Utilization of Information Technology of Negros Oriental State University towards Total Quality Management

Ildefe T. Villanueva, MPM, MPA, DBA

Department of Business Administration
College of Business Administration
Negros Oriental State University
Negros Oriental, Philippines.

ABSTRACT

This study aimed to identify the extent with which Information Technology (IT), used to support Total Quality Management (TQM) at Negros Oriental State University (NORSU), and the effect of IT in implementing TQM.

The study used the descriptive correlation method which utilized the questionnaire in determining the IT utilization on TQM Implementation at NORSU. The findings indicated that majority of the respondents were in their early adulthood and were male-dominated. Majority of the respondents were college students who were from the College of Business Administration and staff from the different campuses.

The findings also revealed that IT resources in the institution were mostly used in all aspects of NORSU operation. On the other hand, the extent of IT usage on the eight (8) dimensions of TQM showed that IT was intensively used in almost all of the dimensions of TQM.

Findings further showed significant relationship in the usage of IT resources and the eight (8) dimensions of TQM. Thus, the utilization of IT had an impact on the dimensions and applications of TQM. IT was found to support TQM in the operation of the institution. Recommendations were on the utilization of IT on TQM in business strategies to improve the quality performance of NORSU employees.

Keywords: Information Technology, TQM, IT Utilization, Technology, Quality, NORSU.

Introduction:

Total Quality Management is typically directed toward manufacturers in order to convince them that they need to introduce it. However, the technique is equally applicable to service industries and therefore, can be applied to education. Higher Education could benefit from TQM because of the increased emphasis on quality and consumer satisfaction and interest. TQM can help higher education focus on the proper needs of the market, achieve top-quality performance, develop measures of achievement, help institutions to become competitive, develop team approaches, improve communication, reward outstanding achievement, and facilitate a continual review process. Hence, to reach high quality service, effective integration of information technology into the organization's business processes can help speed up the work.

It is habitually contented that IT speculations are exceptionally imperative components efficiency and lessening costs (Beesen, 2002). In like manner, difference implies for progressing quality and expanding efficiency for IT administrations are being looked for and actualized by instruction business looking for nonstop advancements in commerce execution. These incorporated Add up to Total Quality Management (TQM), add up to profitable upkeep, commerce prepare re-engineering and administration, frabricating assets arranging, just-in-time, and self-directed work groups. (Weston, 1993) claims that all these mediations depend on IT, which as an input instrument to clients who are sharp to degree measurement and degree efficiency. In expansion, they moreover serve as implies to induce fast and more exact data, move forward communication joins, and encourage the execution of progressed tools,

systems and modeling strategies. There's small question that application of IT influences all segments and capabilities of the organization. Therefore, it is argue that IT also must affect TQM.

Thus, this study aimed to identify the extent to which Information Technology has been used to support TQM at Negros Oriental State University (NORSU) in order to identify the effect of IT in implementing TQM. The primary emphasis of this study is on how IT provides help and support in the TQM processes of the institution. The output of the study will be basis in the enhancement of IT increasing productivity that affects the Total Quality Management of the institution.

Literature Review:

In embarking on the quality journey, as with any other change management initiatives, one must first have a clear definition and an understanding of the basic philosophy being pursuit. This chapter provides an overview on various aspects of Total Quality Management (TQM) and Information Technology relating to the research. It traces the origins of the term TQM and describes the numerous definitions employed by academics, consultants, engineers and practitioners.

History of Information Technology in NORSU:

The Internet Node of Negros Oriental State University was established on July 16, 1996 with a 64Kbps Internet Backbone Link to Global Systems Interconnection (an Internet Service Provider based in Cebu City). NORSU was the pioneer of Internet services in Negros Oriental. This project materialized through the efforts of the Information Technology Office. The purpose of the project is to provide research and communication tool/facilities to the students of the University.

With the continuing demand from the other government agencies like the Department of Science and Technology and the Department of Trade and Industry and the community, Internet services were extended to the outside community.

Negros Oriental State University- Computer and Information System (CIS) Office accepts subscribers from the public and private schools, business institutions, organizations of all kinds, government and non – government agencies and individuals.

In October of 1997, the Internet backbone was transferred from Global Systems Interconnect to SkyInternet Inc. then to Infocom Technologies in March, 1999 and to Fil-Products Television Inc. in 2011 which provides both the Fiber Optic technology and Internet services.

At present, NORSU is a pioneer in the province to have a network infrastructure known as "One NORSU One Network" that aims to interconnect all campuses into one network with Fiber Optic cable as the network backbone for the local loop and for the internet leased line connection.

As a leader in innovation, the NORSU-CIS Office has served its faculty, staff, students and the people of Negros Oriental by providing them reliable and fast access to the Information Superhighway (NORSU IPO, 2014).

Total Quality Management:

Total Quality Management is a management approach that started within in the 1950s and has steadily become better known since the early 1980s. Total Quality may be a portrayal of the culture, state of mind and organization of a company that endeavors to supply clients with items and services that fulfill their needs. The culture requires quality in all viewpoints of the company's operations, with forms being done right the primary time and absconds and squander annihilated from operations (Hashmi 2000).

Total Quality Management (TQM) could be a strategy by which management and workers can gotten to be included within the continuous improvement of the generation of products and administrations. It may be a combination of quality and administration apparatuses pointed at expanding commerce and decreasing misfortunes due to inefficient hones (Hashmi 2000).

On the other hand, (Matta et al. 2001) describe into nine dimensions which includes: leadership; strategic planning process; output quality assurance; supplier quality assurance; important innovations; information and analysis; human resource utilization; customer satisfaction; quality results, could be Likewise, Brun 2011 asserts that Total Quality Management is a vision which the firm can only achieve through long-term planning, by drawing up and implementing annual quality plans which gradually lead the firm towards the fulfillment of the vision, i.e. to the point where the following definition of TQM becomes a reality, A corporate culture characterized by increased customer satisfaction through continuous improvements, in which all employees in the firm actively participate.

Quality is a part of this definition in that TQM can be said to be the culmination of a hierarchy of quality definitions:

1. Quality – is to continuously satisfy customers' expectations.
2. Total quality – is to achieve quality at low cost.
3. Total Quality Management – is to achieve total quality through everybody's participation.

Burn, added, that TQM is no inconsequential vision. At a time when most domestic and overseas markets are characterized by 'cutthroat competition', more and more firms are coming to realize that TQM is necessary just to survive. Today, consumers can pick and choose between a mass of competing products –

and they do. Consumers choose the products that give the 'highest value for money', i.e. those products and services which give the highest degree of customer satisfaction in relation to price.

Total Quality Management (TQM) consists of continuous process improvement activities involving everyone in an organization, managers and workers, in a totally integrated effort toward improving performance at every level. This improved performance is directed toward satisfying such cross-functional goals as quality, cost, schedule, mission, need, and suitability. TQM integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach focused on continuous process improvement. The activities are ultimately focused on increased customer/user satisfaction (Wiley, John & Sons, 2005).

