

TQM AND SIX SIGMA IN ACCOUNTING LITERATURE

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Resumo

Este estudo tem por base a investigação da relação entre a contabilidade de gestão e as ferramentas de gestão de qualidade TQM e six sigma, em publicações nas principais revistas da área da contabilidade, especificamente contabilidade de gestão: *Management Accounting Review*; *European Accounting Review*; *Accounting, Auditing and Accountability*; *Critical Perspectives on Accounting*; and *Accounting Organizations and Society*.

Apesar da vasta literatura existente sobre ambos os temas, este trabalho pretende contribuir para a investigação da relação entre ambos. Para tal, várias variáveis, como a caracterização dos autores, a metodologia de estudo, temas abordados e a teoria organizacional presente, foram analisadas e associadas de forma adequada.

Os resultados deste estudo mostram que a investigação nesta área é dominada por autores do sexo masculino, na maioria afiliados com a Europa ou Estados Unidos, origem da maioria dos artigos analisados. O método de estudo preferido foi o case study na Europa e nos Estados Unidos o questionário. A teoria da contingência foi a mais adoptada para este tipo de estudo, apesar das teorias actor-network e institucional terem sido bastante adoptadas, também. É também de salientar que nenhum artigo correspondente aos requisitos deste estudo foi encontrado na revista *European Accounting Review*.

Classificação JEL:M40, M41

Palavras-chave: contabilidade, qualidade, TQM, six sigma.

Abstract

This study is based on the investigation of the relation between management accounting, Total Quality Management and six sigma, in articles published in 5 of the most renowned accounting journals: *Management Accounting Review*; *European Accounting Review*; *Accounting, Auditing and Accountability*; *Critical Perspectives on Accounting*; and *Accounting Organizations and Society*.

Despite the vast existent literature related to both management accounting and quality management, this investigation contributes by characterizing the relation between them. This study was developed by extracting and analyzing variables such as author's characterization, research method, studied subjects and underlying organizational theory. These variables were subsequently associated with each other.

This study's results show that investigation in this area is largely dominated by male authors, generally affiliated to either Europe or the US. The preferred research method in Europe was the case study, while US authors preferred the survey method. Contingency theory was the most adopted organizational theory. Actor-network and institutional theories were also used in a relevant amount of studies. It is also important to state that no article was extracted from *European Accounting Review* journal, since none met this study's requirements.

JEL Classification: M40, M41

Keywords: accounting, quality, TQM, six sigma.

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Glossary

MAR: Management Accounting Research Journal

AAA: Accounting, Auditing and Accountability Journal

EAR: European Accounting Review Journal

CPA: Critical Perspectives on Accounting Journal

AOS: Accounting, Organizations and Society Journal

TQM: Total Quality Management

JIT: Just-in-Time

TQC: Total Quality Control

1. Introduction

1.1. Objectives

This study was developed with the main objective of characterizing general accounting and management accounting publications related to either TQM or Six Sigma quality tools, in the most relevant accounting journals with an established time frame from 2000 to 2013. The following publications were studied: *Management Accounting Research* (MAR); *European Accounting Review* (EAR), *Accounting, Auditing and Accountability* (AAA); *Accounting, Organizations and Society* (AOS); and *Critical perspectives on Accounting* (CPA). The main objective was then divided into more specific goals.

The first was to analyze specific variables extracted from analyzed articles, such as author's characteristics, preferred research method, studied subject and organizational theory.

Secondly, associations between previously extracted variables were established in order to better comprehend their relevance and consequently, to draw conclusions from.

1.2 Study Organization

The following study is organized in three main chapters.

The first is the literature review where relevant literature was consulted, in order to provide a contextual background on the subject. This review regards topics such as the evolution of the concept of quality and its importance through time, the evolution of the association between management accounting and quality and finally some theoretical contextualization is provided on each of the quality tools identified in the articles represented in the studied universe.

Secondly, there is the empirical study chapter where the study is developed. Here, several variables extracted from the previous publications were analyzed and relevantly associated with each other.

Finally, there is the concluding discussion. This section provides the study's results discussion, its contributions and limitations, and also some thoughts on possible future investigation regarding the subject.

2. Literature review

2.1. Management Accounting and Quality

The American Accounting Association defines accounting as the process of identifying, measuring and communicating economic information to permit informed judgments and decisions by users of the information. Management accounting is widely regarded as the internal branch of accounting due to the fact that it provides information for users within the organization (Drury, 2001). Output information typically focuses on performance data which is generally used for control or decision-making (Hansen and Mouritsen, 2007).

Drury (2001) states that until the 1980s companies were forced to compete mainly in their domestic markets because of limited technology, which acted as a protection for Western organizations. During this time, management practices and efficiency maximization played a small role as the incentive was not there. With globalization, international market's barriers began to fall and the Western world was forced to face competitive products from companies all over the world. Particularly, Eastern goods, specifically from Japan, flooded Western markets with superior quality and lower prices. This evolution was one of the most determinant factors to push management accounting development, since companies were forced to achieve highly efficient processes and revolutionary management practices in order to survive. It was also when Western companies started noticing the importance of quality in management (Drury, 2001).

During this time, highly regarded personalities in the quality field such as Deming, Juran acted as consultants for quality management in several companies. Despite having different visions on quality approaches and the path to achieve it, as will be discussed subsequently, these quality specialists agreed on one point: commitment from top management is essential.

"...I gave the Japanese the same quality lectures I'd been giving here at home. But in Japan, it was the CEOs who listened." Juran (1993: p. 42)

Johnson (1992) stressed the importance of the change that needs to occur in top management in order for businesses to thrive in the modern age. The author states that in order to be successful in the "global economy", a company must not only rely on the adoption of breakthrough techniques but also embrace their changes and allow it to transform the

organization. Johnson (1992: p. 13) states that *“Managers are not the problem. The problem is management thinking that focuses on the wrong imperatives.”*

Accounting information is often problematic. Not the information itself but the way it is used to guide processes regarding business operations. Johnson (1992) even conceptualizes a “hidden tax”, paid by companies that fail to segregate accounting control from the operating control system. Accounting goals must be set aside for organizations to focus on customer oriented goals, prioritizing customer satisfaction. This requires a bottom-up, responsive and flexible structure with an empowered work force that collects information from the market and acts fast and accordingly. Responsiveness comes from relationship building with suppliers, employees and customers while flexibility is achieved through eliminating delays and output variation. Management accounting information has the objective of helping companies achieve these two imperatives, although relying excessively on it could compromise them (Johnson, 1992) .

Reductions in process variance, and consequentially output variance, and the promotion of customer oriented goals are the cornerstones of quality management. In the modern global economy, customers are not only focusing on competitive pricing but also demanding higher quality as a standard (Drury, 2001). This led to companies adopting quality oriented philosophies such as Total Quality Management and quality assurance which proves a company’s commitment to providing quality goods or services. Quality assurance laid the foundation for a standardized ISO 9000 (Fowler, 1999).

The adoption of quality focused philosophies demanded the evolution of management accounting. According to Grant (1995: p. 41) Management accountants should expand their *“...competence and application to the wider range of management information and business issues and plans demanded in the Total Quality environment”*. This change in management accounting translates into three areas: cost determination should support the quality strategy being employed, performance measurement should be more flexible and relevant (Lowe *et al.*, 1992) and integration of quality principles in the accounting function, as in all other areas of the organization (Fowler, 1994).

2.2. Defining Quality

Quality comes as a rather subjective term to define. Juran (1999) states that quality can be seen from two different perspectives: product features that meet customer needs or freedom from deficiencies. The first, as put by Juran, is oriented to income through higher customer satisfaction and is associated with a higher cost of quality. The second has its focus on lowering costs by reducing nonconformities. Figure 1 provides a broader description for both views.

Figure 1 – Juran’s definitions of quality

Product features that meet customer needs	Freedom from deficiencies
Higher quality enables companies to:	Higher quality enables companies to:
<ul style="list-style-type: none"> Increase customer satisfaction Make products salable Meet competition Increase market share Provide sales income Secure premium prices 	<ul style="list-style-type: none"> Reduce error rates Reduce rework, waste Reduce field failures, warranty charges Reduce customer dissatisfaction Reduce inspection, test Shorten time to put new products on the market Increase yields, capacity Improve delivery performance
The major effect is on sales.	Major effect is on costs.
Usually, higher quality costs more.	Usually, higher quality costs less.

Source: Juran (1999, p. 27)

For Juran, the depth of meaning for the word ‘quality’ implies is one of its biggest problems. He even suggests that this distinction should be addressed during training programs and in procedure manuals (Juran, 1999).

Crosby (1979) defines quality as conformance to requirements. In his famous work *Quality is free* he argues, as the title suggests, that quality is free while costs are derived from the lack of it. The cost of “unquality” is increased by the amount of work that has to be repeated because it was not done right the first time.

Both Juran and Crosby support the notion that products and services can be designed so that they match the market’s expectations, provided that the company knows what the market needs.

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Deming (1994) on the other hand, defines quality as a predictable degree of uniformity in which a company can rely on, at low costs and adequate to the market. This means that quality is achieved through stable processes with predictable variations within expectable parameters. Taguchi *et al.* (2005, p. 1622) define quality as “the loss imparted by a product to society from the time the product is shipped.”

Quality can also be quantified as follows:

$$Q=P/E$$

Where Q is quality, P is performance and E means the market’s expectation. The customer’s perception of quality comes when Q is greater than 1.0, which means that the product surpasses the customer’s expectation (Besterfield *et al.*, 1998).

Table 1 presents the 9 dimensions to which quality is subjected. Their independence means that a quality can excel in a number of dimensions and be average or even poor in others. It’s not common for a product to excel in all. The ones it has to be good at are the ones the customers value the most, varying with each market.

Table 1 - The 9 dimensions of quality

Dimension	Meaning
Performance	Primary product characteristics
Features	Secondary characteristics, added features
Conformance	Meeting specifications or industry standards
Reliability	Consistency of performance over time
Durability	Useful life
Service	Resolution of problems and complaints
Response	Human-to-human interface
Aesthetics	Sensory characteristics
Reputation	Past performance and other intangibles

Source: Adapted from Besterfield, *et al.*, (1998: p. 8)

Giaccio *et al.*, (2013: p. 225) states that the fact that main researchers develop so many and so different definitions for quality “...shows that there has been a trend away from the idea of

quality as something objective and intrinsic to the product, and towards an idea of quality as more subjective and dependent on external factors.”

2.3. History of Quality

Quality was not a recent invention; it has been in existence for as long as the human race. Egyptian, Greek, Roman and various other civilizations produced wonders in various fields. These wonders could be attributed to the existence of strict standards for mathematical precision, materials used and craftsmanship (Banks, 1989).

Gitlow *et al.*, (1995) traced the origins of quality as far back as early 2000 BC. The first records of the human pursuit for quality and producer accountability was found in the Code of Hammurabi¹ which stated: “If a builder has built a house for a man, and his work is not strong, and the house falls in and kills the householder, that builder shall be slain”.

From the 12th century, with the creation of guilds² in medieval Europe, rules for product and service quality started being developed. Guilds were highly dependent on reputation and as such their quality standards had to be high. Inspection committees would place a special mark or symbol on flawless products, enforcing the rules. Each craftsman would mark the products with a symbol of his own so products could be traced back to their origin.

In 1776, Adam Smith published his famous book, *The Wealth of Nations*, which introduced society to division of labor. This critical methodology would lay the foundations for the Industrial Revolution to take place. Up until the 18th century, manufacturing would take place on workshops and craftsman’s homes. Young boys would serve as apprentices, learning their craft from the masters. Labor division would later divide the process into specialized task, thus creating the factory system where craftsman became factory workers. Quality was ensured through end of line inspections and audits.

In the late 19th century, Frederick Taylor, an American engineer, would forever change the concept of management. Juran (1994:1) summarized Taylor’s proposal as follows: “the methods for doing work should be based on scientific study, not on the empirical judgment of foremen or workmen, the standards of what constitutes a day's work should likewise be based

¹ The Code of Hammurabi provides the earliest-known example of an entire, organized publicly proclaimed body of laws so that all men might know what was required of them. The code was written by Hammurabi, once the

² Organized unions for craftsmen.

on scientific study, selection and training of workmen should also be based on scientific study, piece work payment should be employed to motivate the selected and trained workmen to use the engineered methods and to meet the standards of a day's work.” These premises separated the notion of planning and executing/controlling. While engineers were responsible for planning production according to the latest scientific researches, workmen were responsible for meeting planned standards. Thus, the Taylor System was set to become the modern management system use to this day.

By the same time, Germany laid the ground for industrial quality with its *Diversified-Quality Production* (DQP) regime. This system has been characterized by a high-level of industrial organization, as well as such corporatist arrangements as management-labor co-determination (Van Hook, 2007). Germany also pioneered the idea of corporations and the creation of quality department and was one of the first countries to adopt trademarks, quality assurance seals and legislation aiming at customer protection from low quality products (Elshennawy, 2004).

