Factors of Total Quality Management Affecting Management Efficiency of Hard Disk Drive Industry in Thailand

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Abstract
This quantitative research was purpose to explore factors of total quality management (TQM) affecting management efficiency of hard disk drive industry in Thailand through data collected by rating-scale questionnaire (IOC = 0.71-1.00, Cronbach's α = 0.97) distributed among simple random sampled 486 employees in the hard disk drive industry. Findings showed that the TQM aspect of manufacturing process management ranked the highest, and transformational leadership the lowest, with component scores of 0.90 and 0.52, respectively. Measures of fit of structural equation modelling after considering □2=42.038, df = 30, GFI = 0.985, AGFI = 0.967, CFI = 0.997, NFI = 0.991, RMSEA = 0.029, all of which fitted, and p-value of 0.071, indicated that the hypothesised model was a good fit to the observed data. Hypothesis testing revealed thattotal quality management significantly affected management efficiency in a positive manner at statistical significance level of 0.01, with path coefficient of 0.94 and regression coefficient of 88%.
Keywords: Total Quality Management, Efficiency, Hard Disk Drives

Introduction
Thailand has been one of the largest hard disk drive manufacturers of the world, as the nation's workforce has a high productivity-to-wage ratio, products made in Thailand are of desirable quality, and Thailand also abounds in supporting industries, rendering foreign corporations of many origins eager to make investments in Thailand for its potential to reduce production costs. The electronics industry has thus become an industry with foreign direct investment accounting for roughly 30% of total investment value in the industrial sector, ranking second behind automotive industry. Computer products, such as hard disk drive, keyboards, and peripherals, generate the highest investment values which account for 40% of the whole investment value in the electronics industry. Furthermore, in view of foreign direct investment in computer products, hard disk drives account for 80% of total foreign direct investment in computer products. Hard disk drives have been the product of focus in computer product manufacturing, being a product with more manufacturing advantages than the others, as world-largest manufacturers such as Seagate Technology (Thailand) Ltd., Western Digital (Thailand) Co., Ltd., and HGST (Thailand) Ltd. have all established their production operations in Thailand. Additionally, clustering in the HDD industry has arisen for motor and integrated circuit productions, for instance, among over 40 entities, and there also are agencies for research and support, such as National Electronics and Computer Technology Centre, and the Hard Disk Drive Institute, fostering the research and development of technology and machinery in hard disk drive manufacturing, and assisting in development of personnel and procedures, and establishment of information centres to promote the cooperation of hard disk drive clusters (Sitthathip, 2010: 65-68). Hard disk drives have become an export merchandise that generates numerous jobs and copious amount of revenues, contributing around 5% to the total of export revenues.

Table 1 Thailand's Total Export Revenues and Hard Disk Drive Exports

Year	Total Export Revenues (in million THB)	HDD Export Revenues (in million THB)	Total Exports (%)
2013	6,907,492.50	356,581.00	5.16
2014	7,304,899.40	377,168.20	5.16
2015	7,220,348.40	375,021.90	5.19

Source: Ministry of Commerce (2016)

For the most part, manufacturing industries share some similar corporate goals and purposes; for example, production or provision of merchandises with favourable qualities, bringing about satisfaction to the customers or consumers. These are considered primary objectives in conducting business affairs. Under the globalisation trend of global competition, organisations must be ready to adapt to changes and able to gain competitive advantages constantly to survive and continue to grow securely. Nowadays, there are countless management systems being used in the manufacturing sector, but total quality management is commonly used, seeing that it emphasises production of quality products and services to maximise customer satisfaction, reaching organisational goals and purposes, leading to success of an organisation. And so, this study was conceptualised on these grounds.

Research Objective

To study factors of total quality management affecting management efficiency of Thailand's hard disk drive industry.

Literature Review

Total quality management is a management approach of an organisation centred on quality, based on the participation of all its members in improving processes, products, and services, along with the goal of reducing waste. This principle partially constitutes management efficiency, as product quality is an attribute desired by customers; development and improvement of manufacturing processes in the system would essentially reduce waste and improve quality of the products being manufactured.

