence*. 11(8). 10041-51.
- Ahire, S. L. and Golhar, D. Y. (1996). Quality Management in Large vs. Small Firms. *Journal of Small Business Management*. 34(2). 1-13.
- Ahire, S. L., Waller, M. A., and Golhar, D. Y. (1996). Quality Management in TQM versus non-TQM Firms: An Empirical Investigation. *International Journal of Quality and Reliability Management*. 13(8). 8-27.
- Ahmed, S. and Hassan, M. (2003). Survey and Case Investigations on Application of Quality Management Tools and Techniques in SMIs. *International Journal of Quality and Reliability Management*. 20(7). 795-826.
- Al-khalifa, K. N. and Aspinwall, E. M. (2000). The Development of Total Quality Management in Qatar. *The TQM Magazine*. 12(3). 194-204.
- Alreck, P. L. and Settle, R. B. (1995). *The Survey Research Handbook*. 2nd Edition. Homewood, IL: Richard D. Irwin, Inc.

- Anderson, M. and Sohal, A. S. (1999). A Study of the Relationship between Quality Management Practices and Performance in Small Businesses. *International Journal of Quality and Reliability Management*. 16(9). 859-877.
- Antony, J., Leung, K., and Knowles, G. (2002). Critical Success Factors of TQM Implementation in Hong Kong Industries. *International Journal of Quality and Reliability Management*. 19(5). 551-566.
- Arshad, S. I. (2004). *Malaysia – Industry, Investment, Trade, and Productivity Performance, Fourth Quarter 2003*. Ministry of International Trade and Industry Malaysia. <http://www.miti.gov.my> [2004, February].
- Atkinson, P. E. and Naden, J. (1989). Total Quality Management: Eight Lessons to Learn from Japan. *Management Services*. 33(3). 6-10.
- Badri, M. A., Davis, D., and Davis, D. (1995). A Study of Measuring the Critical Success Factors of Quality Management. *International Journal of Quality and Reliability Management*. 12(2). 36-53.
- Balderstone, S. J. and Mabin, V. J. (2000). *A Review of Goldratt's Theory of Constraints (TOC) – Lessons from the International Literature*. APICS Series on Constraints management. Boca Raton, F.L.: St. Lucie Press.
- Berry, T. (1991). *Managing the Total Quality Transformation*. New York: McGraw-Hill.
- Black, S. A. and Porter, L. J. (1996). Identification of the Critical Factors of TQM. *Decision Sciences*. 27(1). 1-21.
- Bounds, G., Yorks, L., Adams, M., and Ranney, G. (1994). *Beyond the Total Quality Management Toward the Emerging Paradigm*. New York, NY: McGraw-Hill.

- Carmines, E. G. and Zeller, R. A. (1990). *Reliability and Validity Assessment, Series: Quantitative Applications in the Social Sciences*. Beverly Hills, London: Sage Publications, Inc.
- Chakravorty, S. and Atwater (1996). A Comparative Study of Line Design Approaches for Serial Production Systems. *International journal of Operations and Production Management*. 16(6). 91-107.
- Chang, T. L. (2002). *Six Sigma: A Framework for Small and Medium-sized Enterprises to Achieve Total Quality*. Cleveland State University: Ph.D Dissertation.
- Chin, K. S. and Pun, K. F. (2002). A Proposed Framework for Implementing TQM in Chinese Organizations. *International Journal of Quality and Reliability Management*. 19(3). 272-294.
- Chips (2001). *Automaker Urge Malaysian not to Delay AFTA*. <http://www.autoworld.com>. [2001, October 08].
- Co, H. C., Patuwo, B. E., and Hu, M. Y. (1998). The Human Factor in Advanced Manufacturing Technology Adoption: An Empirical Analysis. *International Journal of Operations and Production Management*. 18(1). 87-106.
- Conca, F. J., Llopis, J., and Tari, J. J. (2003). Development of A Measure to Assess Quality Management in Certified Firms. *European Journal of Operational Research*.
- Converse, J. M. and Presser, S. (1986). *Survey Questions, Sage University Press Series on Quantitative Applications in the Social Sciences*. Series No. 63. Beverly Hills: Sage Publications.
- Cooper, D. R. and Schindler, P. S. (2001). *Business Research Methods*. 7th Edition. New York, NY: McGraw Hill.