In 1894, Tomas Bata, a Czech³ entrepreneur, founded the Bata Shoe Company. Bata introduced fundamental changes in management philosophies and technics to the world. Beta enterprises practiced quality since before the First World War and through the 1920s, 30s and 40s. Japanese researchers traveled to Zlin, the location of the company, to learn about these technics and practices. Bata executives also traveled to Japan in 1937, predicting the industrial rise that would happen decades later (Fisher and Nair, 2009).

The 20th Century

The modern era of quality started in the 1920s with an employee of the American company Western Electric, an engineer called Walter Shewhart. Deemed as the father of statistical methods of quality control, Shewhart was responsible for the invention of control charts and the development of theories of knowledge in the field of statistics, specifically in the context of industrial mass production. In the 1930s Shewhart's ideas would eventually spread, as quality management started gaining international momentum.

The Second World War played a key role in the evolution of quality management. In the U.S., virtually every military production unit, such as bullets or weapons, was inspected. The resources wasted with this process would lead to the use of sample inspection, using

³ Until the end of the First World War the country was known as Austria-Hungary.

Shewhart's technics. However, it would take the end of the war for the quality revolution to take place. After Japan formally surrendered in 1945, General Douglas MacArthur, the Supreme Commander for Allied Power (SCAP) began the process of post-war reconstruction. In 1946, in an effort by the Japanese government to stimulate post-war recovery, several industrial organizations were created. The Union of Japanese Scientists and Engineers (JUSE) was among those organizations and the most renowned of all.

Dr. William Edwards Deming was the first American quality expert to provide methodological teachings about quality in Japan. Deming began his work on quality in the late 1920's when he was working for the US Department of Agriculture as a mathematical physicist. By then, he was working on his theory of variance⁴ which would provide a gateway for him to work on the US Bureau of Census. In the census of 1940, Deming's work would lead to an increase in productivity and decreased costs. His focus was on identifying and eliminating (or controlling) sources responsible for process variations. Despite his success, his plead to focus American managers on quality management was ignored by the majority, as top management focused more on financial reports and left quality and other production issues for industrial engineers.

In 1947, Dr. Deming was invited to come to Japan to aid and advise General MacArthur on survey methods so they could get a better understanding on demographics and other statistics such as health and social services. He returned in 1950, invited by JUSE to fill in for Shewhart who had declined the invitation to speak at a seminar. Through his seminars, he stressed the importance of establishing a rigorous and systematic approach to quality using statistical control and other tools such as Shewhart's process control charts. Deming's contributions to Japan's industry were of such proportion that the highest achievement in quality management was named after him –the Deming Prize - among other distinctions. Despite his achievements in Japan, his recognition in the West would not come until 1980 when the US was facing huge competition from Japan and struggled to comprehend their edge in product quality. Companies such as Ford and General Motors turned to him in order to better understand the revolution he had inspired across the Pacific.

In 1951 Dr. Joseph Juran published his famous book *Quality Control Handbook* which was brought to the attention of the Japanese by Deming. Juran was one of the western minds to get credit for the Japanese quality revolution. He began his career as an employee of Western

⁴ Based on Walter Shewhart's work on variations within the manufacturing process.

Electrics in the inspections department of Hawthorn Works, a factory in Chicago, IL, where he would rise to become the chief of industrial engineering at Western Electric's home office in New York. During World War II, he served as an assistant administrator for the Lend-Lease Administration in Washington, D.C. where he applied his statistics background to vastly improve process efficiency and reduce resource consumption. Juran left Washington in 1945 as a highly-regarded industrial engineering theorist and statistician.

In 1954, JUSE invited Juran to give lectures in Japan. In these seminars, Juran covered how to produce according to specifications and how to inspect them for defects. But that was not the most important topic discussed. Juran often spoke of the importance of borderless production and quality departments, establishing strategic quality goals and top management involvement. In an article written for the Harvard Business Review in 1993, Juran argued that one of the main reason Japan surpassed European and American quality practices in the 1970s was that in Japan his lectures were attended mostly by CEO's whereas in the US the very same lectures were attended by engineers and middle management. While Western top managers were busy analyzing financial reports and sales figures, the Japanese were involved in reducing waste and creating minimum variance processes with outputs conforming to what the market wanted. Kaoru Ishikawa was responsible for expanding notions of quality management and assurance from the production departments to all aspects involved in managing a business (Ishikawa, 1985; p. 1994).

Ishikawa, son of Ichiro Ishikawa who had co-founded the JUSE, was a member of the organization. He developed the Ishikawa diagram, also known as fishbone cause and effect diagram, and implemented quality circles⁵. Influenced by the lectures of Deming and Juran, Ishikawa would translate, implement and expand their work into the Japanese industry.

The statistician and engineer Genichi Taguchi, another Japanese quality expert, revolutionized quality applied statistics since the 1950's with the introduction of the *Taguchi Methods*. These are: the *quality loss function*, the *off-line quality control* philosophy and innovations in the *design of experiments*. Taguchi's methods provide a system to develop specifications, design those specifications into a product and/or process and produce products that continuously surpass said specifications (Gitlow *et al.*, 1995). The previous methods will be further developed in the next sub-chapter.

⁵ Group of volunteers with similar activities who regularly meet and discuss, analyze and propose solve organizational problems.

In 1979, during the American quality crisis, Philip Crosby's *Quality is free* was published. In his book, Crosby expanded the notion that quality systems should be preventive seen that if the activity must be performed, might as well do it right the first time. One of Crosby's main points was that quality is a people's problem (Pires, 2000). Crosby argued that the *cost of quality*, measured by the cost of nonconformance⁶, is free in a zero defect environment, a performance standard introduced by him as well.

In 1951, Armand V. Feigenbaum published his famous *Total Quality Control*⁷, being the first author to use such term (Martinez-Lorente *et al.*, 1998). Feigenbaum was an American quality expert and businessman who advocated the total quality control (TQC) as "an effective system for integrating the quality development, quality maintenance, and quality improvement efforts of the various groups in an organization so as to enable production and service at the most economical levels which allow full customer satisfaction." (Feigenbaum, 1991, p. 4). Feigenbaum also popularized the concept of "hidden plant" which states that every factory has a proportion of wasted capacity through not getting things right the first time.

There is much discussion on the origins of total quality control, which later became known as Total Quality Management (TQM). Nevertheless, the term would be popularized during the 1970s and 1980s, during the western quality crises, when Japan surpassed the US and Europe in quality of exported goods. During this period, western companies began reexamining the quality control procedures and technics that led Japan to establish quality supremacy in manufacturing goods. Together with contributions from experts such as Deming, Juran, Crosby, Feigenbaum and Ishikawa, TQM would take root as the first organization-wide quality management system.

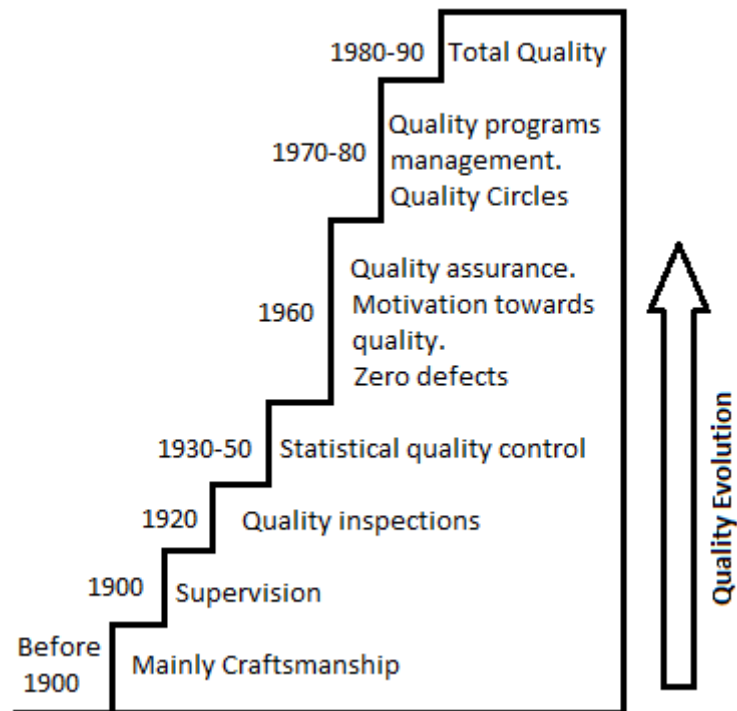
Today, quality has become one of the most important competitive weapons. "Increasing the satisfaction of customers and other stakeholders, through effective goal deployment, cost reduction, process improvement, people involvement and supply chain development has proved essential for organizations to stay in existence in the 21st century." (Oakland, 2014, preface)

Figure 2 provides a graphical exploration of the evolution of quality through history.

⁶ A principle also introduced by Crosby.

⁷ Originally titled *Quality Control: Principles, Practices and Administration*.

Figure 2- Quality Evolution



Source: Pires, (2000, p. 34)

2.4. Quality Methodologies

This chapter's purpose is to compile the most important quality achieving methods according to previously introduced and history's most regarded quality experts.

- **Edward Deming**

In *Out of the crisis* (1986, p. 23), Deming provides 14 points for management:

1. Create constancy of purpose toward improvement of product and service.
2. Adopt the new philosophy (Take on leadership for change).
3. Cease dependence on inspection to achieve quality (Build quality into the product in the first place).
4. Do not award business based on price; minimize total cost by having single suppliers on long-term relationships of loyalty and trust.
5. Constantly improve the system of production and service (forever).
6. Institute training on the job.

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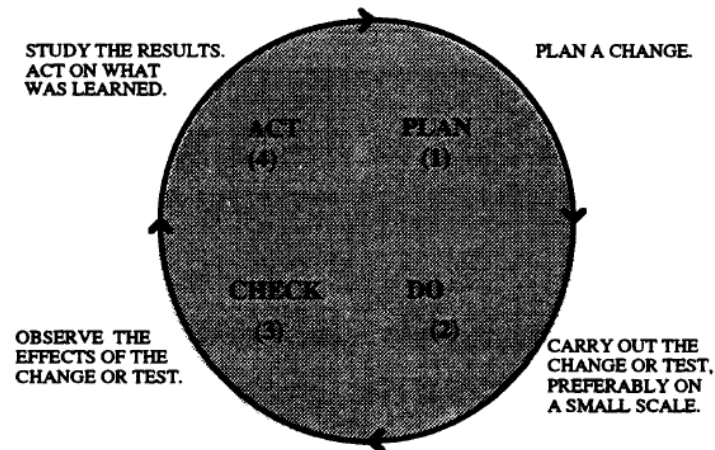
7. Institute leadership. (The aim of supervision should be to help people, machines and gadgets to do a better job. Supervision of management is in need of overhaul as well as supervision of production workers.)
8. Drive out the fear (so that everyone may work effectively for the company).
9. Break down barriers between departments.
10. Eliminate slogans, exhortations, even target goals etc. aimed at the work force (because the bulk of the causes of problems belong to the system and are beyond the power of the workforce per se).
11. Eliminate work standards (quotas) and Management by objectives. Substitute leadership (If you have a stable system, there is no need to specify a goal: you will get what the system produces.)
12. Remove barriers that rob the employee/managers of pride of workmanship.
13. Institute a vigorous program of education and self-improvement.
14. Put everyone in the organization to work to accomplish the transformation.

Deming also introduced the system of profound knowledge (SoPK) which stresses Deming's critical point in the importance of knowledge as a means to achieve quality in organizations. Without profound knowledge, management action can cause ruination. (Deming, 1989) This system is comprised by the following 4 interrelated parts:

- Theory of Systems – Study of the system and it's actors;
- Theory of Variation - Knowledge of statistical theory;
- Theory of knowledge – Study of knowledge advancements;
- Knowledge of Psychology – Dynamics of people in the workplace, group performance and cultural change.

Deming emphasized the continuous improvement of the system and so he advocated the use of the Plan–Do–Check–Act cycle, developed by Shewhart. The PDCA cycle can be seen in Figure 3.

Figure 3 – Shewhart’s Plan-Do-Check-Act cycle as described by Deming (1986)



Source: Suarez, J.G. (1992:8)

- **Joseph Juran**

Juran believed that in order to attract top management’s interest in quality, it should be translated to an economic language (Madu, 1998). So, he developed cost of quality (COQ) identifying four categories of quality associated costs:

1. Internal failure costs;
2. External failure costs;
3. Appraisal costs;
4. Prevention costs.

Stressing top management’s impact on an organization’s quality policy, Juran developed his *Quality Trilogy* (Juran, 1986):

1. Quality planning;
2. Quality Control;
3. Quality improvement.

- **Philip Crosby**

Crosby (1979), in the book *Quality is Free* introduced the Management Maturity Grid, consisting of five stages that helped management realize their current position and benchmark competition regarding quality performance.

