

## **Protocol: A Meta-Review on continuous improvement to know the state of this research field**

### ***Protocolo: Realización de una Meta-Revisión sobre mejora continua para conocer el estado del campo de investigación***

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#### ***Abstract***

*Continuous improvement is a concept that has been widely studied from multiple perspectives during the last decades. However, new studies on the topic appear because it seems that there are still questions to be resolved. Therefore, the key question is what future research lines should be developed. As such, the possibility of carrying out a systematic review of literature was raised. However, given the high number of systematic reviews published in recent years, the final objective of this paper is to perform a meta-review of the concept of continuous improvement. Therefore, this study presents the research protocol followed to perform a meta-review of the concept of continuous improvement; being the main objective of the meta-review to know the state of this field of study and to find out where future research should be oriented.*

**Keywords:** *Continuous improvement, kaizen, meta-review, literature review, protocol*

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#### ***Resumen***

*La mejora continua es un concepto que ha sido ampliamente estudiado desde múltiples perspectivas durante las últimas décadas. Sin embargo, siguen apareciendo estudios sobre el tema porque parece que aún hay preguntas por resolver. La cuestión es ¿qué líneas de investigación futura hay que desarrollar? Ante esta cuestión se planteó la posibilidad de realizar una revisión sistemática de literatura. No obstante, dado el elevado número de revisiones sistemáticas publicadas en los últimos años, el objetivo planteado fue realizar una meta-revisión del concepto de mejora continua. Por tanto, este estudio plantea el protocolo de investigación seguido para realizar una meta-revisión de literatura del concepto de la mejora continua; siendo el objetivo principal de la meta-revisión conocer el estado de este campo de estudio y averiguar hacia dónde debe orientarse la investigación futura..*

**Palabras clave (si el texto está escrito en castellano-opcional):** *Mejora continua, kaizen, meta-revisión, revisión literatura, protocolo*

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## Introduction

Continuous improvement, also known as Kaizen, has been widely studied along literature during the last decades. As a result, endless definitions can be found. In this research, authors will adopt the definition stated by Sabater and García (2011), which define continuous improvement as the planned, organised and systematic process of continued and incremental change. Additionally, it is important that these changes are extended along the company and adopted by all staff members (Hyland, Becker, Sloan, & Jorgensen, 2008; Jorgensen, Boer, & Gertsen, 2003). This same idea was expressed by Sanchez and Blanco (2014) who defined continuous improvement as the continuous process of improvement in the company done with the participation of all the staff.

Despite the fact that numerous research works about continuous improvement have been published, many papers are still developed nowadays. Therefore, after this long path, that begs the question of where the research on continuous improvement has to go, what research questions have already been solved and which are still to be answered.

In order to respond to this need, the initial approach was aimed at carrying out a systematic literature review on continuous improvement. However, the first searches on the topic showed that in the last years (2013-2018) numerous authors had carried out works of this type. Given this situation, and given that the initial objective seemed to be solved, this study is aimed at carrying out a metareview on continuous improvement. A metareview consists of doing a review of previous literature reviews. The final objective is to establish the status of this field of study at present and see what research questions have not been covered by previous reviews and what research niches emerge for new studies on continuous improvement. This kind of studies have been previously done in other areas of the management field (Cullen & Turnbull, 2005; Gattoufi, Oral, Kumar, & Reisman, 2004; Jiang & Messersmith, 2018; Leyer, Vogel, & Moormann, 2015; McArthur, Weaven, & Dant, n.d.; Mueller, Renzl, & Will, 2018; Perdana, Robb, & Rohde, 2014; Perren, 2003; Reisman, Kumar, & Montwani, 2014; Serenko & Bontis, n.d.; Wales, 2016).

Having this objective in mind the rest of this paper is structured as follows. First, a general review about the main topics of the previous existing literature reviews is included. Secondly, the main research questions the authors want to answer by doing the metareview are established. Thirdly, the potential contributions of derived from the metareview are described. Fourthly, in the methodology section, the main stages followed to do the metareview are listed and briefly described. Finally, the workplan is included.

## Previous reviews about continuous improvement

As far as authors are concerned, the amount and variety of literature reviews on continuous improvement is very broad. Along this section, a brief comment about their main topics is included.