- Cronbach, L. J. (1990). *Essentials of Psychological Testing*. 2nd Edition. New York: Harper and Row.
- Crosby, P. B. (1979). *Quality is Free: The Art of Making Quality Certain*. New York, NY: McGraw-Hill.
- Dale, B. G. and Boaden, R. J. (1993). Improvement Framework. *The TQM Magazine*. 5(1). 23-26.
- Dale, B. G. (1994). A Framework for the Introduction of A Process of Quality Improvement in Retail Organizations. *International Journal of Retail and Distribution Management*. 22(8). 25-32.
- Deros, B. M., Yusof, S. M., and Salleh, A. M. (2004). A Survey on Benchmarking Perceptions of Importance and Practices in Malaysian companies. *Proceedings of the Third International Conference on Advanced Manufacturing Technology (ICAMT) 2004*. May 11-13. Kuala Lumpur, Malaysia: Research Center IIUM.
- Dettmer, H. W. (1995). Quality and the Theory of Constraints. *Quality Progress, Milwaukee*. Vol. 28, Iss. 4. pp. 77, 5 pgs.
- Dettmer, H. W. (1997). *Goldratt's Theory of Constraints: A System Approach to Continuous Improvement*. Milwaukee, WI: ASQC Quality Press.
- Dettmer, H. W. (1998). *Breaking the Constraints to World-Class Performance*. Milwaukee, WI: ASQ Quality Press.
- Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *Academy of Management Review*. 14(4). 532-550.
- FMM (2000). *Federation of Malaysian Manufacturers Directory Malaysian Industries*, 31st Ed. (Kuala Lumpur).

- Fredendall, L. D., Patterson, J. W., Lenhartz, C., and Mitchell, B. C. (2002). What should be Changed? *Quality Progress*. 35(1). 50-60.
- Feigenbaum, A. V. (1983). *Total Quality Control*. 3rd Edition. New York, NY: McGraw-Hill.
- Flynn, B. B., Sakakibara, S., Schroeder, R. G., Bates, K. A., and Flynn, E. J. (1990). Empirical Research Methods in Operations Management. *Journal of Operation Management*. 9(2). 250-284.
- Gader, A. M. (2003). *The Motives for ISO 9000 Certification*. Universiti Putra Malaysia: Unpublished Master Thesis.
- Gardiner, S. C., Blackstone, J. H., and Gardiner, L. R. (1994). The Evolution of Theory of Constraints. *Industrial Management*. 36(3). 13-16.
- Garvin, D. A. (1988). *Managing Quality, The Strategic and Competitive Edge*. New York: Free Press.
- Garvin, D. A. (1991). How the Baldrige Award Really Works. *Harvard Business Review*, 69(6). 80-93.
- Ghobadian, A. and Gallear, D. N. (1996). Total Quality Management in SMEs. *Omega*. 24(1). 83-106.
- Goldratt, E. M. and Cox, J. (1984). *The Goal: An Ongoing Improvement Process 2nd Edition*. Aldershot, England: Gower.
- Goldratt, E. M. and Fox, J. (1986). *The Race*. New York, NY: North River Press.
- Gonsalves, G. C. (2002). *Business Process Management: Integration of Quality Management and Reengineering for Enhanced Competitiveness*. College of Business and Economics, University of Kentucky: Ph.D Dissertation.