These five stages are:

Stage I – Uncertainty

Stage II – Awakening

Stage III – Enlightenment

Stage IV – Wisdom

Stage V – Certainty

- **Genichi Taguchi**

Taguchi revolutionized quality and the statistical application to achieve it. He is mostly known for the development of the *Taguchi Methods* (Taguchi *et al.*, 2005).

1. *Quality Loss Function (QLF)* – Parabolic approximation of the quality loss that occurs when quality deviates from its best or target value, expressed in monetary units.
2. *Design of Experiments (DoE)* – Experimental and analysis methods to construct mathematical models related to the response of to the variables.
3. *Off-line quality control* – Activities that use design of experiments or simulation to optimize product and process designs. These activities include system design, parameter design, and tolerance design.

- **Kaoru Ishikawa**

Ishikawa (1968) contributed to the quality revolution through the development of the cause-and-effect diagram, also known as the fishbone diagram or Ishikawa diagram and quality circles.

1. *Cause-and-effect diagram* – Structured approach to problem solving. Problems are often identified through brainstorming and later divided into general categories. Several steps are taken in order to identify and analyze the root causes of concerned problems.

2. *Quality Circles* – An informal team formed with the objective of conceptualizing ideas for improvements within the organization, such as processes or products. These teams are generally empowered to make certain changes.

2.5. Quality Philosophies and Tools

2.5.1. Lean Manufacturing

Lean manufacturing was developed in Japan in the mid-20th century in the automotive industry by Taiichi Ohno. The concept started as a revolutionary production system called Toyota Production System (TPS) of the Toyota motor company. Ohno, while experimenting to perfect a technique for quick die change in the manufacturing process⁸, discovered that producing smaller batches of stamping would result in lower costs per unit. This resulted from the elimination of carrying costs of enormous inventories of finished parts produced by the mass-production systems. Nonconformities were also easier to spot in smaller batches.

The TPS would eventually become worldwide known as lean production through the book *The Machine That Changed the World* by James Womack, Daniel Jones and Daniel Roos, in 1991 as part of the International Motor Vehicle Program at the Massachusetts Institute of Technology (MIT). The term lean production had, however, been coined by John Krafcik⁹ in his 1988 article *Triumph of the Lean Production System* (Holweg, 2007).

Lean thinking, in organizational context, consists of a continuous identification and elimination of waste from an organization's processes, leaving only value added activities in the value stream (Rother and Shook, 1999). Value can be defined as "a capability provided to a customer at the right time at an appropriate price, as defined in each case by the customer" (Womack and Jones, 1996: p. 311). The same authors define *muda*, Japanese word for waste "as any human activity which consumes resources but creates no value" (Womack and Jones, 1996: p. 15).

The thought process for lean techniques to be implemented is comprised of five key principles: 1) *Value identification*, 2) *Value stream identification*, 3) *Flow creation*, 4) *Establish pull system* and 5) *Pursuit of perfection* (Castro, 2013).

⁸ The Toyota motor company developed from Toyota Industries which is a Japanese machine maker. Originally it manufactured automatic looms.

⁹ John Krafcik, at the time was enrolled in an MBA at MIT. Previously he had worked as a quality engineer in New United Motor Manufacturing, Inc. (NUMMI)

1. *Value specification*

The first step is to recognize that in every organization only a small fraction of its resources add value. The key is to specify and understand where waste comes from. Waste typically comes from two different sources: Various wasteful situations such as excess of production, waiting times, transportation, stock, defects, etc.; and activities that do not add value.

For an activity to add value to the organization it should follow the following three criteria:

- Customers must perceive the activity as being important;
- Activities must be properly executed the first time, so reworks are not necessary; and
- It must be associated with physical transformation of the product.

2. *Value stream identification*

Value stream is essentially the end-to-end process that delivers value to customers. All its participants, activities and everything else must be clearly identified so that any component that does not add value can be trimmed out (3.). Ideally, the value stream in its entirety must be aligned and committed to building a lean environment, in order for the system to succeed.

3. *Flow creation*

This is the step that offers more resistance because it involves an evolution from departmental to global thinking. The main goal here is to eliminate waste throughout the entire value stream, creating a more efficient process so that the product or service can “flow” as seamless as possible to reach the client.

4. *Establish “pull” system*

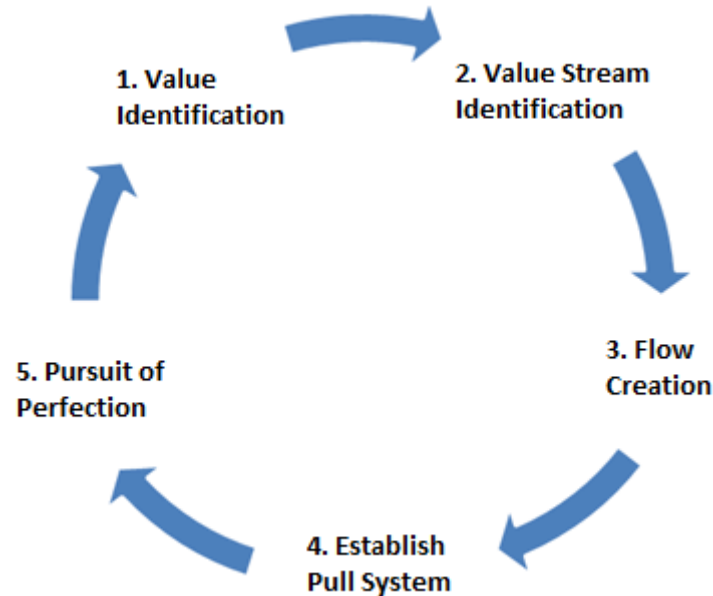
In order for a manufacturing process to be *lean*, waste must be reduced to a bare minimum. A *pull system* which represents a manufacturing system based on what the market wants, when it wants it, is the best solution. Production starts only after downstream orders arrive. This system does not generate stock since it is the customer’s product consumption that stimulates the chain. A *push system* on the other hand promotes stock accumulation with the expectation of selling it to customers. This creates wasted resources such as the money stuck on production, storage area and human capital (Castro, 2013).

5. *Pursuit of perfection*

The final step refers to *lean* perfection as the systematic use of the previous steps. By following this methodology in an integrated and continuous improvement perspective the

process can improve significantly. New layers of waste eventually become apparent and are eliminated systematically thus forming the cycle described in Figure 4 (Castro, 2013).

Figure 4 – 5 Principles of Lean



2.5.2. *Just-In-Time*

JIT is a lean comprehensive strategy aimed at continuous improvement, originated in the 1950s in Japan, pioneered by the Toyota motor company. The goal of this strategy is to drive out waste and optimally utilize resources throughout the supply chain through the combination of primary elements of JIT-production and JIT-purchasing (Claycomb *et al.*, 1999).

JIT establishes a “pull” system. As orders are demanded, the inventory is pulled through production, keeping inventories at minimum levels which translate to faster responses and flexibility by the manufacturing process. JIT also reduces non-value-added activities, such as inspections, waiting and moving times which can ascend up to 95% of a product’s cost (Peters, 1990).

JIT-production is a production strategy with the goal of identifying and eliminating waste in all its forms within the manufacturing process. This waste generally comes in the form of excess inventory, rejects and reworks and material movement (Wisner *et al.*, 2012). JIT-purchasing is comprised by techniques and concepts, such as maintaining good relationships with suppliers, shared information, minimizing delivery lots, reducing inspections and

integrating suppliers in process/product design (Freeland, 1991). The use of such tool allows a company to eliminate waste and inefficiency from the purchase function (Inman *et al.*, 2011). The combination of previous techniques enables the implementation of a JIT strategy, providing a company with the capability of reducing variance and non-conformities to almost zero, with precise lead times (Green and Inman, 2005).

Research has led to believe that JIT implementations are usually beneficial for a company. The most referred benefits are inventory reductions and an increase in inventory turnover (Ockree, 1993; Balakrishnan *et al.*, 1996; Droge and Germain, 1998). Other research reports improvements to production performance after JIT adoption (Kim and Takeda, 1996; Nakamura *et al.*, 1998). Bronx and Fader (1997) discovered that JIT companies are more cost effective and a few other studies had consistent results while analyzing JIT implementations on traditional financial performance measures (Ockree, 1993; Balakrishnan *et al.*, 1996).

2.5.3. TQM

TQM represents a management paradigm based on four principles: customer satisfaction, continuous improvement, employee involvement and management leadership (Venkateswarlu and Nilakant, 2005). This management practice advocates the total quality philosophy in an organization, doing the job right the first time, reducing waste and attending the needs of the market. TQM is very broad in its range. It is a tool for everyone, as it made quality a transversal task within the company, elevating quality management from an operational to a strategic level. (Bounds *et al.*, 1994)

As was previously stated, TQM enjoyed widespread attention during the 1970s and 1980s, a period when western societies faced major quality competition from Japan. During this era, TQM was mainly directed at manufacturing companies since the most important researchers had academic and career background in engineering and operations (McCarthy and Keefe, 1999).

TQM is divided into two dimensions. The soft dimension is the one where human and cultural factors are comprised whereas the hard dimension regards the technical aspects, such as the use of JIT principles, the use of technology and statistical tools. Both these dimensions affect organizational performance, although the most impactful is the soft dimension because it not only has a direct effect, but also impacts hard dimension, playing a key role in its diffusion (Rahman and Bullock, 2002, Singh *et al.*, 2011). However, soft dimensions are often

disregarded, since the main contributors for this tool come from the operations management discipline, who tend to emphasize the technical aspects of an implementation (Singh *et al.*, 2011).

The implementation of TQM in an organization takes time and its results are not immediate, sometimes taking up to 10 years (Luft, 2007). As a systemic concept, it requires a different organizational culture and climate, often a complete change which can be hard to adapt to. The relation between TQM implementations and the increase in company's performance is not as linear as one might expect, though. There are studies in which no positive relation was identified (Powell, 1995; Westphal *et al.*, 1996). There are other that identify this positive relation which, generally, falls into two categories (York and Miree, 2004): customer satisfaction resulting from the production of higher quality products or services (Ahire and Dreyfus, 2000; Choi and Eboch, 1998; Hendricks and Singhal, 1996), and efficiency improvements which derives from higher productivity and better processes and design (George and Weimerskirch, 1998; Handfield *et al.*, 1998; Reed *et al.*, 1996).

When it comes to innovation, Prajogo and Sohal (2001) in a literature review identify two major arguments: companies improve their innovation potential with TQM providing a fertile environment of innovative ideas (Dean and Bowen, 1994; Kanji, 1996; Tang, 1998) and TQM inhibits innovation through the implementation of its principles (Harari, 1993; Samaha, 1996). A later study would reveal that TQM is positively associated with differentiation strategies, although it should be complemented by other resources to achieve higher levels of performance.

In the 1990s, several standards organizations from several countries tried to standardize TQM's principles, although, they would eventually be replaced by the ISO 9000 family.

2.5.4. ISO 9000

As was mentioned before, the ISO 9000 arose from the necessity to assure the markets that companies were complying with quality standards. It was developed by the International Organization for Standardization (ISO) in 1987 and became leverage for doing business (Martínez-Costa *et al.*, 2009). According to the ISO, in 2009 there were more than 900.000 companies worldwide certified with ISO 9000. In 2000, this standard was upgraded to ISO 9001.

ISO 9000/1994 was developed with the objective of providing quality assuring guidelines regarding design, development, production, installation and support of products or services. This certification addresses both internal and external functions. Procedures regarding control and decreasing variations within company's processes are required by the standard as much as coordinative processes with customers and suppliers, regarded as external stakeholders (Prakash *et al.*, 2011). Since its beginning, however, the ISO 9000/1994 certification was targeted by critics for not integrating TQM comprehensively (Gotzamani and Tsiotras, 2001; Lee *et al.*, 1999; Reimann and Hertz, 1996; Zhu and Scheuermann, 1999). Despite the criticism, many authors state that ISO 9000/1994 performed well regarding a primary approach to quality implementation (Sun, 2000; Yusof and Aspinwall, 2000; Escanciano *et al.*, 2001; Withers and Ebrahimpour, 2001; Claver *et al.*, 2002).

In 2000, ISO 9001/2000 was introduced. This iteration focused on process management as the optimization and control system, instead of finished product inspections. Top management involvement in quality functions was also concerned by this update, as well as using performance metrics to improve effectiveness. Martínez-Costa *et al.* (2009) argue that companies who adopted the updated certification do not perform noticeably better than those with ISO 9000/1994. However, the same study points towards the hypothesis of ISO 9001 providing better integration for TQM imperatives. In 2008, ISO 9000 received its most recent update which focused on reinforcing and clarifying the requirements of ISO 9001/2000.