TQM is a systematic approach to education reform based on the philosophy of (Deming, W. E., 2000). Deming's work is not merely about productivity and quality control; it is a broad vision on the nature of organizations and how organizations should be changed.

When educators look at TQM principles, they assume that the model applies only to profit-making organizations. Actually, TQM applies as well to corporations, service organizations, universities, and elementary and secondary schools.

Indeed, the concepts formulated by TQM founder, W. Edwards Deming, have proved so powerful that educators want to apply TQM to schools. Deming's philosophy provides a framework that can integrate many positive developments in education, such as term-teaching, site-based management, cooperative learning, and outcomes-based education.

(Brocka and Brocka, 1992) states that TQM is a continuous management process where a whole lot of deliberation is needed in improving the performance of every level of operation by proper management of both resources, human as well as capital. (Toremen, Karakus and Yasan 2009) further states that, organizations are the places which have a defined set of aims and objectives to be achieved. As such, they cannot be thought of as separate from the outside world. To remain competitive, they need to monitor every change that takes place within the organization to achieve better output. Hence, TQM has become the most vital tool that ensures the organization's goals are achieved and performances are improved (Gunbayı & Cevik, 2004).

Information Technology:

Information Technology (IT) is the study, design, development, implementation, support or management of computer-based information systems, particularly software applications and computer hardware. In short, IT deals with the use of electronic computers and computer software to convert, store, protect, process, transmit and retrieve information.

Information technology is also the study and use of systems for storing, retrieving, and sending information. This can include software, hardware, applications, and so much more. Much of what people use in the 21st century was created with help from information technology. In this modern day and age, information technology plays a big role. Items as common as cars use information technology. Business, education, and even healthcare have all been redesigned thanks to information technology. Using computers and software, businesses use information technology to ensure that their departments run smoothly. They use information technology in a number of different departments including human resources, finance, manufacturing, and security.

With so much focus placed on education, it can sometimes be difficult to hold a job and still get the training needed to get a better job. Information technology plays a key role in students being able to keep their jobs and go to school. Now, most schools offer online classes that can be accessed on computers or laptops, tablets, and even mobile phones. A busy student at work can easily check in or submit assignments while on their lunch break. Teachers need to be prepared by staying up to date with information technology, and this can mean more than just reading about the latest gadgets. Information technology is helping to prevent more high school and college dropouts as well. Life events can happen to anyone at any time, and even high schools are taking advantage of online classes so that students can continue their education instead of considering dropping out (Quinonez, 2014).

According to (Gabriel et al. 2000), Information Technology consists of many instruments apart from computers (such as pens, paper and erasing fluid), machines (such as typewriters, adding machines, telephones, computers) and systems for gathering, storing, processing and communicating information.

On the other hand, (Orlikowski and Gash, 1991) define IT as any form of Computer-based information system, including mainframe as well as micro-computer applications. A list of information technologies was obtained based on previous literature Information technologies were then classified into six broad categories (constructs) relating to their IT uses: administrative, communications – related, decision support, production planning, product design, and production control.

The occupational choices made by emerging adults have their roots in earlier interactions and experiences. For instance, children begin to learn about possible future jobs through seeing adults in their communities and parents' social networks. Self-perceptions develop through experiences in school and feedback from one's social network. During adolescence, individuals

often engage in and value the same activities as their friends in order to fulfill a need for relatedness; such activity participation may lead them toward particular career paths. Part-time work during adolescence is also a key source of information about work and one's place in the workforce. Thus, the proximal, internal influences on emerging adults' career have their roots in earlier experiences. (Messersmith, E. et al. 2012)

Role of IT in TQM:

(Brah and Lim 2006) states that TQM and technology play important and complementing roles in improving performance. Their analysis showed that both high technology firms and high technology TQM firms perform significantly better than their low technology peers. (Mjema et. al. 2005) showed that the introduction of IT on quality management has contributed greatly to the enhancement of quality awareness in the improvement of product quality and in the reduction of quality costs.

However, it is possible that some of the situations which the introduction of IT generates do not necessarily support the TQM philosophy and its ideals. This is explored by mapping the implications of the introduction and application of IT on each of the ten chosen TQM dimensions.

TQM Eight (8) Dimensions:

The study used the TQM dimension identified by (Ahire et al. 2001), Flynn et. al. and Saraph et al. Accordingly eight key TQM dimensions were identified: top management support, workforce management, employees attitudes and behavior, customer relationship, supplier relationship, product design process and process flow management.

Top Management Support:

The support from the senior management is necessary both for the success of TQM and the introduction of IT. (Jusoh et al 2008) stressed that top management leadership is a major factor in TQM programs and initiative especially in the context of research and development (R&D). Purpose of the authors' study was to determine the constructs of TQM in the R&D context from academic researchers' perspectives. It involved researchers in the field of science and technology from the largest four public Malaysian universities. The investigation of the role of top management leadership was conducted from different approaches such as commercialization of research findings, research coaching and commitment to R&D activities. The fresh insight showed in this study was combination of two TQM practices, leadership and strategic planning, in one construct namely top management leadership.

Management commitment is not a gift. It is earned and maintained through hard work, loyalty, communication and good staff work. Commitment

from top management may be the most critical factor in the success of any programs. Senior management commitment is essential to help get started with a TQM program. Often, the first step is to convince senior managers of the financial and wider benefits and overcome any barriers that they may have. One of the best ways to do this is to identify obvious areas of cost reduction and environmental improvement and where to make immediate savings through no-cost or low-cost measures (Yousaf 2006).

Furthermore, Top management must not only give a lead to the rest of the company but also ensure that the necessary decisions and actions are taken. Only top management has the motivation and the power to effect changes. Whereas many of the factors concerned with successful TQM involve management lead and follow-up with others carrying out the actions, top management must be fully involved in managing process (Yousaf 2006).

Customer Relationship:

The TQM role in building customer relationships lies in making customer satisfaction measurements the basis of quality standards, ensuring that each level of the quality chain strives to satisfy its internal customer and thereby satisfy the end-customer, and effecting a cultural change to ensure customer requirements remain a top quality consideration (Nayab, 2011).

Information technology can be used to improve customer service in so many ways. However, IT experts must know some basics about their customers before they implement any technological method which can add value to their customer service section. As an entrepreneur, one has to make sure that his or her business is using information technology in a manner that helps the customer and not hinder customer experience. There is only one chance to make a great impression, so make sure that you use information technology must be used very well to serve the clients (Ramey, 2013).

(Sallis, 2002) pointed out that the customer focus aspect of TQM does not just involve meeting the requirements of the external customers. He further explains that colleagues within the institution are also customers, and rely upon internal services of others to do their job effectively. Everyone working in a school, college or university is both a supplier of services and a customer of others. Each member of staff both gives and receives services. Internal customer relationships are vitally important if an institution is to function efficiently and effectively. The best way of developing the internal customer focus is to help individual members of staff to identify the people to whom they provide services. This is known as the next-in-line analysis.

