

Challenges of Quality Management: A Case Study at Malaysian Electronics Manufacturing Services Company

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Graphical abstract

Keywords	Abstract
Quality management, electronics manufacturing services, quality management, challenges, TQM, quality gurus	The majority of Malaysian electronics manufacturing companies are electronics contract manufacturers (CM) and the industry is known as electronics manufacturing services (EMS). The industry is lucrative yet challenging. Companies in this industry need to have strong and flexible production system as well as supply chain to cater for diverse customer requirements such as high mix low volume demand. The objective of this paper is to identify the challenges in managing quality effectively and efficiently in a contract-manufacturing environment. Observation and semi-structured interviews were conducted to understand and identify the operational problems in a local EMS company. The problems are then analyzed and generalized against existing quality theories. Interestingly, the findings showed that all the problems have been addressed in the quality theories some 30 years ago.

Abstract

The majority of Malaysian electronics manufacturing companies are electronics contract manufacturers (CM) and the industry is known as electronics manufacturing services (EMS). The industry is lucrative yet challenging. Companies in this industry need to have strong and flexible production system as well as supply chain to cater for diverse customer requirements such as high mix low volume demand. The objective of this paper is to identify the challenges in managing quality effectively and efficiently in a contract-manufacturing environment. Observation and semi-structured interviews were conducted to understand and identify the operational problems in a local EMS company. The problems are then analyzed and generalized against existing quality theories. Interestingly, the findings showed that all the problems have been addressed in the quality theories some 30 years ago.

Keywords: Electronics manufacturing services; quality management; challenges; TQM; quality gurus

Abstrak

Kebanyakan syarikat pembuatan elektronik di Malaysia terdiri daripada syarikat pembuatan berkontrak (CM) dan industri ini dikenali sebagai perkhidmatan pembuatan elektronik (EMS). Industri ini mendatangkan hasil yang lumayan namun mencabar. Syarikat yang terlibat dalam industri ini memerlukan sistem pembuatan dan rantaian bekalan yang kuat dan fleksibel untuk memenuhi keperluan pelanggan seperti volum permintaan yang pelbagai. Tujuan kajian ini adalah untuk mengenal pasti cabaran dalam pengurusan kualiti yang berkesan dan cekap dalam persekitaran pembuatan berkontrak. Pemerhatian dan temubual berstruktur telah dijalankan untuk memahami dan mengenal pasti masalah operasi di sebuah syarikat EMS tempatan. Masalah-masalah ini kemudiannya dianalisis dan digeneralisasi berdasarkan kepada teori-teori kualiti yang sedia ada. Hasil kajian menunjukkan semua masalah yang dikenali pasti telah pun wujud dan dibincangkan dalam teori-teori pengurusan kualiti sejak 30 tahun dahulu.

Kata kunci: Perkhidmatan pembuatan elektronik; pengurusan kualiti; cabaran; TQM; pakar kualiti

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1.0 INTRODUCTION

Electronics manufacturing services (EMS) or contract manufacturing (CM) provides the services of assembly and consignment to the original equipment maker (OEM) where the contractors own no material but only assemble what is supplied [1,2]. The industry started in the late 1970s and grew rapidly in the 1990s when many OEMs were forced to downsize due to recession [1]. The expansion stimulates the evolution of EMS industry to become original design and manufacturing service (ODM) today, some top EMS companies are providing services from design, build, store to ship, which is the whole supply chain [1,2]. According to [3], EMS industry registered high growth of 20-25% from 1995 to 2005, but recorded a decline of 8.3% in 2009. However, based on the latest industry report released by the

same industry analyst, the industry has rebounded in 2010 and is projected to grow from US\$371 billion (2010) to US\$660 billion in 2015[4]. Similarly, iSuppli, another leading industry analyst too projected the industry will continue to grow but at a slower pace [5]. In Malaysia, local EMS companies provide vital support for the electronics and electrical (E&E) industry, the leading manufacturing sector that contributes 31% of the country's manufacturing output, 48.7% exports and 33.7% employment [6,7]. In 2010, RM2.6 billions of investment were from EMS for the industrial electronics sector producing low volume high mix products for various applications such as medical, aerospace, oil and gas and telecommunication [7].