Total Quality Management

Whether in the industrial or service sector, every organisation will apply different forms and approaches of management in pursuit of development goals, improvements of work processes so as to bring success to the organisation and achieve its objectives. Total quality management focuses on customer satisfaction depending on total participation of employees and continual improvement to build competitive advantages and sustainable organisational development. Total quality management differs from conventional quality management and control which relies on corrective actions to correct issues in response, whereas total quality management proactively approaches issues at root cause, which can, in turn, help reduce costs, build competitive advantages, and satisfaction of employees and the customers (Kovilaikool, 2004: 61-63, Kechara nanta et al, 2002: 69). Some theories and concepts have been associated with total quality management:

Thailand Quality Award (TQA) embodies a practice to bring one's organisation towards success and become a role model for other organisations to adapt to in their own contexts to achieve success in accordance. Thailand Quality Award is considered a world-class award, as its fundamental of the technical and decision-making processes are identical to the Malcolm Baldrige National Quality Award (MBNQA) of the United States of America, which is the model of national quality award adapted by more than 70 countries worldwide. Criteria of

Thailand Quality Award consist of seven categories; 1) leadership, 2) strategic planning, 3) customer and market focus, 4) measurement, analysis, and knowledge management, 5) human resource focus, 6) process management, and 7) business results (Thailand Productivity Institute, 2011 cited in Thongpuang, 2013: 90).

Kano Model suggests that total quality management is similar to a house, consisting of three major constituents, the roof or customer satisfaction, supported by three pillars. The first pillar is further elaborated into seven concepts; market in, next processes are our customers, process orientation, standardization, prevention, PDCA cycle, and management by facts. The second one houses some of the importance techniques; 7 QC tools, 7 new QC tools, statistical methods, and others. The third pillar of the Kano's house of quality is the vehicles that drive the TQM process; policy management, daily management, cross functional management, and bottom-up activities. The basement of the quality house composes of intrinsic technology and motivation for quality (Lueprasitsakul, 2007 cited in Tiewtoy, 2008: 48-49).

In short, total quality management, from aforesaid theories and concepts, together with literature reviews from the researcher, comprises 7 aspects; 1) transformational leadership, 2) employee engagement, 3) customer focus, 4) human resource development, 5) production management, 6) information and analysis, and 7) strategic management.

Management Efficiency

The reality of an organisation having an efficient organisational management certainly would drive such organisation towards its goals. Yet, to attain efficiency in management, one must realise and truly understand the meaning of "efficiency", so as to be able to apply theories and concepts into practice properly. A number of scholars have defined efficiency as follows:

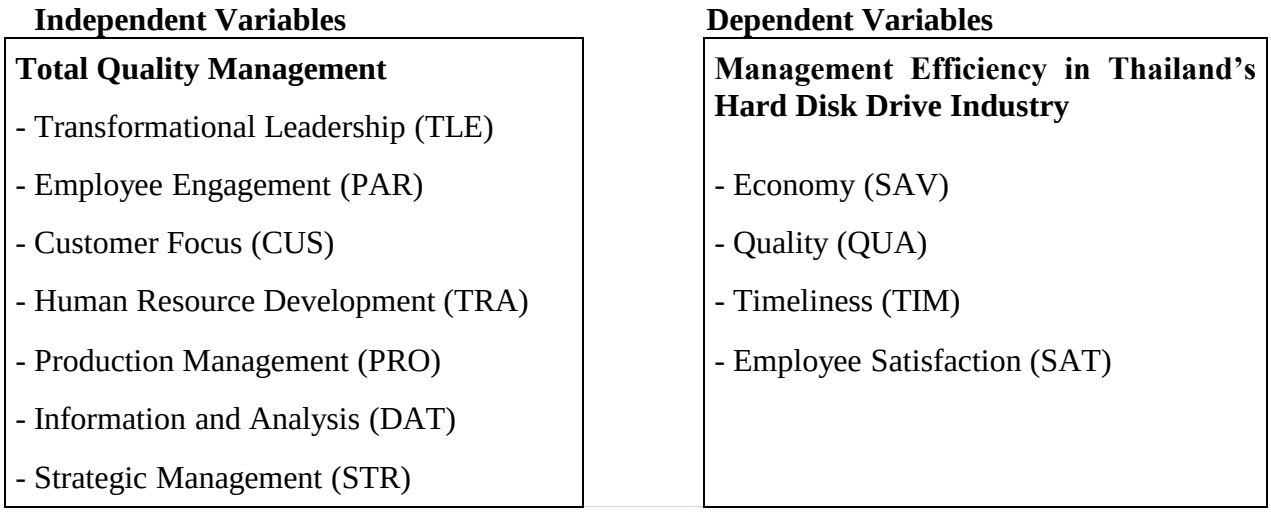
T. Meksawan (1995) mentions that the meaning of efficiency also includes productivity and capability, which could be measured in various perspectives per intention in consideration, that is, 1) process efficiency or the capability of human resources to carry out a certain process in the way that ensures minimised consumption of effort and energy, and 2) efficiency of output and outcomes or qualities of work that benefits the society, generates timely profitability, rendering the operator satisfied and conscientious of the work, and deliver satisfactory services to the customers and clients.