Prakash *et al.* (2011) identifies two main groups of literature regarding the purpose of adopting ISO certification by companies worldwide: internal and external justifications. Some authors justify ISO 9000 adoption based on internal process improvement and overall performance (Tzelepis *et al.*, 2006; Benner and Veloso, 2008). This notion is discredited by other studies which found no empirical evidence for progress other than marginal improvements on performance (Lima *et al.*, 2000; Rahman, 2001). Other studies focus on external justifications, stating that companies register for the standard in order to comply with the market's expectation or regulations (Anderson *et al.*, 1999), or even as a status banner (Terlaak and King, 2006). Corbett *et al.* (2005), however, discovered that internal productivity improvements had a bigger impact on overall performance enhancement over external benefits.

2.5.5. Six Sigma

Six Sigma was developed by Motorola in the mid-1980s as quality performance measurement tool (Rancour and McCracken, 2000). It would later evolve into a statistically oriented approach to process and product quality improvement (Banuelas and Antony, 2002). The interest in this tool sparked when Motorola received a Malcolm Bridge National Quality Award and is now present in almost every industry (Andersson *et al.*, 2006).

Conceição and Major (2010, p. 314), define Six Sigma as “an approach which emphasizes the use of statistical tools’ in which ‘standard deviations are used to analyze process variability, analyzing their consistency while reducing defects.” While doing so, this business process reduces waste and resources and increases customer satisfaction through a drastic improvement on a company’s bottom line by designing and monitoring daily activities (Magnusson *et al.*, 2003) and seeking continuous improvement (Andersson *et al.*, 2006). According to Goh (2010) however, Six Sigma has been hitherto rather complex to define, as it is differently perceived by the interpreter, being engineers, managers, academics or even consumers. Six Sigma’s objective is to reduce defects to as low as 3.4 occasions per million opportunities (Anthony, 2002).

Table 2, highlights the impact of this tool by analyzing the increasing cost of quality associated with lower sigma levels. An increase in costs associated with lack of quality is perceptible throughout the company. This reflects on shorter revenue and consequentially, shorter net income. With lower sigma levels we may expect lower customer satisfaction levels which will not only impact the company’s results, but also compromise its future sustainability.

Table 3 provides realistic examples of the difference between a seemingly enough 3σ level and the level of quality achieved through six sigma. From these examples, it is clear that there is no acceptance for anything lower than a six sigma level, in our modern world. This table is, however, criticized by Goh (2010, p. 222), who states that “...many questions can be asked about the nature and reliability of the base data from which the conclusions are derived, not to mention the adequacy of the assumed probability distribution functions, the validity of extrapolation, the non-Bernoulli nature of events, the different degrees of criticality of faulty outcomes, and so on.” However, this table is used as mere reference to the impact that different sigma levels can have.

Table 2 – Six sigma process capability

Sigma Level	Defects per million	Cost of quality (Sale %)
6σ	3.4	<10%
5σ	230	10-15%
4σ	6,200	15-20%
3σ	67,000	20-30%
2σ	310,000	30-40%
1σ	700,000	

Source: Lucas (2002, p. 28)

Table 3 - ‘99% good is not good enough’

99% good: 3 sigma	99.99966% good: 6 sigma
20 000 lost articles of mail per hour	7 mail articles lost per hour
Unsafe drinking water for 15 min each day	1 unsafe minute of water supply every 7 months
5000 incorrect surgical operations per week	1.7 incorrect operations per week
2 short or long landings at most major airports each day	1 short or long landing every 5 years
200 000 wrong drug prescriptions each year	68 wrong prescriptions per year
No electricity for 7 h each month	1 h without electricity every 34 years

Source: Goh (2010, p. 222)

Despite being perceived as a quality improvement initiative, six sigma comprises a larger role in organizations. It can be regarded as a breakthrough management strategy due to impacts on adjustments to the firm’s values and culture in its implementation (Banuelas and Antony, 2002). The alignment between objectives set by the Six Sigma implementation and business strategy must be intertwined and focused on the same goals (Cheng, 2013). This means that a Six Sigma adoption not only supports integration for the organization’s strategic goals but also promotes objective alignment throughout the entire structure.

Despite its success, six sigma studies related to its dissemination and implementation are rather limited (Cheng, 2007; Carvalho *et al.*, 2007; Iwaarden *et al.*, 2008). Banuelas and Antony (2002) list the following critical success factors for a successful six sigma implementation: management involvement and commitment, changes in organizational culture, an effective communication plan, a predisposed organizational structure, staff training, relation between six sigma and business strategy, relation between six sigma and the customer, relation between six sigma and suppliers, understanding six sigma tools and

techniques , project management skills and project prioritization and selection. Six sigma implementation is usually top-down. An executive management team selects a champion for each project. This is the person responsible for the success of the project. The leader of the six sigma project team is called the Black Belt and the remaining constituents are called Green Belts. These people usually seek improvement and better business environment. Master Black Belts are resourceful, experienced people whose objective is to help the team in accomplishing its purpose (Lucas, 2002).

The classic six sigma methodology is DMAIC, which stands for (Castro, 2013):

1. Define – This stage is where the implementation plan is conceived. Definition of the scope, deliverables and other project planning factors occur in this step. The six sigma project is then approved or not, according to what the client wants, being internal or external.
2. Measure – In this stage, the process, product or service's actual performance is evaluated, according to what is established in the previous step, creating a starting point for improvement comparisons to be perceptible.
3. Analyze – This step is considered the most important from the technical point of view. The variables that comprise the object of the project, being a process, product or service, are thoroughly analyzed, ensuring the team gets a perfect understanding of what they are dealing with.
4. Improve – This stage is usually divided into 4 processes. First the innovation process where solutions arise. Then a risk analysis takes place to evaluate all innovative suggestions. The third process is a cost/benefits analysis to consider whether a solution is financially viable or not. The final process is the implementation and evaluation of the solution.
5. Control – The final stage aims to assure that accomplished improvements stand through time in a sustainable way. Critical variables must be automated and immune to external disturbances.

3. Empirical Study

3.1. Research Methodology

This literature review was developed according to Tranfield *et al.* (2003) with the purpose of presenting data in a rigorous way. In this paper the authors criticize traditional reviews by claiming that they are usually biased by the author, often lacking rigour and thoroughness. Following the previous critical arguments, Tranfield *et al.* (2003) suggest that management reviews should follow the systematic review framework, used in medical science research. This approach provides the foundation for a more rigorous and transparent research with reproducibility characteristics that enhances the knowledge base while providing better information for policymakers and practitioners. The author of a systematic review should find the maximum available data, not only reviewing literature related to the subject discipline but also from other related and relevant topics. As such, the literature review presented in this study, not only approaches management accounting, TQM and Six Sigma literature, but also other relevant literature to better contextualize the subject.

The development of this systematic review was divided in three stages: (i) planning the review, (ii) review development, and (iii) analyzing and discussing the results.

3.1.1. Planning the Review

This systematic review's proposal is to synthesize and identify research opportunities within the scope of accounting literature related to TQM or Six Sigma. In accordance with Tranfield *et al.* (2003), the first step in this review was to properly define the research relevance and scope. The research base was then formalized, encompassing the following databases: *B-ON*, *ABI-INFORM complete* and *ScienceDirect*.

3.1.2. Review Development

In order to conduct this review, a systematic search framework was employed, assuring this study's reproducibility. The search focused on five academic journals with articles written in English, from 2000 to 2013. These journals were: *Management Accounting Research* (MAR); *European Accounting Review* (EAR); *Accounting, Auditing and Accountability* (AAA); *Critical Perspectives on Accounting* (CPA); and *Accounting, Organizations and Society* (AOS). The search was performed through previously mentioned databases, using the following keywords adequate to this research's scope: "TQM", "Six Sigma", "Quality" and

“Quality Management”. Extracted articles had to figure at least one of the keywords in the title, abstract or keywords in order to meet this research’s conditions. This search was conducted in June 2014 and resulted in the extraction of 24 articles, for the established timeframe, all written in English, and excluding conference proceedings, books and calls for papers. These 24 papers were manually analyzed, with the objective of assessing the research’s nature and context of previously identified keywords in each article. From this process resulted the elimination of 3 articles (Malmi *et al.*, 2004; Carter and Crowther, 2000; and Ezzamel *et al.*, 2008). These articles did not meet this research’s requirements due to the fact that identified keywords were merely contextual and did not relate either TQM or Six Sigma to quality management or accounting. Thus, the studied universe was established with 21 articles.

The remaining 21 articles were analyzed for key methodological and bibliographical characteristics, as presented in chapter 3.3. These variables were: author’s characteristics, research method, underlying organizational theory, and studied subject. Author’s characteristics are comprised by the following variables: authorship, gender, affiliated country and affiliated university. The variable “Covered Subject”, due to its subjective nature, was categorized by general studied fields related to the main topic under investigation for each article, resulting in the formation of 5 clusters: *accounting investigation*, *financial performance*, *management accounting investigation*, *management control and performance management*.

In order to draw conclusions from the relation of TQM and Six Sigma with accounting literature, these variables were adequately associated with each other. Relations between geographical and research characteristics were analyzed and are represented in chapter 3.4. Chapter 4 provides a synthesis of the findings in this review, both from variables and their association’s analysis.

3.2. Introduction and Data Collection

This study revolves around the impact that TQM and Six Sigma methodologies have had in publications in four of the most renowned journals in the field of accounting: Management Accounting Research (MAR); Accounting, Auditing and Accountability Journal (AAA); Critical Perspectives on Accounting (CPA); and Accounting, Organizations and Society

(AOS). All four of these journals cover a range of topics within the accounting scope, although I will focus exclusively on articles related to the TQM and Six Sigma quality tools.

In order to make conclusions, relevant variables were extracted, analyzed and associated with each other adequately. Data was collected from the previous list of journals for the time frame from 2000 to 2013 through the following data bases: *B-ON*, *ABI-INFORM complete* and *ScienceDirect*. A search by keywords was then conducted, each extracted article was analyzed and later cataloged accordingly. This led to the extraction of 21 articles which comprise our universe. Some articles, while mentioning TQM or Six Sigma, were not included in this study for these references were merely contextual. This dictated the exclusion of two articles from AAA, two from CPA, one other from AOS and the complete exclusion of the European Accounting Review journal from this study, since only one publication was extracted from it and it did not meet this study’s requirements.

Table 4 and Graphic 1 both provide a better notion of the universe under study. AOS was the journal that published more articles related to TQM and Six Sigma with a total of 9, which comprises 43% of the universe, while AAA had the lowest number publications extracted with only 2 papers, or 10% of the universe. Of the four journals under study, only MAR and AOS had publications regarding both TQM and Six Sigma. AAA and CPA had no Six Sigma publications whatsoever. 86% of published papers focused on discussing TQM while only 5% did so for Six Sigma. There were also 2 articles (10%), both published in AOS, which studied both quality tools.

Graphic 1 – Distribution of published quality tool related articles

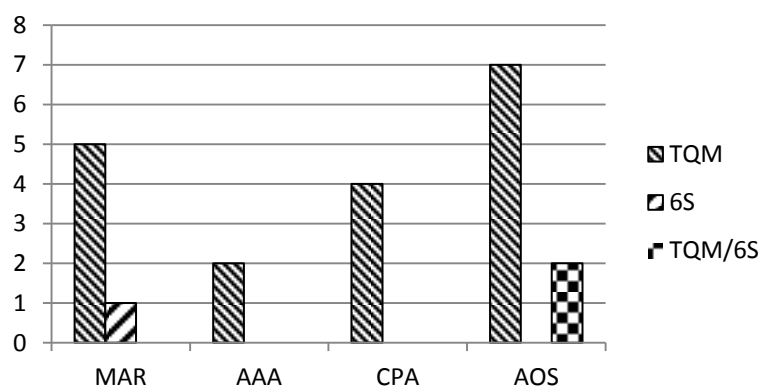


Table 4 – Number of articles extracted per journal by quality tool

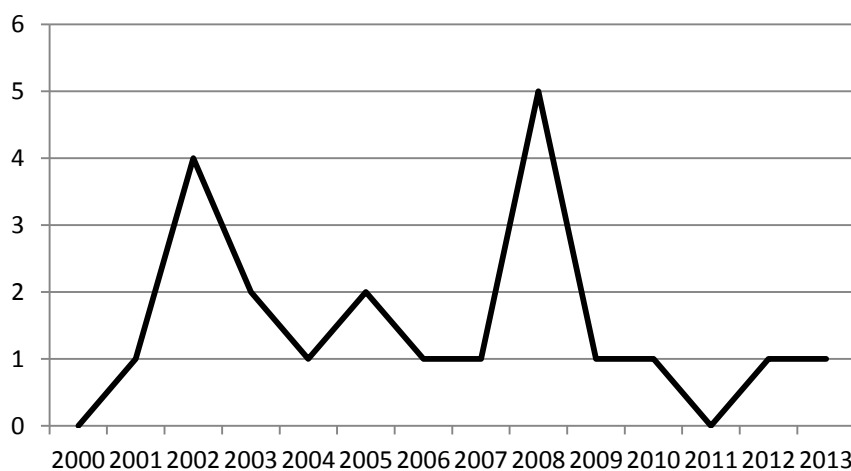
	TQM		6S		TQM/6S		Total	
	F	%	F	%	F	%	F	%
MAR	5	24%	1	5%	0	0%	6	29%
AAA	2	10%	0	0%	0	0%	2	10%
CPA	4	19%	0	0%	0	0%	4	19%
AOS	7	33%	0	0%	2	10%	9	43%
Total	18	86%	1	5%	2	10%	21	100%

The evolution of TQM and Six Sigma related articles through the established time frame is evident in Table 5 and Graphic 2. The evolution described is of the total amount of articles extracted per year. Evidently, the year with the highest number of publications was 2008, with 5 articles, while in 2000 and 2011 there was no article referring to either TQM or Six Sigma. After the 2008 peak, there was only one article related to TQM or Six Sigma per year, except for 2011 from which no article was extracted.