Supplier Relationship:

The adoption of TQM is considered to be the first step that service organizations take to improve their

performance. While prior studies stressed on supplier relationship as among the important elements of soft TQM in the manufacturing, TQM adoption is considered to facilitate service organizations' achievement of enhanced performance (Ramseook-Munhurrun, *et al.*, 2011). Some studies dealt with TQM and supplier relationship as two distinct concepts. For instance, (Gunasekaran and McGaughey, 2003) revealed that TQM facilitates the enhancement of customer satisfaction whereas, (Tutuncu and Kucukusta 2008) claimed that supplier chain management is viewed as a method for competitive performance enhancement through the integration of the internal process of an organization and the external operations of suppliers, customers and members of the supply chain. Several researchers (Koh *et al.*, 2007) examined supplier relation as a distinct concept while others examined supplier relationship and TQM to be interdependent and integrative concepts (Talib *et al.*, 2011). Both concepts have the common goal of achieving customer satisfaction. Despite the different methods of studying both concepts, most researchers deal with supplier relationship as a part of TQM such as (Khamalah and Lingaraj, 2007), few studies examined both concepts as an integrated concept (Talib *et al.*, 2011). Additionally, literature recommends that both TQM and supplier relations are significant to organizational performance and only a few studied TQM and supplier relationship as one (Vanichchinchai & Igel, 2009)

Technology, especially Internet-based communications can help the people develop and maintain a good relationship with suppliers in many ways like the use technology to improve efficiency. A high speed Internet connection such as broadband will allow the users to collaborate more closely with suppliers through sharing plans, forecasts and consumer data. Sharing such information with suppliers makes it easier for the team in the following ways: analyze real-time information about sales, orders or market trends, forecast and react quickly to changes in demand, and improve efficiency - accurate information on stock means you will only order the supplies you need (Manage Your Suppliers, 2009).

Workforce Management:
People management, also referred to as employee focus and employee relationship, is in numerous studies referred to as one of the most important factors underlying a successful employment of TQM, as TQM implies involving the whole organization, that is, each employee at all levels (Sun, 2000).
In the TQM philosophy, the importance of internal and external information sharing is widely emphasized. Sharing information across functional groups of the organization is in several studies seen as a way of encouraging employees and making them feel

responsibility for quality decisions and improvements. Likewise, involving employees encourage them to come up with suggestions related to quality development and improvements, is by many seen as an essential element underlying a successful implementation of TQM and performance enhancement. (Sun, 2000) argued, that the essence of involving employees in the decision making process, is that the employees nearest to a potential opportunity or a problem are in the best position of making the necessary decisions, if they have control over the process. Ensuring an efficient flow of feedback is thus essential to remove barriers to performance improvements.

Workforce Management is basically all the activities needed to maintain a productive workforce, including payments and benefits, human resources planning, training and development, time-keeping and attendance, recruitment, performance management, and forecasting and scheduling. In essence it is about assigning the right employees with the right skills to the right job at the right time to meet demand while optimizing the scheduling of staff (Workforce Management 2010).

Workforce management solutions now have to deal with environments which are getting much more complex, in order to satisfy the reality of the work that is being presented to agents. For example, all agents require good listening ability, familiarity with keyboard and IT skills and knowledge of the business they are working in, but more now need a pool of in-depth and specific talent to be available in order to satisfy customers fully (Workforce Management, 2010).

Employee Attitudes and Behavior:
Newer types of IT such as electronic mail and groupware are creating significant changes in the way that information flows around group ware, and between them and their customers and suppliers. It can hasten the development of more open and innovative cultures. However, as experts like Davenport warns, and surveys from companies like Reuters confirm, the notion that "information is power" still reigns large in many organizational group, their experience shows that many new systems fail to become accepted by their users, because the systems developers have not been *culturally sensitive* to the department or group ware, in which the new systems are to be used (David Skyrme Associates, 2011).
IT is dramatically changing the nature of professional work. There are few offices where professional do not make use of personal computers, and in many jobs involving extensive information and knowledge based work, the use of the computer is often a core activity. Becoming effective not only requires traditional skills of organizing, thinking, writing etc., but knowing how best to use the power of IT for researching sources, accessing information, connecting to experts, communicating ideas and results, and packaging the

knowledge (asset) for reuse. One aspect of this is the need for hybrid managers - people who are competent at both their discipline and IT (David Skyrme Associates, 2011).

When new systems are introduced, based on IT, some organizational restructuring is implied, and the natural resistance of employees to this change may reduce the level of commitment to company goals and objectives. The usual argument that IT applications will lead to a reduction in the number of employees has its protagonists who claim that this may not be the case. Also, when IT implementation means deskilling and loss of worker autonomy, it is likely that motivation will decrease. (Wilson 1994) describes a situation where the conflict between the utilization of IT and the TQM programmed generated some ill-feeling amongst management and staff. This is because the increase of information requirements demanded by top management through the new faster means of communications that IT enabled was contradictory with the demand for improved customer service that TQM implies. On the other hand, when IT is used as an enabler to eliminate boring, dirty and hazardous jobs, job satisfaction increases. In any case, the change in workforce attitudes that may occur after the introduction of IT needs to be considered in order to prevent a decrease in factors such as loyalty to the organization, pride in work, ability to work with employees from other departments, job satisfaction, and stress.

A positive effect of IT is that they help to share information among different departments and functions. However, the implementation of IT does not mean that people will be more disposed to share information; if they think that they have reasons to believe that this will not be in their best interests then this will not happen. A strong emphasis in the need for the sharing of information should be made if an organization wishes to make the best use of shared databases.

Product Design Process:

(Sallis, 2002) posits that for a product to be the subject to a quality assurance process, the producer needs firstly to specify and control the source of supply. Secondly, the 'raw material' must pass through a standard process or set of processes, and the output must meet predetermined and defined specifications. Such a model does not easily fit education, although there are those who might wish it would. Such a model would clearly require an initial selection of learners to be made. Some sectors of education do this, but many, following the comprehensive principle of open access, do not. However, it is from there on that the analogy begins to fall apart. While processes such as the national curriculum and the specification of standards and competencies in National Vocational Qualifications (NVQs) in the UK have improved the standardization of the process, nevertheless the process of education is anything but uniform.

A technological revolution that impacts information processing has the potential to affect the core processes and products of architecture, and have a 'revolutionary' effect on the profession and the discipline of architecture. It can do so by transforming the current strictly hierarchical design process into a network of design, manufacturing, marketing, and management organizations, where the responsibility for design operations is distributed across multiple professions, organizations, and geographic locations. It can do so by transforming the access to the information from a sequential process into an interleaved one, where decisions are made in a-synchronous yet coordinated manner. It can accentuate and promote the configurational principles underlying architecture (the integration of disparate standardized products and services into a unique whole), thereby promoting mass-customization and lowering costs without sacrificing quality (Kalay, 2005).

