

## THREE DECADES OF CONTINUOUS IMPROVEMENT.

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### **Abstract**

The aim of this study is to provide a literature review on continuous improvement analysing the evolution of the field by combining quantitative and qualitative analysis. More than 1,000 articles have been reviewed. The articles have been collected through the prestigious database Web of Knowledge (Thomson Scientific). The results show an increasing interest in the field of continuous improvement over the past 30 years. The most discussed topics have been “*implementation of continuous improvement systems*” and “*methodologies*”. Other findings from the study are: the existence of regional differences in research on continuous improvement, the predominance of the case study and the survey as research methodologies, and the positioning of *Total Quality Management and Business Excellence* as the lead scientific publication in continuous improvement areas. The present review adds value to other studies on the same topic due to number of items used (1090), the time period covered

(1980-2011), the prestigious database used (Web of Knowledge) and the combination of different analysis (quantitative and qualitative).

**Keywords:** continuous improvement, kaizen, literature review, methodologies, future directions

## 1. INTRODUCTION

Nowadays, continuous improvement is an extremely important phenomenon that has been considered a vital element in achieving business excellence for years as De Leede and Jan Kees Looise (1999) highlighted.

We think that the importance of continuous improvement in the business environment has been motivated by three major phenomena: changes in the business environment, the emergence of new management systems and the importance of quality management itself.

Over the last several decades, the business environment has witnessed numerous changes such as globalization, the emergence of dramatic technological advances, the emergence of a more demanding and informed customer, the emergence of quality as a key business concept, the importance of time as a competitive variable or the increasing awareness of society towards ethical and environmental issues, among others (Bayraktar et al. 2007).

Secondly, the emergence of new management systems such as Lean Management – see Womack et al. (1990) and Womack and Jones (2005) – and the Theory of Constraints – see Goldratt (2001, 2005) – has also led the progress of continuous improvement, as it is one of the basic pillars of such management systems.

Finally, the Total Quality Management movement emerged in the eighties driven by worldwide experts such as **Deming** (1982) who proposed a 14 point plan to be applied to organizations in order to improve, **Juran** (1990) who developed the quality trilogy (quality planning, quality control and quality improvement), **Feigenbaum** (1992) who first coined the term Total Quality Management (TQM) or **Crosby** (1989) known by his “zero defects” philosophy based on “doing things right the first time”. The Total Quality Management movement integrated the concept of continuous improvement and drove it to the top as Marsh (2000) and Cuatrecasas (2005) highlighted.

In addition, in recent years, some new models and standards intended to serve as a guide for firms to redirect their activities towards Total Quality Management have been created. The ISO 9000 is the best known standard, and the Deming Prize, the Malcolm Baldrige National Quality Award in the United States and the EFQM Excellence Award in Europe are the most well-known international awards. The Deming Prize is aimed to those companies that have achieved some quality improvements by analysing their initial situation, establishing their own aims and transforming themselves in order to achieve their objectives (not only the results are evaluated, but also the processes followed), whereas the Malcom Baldrige National Quality Award and the EFQM Excellence Award are designed to reward those companies that achieve excellence. These last two awards are based on two models that establish the evaluation criteria for the awards (the Malcom Baldrige Criteria for Performance Excellence and the EFQM Excellence Model, respectively). It should be highlighted that many companies follow the guidelines offered by the models or frameworks for self-assessment without applying to the awards.

The importance of continuous improvement in the real world has also been reflected in the academic world and, as discussed extensively in later sections, the subject of continuous improvement has been addressed from multiple perspectives.

Taking this into consideration and after more than 30 years of research on the subject, it seems interesting to analyse the position of the field, identifying which topics have been widely developed and which ones must be developed more deeply.

There are some previous studies that reviewed the evolution of the continuous improvement concept from a theoretical perspective. Some examples of theoretical studies are Bhuiyan et al. (2006), Suárez-Barraza (2008), Suárez-Barraza et al. (2011), Singh and Singh (2009, 2012) or Dahlgaard-Park et al. (2013). However, among the analysed studies we have not found papers that, combining qualitative and quantitative analysis, review the evolution of the continuous improvement field.

Overall, this paper aims to offer a literature review of the continuous improvement concept by analysing papers that have been published over the last 30 years.