Table 5 – Distribution of articles per year

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
MAR	0	1	1	0	0	0	1	1	1	0	1	0	0	0
AAA	0	0	0	0	0	0	0	0	1	1	0	0	0	0
CPA	0	0	2	1	0	0	0	0	1	0	0	0	0	0
AOS	0	0	1	1	1	2	0	0	2	0	0	0	1	1
Total	0	1	4	2	1	2	1	1	5	1	1	0	1	1

Graphic 2 – Evolution of articles related to TQM and Six Sigma from 2000 to 2013



3.3. Universe Characterization

Table 6 represents the study’s universe. It encompasses all articles extracted from MAR, AAA, CPA and AOS journals from 2000 to 2013. The number of articles per journal is 6, 2, 4 and 9, respectively which gives us the total of 21 articles.

Table 6 – List of extracted articles per journal.

Management Accounting Research	Accounting, Auditing and Accountability Journal
Modell (2001) Cagwin and Bouwman (2002) Busco <i>et al.</i> (2006) Modell <i>et al.</i> (2007) Kennedy and Widener (2008) Sharma <i>et al.</i> (2010)	Emsley (2008) Modell (2009)
Critical Perspectives on Accounting	Accounting, Organizations and Society
Dillard (2002) Sharma and Lawrence (2002) Hoque (2003) Gleadle and Cornelius (2008)	Fullerton and McWatters (2002) Chenhall (2003) Ezzamel <i>et al.</i> (2004) Dechow and Mouritsen (2005) Gerdin (2005) Chenhall (2008) Banker <i>et al.</i> (2008) Jordan and Messner (2012) Mouritsen <i>et al.</i> (2013)

3.4. Variables

3.4.1. Authors

This subchapter’s objective is to analyze and describe the authors of the extracted articles. To do so, several aspects are scrutinized. These are: *authorship, gender, affiliated country and affiliated university.*

3.4.1.1. Authorship

In this study, 40 authorships were identified which translates to an average of approximately two authors per article. The number of authors was 33. These are listed in Table 6 which classifies the number of articles that each distinct author took part in.

TQM and Six Sigma in Accounting Literature

Of the 33 authors, 6 wrote more than 1 article. These are Sven Modell, Robert H. Chenhall, Stewart Lawrence, Umesh Sharma, Frances A. Kennedy and Sally K. Widener. Sven Modell with 3 articles has the highest number of authorships while the remaining 5 account for 2 articles each. These 6 authors account for 33% of the authorships identified in this study. The remaining 27 authors were present in 1 article each.

Table 7 – Authors and associated authorships

Authors	N° Art°	%
Modell, Sven	3	8%
Chenhall, Robert H.	2	5%
Lawrence, Stewart	2	5%
Sharma, Umesh	2	5%
Kennedy, Frances A.	2	5%
Widener, Sally K.	2	5%
Banker, Rajiv D.	1	3%
Bardhan, Indranil R.	1	3%
Bouwman, Marinus J.	1	3%
Busco, Cristiano	1	3%
Chen, Tai-Yuan	1	3%
Dechow, Niels	1	3%
Dillard, Jesse F.	1	3%
Emsley, David	1	3%
Ezzamel, Mahmoud	1	3%
Gerdin, Jonas	1	3%
Jacobs, Kerry	1	3%
Hoque, Zahirul	1	3%
Lowe, Alan	1	3%
Messner, Martin	1	3%
Riccaboni, Angelo	1	3%
Mouritsen, Jan	1	3%
Scapens, Robert W.	1	3%
Willmott, Hugh	1	3%
Worthington, Frank	1	3%
Wiesel, Fredrika	1	3%
Cagwin, Douglass	1	3%
Gleadle, Pauline	1	3%
Cornelius, Nelarine	1	3%
Jordan, Silvia	1	3%
Mouritsen, Rosemary R.	1	3%
Fullerton, Rosemary R.	1	3%
McWatters, Cheryl S.	1	3%

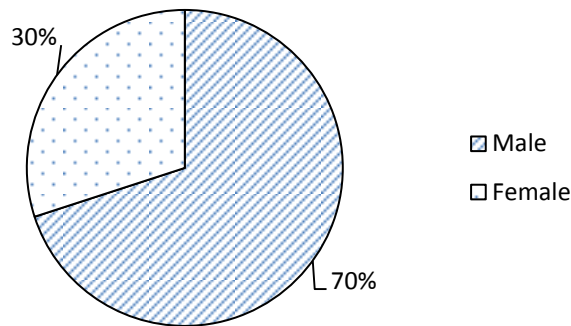
3.4.1.2. Gender

The following Table 7 pictures the distribution of author’s gender per journal. Of the 40 identified authorships 28 are male and the other 12 are female. With 33% each, journals CPA and AOS have the highest relative female contribution, while MAR has the highest male authorship relative contribution with 71%. AAA had no female authorships, although there were only 2 articles extracted from this journal and both had only one author.

Table 8 – Author’s gender distribution.

	MAR		AAA		CPA		AOS		Total	
	F	%	F	%	F	%	F	%	F	%
M	10	71%	2	100%	4	67%	12	67%	28	70%
F	4	29%	0	0%	2	33%	6	33%	12	30%
Total	14	100%	2	100%	6	100%	18	100%	40	100%

Graphic 3 – Author’s gender distribution



These values point to a distribution of about two thirds of male authorships and a third female authorships in our universe as seen in Graphic 3, which is consistent with the findings of Correia and Machado (2013).

3.4.1.3. Affiliated Countries

As seen in Table 8, 12 countries are associated with the 40 identified authorships in the articles present in the studied universe, from Europe, America, Asia and Oceania.

Europe, with 6 present countries, is the continent with highest presence and most affiliated articles (43%). Oceania is the continent with the second highest number of present countries with 3, although it is the third highest authorship contributor with 25%. America, with 30% of

affiliated authorships, provides the second highest contribution for the study of TQM and Six Sigma in the studied journals, despite only having two countries present, the US and Canada. From Asia, only China is represented having one associated author. Africa is the only continent not present in this study.

Of the previously mentioned 12 countries, 6 have more than 1 associated article, as is visible in Graphic 4. These are: Australia, Austria, New Zealand, Sweden, the US and the UK. These last two countries have the highest number of affiliated authorships with 28% and 23%, respectively. Together, both countries account for 50% of the authorships in this study.

AOS is the most diversified journal in this study, with contributions from 8 different countries, while AAA is the least diversified with 2 countries.

Graphic 4 - Affiliated country distribution.

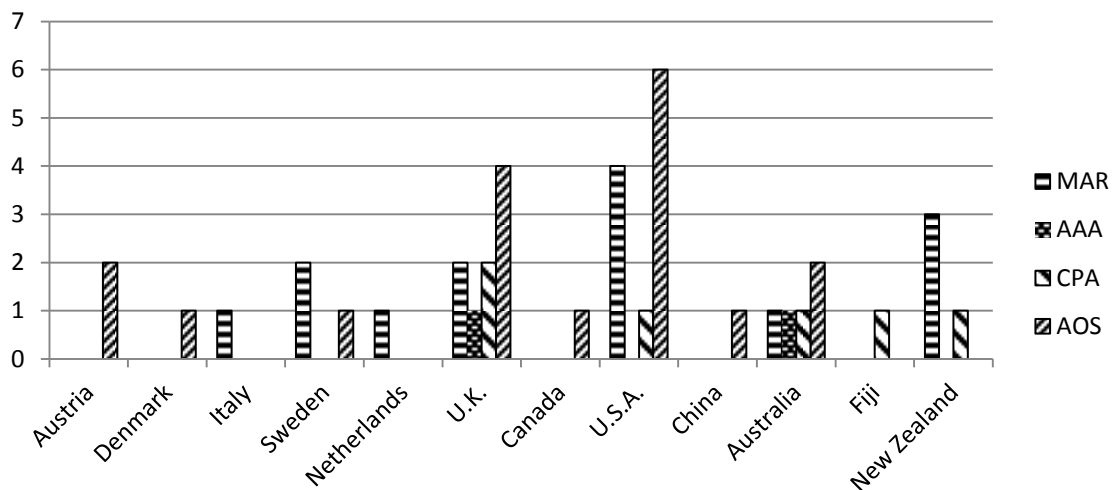


Table 9 – Affiliated countries

	MAR	AAA	CPA	AOS	Total	
	F	F	F	F	F	%
Europe	6	1	2	8	17	43%
Austria	0	0	0	2	2	5%
Denmark	0	0	0	1	1	3%
Italy	1	0	0	0	1	3%
Sweden	2	0	0	1	3	8%
Netherlands	1	0	0	0	1	3%
UK	2	1	2	4	9	23%
America	4	0	1	7	12	30%
Canada	0	0	0	1	1	3%
US	4	0	1	6	11	28%
Asia	0	0	0	1	1	3%
China	0	0	0	1	1	3%
Oceania	4	1	3	2	10	25%

TQM and Six Sigma in Accounting Literature

Australia	1	1	1	2	5	13%
Fiji	0	0	1	0	1	3%
New Zealand	3	0	1	0	4	10%
Total	14	2	6	18	40	100%

3.4.1.4. Affiliated University

There were 30 identified affiliation universities in this study. 8 of those universities have been affiliated with more than one author. These are aggregated in Table 9. These include: Monash University, University of Innsbruck, University of Waikato, University of Manchester, Clemson University, Rice University, University of Texas and Utah State University. The University of Waikato in New Zealand produced 10% of identified authorships, which makes it the highest contributor for TQM and Six Sigma related articles in the selected journals. The rest of the universities represented in Table G account for 5% of affiliated authors each. A table detailing every university represented in the studied universe can be found in the Annex section.

Table 10 - Affiliated University

Country	Institution	MAR	AAA	CPA	AOS	Total	
		F	F	F	F	F	%
Australia	Monash University	0	0	0	2	2	5%
Austria	University of Innsbruck	0	0	0	2	2	5%
New Zealand	University of Waikato	3	0	1	0	4	10%
UK	University of Manchester	1	1	0	0	2	5%
US	Clemson University	1	0	0	1	2	5%
	Rice University	1	0	0	1	2	5%
	University of Texas	1	0	0	1	2	5%
	Utah State University	0	0	0	2	2	5%

3.4.2. Research Methods

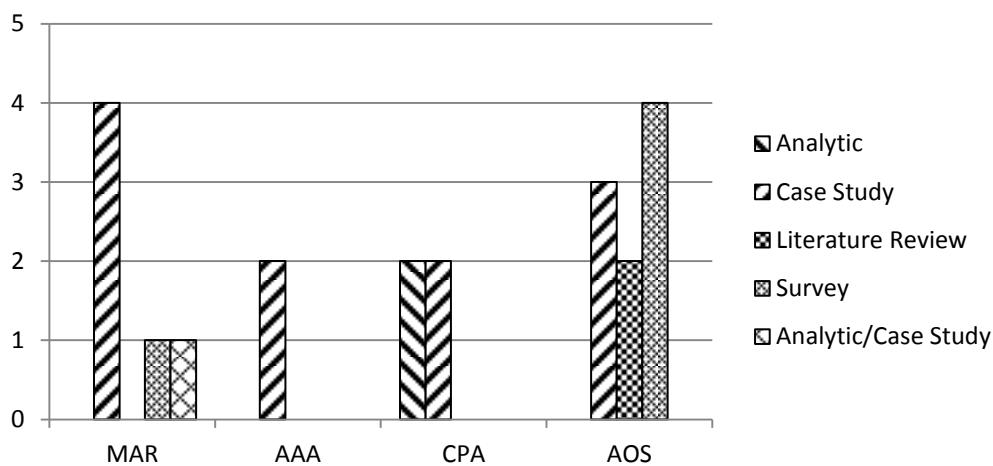
Table 10 aims at providing a better perspective on the research methods used to develop the articles under study. It is clear that the preferred research method for investigations related to TQM and Six Sigma from the management accounting perspective is the case study, followed by surveys which represent 52% and 24% of the studies, respectively. This information is consistent with the findings of Simões and Rodrigues (2011) who state that investigation in management accounting has evolved from a quantitative to a qualitative perspective, particularly case studies, since the 1980s. Only one study used multiple research methods, both analytic and case study, to conduct a study on Swedish governmental institutions.