First, there is a set of reviews that analyze continuous improvement in a global way. This is the case, for example, of the work of Carnerud, Jaca and Bäckström (2018), Álvarez-García, Durán-Sánchez and del Río-Rama (2018), Singh and Singh (2015), or Sanchez and Blanco (2014), among others. The objective of these works seems to be the analysis of the published works on the subject in order to clarify the term conceptually, analyze its evolution over time and/or propose future lines of research.

On the other hand, there is another group of articles focused on more specific aspects of continuous improvement. This is the case of the study of Gonzalez Aleu and Van Aken (2016) aimed at synthesizing and assessing the published literature about critical success factors for continuous improvement projects. In this same line is the work of McLean and Antony (2014) focused on presenting the core themes derived from literature that contribute to the failure of continuous improvement initiatives in the manufacturing industry. As another example of a specific revision, the work of Jurburg, Viles, Tanco and Mateo (2017) is focused on assessing the main elements that motivate employees' intention to participate in CI activities.

Among the found reviews, works focused on specific sectors are also common. For example, the work of Farrington, Antony and O'Gorman (2018) aims to present a systematic literature review of continuous improvement research in hospitality and tourism management literature. While the work of Gonzalez Aleu, Van Aken and Keathley-Herring (2017) analyzes the main research topics addressed in scholarly works on continuous improvement projects (Kaizen events, Six Sigma projects, Lean Six Sigma).

Reviews focused on certain tools associated with continuous improvement are also common. Paipa-Galeano and Agudelo-Otalora (2016) conducted a review in order to analyze how the Kaizen Events concept has evolved, its main characteristics, the state of the concept and, finally, the recognition of gaps for future studies and implementations. This is also the case of the study by Lim, Antony, Arshed and Albliwi (2017) who conducted a systematic review of the literature on statistical process control (SPC) implementation in the food industry. On the other hand, the paper of Randhawa and Ahuja (2017) aims to investigate the process of 5S implementation across all the levels of organizations and highlight the significant contributions of 5S to the organizations. In this same line would be the work of Tezel, Koskela and Rzortzopoulos (2016) whose objective is to holistically discuss, explore and synthesise the key literature on Visual Management.

Finally, it is important to highlight that, although the search terms are focused on continuous improvement, there are numerous reviews that include terms such as lean management and six sigma (Balzer, Francis, Krehbiel, & Shea, 2016; Chiarini, Baccarani, & Mascherpa, 2018; Cudney, Venuthurumilli, Materla, & Antony, 2018; de Freitas & Costa, 2017; Henrique & Godinho Filho, 2018; Ingvaldsen & Benders, 2016; Kovacevic, Jovicic, Djapan, & Zivanovic-Macuzic, 2016; Sreedharan & Raju, 2016; Vashishth, Chakraborty, & Antony, 2017). For this reason, it may be interesting to consider what is the most appropriate search strategy to identify research works that study continuous improvement in organizations.

## Research questions

The ultimate goal of this meta-review is to know what the state of the research field of continuous improvement is at present and, for this, the following research questions are posed:

- Which objectives and research questions do the reviews made in the period 2013-2018 respond to?
- Is the term of continuous improvement limited, or do the reviews identified include broader concepts? Are the conclusions of the reviews limited to the concept of continuous improvement or do they include more general concepts such as lean management?

- Based on the meta-review, what limitations do the identified revisions have? Is there a need to develop new literature reviews on a specific aspect related to continuous improvement? What lines of research should be considered for new research studies in order to cover the scientific gaps that current reviews have identified?
- From a methodological point of view, what are the main keywords that are used in systematic reviews on continuous improvement? What search strategies are used? What are the inclusion and exclusion criteria?

## Why is it important to carry out this meta-review?

Our meta-review aims to provide different contributions to academics who investigate the field of continuous improvement. In the first place, the fact of summarizing the research questions resolved by the reviews will be useful to identify if it is necessary to develop new reviews and, if so, on which topics or specific aspects of the continuous improvement field. Therefore, from a conceptual point of view, this meta-review will allow knowing if the term of continuous improvement is sufficiently limited or if, on the contrary, it is a broad concept in which other terms or organizational interventions are included and confused. Likewise, based on the future research lines proposed by the reviews already carried out, it will be possible to identify gaps in the literature that will have to be covered by field research in the future.