## **2. WHAT IS “CONTINUOUS IMPROVEMENT”?**

The concept of continuous improvement comes from the Japanese term Kaizen that was initially developed and spread by Masaaki Imai (see Imai, 1989) who is known as the father of continuous improvement. Kaizen is a compound word in Japanese that includes two concepts: Kai (Change) and Zen (to improve).

Bearing this in mind, a list with some definitions of continuous improvement is included first. They are chronologically ordered (Table 1.).

**Insert table 1 around here**

Despite each author has his own definition of continuous improvement, the following characteristics can be highlighted:

- Continuous improvement is a cycle; it is not an only act. As a result, it is a constant activity that must be done over time. It should not be an independent activity.
- All people from the organisation should participate in the continuous improvement cycle.
- Continuous improvement aim is, precisely, to improve. In order to do so the organisation should focus on eliminating wastes and identifying new areas of improvement.

Based on these characteristics, in this study continuous improvement is defined as the continuous process of improvement in the company done with the participation of all staff. In later stages, this definition will be considered in order to ensure that the papers found effectively deal with the subject of this study.

### **3. RESEARCH APPROACH**

In order to carry on the research, a review has been made. It consisted of the analysis of a number of primary studies, in this case, scientific articles related with the continuous improvement field.

Reliable sources must be used to obtain the primary information. In this study the Web of Knowledge database has been used because it is a prestigious internationally well known database.

The search criteria used were the following:

- The first criterion was related to the type of document. We were only interested in scientific articles. The reasons why this decision was taken were mainly two. Firstly,

scientific papers are considered certified knowledge as Ramos (2004) and Ramos-Rodríguez and Ruiz-Navarro (2008) already stated; and secondly, proceedings started to be included in Web of Knowledge database in 2008, so if we had wanted to use them, the period of time analysed would have been really short.

- The second criterion was about the period of time. We were interested in those papers published between 1980 and 2011. Due to the analysis was started in the summer of 2012, the authors considered that that year should not be included in the analysis so the results were more accurate.
- The third and last criterion was about the topic. Logically, we were only interested in those articles related with the continuous improvement literature. So they should include the keywords “Continuous Improvement” and/or “Kaizen” in their title, abstract or keywords.

After doing the search, all the papers found were revised to check that they were not included twice and that, effectively, they were related with the topic. The final sample was integrated by 1090 scientific articles (the list of references to these articles has not been included due to its length but it can be obtained from the authors).

The analysis made combined qualitative and quantitative methods. In the analysis the structure used by Houy et al. (2010) was followed. According to this structure the data was analysed from three different perspectives:

1. **Meta-perspective:** describing the findings from the application of a selection of scientometric methods in order to measure the development of a field of research (Hood & Wilson, 2001) with regard to temporal, regional as well as other aspects.

2. **Content-based perspective:** describing aspects with regard to the content of a contribution as far as the application context is concerned;
3. **Methodological perspective:** examining the applied methodology of the empirical studies found along the search.

Table 2 summarises the different analysis made in each of the perspectives above mentioned.

**Insert table 2 around here**

#### **4. “CONTINUOUS IMPROVEMENT” REVIEW**

##### **4.1. Literature review from the meta-perspective**

###### *Number of contributions per year*

As it was stated earlier, the search made covered the period between 1980 and 2011. A total of 1090 papers related to continuous improvement were found. However, due to there were no articles from the period 1980-1985, this period has not been included in the analysis (Figure 1).

**Insert figure 1 around here**

The number of published papers related to continuous improvement has been rising since the mid eighties. However, two periods may be distinguished. The first period from 1986 to 2007 when the number of publications follows a flat trend with continuous ups and downs. And,

the second period since 2007, when there is a dramatic rise in the number of contributions. In fact it was in 2011 when the scientific production related to continuous improvement reached its peak with 96 articles published.

Regarding the type of papers, the high percentage of existing empirical articles since the early years of analysis was remarkable. This might be understood as a signal of the high interest in the topic beyond academia.

### ***Number of contributions per journal***

This analysis aimed to know which journals were the most prolific ones when publishing papers related to continuous improvement. The first observation relates to the large number of existing journals obtained. In total, 525 journals had published at least one article related to continuous improvement during the period analysed. In Table 3 the frequency of distribution of the analysed journals according to the number of papers that they have published is shown.

**Insert table 3 around here**

Given the large number of journals obtained on the results, only those that had published five or more articles related to continuous improvement are included in Table 4.