Table 11 – Research Methods

Research Method	MAR	AAA	CPA	AOS	Total	
	F	F	F	F	F	%
Analytic	0	0	2	0	2	10%
Case Study	4	2	2	3	11	52%
Literature Review	0	0	0	2	2	10%
Survey	1	0	0	4	5	24%
Analytic/Case Study	1	0	0	0	1	5%

The case study research method was used in all of the 4 journals. However, it was more frequently used on MAR, as seen in Graphic 5. Literature reviews were identified only on AOS and analytic studies only on CPA. Surveys were used more frequently on AOS, being the most used research method on this journal.

Graphic 5 – Research Method Distribution



3.4.3. Organizational Theories

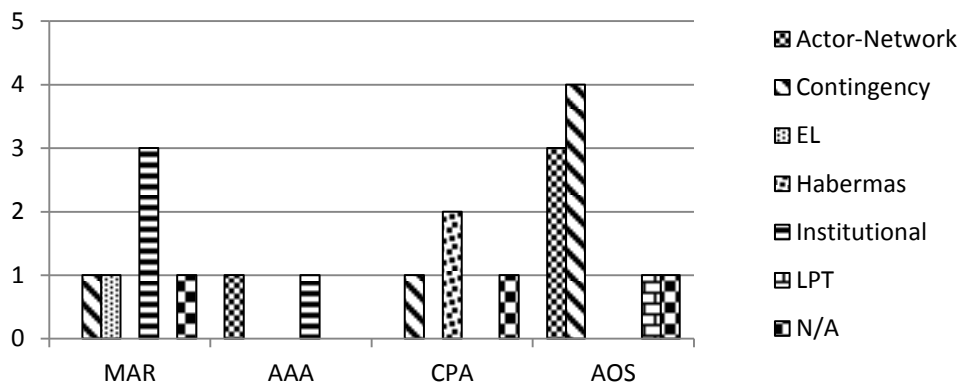
In the studied universe, 86% of the studies adopt an underlying organizational theory attempting to get a better understanding on the social dynamics of the subject under study. Through the analysis of Table 11, we notice that the contingency theory was the most used since 29% of the studies were based on it. Actor-Network and Institutional theories were the second most used, both used 19% of the cases. Contingency was identified in 3 out of the 5 studied journals, which means it was the theory represented in most publications.

Table 12 – Underlying organizational theories

	MAR	AAA	CPA	AOS	Total	
	F	F	F	F	F	%
Actor-Network	0	1	0	3	4	19%
Contingency	1	0	1	4	6	29%
Experiential Learning	1	0	0	0	1	5%
Habermas	0	0	2	0	2	10%
Institutional	3	1	0	0	4	19%
Labor-process	0	0	0	1	1	5%
N/A	1	0	1	1	3	14%
Total	6	2	4	9	21	100%

From Graphic 6 we have a better notion on the distribution of underlying organizational theories through the 4 journals. It is then clear that MAR and AOS are the most diversified in organizational theories. Institutional theory was used in 50% of the articles from MAR, while the contingency theory dominated articles published in AOS, followed by actor-network. Habermas’s theory was used twice and exclusively in CPA. Experiential learning and labor process theory were identified once on MAR and AOS, respectively.

Graphic 6 – Organizational theory distribution



3.4.4. Covered Subjects

Our universe’s comprising articles have underlying subjects to which TQM and Six Sigma methodologies are related. Table 12 contains all identified topics and respective frequency. Presented subjects are general and all articles are classified accordingly, despite possibly covering other topics.

Management accounting investigation was the most studied topic, identified in 39% of all articles. Management control and performance management’s relation to TQM and Six Sigma

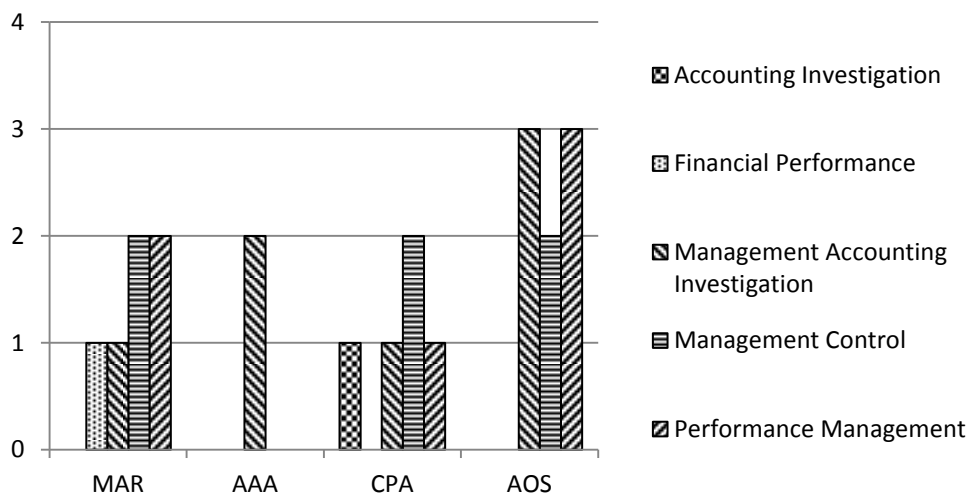
were studied in 29% of the studies, each while accounting investigation and financial performance were studied in one article, each.

Management accounting investigation was not only the most frequently studied subject but also the one studied in most journals, since it was represented in all 5 publications.

Table 13 – Related subject

	MAR	AAA	CPA	AOS	Total	
	F	F	F	F	F	%
Accounting Investigation	0	0	1	0	1	5%
Financial Performance	1	0	0	0	1	5%
Management Accounting Investigation	1	2	1	3	7	33%
Management Control	2	0	2	2	6	29%
Performance Management	2	0	1	3	6	29%
						100%

Graphic 7 – Distribution of related subjects



From the journal perspective, MAR and CPA are the publications with the highest diversification of studied subjects, covering 4 of the 5 identified topics. All articles extracted from AAA are related to management accounting investigation, meaning it is the journal that relates the least subjects to the quality methodologies under study. AOS, despite being the journal with highest number of extracted articles, only covers 3 of the 5 disciplines, as we can see from Graphic 7.

3.5. Variable Association Analysis

After the extraction and analysis of all relevant variables, these were logically associated with each other in order to make conclusions. It is then relevant to say that in these associations, articles are treated as part of the whole universe, comprised by 21 publications from the journals MAR, AAA, CPA and AOS that study TQM or Six Sigma, from the year 2000 to 2013, with no journal differentiation whatsoever.

3.5.1. Association between Subject and Affiliated Country

This association crosses data between authorship's affiliated country and the articles studied subject in order to better describe the interest in discussed topics in a geographic context. The following analysis takes all 40 authorships into account, since there are articles with authorships from as much as 3 different countries.

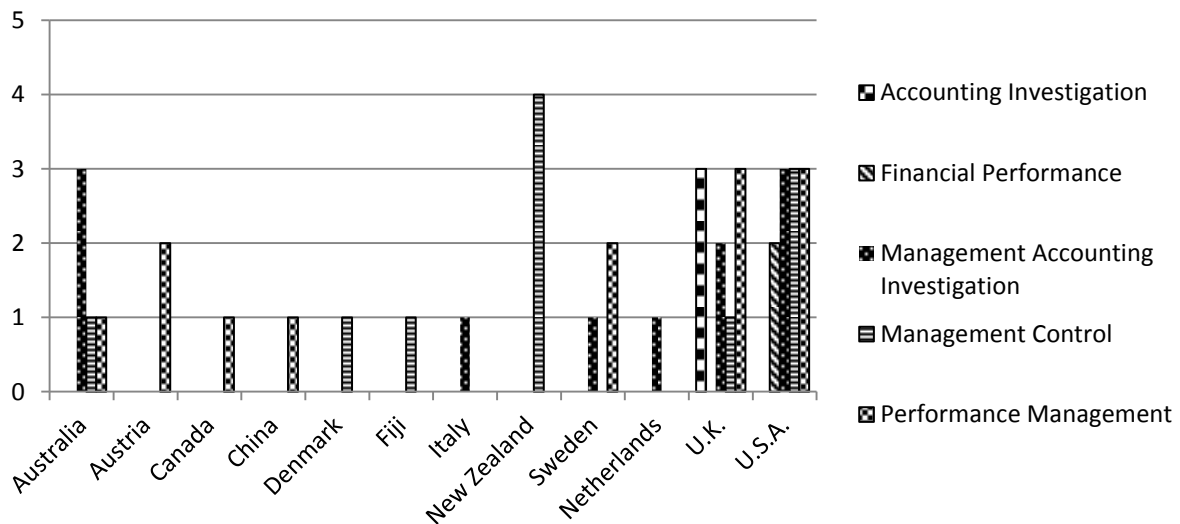
As we can see from Table 13 and Graphic 8, the studied subject with most associated authorships was performance management since 33% of identified authorships developed studies related to this topic. Although, it was not the most frequently studied subject, as was previously described. Performance management was also the topic with the highest diversification of author nationalities since 7 different countries were associated with this subject. Approximately 54% of performance management related articles were associated with European authorships, 31% with American and 8% with Asia and Oceania, each, meaning that all identified continents contributed for the study of this subject.

Management accounting investigation and management control were associated with 28% of total identified authorships, each. Both topics also had the same number of affiliated country diversification with 6 distinct nationalities. Affiliated continent's distribution for management control was 18% from Europe, 27% from America and approximately 55% from Oceania. For management accounting investigation 54% of published articles were affiliated with Europe while America and Oceania accounted for 27%, each.

Table 14 – Association between studied subject and affiliated country

	Accounting Investigation		Financial Performance		Management Accounting Investigation		Management Control		Performance Management		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
Europe	3	100%	0	0%	5	45%	2	18%	7	54%	17	42,5%
Austria	0	0%	0	0%	0	0%	0	0%	2	15%	2	5,0%
Denmark	0	0%	0	0%	0	0%	1	9%	0	0%	1	2,5%
Italy	0	0%	0	0%	1	9%	0	0%	0	0%	1	2,5%
Sweden	0	0%	0	0%	1	9%	0	0%	2	15%	3	7,5%
Netherlands	0	0%	0	0%	1	9%	0	0%	0	0%	1	2,5%
UK	3	100%	0	0%	2	18%	1	9%	3	23%	9	22,5%
America	0	0%	2	100%	3	27%	3	27%	4	31%	12	30,0%
Canada	0	0%	0	0%	0	0%	0	0%	1	8%	1	2,5%
US	0	0%	2	100%	3	27%	3	27%	3	23%	11	27,5%
Asia	0	0%	0	0%	0	0%	0	0%	1	8%	1	2,5%
China	0	0%	0	0%	0	0%	0	0%	1	8%	1	2,5%
Oceania	0	0%	0	0%	3	27%	6	55%	1	8%	10	25,0%
Australia	0	0%	0	0%	3	27%	1	9%	1	8%	5	12,5%
Fiji	0	0%	0	0%	0	0%	1	9%	0	0%	1	2,5%
New Zealand	0	0%	0	0%	0	0%	4	36%	0	0%	4	10,0%
Total	3	100%	2	100%	11	100%	11	100%	13	100%	40	100,0%

Graphic 8 – Subject and affiliated country association distribution



Financial performance and accounting investigation were the least studied subjects and, as such, had the lowest affiliated continent representation. Accounting investigation was studied by 8% of identified authorships and represented solely by Europe, specifically the UK, while financial performance was studied by 5% of identified authorships, exclusively in the American continent, specifically the US.

3.5.2. Association between Subject and Research Method

This section provides an analysis regarding the association between the studied topic and the research methods used to develop the study. As it was said before, the case study method had the highest adoption rate since it was used to collect data in 52% of the studies. Surveys were the second most used with 24% adoption rate. Analytic and literature review research methods were employed in 10% of the studies, each. An article which used both analytic and case study methods was also extracted, being the only article with multiple data collection methods. Table 14 and Graphic 9 provide a better perspective on the matter.

Accounting investigation and financial performance were topics developed in only one article each. The first was study was developed through case study research method, while the financial performance publication collected data through surveys.

In order to develop the studies related to management control the following research methods were employed: analytic, case study and literature review. Case study was used in approximately 67% of the studies making it, not only the most used data collection method for this subject, but also the subject where case studies were used the most.