On the other hand, from a methodological point of view, knowing the search strategies used (keywords, inclusion and exclusion criteria) in the reviews would help to identify good practices to be included not only in future literature reviews but also in all the individual studies in order to harmonize the keywords, so that the studies are easily found. This would facilitate the fact of conducting literature reviews ensuring that key literature on the subject is being analyzed and reducing false positives in initial searches. In the same way, it would facilitate the work of the reviewers and editors who, as a first filter, could analyze the suitability of the review based on their search strategy.

## Methodology

The first step is the identification of the existing literature reviews on continuous improvement in the period 2013-2018. Throughout this section we describe the different phases that have been followed in the search (Marin-García, Betancour, & Giraldo-O'Meara, 2018; Medina-López, Alfalla-Luque, & Marin-Garcia, 2011; Medina Lopez, Marin Garcia, & Alfalla Luque, 2010).

The objective of this search is to identify literature reviews on continuous improvement that have been published in the last 5 years.

The inclusion criteria used were:

- Databases: Scopus and Clarivate-WoS
- Document type: all
- Publication language: English or Spanish
- Period: 2013-2018
- Topic: Continuous improvement reviews

Following these criteria, we have created the automatic search strategies shown in table 1.1 where the results in WoS and Scopus are collected.

Subsequently, the first author of this protocol reviewed the title and abstract of the results of the automatic search to eliminate those that meet the exclusion criteria:

- Papers that were not focus on continuous improvement
- They were not literature reviews

**Table 1.1. Search strategies**

Search 1 - WoS	TOPIC: ("continuous improvement" OR "kaizen") AND TOPIC: (review)  Refined by: LANGUAGES: ( ENGLISH OR SPANISH )  Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI Publication years=2013-2018	437
Search 2 - Scopus	( TITLE-ABS-KEY ( "continuous improvement" OR "kaizen" ) AND TITLE-ABS-KEY ( review ) ) AND PUBYEAR > 2012 AND ( LIMIT-TO ( LANGUAGE , "English" ) OR LIMIT-TO ( LANGUAGE , "Spanish" ) )	704

Source: Authors

Finally, 1,141 publications were identified using the inclusion criteria (437 in WoS and 704 in Scopus). Among the 1,141 references identified, there might be duplicates. However, it was decided to, first, review the title and abstract of all the references to identify the literature reviews and, once the reviews were pinpointed, the duplicates between them were eliminated. The process may have consumed a little more time, but by doing this, it was less likely that an important study was left out. Following this process, after applying the exclusion criteria, there were a total of 36 reviews in WoS and 46 reviews in Scopus, this is 82 reviews in total. After eliminating duplicated, the final sample included 54 reviews.