The experience of the machine tool industry suggests that many manufacturing organizations are re-examining their manufacturing processes and technologies in response both to the need to gain flexibility and efficiency in their operations and to a rising awareness of resource costs and environmental concerns. The adoption of new technologies, especially technologies which reduce material requirements and waste, will require organizations to rethink how they design and manufacture their products. Changes in product and process design will affect the technologies and operations of numerous organizations along the production supply chain (IEEE, 2015).

Process Flow Management:

Process improvement is in a study by (Ravichandran and Rai 2000) said to be grounded on statistical process control theories and has developed to comprise practices aiming at eliminating waste by continuous improvement. Preventive actions, such as waste reduction and error prevention are thus highlighted as an essential premise when designing TQM processes (Kanji, 2002). The importance of applying adequate statistical methods to secure a high level of process control and in continuation hereof using the assessment results to gain knowledge of the processes is likewise emphasized as important factors in several empirical studies.

The major thrust of Total Quality Management (TQM) is to achieve productivity and process efficiency by identifying and eliminating problems in work processes and systems. TQM addresses key problem areas such as mistakes in work processes, redundant processes, unnecessary tasks, and duplicate efforts. TQM interventions also help with predicting and pre-empting such mistakes and unproductive

activities. Improving process efficiency brings about many benefits to the organizations in terms of costs and time (Nayab 2011).

Quality Information and Analysis:

Quality information and analysis involves a high degree of documentation, tracking and feedback. Clearly documenting various process procedures and waste and defect rates in the manufacturing process, as well as keeping the information readily available to every employee, is argued to be an important factor underlying the success of the organization (Kaynak, 2003).

Information and analysis consist of evaluation for various policies and strategies, quality audit, analysis of quality costs, department/function performance evaluation, and employee and supplier performance evaluation. If there is inferior dissemination of the generated information, quality techniques like benchmarking and SPC tools will be rendered ineffective. To maintain a true customer focus, an organization must ensure prompt feedback of customer survey results to appropriate functional areas for effective actions (Metri, 2005).

Quality systems in the organization lead to improved organizational performance as well as customer requirements and expectations. Continuously evaluating and adjusting quality and strategic policies within an organization will further strengthen the quality systems in the organization (Saravanan & Rao, 2006). Quality systems such as ISO9000 standards, statistical process control, and qualitative tools and techniques may help to create a solid basis for quality improvement and implementing TQM in an organization (Curry & Kadasah, 2002).

Methodology:

The study used the descriptive correlational method. It utilized the questionnaire in determining the effect of Information Technology on Total Quality Management Implementation in Negros Oriental State University. The researcher prepared one questionnaire each for staff, students and office heads. The survey questionnaire was based on the extent of usage of IT resources and impact of IT on TQM dimensions.

There were two (2) parts of the questionnaire: Part I was the profile of the respondent which includes the name (optional), age, gender, educational qualification, office/department and position occupied in the organization. Part II was the IT/TQM questionnaire which was used to assess the (A) extent of usage of IT resources, and (B) the impact of IT on TQM dimensions.

Furthermore, the questionnaire in Part II was divided into sections wherein a particular respondent answered the corresponding questions re his office/field of work. In Section A, the following questions were answered by the following office personnel's: IT Administration by the Accounting Office, IT Communication by Information Technology Office (ITO), Decision Support and Planning by Administration Office, and, Product Design and Production Control by ITO and Supply Office.

On the other hand, the following respondents from the different offices were also identified to answer the questions on Section B: Top Management by Administration, Customer Relationship by the students, Supplier Relationship by the ITO and Supply Office, Workforce Management and Employee Attitudes and Behavior by the HR, Deans and Assistant Deans, Product Design by the Deans, Assistant Deans, ITO, and supply office, Process Flow Management by the Administration, ITO and Supply Office, and Quality Information and Analysis by the HR, registrar office, supply office and ITO.

After the data was collected, survey results were tabulated and analyzed with the aid of Microsoft Excel Data Analysis version 2013. Percentage/mean, Two-tailed Test and correlation tool were used in the analysis and interpretation of the data.

Results and Discussions:

The data gathered from the study are presented with their corresponding analyses and interpretation. The discussion consists of two (2) parts: personal background organized in five sections; age, gender, educational level, position and office/department profile; and extent of IT and TQM implementation. Further, the significant difference on the respondents' usage of IT resources and the relationship between the usage of IT resources to the eight (8) dimensions of TQM were also investigated to determine the effect of information technology on the Total Quality Management of the University.

Table 1: Age Profile of Respondents

Age	*f*	%
Below 20	20	25%
20 – 30	23	29%
31 – 40	18	23%
41 – 50	12	14%
Above 51	7	9%
Grand N	**80**	**100%**

Table 1 shows the age profile of the respondents. These data identify the age bracket of the respondents. It can be viewed in the table that majority of the respondents belong to the age bracket of below 20, 20-30 and 31-40. It constitutes 25%, 29% and 23% respectively. The result was evident that most of the employees were in their early adulthood stage.

Table 2: Gender Profile of Respondents

Gender	f	%
Male	44	55%
Female	36	45%
Grand N	**80**	**100%**

Table 2 presents the age profile of the respondents. These data provide background information on which group dominates in the research environment. As shown in Table 2, majority of the respondents of both campuses were male-dominated with total percentage of 55%. This implies that information technology was more appealing to male employees.

Table 3: Educational Profile of Respondents

Educational Profile	f	%
Undergrad(Students)	40	50%
BS/BA	25	31%
MS/MA	5	6%
Doctorate	10	13%
Grand N	**80**	**100%**

Table 3 presents the educational profile of the respondents. These data determined the education level achieved by the respondents. As shown in table 3, majority of the respondents were students and Bachelor's degree holder. This implies that majority of the respondents have not yet obtained a master's degree or higher.

Table 4: Position Profile Respondents

Position Profile	f	%
Deans/Head of Offices	12	15%
Assistant Deans	8	10%
Staff	20	25%
Students	40	50%
Grand N	**80**	**100%**

Table 4 presents the position profile of the respondents when the study was conducted. These data are intended to find out the position occupied by the respondents. Data shows that majority of the respondents were staff and students of the institution.

Table 5: Office/Department Profile of Respondents

Office/Department Profile	f	%
Administrative Offices	24	30%
College of Arts and Sciences (CAS)	2	2%
College of Business Administration (CBA)	45	56%
College of Engineering and Architecture (CEA)	3	4%
College of Industrial Technology (CIT)	3	4%
College of Nursing, Dentistry, Pharmacy and Allied Sciences(CNDPHAS)	3	4%
Grand N	**80**	**100%**

Table 5 presents the office profile of the respondents. These data were intended to determine the distribution of respondents by offices or department. Data shows that majority of the respondents were from the College of Business Administration and the administrative office. Administrative offices include the Registrar, Accounting, Information Technology, HR, and Supply. They were the end users of the Information Technology, which the study intended to answer.

Extent of IT Usage:

This part shows the result of the extent of usage of IT resources in administration, communication, decision support, planning, product design and production control.