**Insert table 4 around here**

The *Total Quality Management and Business Excellence* journal is undoubtedly the reference journal on issues related to continuous improvement. In the second and third positions are the



*International Journal of Technology Management* and the *International Journal of Operations and Production Management*, respectively.

Despite the fact that the first journals in the ranking dealt with business management topics, the complete list included a wide range of journals from very different research areas. This only highlights the multidisciplinary orientation of the continuous improvement field.

***Number of contributions per country/region and date of first publication.***

In Table 5 the number of contributions that have been developed in each country or region can be seen. In order to assign a paper to a certain country, the nationality of the first author has been taken into account.

The year when the first article has been published in each region is also included.

**Insert table 5 around here**

The United States (USA) and the United Kingdom (UK) are the countries with the highest number of publications on continuous improvement. They are followed in third and fourth place, although quite distant, by Spain and Australia respectively. USA is also the pioneer in the subject as it was in 1986 when the first article on the subject was published there.

***Language of publication***

Considering that the USA and the UK lead the list of countries as highlighted above, it is not surprising that the predominant language in the field of research is English (Table 6). There is an abysmal distance between English and the following languages used in the papers, Spanish and German. It is true, however, that the real distance might be smaller because of the fact

that the database used includes a higher number of journals that only publish articles in English.

**Insert table 6 around here**

#### *Number of contributions per researcher*

In the 1090 articles analysed 2401 co-authors were identified. In Table 7 the ten most prolific researchers on the subject of continuous improvement are listed. Terry Sloan appears as the most productive co-author with ten articles published.

**Insert table 7 around here**

Regarding authorship it is interesting to analyse the trend in the number of authors signing on each paper. Table 8 shows that papers with one or two authors are the most common ones.

**Insert table 8 around here**

#### **4.2. Literature review from the content-based perspective**

The aim of this section was to identify what were the major issues addressed within the field of continuous improvement. Knowing the trend in the field, not only enables us to know what the current state of the art is, but it also facilitates the establishment of future lines of research.

Following a first reading of the 1090 abstracts, nine thematic areas were established by the authors. These nine topics were:

- **Concept:** under this heading studies focused on the analysis of the concept “continuous improvement” itself are grouped.
- **Implementation:** studies that present results related to the implementation of continuous improvement in a company are included in this area. The studies include both, empirical papers which presented a case study, as well as theoretical studies where implementation methodologies that had not been tested yet are proposed.
- **Factors:** this section includes studies that examined the obstacles, facilitators, drivers, benefits and disadvantages that result from the implementation of a continuous improvement program.
- **Methodologies:** it includes works focused on the application of one or more methodologies of any kind as a means of developing a continuous improvement program.
- **Culture:** this area includes studies focused on the relationship between continuous improvement and other topics such as corporate culture, best practices, social responsibility or environmental issues.
- **Control:** this area includes studies related to the establishment of measurements and indicators that help to control how the continuous improvement process evolves. Given the importance of establishing control systems when implementing a system of continuous improvement, we considered appropriate to devote a separate section to this topic instead of including it in the implementation section, where it also could have been included.
- **Management philosophies:** studies included in this section relate continuous improvement with other management philosophies such as Lean Management, Process Management, Total Quality Management or the Theory of Constraints.

- **Innovation:** it encompasses those studies that analyse the relationship between continuous improvement and innovation.
- **Human resources:** This topic groups those studies that link human resource management (training, motivation, participation...) to the success of continuous improvement and vice versa. That is, the influence of continuous improvement on the human resources systems (for instance, employee satisfaction).

After determining the nine topics, all the papers were revised again and each of them was assigned to a maximum of two topics. As a consequence of this, the results should not be analysed in absolute terms but in relative terms. However, due to the rigorous approach used in the analysis, the authors consider that the results are accurate enough and they may be used to define the state of the art and determine future lines of research.

Table 9 summarizes the results obtained:

**Insert table 9 around here**

The most common topic among the articles analyzed was *Implementation*. There are many studies that present specific cases of implementation of continuous improvement initiatives, as well as others that propose new implementation methodologies.

The second most interesting topic was *Methodologies*. It is closely related to the first topic due to the use of methodologies is very common during the implementation processes. Given the importance of the subject, we also analysed what methodologies were identified. Thus, the following results were obtained (Table 10):

**Insert table 10 around here**

The most common methodology or tool was “Standards/Frameworks”. In Table 11 all the “Standards/Frameworks” analysed are stated. As it can be seen in that table, apart from the globally known standards, there is a heading entitled “*Others*” which includes other national less known standards. We consider that these standards should be analysed in this section as they help companies to carry out self-diagnosis and start continuous improvement programs.