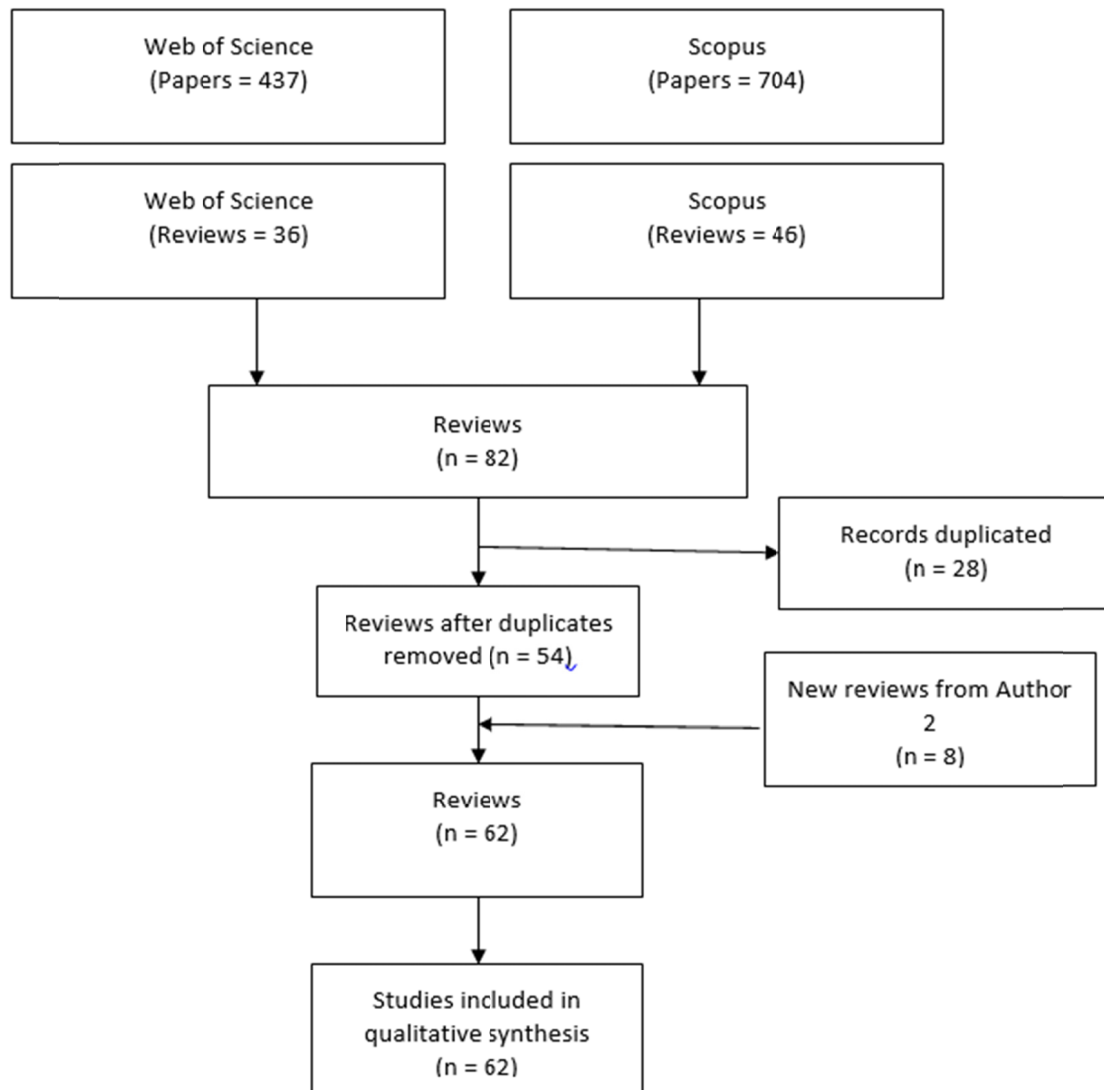
As a complement to the initial search, the second author contributed 8 additional references. In the following lines, the reasons why these 8 references had not been identified in the search are explained:

- Papers published in journals not included in any of the databases specified in the initial search
  - o Paipa-Galeano, L., & Agudelo-Otalora, M. (2016). Kaizen Events: Concepts, current status and perspectives. *Dyna*, 91(1), 11–14. Retrieved from [https://scholar.google.es/scholar?hl=es&as\\_sdt=0%2C5&q=Kaizen+events%3A+Concepts%2C+current+status+and+perspectives&btnG=](https://scholar.google.es/scholar?hl=es&as_sdt=0%2C5&q=Kaizen+events%3A+Concepts%2C+current+status+and+perspectives&btnG=)
- Papers that do not include the keywords “continuous improvement”, “kaizen” and/or “review”. On the contrary these papers include concepts such as “lean”, “trends” or “bibliometric”.

- Henrique, D. B., & Godinho Filho, M. (2018). A systematic literature review of empirical research in Lean and Six Sigma in healthcare. *Total Quality Management & Business Excellence*, 1–21. <https://doi.org/10.1080/14783363.2018.1429259>
  - Rafique, M. Z., Ab Rahman, M. N., Saibani, N., & Arsad, N. (2017). A systematic review of lean implementation approaches: a proposed technology combined lean implementation framework. *Total Quality Management & Business Excellence*, 1–36. <https://doi.org/10.1080/14783363.2017.1308818>
  - Vashishth, A., Chakraborty, A., & Antony, J. (2017). Lean Six Sigma in financial services industry: a systematic review and agenda for future research. *Total Quality Management & Business Excellence*, 1–19. <https://doi.org/10.1080/14783363.2017.1308820>
  - Carnerud, D., Jaca, C., & Bäckström, I. (2018). Kaizen and continuous improvement – trends and patterns over 30 years. *TQM Journal*. <https://doi.org/10.1108/TQM-03-2018-0037>
  - Álvarez-García, J., Durán-Sánchez, A., & del Río-Rama, M. de la C. (2018). Systematic bibliometric analysis on Kaizen in scientific journals. *The TQM Journal*, TQM-12-2017-0171. <https://doi.org/10.1108/TQM-12-2017-0171>
- Very recent papers that have not been included in the databases yet.
- Lizarelli, F. L., & Alliprandini, D. H. (2018). Comparative analysis of Lean and Six Sigma improvement projects: performance, changes, investment, time and complexity. *Total Quality Management & Business Excellence*, 1–22. <https://doi.org/10.1080/14783363.2018.1428087>
  - Prashar, A., & Antony, J. (2018). Towards continuous improvement (CI) in professional service delivery: a systematic literature review. *Total Quality Management & Business Excellence*, 1–29. <https://doi.org/10.1080/14783363.2018.1438842>