Table 6: Usage of IT in Administration

Description	Extent of Usage level	Verbal Description
a. Invoicing System	4.50	Intensively Used
b. Stock Control System	3.25	Somewhat Used
c. Payroll Systems	4.25	Intensively Used
d. Databases	3.00	Somewhat Used
e. Cost of Accounting Systems	3.05	Somewhat Used
Grand Mean	**3.61**	**Mostly Used**

Legend:
1.00- 1.79 - Not at all(Never)
1.80 - 2.59 - Barely used (Rarely)
2.60 - 3.39 - Somewhat Used (Occasionally/Sometimes)
3.40 - 4.19 - Mostly Used (Almost Every times)
4.20 - 5.00 - Intensively Used (Every time)

Table 6 presents the usage of IT in Administration of the respondents the institution. These data were necessary in order to know the extent of usage of IT in Administrative operations. As observed in Table 6, the grand mean of the extent of usage level of Information technology on the area of Administration is **3.61** which indicated that the respondents mostly used these resources. This implies that the use of IT in administrative work was necessary for successful application of IT to its various activities.

Table 7: Usage of IT in Communication

Description	Extent of Usage level	Verbal Description
a. Advertising a School web page	4.50	Intensively Used
b. Direct sales by a school web page	4.30	Intensively Used
c. Company intranet	4.80	Intensively Used
d. Electronic data interchange with	2.60	Somewhat Used

Description	Extent of Usage level	Verbal Description
suppliers		
e. Electronic data interchange with customers	2.40	Barely Used
f. Group working with electronic information interchange	4.70	Intensively Used
Grand Mean	**4.66**	**Intensively Used**

Legend:
1.00- 1.79 - Not at all (Never)
1.80 - 2.59 - Barely used (Rarely)
2.60 - 3.39 - Somewhat used (Occasionally/ Sometimes)
3.40 - 4.19 - Mostly used (Almost Every times)
4.20 - 5.00 - Intensively used (Every time)

Table 7 presents the usage of IT in Communication of the respondents of NORSU. These data reveal the extent of usage of IT in Communication operations. The extent of usage in IT Communication was rated as intensively used with a grand mean of **4.66**. This indicated that the used of IT in communication was greatly used in the institution especially in dealing with its stakeholders.

Table 8: Usage of IT in Decision Support

Description	Extent of Usage level	Verbal Description
a. Decision Support System	2.90	Barely Used
b. Data analysis techniques	3.70	Mostly Used
c. Forecasting	3.90	Mostly Used
Grand Mean	**3.50**	**Mostly Used**

Legend:
1.00- 1.79 - Not at all (Never)
1.80 - 2.59 - Barely used (Rarely)
2.60 - 3.39 - Somewhat Used (Occasionally/ Sometimes)
3.40 - 4.19 - Mostly used (Almost Every times)
4.20 - 5.00 - Intensively used (Every time)

Table 8 presents the usage of IT in Decision Support of the respondents of NORSU. These data determined the extent of usage of IT in decision making process. Data shows that the usage of Information Technology in Decision Support in the offices/departments was mostly used with a grand mean of **3.50.** This implied that the University uses IT to support the head of offices in the decision-making process.

Table 9: Usage of IT in Planning

Description	Extent of Usage level	Verbal Description
a. Computer Aided Production Planning (CAPP)	3.20	Somewhat Used
b. Manufacturing Requirements Planning(MRP)	2.80	Somewhat Used
c. Enterprise Resource Planning (ERP)	3.20	Somewhat Used
Grand Mean	**3.07**	**Somewhat Used**

Legend:
1.00- 1.79 - Not at all (Never)
1.80 - 2.59 - Barely used (Rarely)
2.60 - 3.39 - Somewhat used (Occasionally /Sometimes)
3.40 - 4.19 - Mostly used (Almost Every times)
4.20 - 5.00 - Intensively used (Every time)

Table 9 presents the usage of IT in Planning of the respondents of NORSU. These data indicate the extent of usage of IT in planning operations. Data reveals that the extent of usage of Information Technology in Planning. It was observed that all IT resources under Planning were rated as **somewhat used** with a grand mean of 3.07. This implied that the University especially the head of offices considerably used IT in its planning task.

Table 10: Usage of IT in Product Design

Description	Extent of Usage level	Verbal Description
a. Computer Aided Design (CAD)	3.13	Somewhat Used
b. Computer Aided Manufacturing (CAM)	3.00	Somewhat Used
c. Computer Aided Engineering (CAE)	2.87	Somewhat Used
Grand Mean	**3.00**	**Somewhat Used**

Legend:
1.00- 1.79 - Not at all (Never)
1.80 - 2.59 - Barely Used (Rarely)
2.60 - 3.39 - Somewhat Used (Occasionally/ Sometimes)
3.40 - 4.19 - Mostly Used (Almost Every times)
4.20 - 5.00 - Intensively Used (Every time)

Table 10 presents the usage of IT in Product Design of the respondents of NORSU. These data determined the extent of usage of IT in production design support. As shown on table, the use of IT in Product Design

was rated as somewhat used with a grand mean 3.00. This indicated that the use of IT to assist in product design process was adequate.

Table 11: Usage of IT in Production Control

Description	Extent of Usage level	Verbal Description
a. Computers for controlling the University/system	4.33	Intensively Used
b. LAN use for school's operation	4.53	Intensively Used
c. Electronic systems of students and supply identification	4.27	Intensively Used
d. Electronic systems of quality control	3.60	Mostly Use
e. Electronic processing of forms and requirements	4.27	Intensively Used
f. Data Analysis Technique	3.87	Mostly Used
g. Forecasting	4.20	Intensively Used
h. Presentation Graphics Software	4.13	Mostly Used
Grand Mean	**4.15**	**Mostly Used**

Legend:
1.00- 1.79 - Not at all (Never)
1.80 - 2.59 - Barely Used (Rarely)
2.60 - 3.39 - Somewhat Used (Occasionally/ Sometimes)
3.40 - 4.19 - Mostly Used (Almost Every time)
4.20 - 5.00 - Intensively Used (Every time)

Table 11 presents the usage of IT in Production Control of the respondents of NORSU. These data indicated the extent of usage of IT in production control. Data shows that respondents rated this part as **mostly used** with a grand mean of **4.15**. This implied that the respondents intensely used these resources in their office.

IT Usage as to TQM:

This part shows the extent of usage of IT resources in relation to the eight (8) dimensions of Total Quality Management (TQM).

Table 12: IT Usage in Top Management

Description	Extent of Usage level	Verbal Description
a. Make the commitment to TQM visible to staff	4.00	Mostly Used
b. Facilitate communication between top management and employees	4.80	Intensively Used
c. Encourage employee involvement to improve work processes	4.70	Intensively Used
d. Communicate TQM values to employees	4.60	Intensively Used
Grand Mean	**4.53**	**Intensively Used**

Legend:
1.00- 1.79 - Not at all (Never)
1.80 - 2.59 - Barely Used (Rarely)
2.60 - 3.39 - Somewhat Used (Occasionally/ Sometimes)
3.40 - 4.19 - Mostly Used (Almost Every times)
4.20 - 5.00 - Intensively Used (Every time)

Table 12 presents the usage of IT in Top Management Support. These data showed the extent of usage of IT in this TQM dimension. As observed in Table 12, the usage of IT in Top Management was intensively used. It had a grand mean of 4.53. This entailed that respondents fully used information technology in Top Management.