W. Danthamrongkun (2003: 27) states that efficiency is the ability to utilise available resources to attain maximum returns and achievement of objectives. Thus, efficiency is often measured in terms of assets or resources spent in comparison to the output or outcomes, such as costs, labours, time, and return on investment.

Petersen & Plowman (1953) defines that the highest efficiency in business management is the capability to produce goods or services in appropriate quality and quantity with minimum costs, emphasising on 5 aspects, namely, cost, quality, quantity, time, and method of production.

In summary, efficiency refers to work processes that possess the attributes of 1) economy, reduction of money, time and resources used, 2) completion in timely manner, and 3) quality on the whole, from the good inputs or materials, work or production processes, outputs or outcomes, and 4) satisfactory and work-conscientious personnel.

Conceptual Framework



Research Methodology

Population and Sample: The population in this research were employees from two hard disk drive manufacturing firms, a total of 15,276 (Department of Industrial Works, retrieved 19 September, 2015). A sample size of 390 was derived from Yamane's formula (1970), with 0.05 margin. The researcher used simple random sampling to choose the samples.

Data Collection: A questionnaire was employed, starting from subjecting a drafted questionnaire to be checked for language usage, objective congruence, and content validity by seven experts in management and statistics, and derived the index of item-objective congruence (IOC) of 0.71-1.00, which was deemed acceptable (Chamornman, 1998: 67-68). As for validity, the researcher distributed the questionnaire approved by the experts among 30 individuals outside the sample group, and derived validity measurement with Cronbach's alpha coefficient, calculated at 0.97, which was over 0.70, so the questionnaire passed the validity test (Tirakanun, 2007: 175). The researcher distributed a total of 600 copies of the questionnaire during September 2016-November 2016, a total of three-month data collection timeframe, and received 502 sets in response. After checking for completeness and normality, and discarding some sets with data anomalies determined by statistical software, 486 sets with complete information were obtained, which was in excess of minimum requirement of 390 sets, sufficient for further data analysis.

Data Analysis: Quantitative research utilises descriptive statistics, multivariate analysis, structural equation modelling. Three parts of statistical implementations were employed in data analysis with respect to the research objective, as follows:

Part 1 General information of the samples, using frequency and percentage to analyse the data;

Part 2 Basic statistical analysis, using mean, and standard deviation;

Part 3 Structural equation modelling of the causal relationship with empirical data, using multivariate statistical analysis of structural equation modelling.

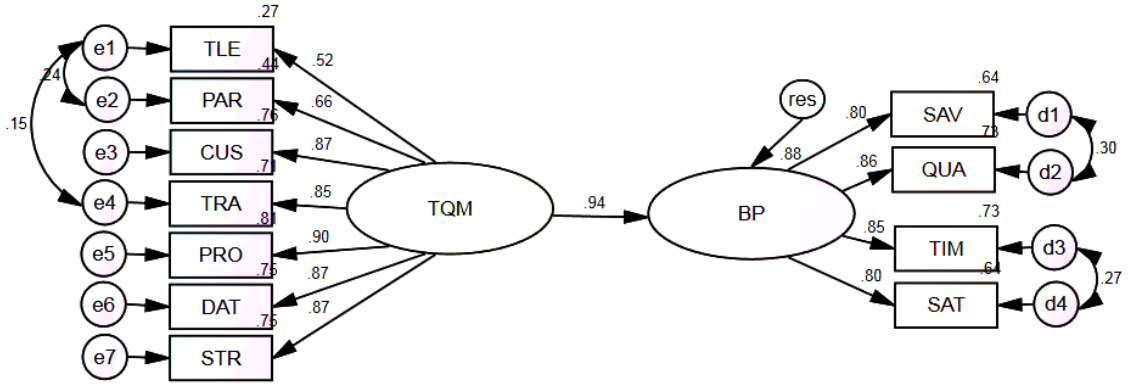
Results

Regarding general information of the respondents, the majority (329 individuals or 67.70%) were found to be male, most (275 or 56.60%) were between 30-40 years of age, 382 or 78.60% were below bachelor's degree in education, 146 or 30.00% had between 5-10 years and over 10 years of

work experience, 351 or 72.20% were operational level employees, and 272 or 56.00% were responsible for a section of manufacturing processes.