After including the 8 publications cited, the total number of revisions is 62. The full text of 59 of them was found, which are those that will be analyzed in the meta-review. Figure 1.1. shows the PRISMA diagram that represents the different phases that have been followed in the systematic literature review, the number of records identified in each phase, as well as those that have been included or excluded for the different reasons (PRISMA, 2015).

Figure 1.1. PRISMA DIAGRAM



Source: Authors based on PRISMA (2015)

Once the reviews have been identified, content analysis must be done. For this, the AtlasTi software will be used.

The three authors have agreed on the initial codes that will be used to extract the information from the documents. The selected codes respond to the objectives set for the meta-review. Table 1.2. include the established codes that will be used in the meta-review. In addition, some coding examples for each of the codes are shown in Appendix 1 after having carried out a pilot test of the codes with 5 of the randomly chosen revisions (Albliwi, Antony, & Arshed, 2014; Glover, Farris, & Van Aken, 2014; Paranitharan, Babu, Pandi, & Jeyathilagar, 2017; Singh & Singh, 2015; Tarwani & Chug, 2016). It should be noted that the last code used "FalsePositive" will be assigned to those studies that, after a thorough review, do not

meet the inclusion criteria or meet the exclusion criteria discussed above. Appendix 1 also shows some examples of these cases and their explanation.

**Table 1.2. Codes**

Objetive	Objective or Research Questions of the review
MainVariable	Concept or concepts which are analysed in the review. Normaly Continuous improvement, but sometimes other names are used or broader or narrower concepts are investigated.
MainVariableDef	Definition of the MainVariable assumed by the authors in the review
DataBase	Which database was used in the review?
SearchStrategy	Search strategy used in the review for identifying the papers
SearchStrat:Keywords	Keywords used in the review in order to identify the documents
InclusionCriteria	Other inclusión criteria, diferent from the keyword. For instance, the analysed period: start and finish year. They can be part of the automatic search strategy or not
ExclusionCriteria	Explicit exclusion criteria mentioned in the review papers
NumberReferences	Number of references included in the review after applying the inclusion and exclusion criteria
Contribution	Explicit contributions highlighted in the review
FutureLine	Explicit future research lines proposed in the review
Limitation:self	Explicit limitations manifested by authors of the review
Limitation:peer	Limitations identified by the authors of this protocol which were not highlighted in the review
FalsePositive	Papers that, after a deep analysis, should not be included in the meta-review by ultimately not fulfilling the inclusion and/or exclusion criteria. In Atlas.ti we use primary document families instead of codes to signal the papers in this category

Source: Authors

The coding process consists of two stages. In the first stage, the three authors will independently code 10 randomly selected reviews. After this, a pooling will be done to compare the degree of agreement reached. The objective of this first phase is twofold. On the one hand, check if the authors have identified the same "false positives", if there are any. On the other hand, test whether the codes set are clear, if there are problems in their use or interpretation, or if it is necessary to include additional codes.

In the second stage, which will be carried out by author 1, the remaining 51 reviews will be codified taking into account the agreements and modifications that have been established in phase 1.

Finally, the analysis of results and the conclusions will be made by the three authors. In particular, each author will independently analyze the text fragments that will have been selected in the final revisions (after having excluded false positives). After the independent analysis, a common work session will be held to draw the final conclusions of the study.



## Workplan

Table 1.3. summaries the workplan the authors want to follow in order to conduct the meta-review.