Table 13: IT Usage in Customer Relation

Description	Extent of Usage level	Verbal Description
a. Receiving requirements	4.05	Mostly Used
b. Receiving complaints and other information	3.98	Mostly Used
c. Measure student satisfaction	3.85	Mostly Used
d. Communications with the school (sending and/or receiving information)	4.28	Intensively Used
e. Analyze student surveys (sending and/or receiving information)	4.00	Mostly Used
Grand Mean	**4.03**	**Mostly Used**

Legend:
1.00- 1.79 - Not at all(Never)
1.80 - 2.59 - Barely Used(Rarely)

2.60 - 3.39 - Somewhat Used (Occasionally/
           Sometimes)
3.40 - 4.19 - Mostly Used (Almost Every time)
4.20 - 5.00 - Intensively Used (Every time)

Table 13 presents the usage of IT in Customer Relation. These data intended to determine the extent of usage of IT in this TQM dimension. In this dimension, the respondents particularly the students rated it as **mostly used** with a grand mean of **4.03** as shown on Table 13. This revealed that the respondents observed that IT was being frequently used and utilized especially in the serving its clientele.

Table 14: IT Usage in Supplier Relation

Description	Extent of Usage level	Verbal Description
a. Identify suppliers	3.67	Mostly Used
b. Improve ordering	4.40	Intensively Used
c. Improve communication between the school and its suppliers	4.53	Intensively Used
d. Improve financial transaction between you and your suppliers	4.20	Intensively Used
e. Reduce the number of suppliers	4.00	Mostly Used
Grand Mean	**4.16**	**Mostly Used**

Legend:
1.00- 1.79 - Not at all (Never)
1.80 - 2.59 - Barely Used (Rarely)
2.60 - 3.39 - Somewhat Used (Occasionally/
           Sometimes)
3.40 - 4.19 - Mostly Used (Almost Every time)
4.20 - 5.00 - Intensively Used (Every time)

Table 14 presents the usage of IT in Supplier Relation. These data were intended to determine the extent of usage of IT in this TQM dimension. As observed in Table 14, respondents mostly used IT in dealing with suppliers. This had a grand mean of 4.16. This infers that information technology is regularly used in making transactions with suppliers.

Table 15: IT Usage in Workforce Management

Description	Extent of Usage level	Verbal Description
a. Help to form work teams or quality improvement groups	3.95	Mostly Used
b. Facilitate team working	4.40	Intensively Used
c. Help solicit suggestions from staff for quality improvement	4.35	Intensively Used
d. Enable staff to share task-related information	4.55	Intensively Used

Description	Extent of Usage level	Verbal Description
e. Supported the planning of staff training on quality issues	4.15	Mostly Used
f. Supported the staff training on quality issues	4.40	Intensively Used
e. Help recognize staff contributions to quality improvement	4.35	Intensively Used
g. Support staff appraisal in quality improvement programmes	4.55	Intensively Used
Grand Mean	**4.34**	**Intensively Used**

Legend:
1.00- 1.79 - Not at all (Never)
1.80 - 2.59 - Barely Used (Rarely)
2.60 - 3.39- Somewhat Used (Occasionally/
           Sometimes)
3.40 - 4.19 - Mostly Used (Almost Every times)
4.20 - 5.00 - Intensively Used (Every time)

Table 15 presents the usage of IT in Workforce Management. This showed the extent of usage of IT in this TQM dimension. In this TQM dimension, respondents rated it as **intensively used** with a grand mean of 4.34. This implies that IT was effectively used in the management of its people.

Table 16: IT Usage in Employee Attitudes and Behavior

Description	Extent of Usage level	Verbal Description
a. Employee Motivation	4.65	Intensively Used
b. Employee Loyalty	4.65	Intensively Used
c. Employee Pride	4.60	Intensively Used
d. Help to recognized employee's contribution to quality improvement	4.15	Mostly Used
Grand Mean	**4.51**	**Intensively Used**

Legend:
1.00- 1.79 - Not at all (Never)
1.80 - 2.59 - Barely Used (Rarely)
2.60 - 3.39 - Somewhat Used (Occasionally/
           Sometimes)
3.40 - 4.19 - Mostly Used (Almost Every times)
4.20 - 5.00 - Intensively Used (Every time)

Table 16 resents the usage of IT in Employee Attitudes and Behavior. These data were intended to find out the extent of usage of IT in this TQM dimension. Table 16 showed that the usage of IT in Employee Attitudes and Behavior was intensively used with a grand mean of 4.51. It was observed that

most of the areas of this dimension are rated intensive which means that the respondents fully used the technology to its purpose.

Table 17: IT Usage in Product Design Process

Description	Extent of Usage level	Verbal Description
a. Monitor and adjust program implementation	3.67	Mostly Used
b. Corrective actions to ensure proper receiving and /or using materials/resources	3.57	Mostly Used
c. The exchange of new design information between departments	3.87	Mostly Used
d. Quality Function Deployment (measuring customer satisfaction with a product/ service)	3.97	Mostly Used
Grand Mean	**3.77**	**Mostly Used**

Legend:
1.00- 1.79 - Not at all (Never)
1.80 - 2.59 - Barely Used (Rarely)
2.60 - 3.39 - Somewhat Used (Occasionally/ Sometimes)
3.40 - 4.19 - Mostly Used (Almost Every times)
4.20 - 5.00 - Intensively Used (Every time)

Table 17 presents the usage of IT in Product Design Process. These data were needed to know the extent of usage of IT in this TQM dimension. As shown in Table 17, the respondents **mostly used** IT in the product design process. This had a grand mean of 3.77. It was observed that all areas under this dimension are rated Mostly Use. This indicates that the usage of IT is frequently used in the process of product design.

Table 18: IT Usage in Process Flow Management

Description	Extent of Usage level	Verbal Description
a. Been used to detect the need for machine maintenance	3.56	Mostly Used
b. Been used to check product adjust to design	3.60	Mostly Used
c. Reduced process variance	4.00	Mostly Used
d. Increase the need for higher quality raw materials and components	4.44	Intensively Used
e. Reduced the need for inspection activities	4.08	Mostly Used
f. Facilitated the application for Statistical Process Control	4.12	Mostly Used
Grand Mean	**3.97**	**Mostly Used**

Legend:
1.00- 1.79 - Not at all (Never)
1.80 - 2.59 - Barely Used (Rarely)
2.60 - 3.39 - Somewhat Used (Occasionally/ Sometimes)
3.40 - 4.19 - Mostly Used (Almost Every time)
4.20 - 5.00 - Intensively Used (Every time)

Table 18 presents the usage of IT in Process Flow Management. These data focus on the extent of usage of IT in this TQM dimension. As observed on Table 18, data reveal that majority of the items of this dimension were rated as mostly used with a grand mean of 3.97. This implies that IT was regularly used this dimension.