Operating an EMS company requires flexible production system and strong supply chain management (SCM). Traditional manufacturing operation in an OEM only focuses on single

requirement, high volume and specific range of products. Whereas an EMS company handles diverse customers with various requirements and expectations, low volume high mix products and fast delivery. Therefore, balancing quality, cost and delivery are far more challenging in an EMS company compared to an OEM. Additionally, according to [8], Frank Squires, a leading management consultant in America, “Management is not against quality. Quantity just has higher priority. Management’s order of importance is always, quantity, cost and quality.” Hence, managing quality in an EMS environment requires more patience and creativity. This study is conducted at a Malaysian EMS company specializing in surface mount technology (SMT) and printed circuit board assembly (PCBA) located in Prai Industrial Estate, Penang to be known as company X. Observation and semi-structured interview which are suitable for a qualitative science research [9] are used. Findings from the research are then generalized and analyzed against the work of existing quality theories. The result is a set of possible proposals derived from the literature that company X can apply to overcome the challenges.

■2.0 RELATED WORK

Deming, Crosby, Juran, Ishikawa and Feigenbaum are among the five quality gurus that have shaped the quality management (QM) theory or principles that we know today. Each of them has contributed to the body of knowledge in their own way [10]. It is very interesting to note that after 30 years, there is not a single definition of the word ‘quality’ [11]. This shows that quality exists in all sectors [10,11] and each field has their own definition from their own perspective. Deming introduced the 14 points of QM as a system of “profound knowledge” for an organization [10]. He stressed that improving quality instead of cutting costs will lead to increase in profit [12] and opposed major management concepts taught then, such as management by objective, merit-reward appraisal system [13]. Crosby, on the other hand called for the building of quality culture of prevention and zero defect instead of focusing on constant improvement using statistical approach [14]. Juran recommended the operational framework of quality processes in planning, control and improvement, also known as the Juran’s trilogy, which he adopted from the financial management analogy [10,15]. Ishikawa is known for his contribution in quality control tools and QC Circle. He introduced the QC seven-tools that worked well within the Deming-Juran framework [16]. Finally, Feigenbaum’s Total Quality Control (TQC) emphasized organizational involvement in improving quality, according to him, “Quality is in its essence a way of managing the organization” [17].

Total quality management (TQM) concept emerged when all the principles by the quality gurus are integrated into management system [18]. According to [18], definition of TQM endorsed by a group of major United States (US) corporations, universities and consultants in 1992 is “TQ is a people focus management system that aims at continual increase in customer satisfaction at continually lower real cost. It is a total system approach and an integral part of high-level strategy; it works horizontally across functions and departments, involves all employees, top to bottom, backward and forward to include the supply chain and the customer chain”. This definition shows that TQM is a holistic approach [19] and there may be many different critical factors, principles or approaches on TQM but the objective is the same, which is to attain customer satisfaction [18]. According to [20], a total of 25 critical success factors can be identified from comprehensive review of 76 survey-based researches published between 1989 and 2000. These factors can be found in the framework used for Malcolm Baldrige National Quality Award

(MBNQA) in the US and the European Quality Award (EQA) [11]. They are, leadership, strategy planning, customer and market focus, information and analysis, human resource focus and process management [21]. Today, TQM is widely adopted by organizations worldwide.

■3.0 METHODOLOGY

A total of 3 inspectors, 5 engineers, 5 supervisors and 4 managers were interviewed using semi-structured questions. Semi-structured questions are preferred as it allows the researchers to pose the questions freely but in a guided manner, basically the questions are the same [9]. This is useful when the interviewees are from different levels in the company. A list consists of 5-6 questions were prepared to guide the researcher when interviewing the inspectors, supervisors and engineers while 9 questions were prepared for managers. The questions to the inspectors, supervisors and engineers are to explore their understanding of their job functions, the problems that they faced and their job satisfaction level. As for the managers, the questions were to gauge their perception and knowledge in QM, job satisfaction and company performance. Apart from the interviews, observations were conducted in company X for about 3 weeks. It includes going through the company quality reports, observing the QA operations, as well as the information technology (IT) services and system. The purpose is to grasp the actual operations situation in company X.