**Table 1.3. Workplan**

Initial literature search	July 2018
Filter results	July 2018
Pilot test: code 5 reviews randomly selected	July 2018
Phase 1: The three authors code 10 reviews	September- October 2018
Phase 2: Coding the remaining 51 reviews by autor 1	October-December 2018
Results analysis	December 2018
Writing final paper	December 2018
Submit paper to a journal	January 2019

Source: Authors

## Appendix 1

### *Code: OBJETIVE*

**P 3: Singh, Singh\_2015\_Continuous improvement philosophy - literature review and directions.pdf - 3:4 [Over the past decades; CI has ..] (4:533-4:827) (Super)**

Codes: [Objective]

No memos

Over the past decades CI has been studied from many perspectives. In this paper, objective is to present the history and the research conducted in this field. Through exhaustive review of literature, a brief description of existing research on CI has been provided in order to gain an understanding of how the use of CI has had an impact on organizations

**P 3: Singh, Singh\_2015\_Continuous improvement philosophy - literature review and directions.pdf - 3:5 [This paper presents a review o..] (4:1239-4:1434) (Super)**

Codes: [Objective]

No memos

This paper presents a review of the literature and attempts to identify the important and useful contributions in this field. The various concepts, case studies and surveys concerned to this field have been systematically reviewed.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:1 [The aim of this systematic lit..] (2:1163-2:1671) (Super)**

Codes: [Objective]

No memos

The aim of this systematic literature review is to summarize, analyze, plan and learn the following things:

- (1) Various Agile methodologies for better performance in software maintenance
- (2) Comparison of waterfall model and agile methodology lifecycle
- (3) The switch from waterfall model to agile methodologies
- (4) Various tools available for Agile methodologies
- (5) Summarize the strength and weaknesses of Agile Methodologies.

Furthermore, there is a provision of future directions for practitioners.

**P12: Albliwi, Antony, Arshed\_2014.pdf - 12:3 [This paper aims to critically ..] (1:2179-1:2505) (Super)**

Codes: [Objective]

No memos

This paper aims to critically review and compare and contrast a number of the existing maturity models in quality/operations management topics. This work is a critical step in the development of a conceptual Lean Six Sigma maturity model, adapted from the current maturity models for process management and process excellence.

**P12: Albliwi, Antony, Arshed\_2014.pdf - 12:4 [The Literature review will dis..] (2:240-2:509) (Super)**

Codes: [Objective]

No memos

The Literature review will discuss the strength and limitations of some existing models as well as highlighting the pros and cons of these models. The scope of the paper also includes comparing and contrasting various maturity models identified in the literature review.

*Code: MainVariable*

**P 3: Singh, Singh\_2015\_Continuous improvement philosophy - literature review and directions.pdf - 3:34 [Kaizen] (2:1873-2:1878) (Super)**

Codes: [MainVariable]

No memos

Kaizen

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:41 [Agile Methodologies] (1:459-1:477) (Super)**

Codes: [MainVariable]

No memos

Agile Methodologies

**P12: Albliwi, Antony, Arshed\_2014.pdf - 12:1 [maturity model] (1:1216-1:1228) (Super)**

Codes: [Variable]

No memos

maturity mode

.....  
*Code: MainVariableDef*

**P 3: Singh, Singh\_2015\_Continuous improvement philosophy - literature review and directions.pdf - 3:27 [Much of this can be done throu..] (3:2321-3:2517) (Super)**

Codes: [MainVariableDef]

No memos

Much of this can be done through the implementation of CI, which we define as a culture of sustained improvement aimed at eliminating waste in all organizational systems and processes, and involving all organizational participants.

**P12: Albliwi, Antony, Arshed\_2014.pdf - 12:2 [A maturity model is a tool to ..] (1:1350-1:1641) (Super)**

Codes: [MainVariableDef]

No memos

A maturity model is a tool to help organisations assess strengths and weaknesses of their business processes. It provides a roadmap for improvement, and evaluates the organisation by comparing the quality standards and best practices of maturity of the organisation to other organisations [1]

.....

**Code: DataBase**

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:7 [The primary source of the lite..] (3:313-3:537) (Super)**

Codes: [DataBase]

No memos

The primary source of the literature survey is Google scholars which extracted data from various databases including IEEE Xplore, Wiley online library, ICSR, Science digest, SpringerLink, World Scientific and Digital library.

.....

**Code: SearchStrategy**

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:4 [Agile AND (software OR develop..)] (2:3698-2:3924) (Super)**

Codes: [SearchStrategy]

No memos

Agile AND (software OR development OR tool OR testing) AND (XP OR scrum OR lean) AND software (Maintenance OR Maintainability OR Quality OR complexity) AND (quality factors OR reliability OR effects OR refactoring OR metrics).

.....