Table 19: IT Usage in Quality Information and Analysis

Description	Extent of Usage level	Verbal Description
a. Collect data about employees, customers and suppliers	4.48	Intensively Used
b. Collect data about work/ production processes	4.60	Intensively Used
c. Maintain quality information system	4.52	Intensively Used
d. Provide DSS, statistical tools, diagrams	4.04	Mostly Used
e. Provide timely information to staff for decision-making	4.24	Intensively Used
f. Provide relevant information to staff that meets their needs	4.48	Intensively Used
g. Improve accuracy of information	4.60	Intensively Used
Grand Mean	**4.42**	**Intensively Used**

Legend:
1.00- 1.79 - Not at all (Never)
1.80 - 2.59 - Barely Used (Rarely)
2.60 - 3.39 - Somewhat Used (Occasionally/ Sometimes)
3.40 - 4.19 - Mostly Used (Almost Every time)
4.20 - 5.00 - Intensively Used (Every time)

Table 19 presents the usage of IT in Quality Information and Analysis. These data were intended to determine the extent of usage of IT in this TQM dimension. As shown on Table 19, data reveal that almost all of the items under this dimension were rated **intensively used** with a grand mean of 4.42. This implies that the respondents fully used the technology to its purpose.

Table 20: Test for Significant Relationship on the usage of IT resources to the eight (8) dimensions of TQM

Correlation between IT implementation vs IT Impact	r=	0.377	Strong Positive Correlation	
The Range of r	Interpretation			
r = -1	Perfect negative correlation			
-1< r -0.8	Strong negative correlation			
-0.8 < r -0.5	Fair negative correlation			
-0.5 < r < 0	Weak negative correlation			
r = 0	No correlation			
0 < r < 0.5	Weak positive correlation			
0.5 r < 0.8	Fair positive correlation			
0.8 r < 1	Strong positive correlation			
r = 1	Perfect positive correlation			

Table 20 presents the result for the test of significant relationship on the usage of IT resources to the 8 dimensions of TQM. The data revealed that the r result of the variables was for the observance of the relationship. Therefore, there was significant relationship on the usage of IT to the eight (8) dimensions of TQM.

Profile of the Respondents:
Majority of the respondents belonged to the age bracket 20-30 and 31-40, while the remaining proportions were in 41-50 and above 50 age brackets. It was presumed that in the said percentage, a considerable number could be among the young adult members of the population; who were male-dominated. Majority of the respondents were bachelor's degree holder and students of the institutions.

Extent of IT Resources Usage in terms of *Administration*:
The extent of usage of IT in administration indicated that majority of the respondents mostly used IT in doing administrative operations which included clerical and administrative tasks especially in Invoicing and Payroll systems. Thus, through the use of IT in dealing with these systems, the institution saved costs, improved processes and improved both their stakeholders' and employees' satisfaction.

Communication:
The extent of usage of IT in communication was rated intensively used. This implied that management of NORSU used IT in communicating with employees and stakeholders in the institution.

Decision Support:
The extent of usage of IT in decision Support was rated mostly used with a grand mean of 3.50 which implied that the institution used IT to support head offices in the decision making process.

Planning:
The extent of usage of IT in planning has a grand mean of 3.07 which mean Somewhat Used. This implied that the University especially the head of offices considerably used IT in its planning task.

Product Design:
The extent of usage of IT in Product Design resulted to Somewhat Used with a grand mean of 3.00. This indicated that the use of IT to assist in product design was adequate.

Production Control:
The extent of usage of IT in Production Control was found to be mostly used with a grand mean of 4.15. This implies that the respondents intensely use these resources in their office.

IT usage as to TQM:
Top Management Support:
The usage of IT in Top management support was intensively used with a grand mean of 4.53. This means that IT was fully used in Top Management.

Customer Relation:
The usage of IT in Customer Relation resulted to mostly use which has a grand mean of 4.03. This revealed that IT is frequently used and utilized in the system especially in dealing with customers. The data and literature support on customer focus aspect.

Supplier Relation:
The usage of IT in Supplier relation was mostly used with has grand mean of 4.16. This infers that IT is regularly used making transactions with the suppliers.

Workforce Management:
The usage of IT in workforce management was intensively used with a grand mean of 4.34. This implied that IT was effectively used in the management of its people.

Employee attitudes and behavior:
The usage of IT in employee attitudes and behavior was intensively used with a grand mean of 4.51. This means that IT was fully used to its purpose.

Product Design Process:
The usage of IT in product design process resulted to Mostly Used with a grand mean of 3.77. This showed that NORSU management frequently used IT in facilitating product design process.

Process Flow Management:
The usage of IT in process flow management was found mostly used with a grand mean of 3.97. Data revealed that almost all the item under this dimension mostly used IT which indicates that IT is frequently used in its process.

Quality Information and Analysis:
The usage of IT in quality information and analysis was intensively used with a grand mean of 4.42. This showed that NORSU management used IT to ensure proper collection data, provide timely and relevant information and improvement of accuracy of data.

Significant relation between the usage of IT resources to the eight (8) dimensions of TQM.
Using the correlation tool, result showed that there was significant relation between the usages of IT resources to the eight (8) dimensions of TQM.

CONCLUSIONS:

This paper analyzed the effects of information technology on the total quality management of Negros Oriental State University (NORSU). In order to test this relationship, six different aspects of IT implementation were measured as well as eight dimensions to measure IT impact on the different TQM dimensions.
The data suggest that NORSU who apply TQM perceived a larger impact of IT on their TQM dimensions. This suggests that IT acts in a supporting role for TQM.
The following conclusions are drawn based on the findings of the study:

- Respondents were in their early adulthood and were male-dominated. Further, majority of the respondents were college students who were from the College of Business Administration and staff of the different campuses.
- IT was mostly used in all aspects of NORSU's operation.
- NORSU intensively used IT in almost all dimensions of TQM.
- There was significant relationship between the usages of IT resources to the eight (8) dimensions of TQM.

Clearly, the extent of use of IT has an impact on the dimensions of TQM and the application of TQM. IT was found to bolster TQM in: improving customer and supplier relationship, increasing process control, facilitating teamwork, facilitating inter-departmental information flow, improving design process and skills, applying preventive maintenance, measuring quality costs and improving the decision process in quality departments.

RECOMMENDATIONS:

In view of the findings and conclusions in this study, the following recommendations are proposed:

1. That trainings, workshops, seminars and continuous education should be provided to further boost the quality management of the institution.
2. That the institution should develop IT capabilities among administrators and college students. They need to know how to mobilize and deploy IT in other organizational to improve its operations.
3. That top management should have higher commitment to the use of IT as a strategic tool for improving TQM and QMS.
4. That top management should allocate appropriate and adequate resources and initiate the setting up of an information system (IS) steering committee for the development of strategic IT application.
5. That the institution should conduct proper and/or continuous planning in the development of LAN, intranet, Internet and specialized software to get comprehensive information for achieving the full QMS status.