**Insert table 11 around here**

After *Standards/Frameworks*, the most used methodologies are the Six Sigma technique, information technologies and benchmarking.

Turning back to the topics addressed the *human resources* topic is in the third position. This is not surprising taking into account that the importance of staff involvement in continuous improvement programs has been repeatedly highlighted.

The *management philosophies* topic is in the fourth position. Again this is a logical conclusion because continuous improvement is often associated with the introduction of larger systems such as Lean Management or Total Quality Management.

The remaining topics are, in order of importance, *culture*, *control*, *continuous improvement concept*, *factors* and *innovation*. Any of these topics, given they are less developed, are presented as future research lines.

### **4.3. Literature review from the meta-perspective**

#### ***Methodologies used***

As we could see in Figure 1, there is a great percentage of empirical articles in the sample analysed. Specifically over the 30 years analysed, 617 empirical articles have been published as opposed to 473 theoretical articles.

The empirical papers are very different in nature and use different methodologies. The aim of this section is to determine which methodologies have been used in the research field of continuous improvement. The sectors where the empirical papers have been applied will also be analysed.

The research methodologies identified in the 617 empirical papers are action research, case study, survey, experiment, Delphi method and multimethod.

The results obtained are summarised in Table 12:

**Insert table 12 around here**

The case study methodology was the most used one. A total of 445 papers used it. The survey was the second most used methodology. This result is logical if we consider that, generally, the case study methodology is used in the initial development stages of a field of research and then, as the field evolves, other methodologies are applied. The experiment is placed in the third position, followed by the multimethod, the Delphi method and action research.

With regard to the sectors where the empirical studies were applied, the results are shown in Table 13:

**Insert table 13 around here**

A total of 239 empirical articles have been made in the manufacturing sector, 298 in the service sector and 80 articles include companies from both sectors. Surprisingly, the number of papers in the service sector exceeds the number of papers in the manufacturing sector.

Going deeper into this fact, it was found that 168 articles of the 298 linked to the service sector were applied in the health subsector. Then, if we leave aside the health sector, the number of papers assigned to services is 130, a result more in line with the expectations.

## **5. DISCUSSION**

This study offers a review of the state of the field of continuous improvement by combining quantitative and qualitative analysis.

With regard to the temporal evolution two distinct periods may be distinguished. The first between the 1988 and 2007 with a flat trend, and the second one from 2007 with a remarkable growth in the number of contributions, reaching the peak in 2011 with 96 articles published. As a result it may be concluded that continuous improvement is still a field of interest to researchers, a conclusion that has recently been obtained in the study of Dahlgaard-Park et al. (2013) as well.

Another interesting finding was the high percentage of empirical papers identified since the first years analysed. This could be interpreted as a reflection of the great interest of continuous improvement to practitioners. This, in turn, could mean that a rapprochement between the academic and the real world is taking place, responding to the need for convergence raised by Alvarez (1996).

With regard to scientific journals, *Total Quality Management and Business Excellence* is placed in the first position, becoming the reference journal in the area of continuous improvement worldwide.

The regional analysis allowed detecting a disparate development in the continuous improvement research field. Two Anglo-Saxon countries, United States and United Kingdom, lead the list of most prolific countries. Not only do they lead because of the number of papers published, but also temporally speaking. Thus, in many Asian, African and Eastern European countries the first papers about continuous improvement were published in 2010 and 2011, while in the USA the first article was published in 1986.

The regional differences detected, far from being a negative aspect, could be seen as an opportunity for collaboration, a conclusion also reached by Sila and Ebrahimpour (2002). Thus, it may be interesting to develop joint research between countries placed at different levels of research development. This could also help to develop the research about the influence of cultural or regional differences in the implementation of continuous improvement programs.

Regarding the content analysis, nine topics were defined by the authors: concept, implementation, factors, methodologies, culture, control, management philosophies, innovation and human resources.

The two most discussed topics were *implementation* and *methodologies*. It seems coherent that these are the most recurring themes as the implementation of continuous improvement systems requires constant adaptation to the sector analysed as Dahlgaard-Park et al. (2013) highlighted. In fact, many of these eminently empirical studies are oriented precisely in the analysis of concrete experiences of implementation of certain methodologies analyzing their utility, their advantages and disadvantages in different sectors.