**Code: SearchStrat:Keywords**

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:5 [Agile software, agile developm..] (2:4114-2:4300) (Super)**

Codes: [SearchStrat:Keywords]

No memos

Agile software, agile development, agile tools, agile testing, XP agile case, agile in small medium companies, agile scrum, agile in software maintainability, extreme programming effects

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:6 [Software maintenance, software..] (2:4322-2:4479) (Super)**

Codes: [SearchStrat:Keywords]

No memos

Software maintenance, software quality, software complexity, software reliability, software maintenance maturity level, quality factors, refactoring, metrics

.....

**Code: InclusionCriteria**

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:8 [Empirical studies using the ag..] (3:1027-3:1073) (Super)**  
Codes: [InclusionCriteria]  
No memos

Empirical studies using the agile methodologies

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:9 [Empirical study comparing the ..] (3:1078-3:1141) (Super)**  
Codes: [InclusionCriteria]  
No memos

Empirical study comparing the waterfall and agile methodologies.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:10 [Empirical study combining agil..] (3:1145-3:1206) (Super)**  
Codes: [InclusionCriteria]  
No memos

Empirical study combining agile methodologies and Data mining.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:11 [Empirical study using extreme ..] (3:1210-3:1287) (Super)**  
Codes: [InclusionCriteria]  
No memos

Empirical study using extreme programming, scrum and test driven development.

.....

**Code: ExclusionCriteria**

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:12 [Studies without empirical resu..] (3:1310-3:1367) (Super)**  
Codes: [ExclusionCriteria]  
No memos

Studies without empirical results of agile methodologies.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:13 [Review studies.] (3:1370-3:1385) (Super)**  
Codes: [ExclusionCriteria]  
No memos

Review studies.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:14 [Web links] (3:1388-3:1397) (Super)**

Codes: [ExclusionCriteria]

No memos

Web links

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:15 [Studies without validation of ..] (3:1400-3:1435) (Super)**

Codes: [ExclusionCriteria]

No memos

Studies without validation of data.

.....

*Code: NumberReferences*

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:28 [These inclusion and exclusion ..] (3:1436-3:1529) (Super)**

Codes: [NumberReferences]

No memos

These inclusion and exclusion criterion helped in the identifying our 30 primary case studies.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:29 [Sixteen journals and twenty fo..] (9:81-9:170) (Super)**

Codes: [NumberReferences]

No memos

Sixteen journals and twenty four conference proceedings have been evaluated in this review

.....

*Code: Contribution*

**P 3: Singh, Singh\_2015\_Continuous improvement philosophy - literature review and directions.pdf - 3:26 [In this paper, we have traced ..] (38:1767-38:1976) (Super)**

Codes: [Contribution]

No memos

In this paper, we have traced the literature of CI from its early roots in manufacturing to the more sophisticated methodologies that can be used in any organization, and that comprise an extensive toolbox for continuous performance improvement.

**P 3: Singh, Singh\_2015\_Continuous improvement philosophy - literature review and directions.pdf - 3:29 [From the literature survey des..] (38:2299-38:2428) (Super)**

Codes: [Contribution]

No memos

From the literature survey described here, it can be seen that there is a general consensus that CI approach is a very effective manufacturing philosophy.

**P 3: Singh, Singh\_2015\_Continuous improvement philosophy - literature review and directions.pdf - 3:31 [The literature highlighted the..] (38:3084-38:3324) (Super)**

Codes: [Contribution]

No memos

The literature highlighted the contributions of various CI implementation initiatives for accruing strategic benefits for meeting the challenges posed by global competition. CI has emerged as a key competitive strategy for manufacturing organizations in the global marketplace.

**P 3: Singh, Singh\_2015\_Continuous improvement philosophy - literature review and directions.pdf - 3:32 [CI has become a new management..] (39:76-39:440) (Super)**

Codes: [Contribution]

No memos

CI has become a new management paradigm in all types of organizations. In recent years, many organizations have demonstrated that significant improvements in business can be achieved through CI. CI concepts and philosophy can be effectively employed to realize fundamental improvements of manufacturing performance in the organization, thereby leading the organizations successfully in the highly competitive environment.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:3 [This was an important step as ..] (2:3070-2:3145) (Super)**

Codes: [Contribution]

No memos

This was an important step as this is the first review paper in this field.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:42 [Our current survey study is th..] (10:90-10:1191) (Super)**