References:

Ahire, S.L., & Ravichandran, T, (2001). An innovation diffusion model of TQM implementation. *J. IEEE Transactions on Engineering Management,* Vol. 48.

Ahmad Jusoh, Rushami Zien Yusoff, & Shahimi Mohtar (2008). Determining TQM practices in university R&D activities using factor analysis: Research experience of Malaysian universities, *Jurnal Kemanusiaan*

Beesen, J. (2002). Technology Adoption Costs and Productivity Growth: The Transition to Information Technology. *Review of Economic Dynamics.*

Brah, S. & Lim, H. (2006). The effects of technology and TQM on the performance of logistics companies. *International Journal of Physical Distribution & Logistics management.*

Brocka, B., & Brocka, S. (1992). *Quality management: Implementing the best ideas of the masters.* Irwin, Inc.

Curry, A., & Kadasah, N. (2002). Focusing on key elements of TQM – evaluation for sustainability. The *TQM Magazine.*

David Skryme Associates (2011). *The Impact of IT in the Organization.* Retrieve from http://www.skyrme.com/insights/5itorg.htm

Deming, W. E. (2000). *Out of the crisis* (rev. ed.). Cambridge, MA: MIT Press.

Gabriel, Y., Fineman, S., and Sims, D. (2000). *Organizing and Organizations,* Sage.

Gunasekaran, A. & R.E. McGaughey (2003). TQM in supply chain management. The *TQM Magazine.*

Günbayı, I., & Cevik, V. (2004). An investigation on the opinions of teachers and managers about total quality management. *Journal of National Education.*

Hashmi, Kharram (2000). *Introduction and Implementation of Total Quality Management.* Retrieve from http://www.isixsigma.com/methodology/total-quality-management-tqm/introduction-and-implementation-total-quality-management-tqm/

IEEE Xplore (2015). Technology adoption, product design, and process change: a case study in the machine tool industry. Retrieve from http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=403737&url=http%3A%2F%2Fieeexplore.ieee.org%2Fiel1%2F17%2F9077%2F00403737.pdf%3Farnumber%3D403737

Kalay, Yehuda E (2005). *The impact of information technology on design methods, products and practices.* Department of Architecture, University of California at Berkeley, Berkeley, CA 94720-1800, USA

Kanji, G. (2002). *Measuring business excellence.* Routledge. London.

Kaynak, K (2003). The relationship between total quality management practices and their effects of firms performance. *Journal Operations Management.*

Khamalah, Joseph N. & Lingaraj, Bangalore P. (2007). TQM in the Service Sector: A Survey of Small Businesses. *Total Quality Management & Business Excellence Journal.*

Koh, S.C.L., M. Demirbag, E. Bayraktar, E. Tatoglu & S. Zaim(2007). The impact of supply chain practices on performance of SMEs. *Industrial Mangement & Data Systems.*

Manage Your Suppliers (2009). Retrieved from http://www.infoentrepreneurs.org/en/guides/manage-your-suppliers

Matta, K., Chen, H.-G., & Tama, J. (2001). The information requirements of total quality management. *Total Quality Management.*

Messersmith, Emily E., Garrett, Jessica L., Davis-Kean, Pamela E., Malanchuk, Oksana, and Eccles, Jacquelynne S. (2012). Career Development from Adolescence through Emerging Adulthood Insights from Information Technology Occupations. Retrieve from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3403705/

Metri, Bhimaraya A. (2005). *TQM Critical Success Factors for Construction Firms.* Retrieve from http://www.researchgate.net/publication/27203428_TQM_CRITICAL_SUCCESS_FACTORS_FOR_CONSTRUCTION_FIRMS

Mjema, E.A.M., M.A.M Victor & M.S.M Mwinuka, (2005). Analysis of roles of IT on quality management. *TQM Mag.,* 17: 364-374.

Nayab, N. (2011). *TQM role in building customer relationship.* Retrieve from http://www.brighthubpm.com/methods-strategies/104254-tqm-role-in-building-customer-relationships/

NORSU IPO (2014). Computer and Information System Office. Retrieve from http://www.norsu.edu.ph/system/info.php?titleID=Computer%20and%20Information%20System%20Office.

Orlikowski, W.J. and Gash, D.C. (1991). *Technological Frames: Understanding Information Technology through Interpretive Schemes.* Unpublished Manuscript, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA.

Quinonez, Natasha (2014). *Importance of Information Technology.* Retrieve from https://www.udemy.com/blog/importance-of-information-technology/

Ramey, Karehka (2013). *5 Ways IT can improve customer service.* Retrieve from http://www.useoftechnology.com/5-ways-improve-customer-service/

Ramseook – Munhurrun, P., V. Munhurrun & A. Panchoo (2011). Total Quality Management Adoption in a Public Hospital: Evidence from Mauritius. *Global Journal of Business Research.*

Ravichandran, T., and Rai, A., (2000). Quality Management in Systems Development: An Organizational System Perspective, MIS Quarterly, 24(3), 381-415. http://misq.org/quality-management-in-systems-development-an-organizational-system-perspective.html.

Sallis, Edward (2002). *Total Management in Education.* 3rd edition. Stylus Publishing, Inc.

Saravanan, R., & Rao, K.S.P. (2006). Development and validation of an instrument for measuring total quality service. *Total Quality Management.*

Sun, H. (2000). Total quality management, ISO 9000 certification and performance improvement. *International Journal of Quality & Reliability management.*

Talib, F., Z. Rahman & M.N. Qureshi (2011). A study of total quality management and supply chain management practices. *International Journal*

of Productivity and Performance Management.

Toremen, F, Karakus, M. & Yasan, T. (2009). Total quality management practices in Turkish primary schools. *Quality Assurance in Education: An International Perspective, v17 n1 p30-44 2009.*

Tutuncu, O. & D. Kucukusta (2008). The role of supply chain management integration in quality management system for hospitals. *International Journal of Management Perspectives.*

Vanichchinchai, A. & B. Igel (2009). Total quality management and supply chain management: similarities and differences. *The TQM Magazine.*

Weston, F. C. Jr. (1993). Weighing 'soft' and 'hard' benefits of information technology, *Manufacturing Systems.*

Wiley, John & Sons (2005). *Chapter1 what is Total Quality Management.* Retrieve from https://src.alionscience.com/pdf/RAC-1ST/SOAR7_1st_Chapter.pdf

Wilson, F. A. (1994). Perspectives on computer-based Systems and Management: Doctoral thesis, *UMIST.*

Workforce Management (2010). *What is Workforce Management?* Retrieve from http://www.callcentrehelper.com/what-is-workforce-management-57249.htm

Yousaf, Nadeem (2006). *Top Management Commitment for TQM – a process model.* Retrieve from http://piqc.edu.pk/casestudies/Nadeem_Yusaf_Top_Management_Commitment_for_Total_Quality_Management_A_Process_Model_Social_Quality_Case_Study_PIQC.pdf

*****