- Gunasekaran, A., Goyal, S. K., Martikainen, T., and Yli-Olli, P. (1998). Total Quality Management: A New Perspective for Improving Quality and Productivity. *International Journal of Quality and Reliability Management*. 15(8/9). 947-968.
- Hair, J. F., Anderson, R. E., Tatham, R. L., and Black, W. C. (1998). *Multivariate Data Analysis*. 5th Edition. New Jersey: Prentice Hall.
- Haksever, C. (1996). Total Quality Management in the Small Business Environment. *The TQM Magazine*. 15(2). 71-81.
- Hansson, J. and Klefsjo, B. (2003). A Core Value Model for Implementing Total Quality Management in Small Organizations. *The TQM Magazine*. 15(2). 71-81.
- Hashim, M. K. (1999). A Study on the Weaknesses of SMEs in the Malaysian Manufacturing Sector. *TITISAN*. July.
- Hashim, M. K. and Wafa, S. A. (2002). *Small and Medium Sized Enterprises in Malaysia, Development Issues*. Malaysia, Selangor: Prentice Hall.
- Hassan, A., Mohd Shariff Nabi Baksh, and Shaharoun, A. M. (2000). Issues in Quality Engineering Research. *International Journal of Quality and Reliability Management*. 17(8). 858-875.
- Ho, S. K. M. and Fung, C. K. H. (1994). Developing A TQM Excellence Model. *The TQM Magazine*. 6(6). 24-30.
- Huang, F. and Chen, Y. (2002). Relationships of TQM Philosophy, Methods and Performance: A Survey in Taiwan. *Industrial Management and Data Systems*. 102(4). 226-234.

- Husband, S. and Mandal, P. (1999). A Conceptual Model for Quality Integrated Management in Small and Medium Size Enterprises. *International Journal of Quality and Reliability Management*. 16(7). 699-713.
- Idris, M. A., McEwan, W., and Belavendram, N. (1996). The Adoption of ISO 9000 and Total Quality Management in Malaysia. *The TQM Magazine*. 8(5). 65-68.
- ISO 9000 (1992). International Organization for Standardization. Geneva.
- Juran, J. M. and Gryna, F. (1980). *Quality Planning and Analysis*. New York, NY: McGraw-Hill.
- Kanji, G. K. and Barker, R. L. (1990). Implementation of Total Quality Management. *Total Quality Management*. 1(3). 375-389.
- Klein, D. J. and Marinus, D. (1995). A Thinking Process for Establishing Management Policies. *Review of Business*. 16(3). pg. 31.
- Lau, R. S. M. and Anderson, C. A. (1998). A Three-Dimensional Perspective of Total Quality Management. *International Journal of Quality and Reliability Management*. 15(1). 85-98.
- Ling, Sieh Lee Mei (2000). *Taking on the World-Globalization Strategies in Malaysia*. Malaysia: McGraw-Hill.
- Litwin, M. S. (1995). *How to Measure Survey Reliability and Validity*. Thousand Oaks, CA: Sage Publications, Inc.
- Malhotra, M. K. and Grover, V. (1998). An Assessment of Survey Research in POM: from Constructs to Theory. *Journal of Operations Management*. 16. 407-425.

- Martins, R. A. and de Toledo, J. C. (2000). Total Quality Management Programs: A Framework Proposal. *Work Study*. 49(4). 145-151.
- Mason, E. J. and Bramble, W. J. (1989). *Understanding and Conducting Research*. New York, NY: McGraw-Hill.
- Masters, R. J. (1996). Overcoming the Barriers to TQM's Success. *Quality Progress*. 29(5). 53-55.
- Meegan, S. and Taylor, W.A. (1997). Factors Influencing A Successful Transition from ISO 9000 to TQM: The Influence of Understanding and Motivation. *International Journal of Quality and Reliability Management*. 14(2). 100-17.
- Mehra, S., Hoffman, J. M., and Sirias D. (2001). TQM as A Management Strategy for the Next Millenia. *International Journal of Operations and Production Management*. 21(5/6). 855-876.
- Montes, J. L. M., Jover, A. V., and Fernandez, L. M. M. (2003). Factors Affecting the Relationship between Total Quality Management and Organizational Performance. *International Journal of Quality and Reliability Management*. 20(2). 189-209.
- Moss, H. K. (2002). *The Application of The Theory of Constraints in Service Firms*. The Graduate School of Clemson University: Ph.D. Dissertation.
- Nunnally, J. L. (1978). *Psychometric Theory*. New York, NY: McGraw-Hill.
- Nwabueze, U. (2001). How the Mighty Have Fallen: The Naked Truth about TQM. *Managerial Auditing Journal*. 16(9). 504-513.
- Othman, R., Abdul-Ghani, R., and Arshad, R. (2001). Great Expectations, CEOs' Perception of the Performance Gap of the HRM Function in the Malaysian Manufacturing Sector. *Personnel Review*. 30(1). 61-80.