■4.0 RESULTS

4.1 High Employee Turnover Rate

The employee turnover rate at QA department is about 11%. Through observation and interviews, the main contributing factor is dissatisfaction with the job. According to the QA engineer in charge of customer complaints, he has to handle the complaints all by himself. It is a norm that no one would turn up for meetings to find the causes and counter measures of the complaints. Similar comment came from an IT staff that has tendered his resignation. Capable staff would be loaded with a lot of tasks and less capable staff would be left alone. Meanwhile managers cry foul over capable trained staff that left to join the customers.

4.2 Unreliable, Slow, and Inaccurate Quality Information

Observation made on the monthly quality report found simple calculation errors. The error gave an extremely high internal production defective ratio. Somehow, the report has been approved and the mistake went unnoticed. Implication is management is not concerned about internal quality performance. According to the QA supervisor who prepares the report, there are a lot of manual works involved. He depends on the inspectors and engineers to provide the data and agrees that there is no ‘system’ to verify the accuracy of his data or report. He added that, different customers request for different data and reporting formats. This is also one of the problems that he faced. Whenever there is a customer complaint it would take up a lot of time locating the reports and tracking the required information manually.

4.3 Wrong Perception about QM

Perception of QM in company X is that obtaining ISO certification reflects that the company is practicing effective QM

and it is the responsibility of QA department to ensure continuous certification. This is what transpired from the interview with the QA manager. Whenever there is a customer complaint, QA would be questioned why the leak out to the customer. The QA engineer who handles customer complaint shared the view too as he hardly gets the support from other departments to solve quality problems.

4.4 Ineffectiveness of QA Buyoff System

According to the QA supervisor, the in-process audit, which is conducted on every shift hardly, detects any discrepancies because the audit check sheet is written in English and some of the inspectors are English illiterate. The inspector was unsure of the checking items during the observation and gave the reason of being new on the job. Apart from that, some customers have their own sets of QA buyoff requirements that they need to comply. Through informal conversation with the QA inspectors conducting buyoff activity, it is a norm to conduct inspection more than the sample size whenever possible. Most of the time they have to perform 100% inspection when there's a customer complaint. Furthermore, one of the tasks of QA supervisor is to count the quantity deliver to customers even though QA merely conducts sampling check on each batch.

5.0 DISCUSSION

The following sub-sections explain the analysis and discuss the findings in 4.0.

5.1 High Employee Turnover Rate

One of the deadly diseases that Deming identified as hindering the transformation of Western style of management is mobility of labor due to job dissatisfaction [12]. This high turnover of labor will impact teamwork and the culprit is poor management whereby the employees could not take pride in their work. Principle number 8, 9 and 13 in Deming's 14 principles for transformation, drive out fear, break down barriers between staff areas and institute vigorous program of education and self-improvement, suggest that management should treat the employees as the most important asset and not as a commodity. Give them the sense of job security; take pride and joy of their work by encouraging teamwork, training for less capable staff and foster greater cooperation with them [12,13]. Crosby believes that each employee should be treated as one who wants to do the right thing and be recognized. Trust in people rather than in system. His approach is creating a cultural revolution by inculcate prevention as the work ethics and habit of doing it right the first time [14]. Feigenbaum calls for the management to create the environment of openness, trust and effective communication so that employees could develop their own forms of teamwork and personal ownership of competitive improvement [18].

5.2 Unreliable, Slow, and Inaccurate Quality Information

In this information age, accurate, reliable and fast information empowers the manager to make effective decisions. It is an important competitive advantage for the survival of today's business. The epilogue of Crosby's *Quality is Still Free* written in 1996, cautioned that, information age could not evolve if there is no integrity. He stressed that integrity means accurate and reliable information. It can be achieved through the culture of prevention and Zero Defect [14]. The process of generating the Monthly Quality Report in company X has no preventive measure to ensure the integrity of a 'quality' report. Looks like the

transformation has to start from the QA department of company X. Meanwhile, Feigenbaum opined that companies should tap on the processing power of IT to integrate key quality information such as quality cost, customer data about product satisfaction and test data from engineering, production and inspection as a plant wide information system [17]. This would help the company to measure and control important areas that impact quality [17].