Given the interest in continuous improvement in the services sector (fact demonstrated by the high percentage of empirical studies applied to this sector, more than 48%), the need for adaptation of continuous improvement systems and tools (originally developed in the



manufacturing field) becomes even more evident and could be an explanation for the success of the two topics outlined.

The third most common topic is *human resources*. This result is logical if we consider the key role played by people in the implementation of continuous improvement programs. Thus, the participation of the entire company, staff motivation and proper training policies for employees are just some human resource practices necessary to develop a continuous improvement program (Warwood & Roberts, 2004; Rapp & Eklund, 2007; Jun, Cai, & Peterson, 2004; Cooney & Sohal, 2004; Berling, 2000).

Other topics less developed that may be of interest for future research are culture and factors. Previously the existing opportunity to develop international partnerships to deepen the concept of continuous improvement and cultural differences has been highlighted. These comparative studies between different countries or geographic areas could facilitate the understanding of the phenomenon of continuous improvement. That is, whether cultural factors facilitate or hinder the development of improvement programs could be detected, so that, subsequently, some "routes" to help businesses in order to implement continuous improvement may be established.

The *concept of continuous improvement* is among the less developed topics. As a result it could be a future research line for two reasons. First, because the concept of continuous improvement needs to constantly adapt to the changing environment. And, secondly, because as Ahire et al. (1995) have already stressed there is a need for greater theoretical development of the subject that, according to their results, seemed to be very practically oriented. The results of this study seem to reinforce this need because, as mentioned above, the percentage of empirical research has remained very high throughout the period analysed.

Finally, there seems to be an area of research that may be widely developed related to the relationship of innovation and continuous improvement.

The last section of the study focused on the analysis of the methodologies used in the empirical papers. The case study is in the first place followed by the survey. This result shows that the field of continuous improvement has reached a certain maturity, as case studies are commonly used for exploratory studies in the early stages of a research field, while surveys are used in more advanced phases to test the ideas conceived from the initial studies.

Overall, the authors consider that this paper adds value to the previous reviews because of the following reasons. Firstly, the period analysed is wider –it is only comparable with the study of Dahlgaard et al. (2013). Secondly, the database used is internationally known and it only includes information about the journals with the highest impact and quality. Previous studies are only focused on individual journals or on databases with less scientific impact. Finally, the present study combines qualitative and quantitative analysis. Therefore, besides the results about the main topics covered, this review offers information about the regional and sectorial development of continuous improvement research, the most prolific journals and the methodologies used in the empirical studies found, among others.

## **6. LIMITATIONS**

The main limitation of the study is given by the use of a single database. However, the effect of this limitation is minimized by the fact that the selected database has an international impact and it includes high impact worldwide known journals.

Therefore, although some results such as those associated with language of publication should be interpreted with caution, since the publication of papers in English is more likely in the selected database, in general, the sample size allows us to suggest that the results obtained are significant.

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**Table 1. “Continuous Improvement” definitions**

<b>AUTHORS</b>	<b>CONTINUOUS IMPROVEMENT DEFINITIONS</b>
(Deming, 1982)	Improve constantly and forever the system of production and service (Principle 5 of transformation).
(Imai, 1989)	Progressive improvement involving everyone in the company (including both workers and managers).
(Bessant et al., 1994) in (Carpinetti, Buosi, & Gerolamo, 2003)	A company-wide process of focused and continuous incremental innovation.
(Juergensen, 2000) in (Bhuiyan & Baghel, 2005)	Improvement initiatives that increase successes and reduce failures.
(Bessant, Caffyn, & Gallagher, 2001)	A particular bundle of routines which can help an organisation improve what it currently does.
(Dahlgaard, Kristensen, & Kanji, 2002)	Small continuous changes for the better.
(Brunet & New, 2003)	Pervasive and continual activities, outside the contributor’s explicit contractual roles, to identify and achieve outcomes he believes contribute to the organisational goals.
(Boer & Gertsen, 2003) in (Middel, op de Weegh, & Gieskes, 2007)	The planned, organised and systematic process of ongoing, incremental and company-wide change of existing practices aimed at improving company performance.
(Chang, 2005)	The continuous improvement cycle consists of establishing customer requirements, meeting the requirements, measuring success, and continuing to check customers’ requirements to find areas in which improvements can be made.
(Bhuiyan, Baghel, & Wilson, 2006)	Culture of sustained improvement aimed at eliminating waste in all organizational systems and processes, and involving all organizational participants.
(Manos, 2007)	Subtle and gradual improvements that are made over time.