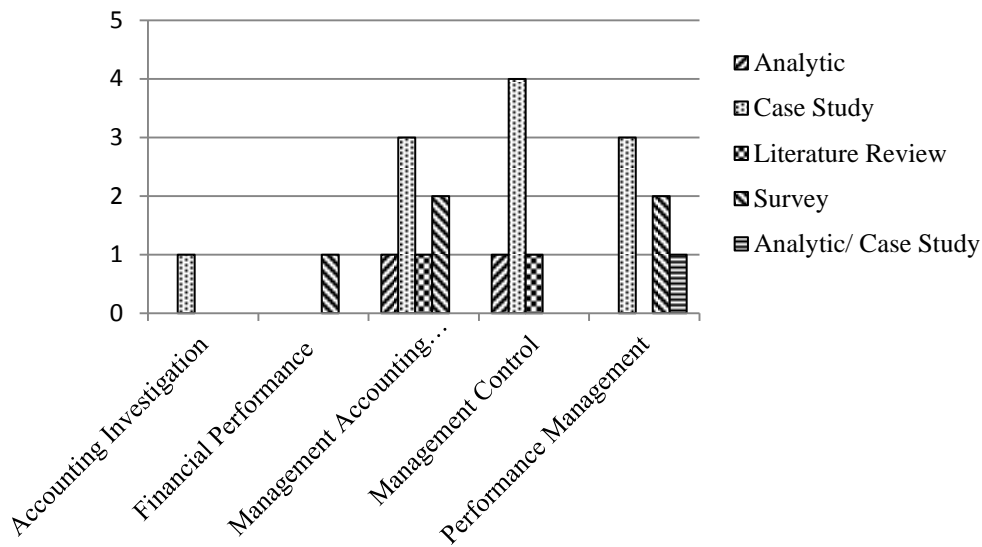
Performance management related articles were developed through case study, survey and analytic methods. Although, the analytic research method was used once and in parallel with a case study. The case study was the most resorted research method in this case, being used in 50% of the studies.

Management accounting investigation was the most diversified studied subject regarding research methodologies. Analytic, case study, literature review and surveys were used to further explore this topic, although the case study had, once again, the highest usage rate with 43%.

Table 15 – Association between subject and research method

	Analytic		Case Study		Literature Review		Survey		Analytic/Case Study		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
Accounting Investigation	0	0,0%	1	100,0%	0	0,0%	0	0,0%	0	0,0%	1	4,8%
Financial Performance	0	0,0%	0	0,0%	0	0,0%	1	100,0%	0	0,0%	2	9,5%
Management Accounting Investigation	1	14,3%	3	42,9%	1	14,3%	2	28,6%	0	0,0%	7	33,3%
Management Control	1	16,7%	4	66,7%	1	16,7%	0	0,0%	0	0,0%	6	28,6%
Performance Management	0	0,0%	3	50,0%	0	0,0%	2	33,3%	1	16,7%	6	28,6%
Total	2	9,5%	11	52,4%	2	9,5%	5	23,8%	1	4,8%	21	100,0%

Graphic 9 – Studied subject and research method distribution



3.5.3. Association between Subject and Organizational Theory

Now, we proceed with an analysis regarding the association between identified research subjects and adopted organizational theories, assisted by Table 15 and Graphic 10. As stated before, 86% of analyzed articles adopted an underlying organizational theory, wherein contingency, with an adoption rate of 29%, was the most used. Actor-network and institutional theories followed after with a usage rate of 19%, each, and Habermas with 10%. Experiential learning and labor-process theories were employed only once, each used in 5% of the articles.

Beginning with an analysis of management accounting investigation, several organizational theories were identified within this subject. The most used was the contingency theory with 43% of adoption. Actor-network was used in 29% of the articles, institutional and experiential learning theories were adopted 14% of the times, each. It was the subject where both actor-network and contingency theories were identified the most. This topic was also the only one where the use of experiential learning was identified. All articles regarding this subject adopted an organizational theory.

Management control related studies adopted the contingency theory as much as Habermas. Each was identified in 33% of the articles. This was the only subject where Habermas was identified as the adopted organizational theory. Actor-network and institutional theories were also used in 17% of the studies, each. There were no articles without an underlying organizational theory regarding this subject, as well.

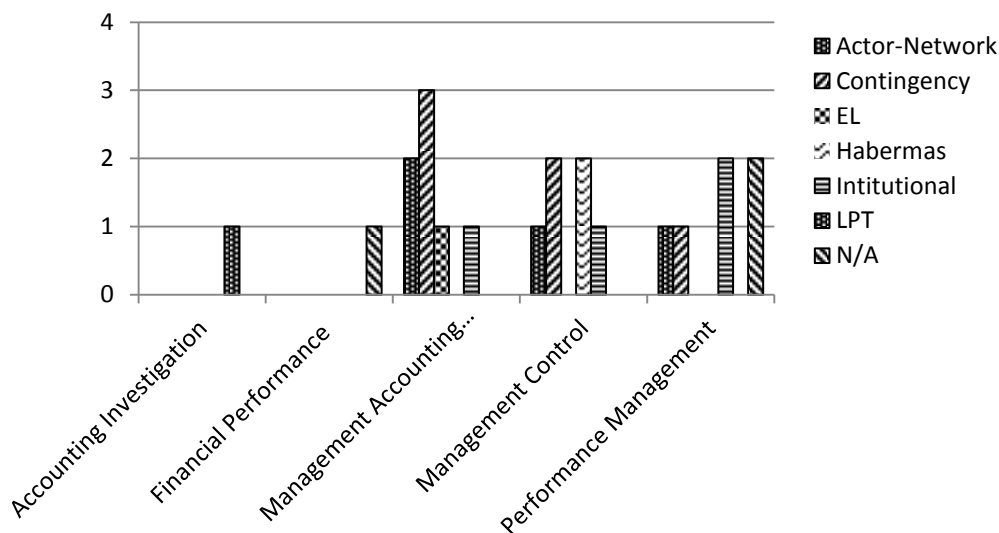
The subject of performance management was studied mainly through institutional theory, with a 33% adoption rate. Actor-network and contingency theories were used in 17% of the articles and 33% of them had no subjacent organizational theory. It was the subject with the highest use of institutional theory.

Accounting investigation was the only subject where labor process theory was used, while the only article related to financial performance did not adopt any organizational theory.

Table 16 – Association between studied subject and organizational theory

	Accounting Investigation		Financial Performance		Management Accounting Investigation		Management Control		Performance Management		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
Actor-Network	0	0,0%	0	0,0%	2	28,6%	1	16,7%	1	16,7%	4	19,0%
Contingency	0	0,0%	0	0,0%	3	42,9%	2	33,3%	1	16,7%	6	28,6%
Experiential Learning	0	0,0%	0	0,0%	1	14,3%	0	0,0%	0	0,0%	1	4,8%
Habermas	0	0,0%	0	0,0%	0	0,0%	2	33,3%	0	0,0%	2	9,5%
Institutional	0	0,0%	0	0,0%	1	14,3%	1	16,7%	2	33,3%	4	19,0%
Labor-process	1	100,0%	0	0,0%	0	0,0%	0	0,0%	0	0,0%	1	4,8%
N/A	0	0,0%	1	100,0%	0	0,0%	0	0,0%	2	33,3%	3	14,3%
Total	1	100,0%	1	100,0%	7	100,0%	6	100,0%	6	100,0%	21	100,0%

Graphic 10– Studied subject and organizational theory’s association distribution



3.5.4. Association between Research Method and Affiliated Country

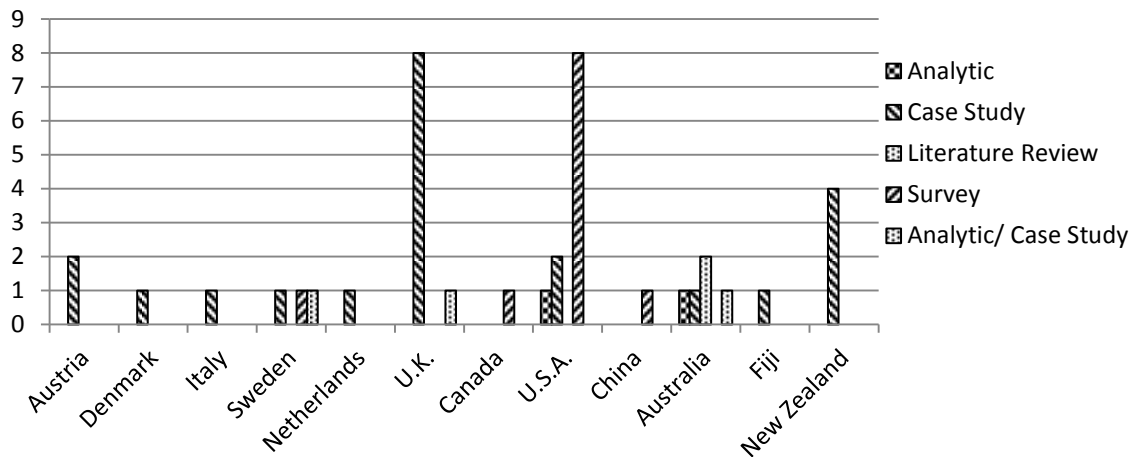
Table 16 and Graphic 11 help us analyze the association between the variables research method and author’s affiliated country in order to better understand the preferred research method from a geographic perspective, regarding TQM and Six Sigma related articles.

As was previously said, the case study was the preferred research method since 55% of the articles within the studied universe are based on this data collection methodology. Europe was the continent where it was employed the most. 64% of identified case studies were written in Europe where the UK had the highest contribution, with 36%. All identified European countries developed case study articles. Oceania also adopts the case study as the preferred research method, since 60% of associated articles resorted to it.

Table 17 - Association between research method and affiliated country

	Analytic		Case Study		Literature Review		Survey		Analytic/ Case Study		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
Europe	0	0%	14	64%	0	0%	1	9%	2	67%	17	42,5%
Austria	0	0%	2	9%	0	0%	0	0%	0	0%	2	5,0%
Denmark	0	0%	1	5%	0	0%	0	0%	0	0%	1	2,5%
Italy	0	0%	1	5%	0	0%	0	0%	0	0%	1	2,5%
Sweden	0	0%	1	5%	0	0%	1	9%	1	33%	3	7,5%
Netherlands	0	0%	1	5%	0	0%	0	0%	0	0%	1	2,5%
UK	0	0%	8	36%	0	0%	0	0%	1	33%	9	22,5%
America	1	50%	2	9%	0	0%	9	82%	0	0%	12	30,0%
Canada	0	0%	0	0%	0	0%	1	9%	0	0%	1	2,5%
US	1	50%	2	9%	0	0%	8	73%	0	0%	11	27,5%
Asia	0	0%	0	0%	0	0%	1	9%	0	0%	1	2,5%
China	0	0%	0	0%	0	0%	1	9%	0	0%	1	2,5%
Oceania	1	50%	6	27%	2	100%	0	0%	1	33%	10	25,0%
Australia	1	50%	1	5%	2	100%	0	0%	1	33%	5	12,5%
Fiji	0	0%	1	5%	0	0%	0	0%	0	0%	1	2,5%
New Zealand	0	0%	4	18%	0	0%	0	0%	0	0%	4	10,0%
Total	2	100%	22	100%	2	100%	11	100%	3	100%	40	100,0%

Graphic 11 - Research method and affiliated country's association distribution



With a 28% adoption rate, surveys were the second most adopted research method. America was the continent that resorted to this methodology the most. 82% of identified surveys were American and 73% of those came from the US. It was also the only research method associated with China, which is the only country representing Asia in this study.

Analytic studies were associated solely with Oceania and the American continent, in Australia and the US. Literature reviews were identified exclusively in Oceania, specifically in Australia. In a collaborative effort between Sweden, the UK and Australia a study using both analytic and case study methods was developed, being the only article associated with multiple research methods.

3.5.5. Association between Research Method and Organizational Theory

This chapter aims to analyze the relation between underlying organizational theory and adopted research method. This analysis is assisted by Table 17 and Graphic 12.

Contingency theory, as stated previously, was identified in approximately 29% of the studies, meaning it is the most adopted organizational theory within the studied universe. Every research method identified in this study, except for the article with both analytic and case study research methods were used at least once to develop studies with contingency as the underlying organizational theory. This means that it was the most diverse theory, regarding data collection methods. 50% of the cases though, the preferred research method was surveys, meaning it was the most used method in studies regarding this theory.

Actor-network and institutional theories were identified in 19% of extracted articles, each. 75% of the articles related to any of these theories were case studies, making it the most used

research method for studies underlined by any of these organizational theories. Also, the case study method was used to study every identified organizational theory.

Experiential learning and labor-process theories were studied exclusively in case study articles. Habermas theory was developed in a case study and in the only identified analytic study. However, not many conclusions can be made from this since these 3 theories were found in very few articles, 4 in total.

There were also 3 articles without an organizational theory. 2 of those were surveys and the other was a case study.