- Porter, L. J. and Parker, A. J. (1993). Total Quality Management-The Critical Success Factors. *Total Quality Management*. 4(1). 13-22.
- Quek, E. E. and Yusof, S. M. (2003). A survey of TQM Practices in the Malaysian Electrical and Electronic Industry. *Total Quality Management*. 14(1). 63-77.
- Quazi, H. and Padibjo, S. (1998). A Journey Toward Total Quality Management through ISO 9000 Certification – A Study on Small and Medium-sized Enterprises in Singapore. *International Journal of Quality and Reliability Management*. 15(5). 489-508.
- Radovilsky, Z. D., Gotcher, J. W., and Slattsveen, S. (1996). Implementing Total Quality Management: Statistical Analysis of Survey Results. *International Journal of Quality and Reliability Management*. 13(1). 10-23.
- Rahman, S. (1998). The Theory of Constraints A Review of The Philosophy and Its Applications. *International Journal of Operations and Production Management*. 18(4). 336-355.
- Rahman, S. (2001). A Comparative Study of TQM Practice and Organizational Performance of SMEs with and without ISO 9000 Certification. *International Journal of Quality and Reliability Management*. 18(1). 35-49.
- Rahman, S. (2002). The Theory of Constraints' Thinking Process Approach to Developing Strategies in Supply Chain. *International Journal of Physical Distribution and Logistics Management*. 32(10). 809-828.
- Reader's Digest Universal Dictionary, 1987, Readers Digest, London.
- Ronen, B. and Paas, S. (1994). A Business-Oriented Approach to Total Quality Management. *Industrial Management*. 36(3). 9-13.
- Rossi, P. H., Wright, J. D., and Anderson, A. B. (1983). *Handbook of Survey Research*. New York, NY: Academic Press.

- Rouse, P. and Putterill, M. (2003). An Integral Framework for Performance Measurement. *Management Decision*. 41(8). 791-805.
- Saraph, J. V., Benson, P. J., and Schroeder, R. G. (1989). An Instrument for Measuring the Critical Factors of Quality Management. *Decision Sciences*. 20(4). 810-829.
- Saylor, J. H. (1992). *TQM Field Manual*. New York: McGraw-Hill.
- Saylor, J. H. (1996). *TQM Simplified A Practical Guide*. 2nd Edition. New York: McGraw-Hill.
- Sierra, J. E. (2003). *Quality Constraint Approach: A Six Sigma/ Throughput Approach in Manufacturing to achieve Company Success and continuous Improvement*. The University of Central Florida, Orlando, Florida: Ph.D. Dissertation.
- Simons, J. V. and Moore, R. I. (1992). The Theory of Constraints Approach to Focused Improvement. *Air Force Journal of Logistics*. Summer. 5 pgs.
- Singh, P. (2003). *The Malaysian Automotive Industry*. <http://www.asean-auto.org/mal/report.htm> [2003, January 28].
- Sivasubramanian, R., Selladuraj, V., and Gunasekaran, A. (2003). Optimum Production Schedule and Profit Maximisation Using the concept: Theory of Constraints. *International Journal of Manufacturing Technology and Management*. 5(4). 325.
- Small and Medium Industry Development Corporation (SMIDEC) Directory. <http://www.smidec.com.my>
- Sohal, A. S., Samson, D., and Ramsay, L. (1998). Requirements for Successful Implementation of Total Quality Management. *International Journal of Technology Management*. 16. 505-519.