**Source: Own elaboration**

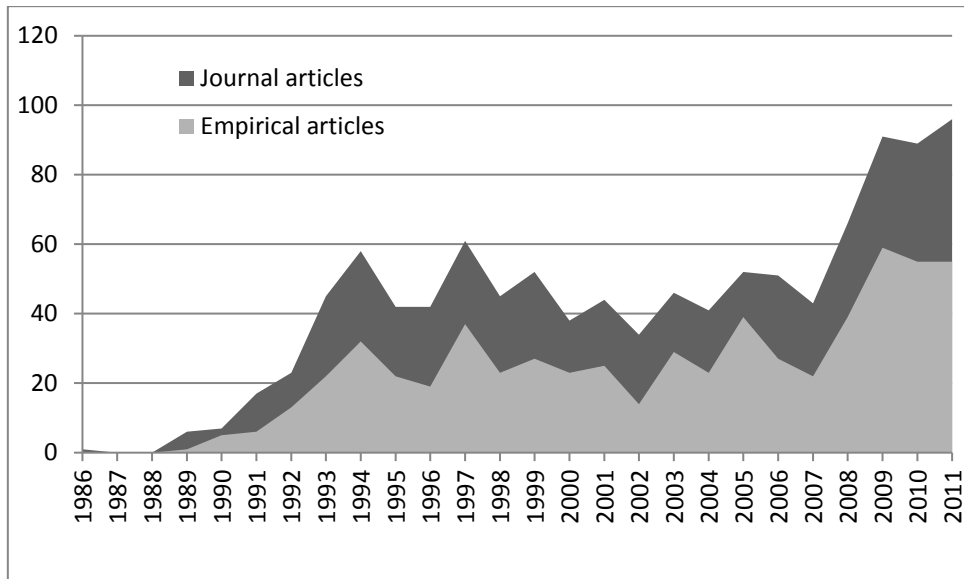
**Table 2. Analysis done in each perspective**

<b>Perspective</b>	<b>Analysis done</b>
<b>Meta-perspective</b>	Number of contributions per year (theoretical/empirical) Number of contributions per journal Number of contributions per country/region Date of first publication per country/region Publication language Most productive authors Number of co-authors
<b>Content-based perspective</b>	Main topic of the article
<b>Methodical perspective</b>	Methodologies used Sectors analysed

**Source: Own Elaboration**



**Figure 1. Evolution of published papers**



**Source: Own elaboration**

**Table 3. Frequency of distribution of the journals according to number of papers published**

<b>Papers published</b>	<b>Number of journals</b>
1	370
2	76
3	35
4	15
5 or more	29

Source: Own elaboration

**Table 4. Journal list and number of papers published.**

**(Only journals that have published five or more papers are included)**

<b>Journal</b>	<b>Number of papers</b>
Total Quality Management and Business Excellence (Formerly known as Total Quality Management (1990-2002))	93
International Journal of Technology Management	46
International Journal of Operations and Production Management	32
Hospital Material Management Quarterly	24
International Journal of Production Research	21
International Journal of Production Economics	16
Technovation	16
Production Planning and Control	15
International Journal of Health Care Quality Assurance Incorporating Leadership in Health Services	14
Quality Progress	12
Industrial Management and Data Systems	11
Computers and Industrial Engineering	9
Dyna	8
Stahl und Eisen	8
Journal of Business Ethics	7
Accreditation and Quality Assurance	6
Assembly Automation	6
Journal of Construction Engineering and Management	6
Journal of Engineering Manufacture	6
Process Safety Progress	6
Service Industries Journal	6
Clinical Laboratory Management Review	5
Interfaces	5
Journal of Cleaner Production	5
Journal of Management In Engineering	5
Journal of Mechanical Engineering	5
Quality and Reliability Engineering International	5
Quality Management in Health Care	5