In terms of total quality management (TQM), on average, strategic management was the highest ($\bar{x}$ =3.46, S.D.=0.69), information and analysis was high ($\bar{x}$ =3.44, S.D.=0.69), customer focus was high ($\bar{x}$ =3.43, S.D.=0.79), human resource development was high ($\bar{x}$ =3.41, S.D.=0.80), production management was moderate ($\bar{x}$ =3.35, S.D.=0.65), employee engagement was moderate ($\bar{x}$ =3.17, S.D.=0.72), and transformational leadership was moderate, being lowest on the whole ($\bar{x}$ =3.13, S.D.=0.82).

With respect to management efficiency (BP), it was found that the mean of the aspect of employee satisfaction ranked the highest on a high level ($\bar{x}$ =3.49, S.D.=0.75), followed by the aspect of quality on a high level ($\bar{x}$ =3.47, S.D.=0.77), timeliness on a high level ($\bar{x}$ =3.41, S.D.=0.74), and economy ranked the lowest on a moderate level ($\bar{x}$ =3.39, S.D.=0.78).



Chi-square =42.038, df = 30, chi-sqrare/df = 1.401, p= .071,
GFI = .985, AGFI = .967,CFI=.997, NFI=.991, TLI=.995, RMSEA=.029

Figure 1 Measures of fit of structural equation modelling of factors of total quality management affecting management efficiency of hard disk drive industry in Thailand (modified)

Table 2 Analysis of fit indices employed in goodness-of-fit tests on variables and observed data (modified)

No	Indexes	Recommended Rate	Final	Conclusion
1	□2	0.05 < P <1.00	0.071	Fitted
2	□2/df	0.00 <□2/df≤3	1.401	Fitted
3	GFI	0.90 < GFI ≤1.00	0.985	Fitted
4	AGFI	0.90 < AGFI ≤1.00	0.967	Fitted
5	CFI	0.95 ≤ CFI ≤1.00	0.997	Fitted
6	NFI	0.90 ≤ NFI ≤ 1.00	0.991	Fitted
7	RMSEA	0.00 ≤RMSEA ≤0.08	0.029	Fitted

From Table 2, it is observable that the fitness between the hypothesised structural equation modelling (modified model) and empirical data is superior, considering □2=42.038, df = 30,

GFI = 0.985, AGFI = 0.967, CFI = 0.997, NFI = 0.991, and RMSEA = 0.029, all of which exceed the thresholds, and $\rho - value$ of 0.71, which is greater than 0.05, indicating that that the hypothesised model was a good fit to the observed data.
Hypothesis testing revealed that total quality management significantly affected management efficiency in a positive manner at statistical significance level of 0.01, with path coefficient of 0.94, that is, the research results agree with the initial hypothesis.

Discussion

Total quality management (TQM) positively affects management efficiency (BP), with an effect size of 0.94 and statistical significance level of 0.01. As total quality management is a management approach of an organisation centred on quality, based on the participation of all its members in improving processes, products, and services, along with the goal of reducing waste, such principle partially constitutes management efficiency, as product quality is an attribute desired by customers; development and improvement of manufacturing processes in the system would essentially reduce waste and improve quality of the products being manufactured. Prior study indicates that total quality management has a supporting relationship with business performance (Jun et al., 2006; Bou & Beltrán, 2007; Gunday et al., 2011; Miyagawa & Yoshida, 2010; Ahmad et al., 2013, Chatchawanchanchanakij, 2013), where total quality management would improve quality in production, teamwork, customer satisfaction, communication, and market share (Besterfield, 2009).

Recommendation

1) Places of business should focus on promotion of management efficiency through development of human resources, especially at operational level.
2) The Ministry of Industry should regulate usage of instruments and equipment, provide training courses, and create networks to promote industrial knowledge and manufacturing technology, so as to expand production base, generate jobs for the workforce, and attract new investments.

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