- Sohail, M. S. and Hoong, T. B. (2003). TQM Practices and Organizational Performances of SMEs in Malaysia: Some empirical Observations. *Benchmarking: An International Journal*. 10(1). 37-53.
- Spencer, M. S., Rogers, D. S., and Daugherty, P. J. (1994). JIT Systems and External Logistics Suppliers. *International Journal of Operations and Production Management*. 14(6). 60-74.
- Staggs, P. (1999). Strategic Planning as A Total Quality Management Critical Success Factor. *Journal of Organizational Leadership*. 1(1). 5-17.
- Stein, R. E., (1997). *The Theory of Constraints, Applications in Quality and Manufacturing*. 2nd Edition. New York: Marcel Dekker, Inc.
- Taylor III, L. J., Moersch, B. J., and Franklin, G. M. (2003). Applying Theory of Constraints to A Public Safety Hiring Process. *Public Personnel Management*. 32(3). Pg. 367.
- Thiagaragan, T. and Zairi, M. (2001). A Proposed Model of TQM implementation based on An Empirical Study of Malaysian Industry. *International Journal of Quality and Reliability Management*. 18(3). 289-306.
- Tsiotras, G. and Gotzamani, K. (1996). ISO 9000 as An Entry Key to TQM: The Case of Greek Industry. *International Journal of Quality and Reliability Management*. 13(4). 64-76.
- Walsh, A., Hughes, H., and Maddox, D. P. (2002). Total Quality Management Continuous Improvement: Is the Philosophy A Reality?. *Journal of European Industrial Training*. 26(6). 299-307.
- Weis, R. J. (2001). *A Potential Solution to Provide Assurance that Total Quality Management Programs Add Long Term Value*. California State University, Dominguez Hills: Master Thesis.

- Whybark, D. C. (1997). GMRG survey Research in Operations Management. *International Journal of Operations and Production Management*. 17(7). 686-96.
- Womack, D. E. and Flowers, S. (1999). Improving System Performance: A Case Study in the Application of the Theory of Constraints (TOC). *Journal of Healthcare Management*. 44(5). Pg. 397.
- Wright, D. T. and Burns, N. D. (1998). New Organization Structures for Global Business: An Empirical Study. *International Journal of Operations and Production Management*. 18(9/10). 896-923.
- Yin, R. K. (1984). *Case Study Research: Design and Methods, Applied Social Research Methods Series*. Volume 5. Beverly Hills, CA: Sage Publications, Inc.
- Yusof, S. M. (2000). *Development of A Framework for TQM Implementation in Small Business*. University of Birmingham: Unpublished Ph. D. Dissertation.
- Yusof, S. M. and Aspinwall, E. M. (1999). Critical Success Factors for Quality Management Implementation in Small and Medium Enterprises. *The TQM Magazine*. 10. S803-809.
- Yusof, S. M. and Aspinwall, E. M. (2000a). Critical Success Factors in Small and Medium Enterprises: Survey Results. *The TQM Magazine*. 11. S448-462.
- Yusof, S. M. and Aspinwall, E. M. (2000b). A Conceptual Framework for TQM Implementation for SMEs. *The TQM Magazine*. 12(1). 31-6.
- Yusof, S. M. and Aspinwall, E. M. (2000c). Total Quality Management Implementation Frameworks: Comparison and Review. *Total Quality Management*. 11(3). 281-294.

Zairi, M. (1996). *Critical Factors for Effective TQM Implementation: A Benchmarking Approach*. Butterworth-Heinemann: Oxford.

Zhang, Q. (2001). Quality Dimensions, Perspectives and Practices – A Mapping Analysis. *International Journal of Quality and Reliability Management*. 18(7). 708-721.