**Source: Own elaboration**

**Table 5. Number of contributions and first publication date per region/country**

<b>Country</b>	<b>Num. Of papers</b>	<b>Year of first publication</b>	<b>Country</b>	<b>Num. Of papers</b>	<b>Year of first publication</b>
USA	422	1986	Hong Kong	4	1996
United Kingdom	174	1992	Portugal	4	2008
Spain	50	1994	South Africa	4	2008
Australia	37	1992	Argentina	3	2006
Germany	35	1994	Greece	3	1997
Canada	34	1991	Norway	3	2000
Netherlands	27	1994	Chile	2	2004
Taiwan	27	1997	Philippines	2	2004
France	24	1993	Hungary	2	2003
Italy	21	1993	New Zealand	2	2009
China	19	2001	Poland	2	2001
Sweden	18	1996	Venezuela	2	2002
India	16	1995	Algeria	1	2009
Japon	16	1995	Saudi Arabia	1	2010
Turkey	15	1997	Cameroon	1	2011
Brasil	13	1996	Costa Rica	1	1999
Switzerland	13	1993	Croatia	1	2007
Denmark	10	1992	Egypt	1	2011
Belgium	9	1998	United Arab Emirates	1	2011
Mexico	9	1997	Kuwait	1	2010
South Korea	7	2001	Lithuania	1	2010
Finland	7	1999	Pakistan	1	2004
Malysia	7	2003	Puerto Rico	1	2004
Romania	6	2009	Czech Republic	1	2011
Colombia	5	2008	Serbia	1	2010
Israel	5	1997	Singapore	1	2007
Austria	4	2002	Sri Lanka	1	2007
Slovakia	4	1995	Thailand	1	1997
Slovenia	4	2005	Ukraine	1	2009

**Source: Own Elaboration**

**Tabla 6. Publication Language**

<b>Language</b>	<b>Num. Of papers</b>
English	1.007
Spanish	33
German	22
French	11
Italian	6
Portuguese	3
Slovak	2
Hungarian	2
Czech	1
Russian	1
Swedish	1
Turkish	1

**Source: Own Elaboration**

**Tabla 7. Most prolific co-authors**

<b>Co-authors</b>	<b>Num. of papers</b>
Sloan, Terry	10
Boer, Harry	8
Bessant, John	7
Caffyn, Sarah	7
Dale, Barrie G.	7
Corso, Mariano	6
Kanji, Gopal K.	6
Antony, Jiju	5
Mortimer, John	5
Sohal, Amrik S.	5

**Source: Own Elaboration**

**Table 8. Number of authors per paper**

Number of authors	Number of papers
1	352
2	336
3	211
4	99
5	45
6	16
7	10
8	6
9	6
10	1
11	1
14	1

**Source: Own Elaboration**

**Table 9. Topics**

<b>Topics</b>	<b>Number of articles</b>
Implementation	550
Methodologies	279
Human Resources	146
Management philosophies	166
Culture	101
Control	96
Concept	78
Factors	59
Innovation	20

**Source: Own Elaboration**



**Table 10. Methodologies mentioned in the papers**

<b>Methodologies</b>	<b>Number of papers</b>	<b>Methodologies</b>	<b>Number of papers</b>
Standards/Frameworks	75	Value Stream Mapping	3
Six Sigma	25	Feedback	2
Information Technologies	24	Failure Mode and Effect Analysis	2
Benchmarking	23	CAD/CAM	2
Statistic Control	19	SMED	2
Material Requirements Planning	8	Seven Quality Tools	2
Just in Time (JIT)	8	No-compliances	2
Customer Managed Inventory	7	Integrated System	2
Taguchi methods	6	Customer Relationship Management	1
5S (Five S)	5	Process Map	2
Visual Management	5	Poka Yoke	1
Plan-Do-Check- Act Cycle	5	Production Leveling	1
Simulator	4	Pull System	1
Enterprise Resource Planning	4	Brainstorming	1
Kanban	4	Suggestion system	1
Quality Function Deployment	3	Automation	1

**Source: Own Elaboration**

**Table 11. Standards/Frameworks included**

<b>Standards/Frameworks</b>	
ISO 9000	27
EFQM Excellence Model	12
ISO 14000	6
Baldrige Criteria for Performance Excellence	4
Other	26

**Source: Own Elaboration**

**Table 12. Methodologies used in the empirical papers**

<b>Research methodology</b>	<b>Number of papers</b>
Case study	445
Survey	117
Experiment	23
Multimethod	17
Action Research	11
Delphi method	4
Total	617

**Source: Own Elaboration**

**Table 13. Sectors**

Sectors	Number of articles
Manufacture	239
Service	298
Mix	80
Total	617

**Source: Own Elaboration**