Graphic 12 - Research Method and Organizational Theory association distribution

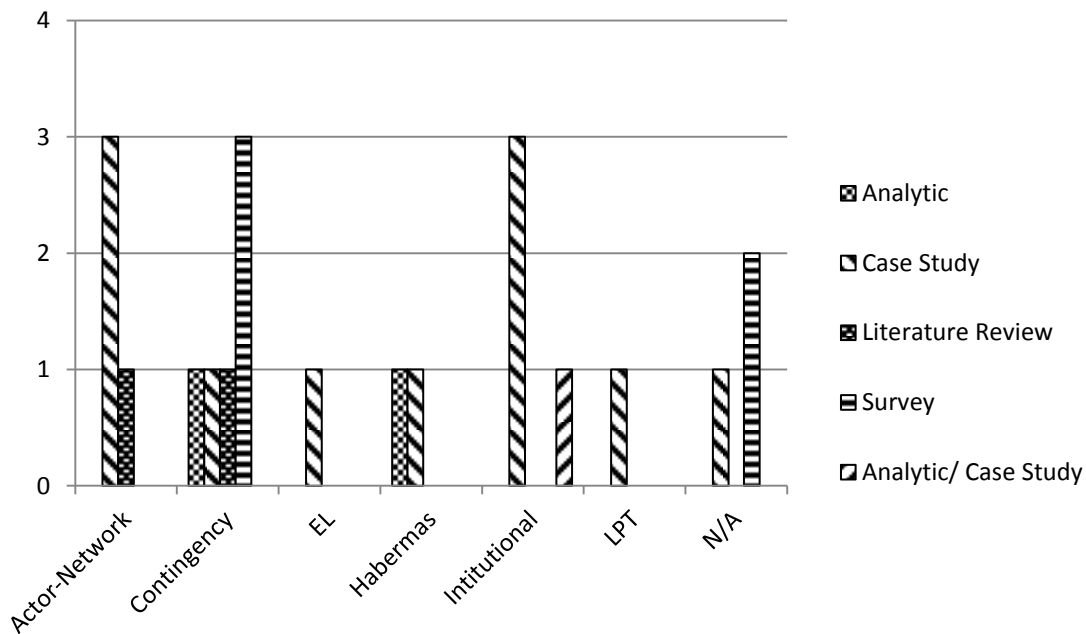


Table 18 – Association between Research Method and Organizational Theory

	Actor-Network		Contingency		Experiential Learning		Habermas		Institutional		Labor-process		N/A		Total	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Analytic	0	0%	1	17%	0	0%	1	50%	0	0%	0	0%	0	0%	2	10%
Case Study	3	75%	1	17%	1	100%	1	50%	3	75%	1	100%	1	33%	11	52%
Literature Review	1	25%	1	17%	0	0%	0	0%	0	0%	0	0%	0	0%	2	10%
Survey	0	0%	3	50%	0	0%	0	0%	0	0%	0	0%	2	67%	5	24%
Analytic/ Case Study	0	0%	0	0%	0	0%	0	0%	1	25%	0	0%	0	0%	1	5%
Total	4	100%	6	100%	1	100%	2	100%	4	100%	1	100%	3	100%	21	100%

3.5.6. Association between Organizational Theory and Affiliated Country

In this final association, we analyze the relation between author’s affiliated country and the study’s underlying organizational theory, resorting to Table 18 and Graph 13.

Actor-network related studies were found only in Europe and Oceania, with a higher frequency in Europe (67%), mainly in Austria and Australia.

Institutional theory related studies were also associated with authorships from both Europe and Oceania, with relatively equal contributions from Sweden (25%), the UK (25%), Australia (13%) and New Zealand (38%).

Contingency was the organizational theory represented in most continents since 3 out of 4 were associated with it. Asia was the only continent that was not represented. America was where this theory was identified the most (70%), specifically the US. where 60% of studies related to contingency were developed.

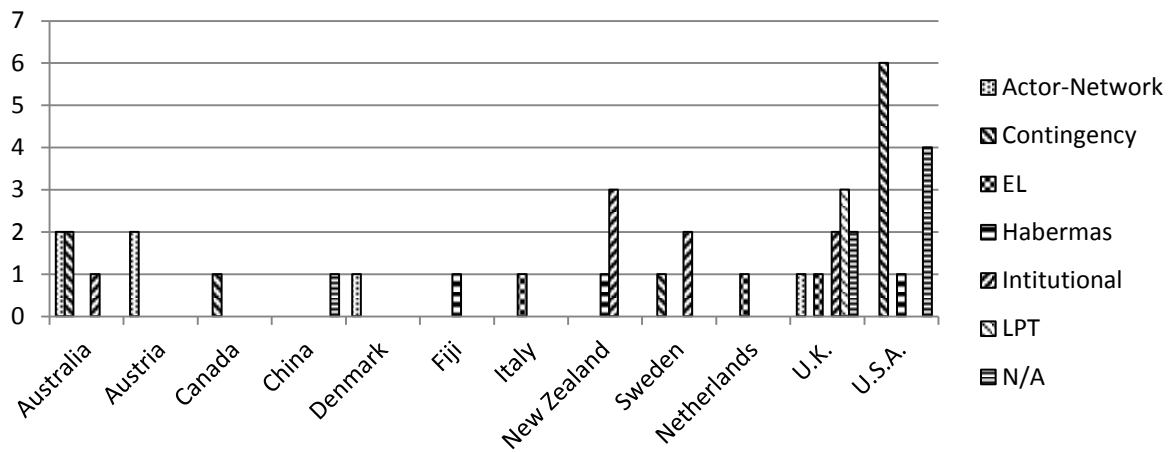
Experiential learning theory was exclusively studied in Europe in a study associated with Italy, the Netherlands and the UK. Labor-process theory was also identified solely in Europe, specifically in the UK. Habermas theory related articles were developed both in America, specifically the US, and in Oceania.

Table 19 - Association between organizational theory and affiliated country

	Actor-Network		Contingency		EL		Habermas		Institutional		LPT		N/A		Total	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Europe	4	67%	1	10%	3	100%	0	0%	4	50%	3	100%	2	29%	17	43%
Austria	2	33%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	2	5%
Denmark	1	17%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	3%
Italy	0	0%	0	0%	1	33%	0	0%	0	0%	0	0%	0	0%	1	3%
Sweden	0	0%	1	10%	0	0%	0	0%	2	25%	0	0%	0	0%	3	8%
Netherlands	0	0%	0	0%	1	33%	0	0%	0	0%	0	0%	0	0%	1	3%
U.K.	1	17%	0	0%	1	33%	0	0%	2	25%	3	100%	2	29%	9	23%
America	0	0%	7	70%	0	0%	1	33%	0	0%	0	0%	4	57%	12	30%
Canada	0	0%	1	10%	0	0%	0	0%	0	0%	0	0%	0	0%	1	3%
U.S.A.	0	0%	6	60%	0	0%	1	33%	0	0%	0	0%	4	57%	11	28%
Asia	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	14%	1	3%
China	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	1	14%	1	3%
Oceania	2	33%	2	20%	0	0%	2	67%	4	50%	0	0%	0	0%	10	25%
Australia	2	33%	2	20%	0	0%	0	0%	1	13%	0	0%	0	0%	5	13%
Fiji	0	0%	0	0%	0	0%	1	33%	0	0%	0	0%	0	0%	1	3%
New Zealand	0	0%	0	0%	0	0%	1	33%	3	38%	0	0%	0	0%	4	10%
Total	6	100%	10	100%	3	100%	3	100%	8	100%	3	100%	7	100%	40	100%

Europe was the continent associated with most organizational theories. Of the 6 represented theories, only Habermas was not associated with Europe, in the studied universe. Oceania was the second most diversified continent, being associated with 4 of the 6 organizational theories represented in this study. American studies resorted exclusively to contingency and Habermas theories. America however, was the continent with highest frequency of articles without an underlying theory. Finally, Asia, which accounted for only one study in this analysis, was the continent with lowest theory diversification since only labor-process theory was studied.

Graphic 13 - Organizational theory and affiliated country's association distribution



4. Concluding Discussion

4.1. Results

This study was developed with the purpose of analyzing and making conclusions out of relevant variables and their applicable associations, regarding TQM and Six Sigma related articles published in four of the most renowned accounting journals: MAR, AAA, AOS and CPA, from 2000 to 2013.

Some conclusions regarding the studied universe, there were very few articles relating accounting, specifically management accounting, and quality tools such as TQM or Six Sigma in the analyzed journals. The number of extracted articles reached as high as 21, which comprises a small sample for such a study. This is enforced by the fact that there was only one contribution from Asia, represented only by China. South America and Africa had no contributions for this investigation.

Regarding authorships, 70% were male and 30% were female. Most of these authors were affiliated with Europe (43%) although the country with most associated authors was the US (28%). The University of Waikato had the highest number of affiliated authorships.

The subject most associate with either TQM or Six Sigma in this study was management accounting investigation (33%) and was developed mainly in Europe (45%). Management control accounted for 29% of the studies, being more frequently developed in Oceania (55%). Performance management was also identified in 29% of the articles and Europe was the continent where this subject was studied the most (54%). The previously mentioned subjects where studied mostly through case studies.

The preferred research method was the case study (52%) which was used mainly in Europe (64%), specifically the UK (36%). The survey research method was adopted in 24% of studies, making it the second most used. America was the continent with which it was identified the most (82%), particularly the US (73%).

Organizational theories were identified in 86% of the articles, with contingency theory being the most used (29%). This theory was used mostly on management accounting investigation related articles (43%) and studied mostly using surveys (50%). The majority of contingency related studies were affiliated with the US (60%). Actor-network and institutional were identified in 19% of the articles, each. While the first was mainly associated with Europe

(67%) and mostly used in management accounting investigation studies (29%), institutional theory was used as much in Europe (50%) as in Oceania (50%), and mostly in articles regarding performance management (33%). Both these theories were developed mainly through case studies (75%)

4.2. Study Contribution

This study contributed for the study of management accounting and quality management theory.

Firstly, the analysis of the five most renowned journals in the field of accounting establishes an ample base for comparisons to be made, regarding extracted variables.

Secondly, extracted articles and variables were analyzed and associated, providing a specific characterization for each journal. Variable analysis and their associations by themselves contribute, providing a better perspective on the way these subjects are usually studied, weather the author's characteristics, research method or organizational theory used more often.

4.3. Study Limitations

This study was conditioned by some constraints. First, the number of articles published in analyzed journals that related TQM or six sigma to accounting subjects was quite low. This led to a relatively small studied universe which may leave some restrictions when drawing conclusions.

Studied subjects from extracted articles may be considered subjective or generic. Some of the also articles studied other topics. However, the one that was selected to integrate this analysis was the general and most relevant subject.

4.4. Future Studies Suggestions

This study opens the possibility for further investigation relating the subject of management accounting and quality tools. Future studies can perceive a more scientific perspective on this subject. A broader scope can be applied to include more quality philosophies or more journals. Seen that the US and Europe are responsible for the vast majority of studies relating quality tools to management accounting, both could be the subject of a more thorough investigation.

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TQM and Six Sigma in Accounting Literature

Annex

Country	Institution	MAR	AAA	CPA	AOS	Total	
		F	F	F	F	F	%
Australia	The Australian National University	1	0	0	0	1	3%
	Griffith University	0	0	1	0	1	3%
	Monash University	0	0	0	2	2	5%
	University of Sydney	0	1	0	0	1	3%
Austria	University of Innsbruck	0	0	0	2	2	5%
Canada	McGill University	0	0	0	1	1	3%
China	Hong Kong University of Science and Technology	0	0	0	1	1	3%
Denmark	Copenhagen Business School	0	0	0	1	1	3%
Fiji	University of the South Pacific	0	0	1	0	1	3%
Italy	University of Siena	1	0	0	0	1	3%
New Zealand	University of Waikato	3	0	1	0	4	10%
Sweden	Örebro University	0	0	0	1	1	3%
	Royal Institute of Technology	1	0	0	0	1	3%
	Stockholm University	1	0	0	0	1	3%
Netherlands	University of Groningen	1	0	0	0	1	3%
U.K.	Brunel School of Business	0	0	1	0	1	3%
	Cambridge University	0	0	0	1	1	3%
	Cardiff University	0	0	0	1	1	3%
	Manchester Business School	1	0	0	0	1	3%
	Saïd Business School, Oxford	0	0	0	1	1	3%
	The Open University Business School	0	0	1	0	1	3%
	University of Liverpool	0	0	0	1	1	3%
	University of Manchester	1	1	0	0	2	5%
	U.S.A.	Clemson University	1	0	0	1	2
	Rice University	1	0	0	1	2	5%
	Temple University	0	0	0	1	1	3%
	University of Texas	1	0	0	1	2	5%
	University of Arkansas	1	0	0	0	1	3%
	University of New Mexico	0	0	1	0	1	3%
	Utah State University	0	0	0	2	2	5%
	Total	14	2	6	18	40	100%