5.3 Wrong Perception about Quality Management

The wrong perception of ISO certification could takeover the job of QM has been highlighted by Crosby back in 1996 [14]. Deming listed "We installed quality control" as one of the obstacles in the transformation of Western management [12]. All the quality gurus have a common stand that quality is not the sole responsibility of QA Department but a shared responsibility through the leadership from top to bottom. The role of the department is to coordinate quality control activities through use of procedures, feedback and report the quality status of the processes [10]. *Feigenbaum's* TQC calls for quality management functions to be distributed throughout the organization [16].

5.4 Ineffectiveness of QA Buyoff System

"Cease dependence on mass inspection to achieve quality" is the 3rd principle of Deming's 14 principles for transformation [12]. Even though the principle is referring to the final inspection in production, similar concept applies to the 100% inspection by QA. When internal QA buyoff failed to detect any discrepancies, the cost incurred for the inspection is considered a waste. Every customer complaint that results in 100% sorting by QA is a very primitive thinking. This concept has been proven wrong by many quality gurus in the 1950s [16]. Effective quality control requires the understanding of process variance and control [12]. The involvement of operators or inspectors in solving process problems and continuous training for the operators and inspectors on the understanding of quality concepts and tools are the major approaches recommended by Deming, Juran and Ishikawa [10,15,16].

5.5 Challenges and Principles from Quality Gurus

Summary of the above analysis is shown in Table 1. The challenges identified through the initial empirical study at company X were generalized against the works by five prominent quality gurus. The result is a proposal of possible solutions derived from the literature that company X may adopt.

5.6 Challenges and TQM Concepts

The challenges can be matched against the critical success factors in TQM concepts as well and they affect the effectiveness of QM practices in the company. High employee turnover rate can be classified under human resource focus, also known as people management where employee empowerment, training, involvement and satisfaction are crucial in ensuring the success of TQM implementation [22]. Unreliable, slow and inaccurate quality information system is related to information and analysis where decision-making process based on fact or accurate data is the emphasis in TQM [22]. Leadership or top management commitment is the most important driver in TQM implementation. Senior executives involvement and leadership are required to set the correct perception on QM, strategic direction and encourage innovation throughout the organization so that culture change can take place, this factor covers the wrong perception about QM identified in this study [18,22]. Finally,

process management or process orientation is about designing processes systematically from input to achieve quality output [19]. Hence, QA buyoff system cannot create quality, quality of products begins from suppliers and well designs processes that links the entire system coupled with control using scientific method [12,18]. A 100% inspection by QA is a temporary solution and should not become a norm.

Table 1 Summary of results

Challenges	Possible Solution	Quality Gurus
High employee turnover rate due to job dissatisfaction	<ul style="list-style-type: none"> Give the workers a sense of job security, pride and joy of their work by encouraging teamwork, institute training for less capable staff and foster greater cooperation with them 	Deming
	<ul style="list-style-type: none"> Each employee should be treated as one who wants to do the right thing and be recognized. 	Crosby
	<ul style="list-style-type: none"> Develop individual job entrepreneurship 	Feigenbaum
Unreliable, slow and inaccurate quality information system	<ul style="list-style-type: none"> System integrity where data is accurate and reliable is crucial for survival in information age and it is attainable through Zero Defect and prevention work culture 	Crosby
	<ul style="list-style-type: none"> Integrate key quality information into plant wide information system 	Feigenbaum
Wrong perception about quality management	<ul style="list-style-type: none"> Quality is not the sole responsibility of quality department but a shared responsibility through the leadership from top to bottom. 	All
	<ul style="list-style-type: none"> The role of quality department is to coordinate quality control activities through use of procedures, feedback and report the quality status of the processes. 	Juran
Ineffectiveness of QA buyoff system.	<ul style="list-style-type: none"> Cease dependence on mass inspection and understand the nature of variance in a process. 	Deming
	<ul style="list-style-type: none"> Give training on quality tools, concepts, process variance and control; involve operators and inspectors in solving process problem. 	Deming, Ishikawa, Juran,

6.0 CONCLUSION

The exploratory findings from this preliminary study using qualitative approach have shown that all the challenges in company X have been addressed in the literature. It shows that company X could have learned from the literature to improve its operations. The limitations of this research are the findings highlighted are from one company that cannot be generalized as common problems in Malaysian EMS industry. Nevertheless the study does provide an insight into a Malaysian EMS company with yearly sales of RM100 million. More empirical studies are needed at different companies to give a comprehensive representation.

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