Codes: [Contribution]

No memos

Our current survey study is the review of 30 research studies. After observing the evidences from the research studies, it was observed that by introducing agile software development methodologies there has been a continuous improvement in the field of software development. Various methodologies have been used and practiced by practitioners. Agile uses product backlog, sprint backlog and carries work in iterations. The small products are released after every iteration to help the customers to add more requirements according with their needs. As maintenance is very tedious job and is the most expensive phase of the software lifecycle, this has always been a concern under the traditional waterfall approach and is something that's the introduction of agile methodology has addressed in terms of visibly reduced cost. This helps the organizations to minimize the cost and concentrate on the provision of greater productivity and

quality. Extreme programming is the most practiced and used methodology and provides productivity not only in small but also in medium as well as large organizations.

**P12: Albliwi, Antony, Arshed\_2014.pdf - 12:6 [Therefore, the majority of the..] (4:3403-4:3664) (Super)**

Codes: [Contribution]

No memos

Therefore, the majority of the available models were developed on the practical experience of the researchers. Hence the theoretical basis is missing in most of the models. We also observed that the validity and generalization of the models is limited in scope.

**P12: Albliwi, Antony, Arshed\_2014.pdf - 12:9 [This paper has critically revi..] (5:264-5:363) (Super)**

Codes: [Contribution]

No memos

This paper has critically reviewed the most common maturity models for Business Process excellence.

.....

**Code: FutureLine**

**P 3: Singh, Singh\_2015\_Continuous improvement philosophy - literature review and directions.pdf - 3:22 [There is considerable scope fo..] (37:758-37:1020) (Super)**

Codes: [FutureLine]

No memos

There is considerable scope for further research within the broad area of Kaizen strategies, particularly on system-wide benefits and customer-perspective benefits. This research would benefit from utilizing a number of research methodologies from modelling to quantitative and qualitative approaches.

**P 3: Singh, Singh\_2015\_Continuous improvement philosophy - literature review and directions.pdf - 3:23 [Consequently, there is a need ..] (37:1245-37:1396) (Super)**

Codes: [FutureLine]

No memos

Consequently, there is a need for further research within the field to identify the benefits attained by the small incremental activities and the factors affecting those benefits

**P 3: Singh, Singh\_2015\_Continuous improvement philosophy - literature review and directions.pdf - 3:24 [A further problem which emerge..] (37:2697-37:3085) (Super)**

Codes: [FutureLine]

No memos

A further problem which emerges from a study of the literature is that there is no general consensus among practitioners and researchers regarding a particular recommended route to Kaizen implementation. Research in this field has been mainly focused on defining the nature of CI, its tools, organizational issues



required to support CI initiatives, its applicability to various types of organizations, implementation issues, and critical success factors

**P 3: Singh, Singh\_2015\_Continuous improvement philosophy - literature review and directions.pdf - 3:25 [The literature extols the many..] (37:3087-37:3251) (Super)**

Codes: [FutureLine]

No memos

The literature extols the many virtues of CI, but researchers have found that a more critical analysis of CI is required as is a more rigorous theoretical basis for conducting research in the field.

**P 3: Singh, Singh\_2015\_Continuous improvement philosophy - literature review and directions.pdf - 3:28 [There are areas of potential r..] (37:1021-37:1244) (Super)**

Codes: [FutureLine]

No memos

There are areas of potential research in taking a system-wide perspective of the Kaizen activities. Kaizen activities are important aspect of any firm's overall CI programme and it is therefore vital to address the problems preventing successful implementation.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:32 [As per the analysis, author's ..] (10:1408-10:1671) (Super)**

Codes: [FutureLine]

No memos

As per the analysis, author's observed that improvement in the pair programming will help the programmer to make up for theory lack of training. Although this is an advantage but still it needs to be incorporated in a company so that it become part of its fabric.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:33 [n future we are planning to co..] (10:1675-10:1824) (Super)**

Codes: [FutureLine]

No memos

In future we are planning to compare the quality of a product that can be achieved through the use of waterfall alongside that of agile methodologies.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:34 [To the best of author's knowle..] (10:1827-10:2040) (Super)**

Codes: [FutureLine]

No memos

To the best of author's knowledge, analysis of detailed metrics should be done with the help of agile methodologies and this analysis could be extended to consider not only the number of defects but also severity.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:35 [There is a strong need for the..] (10:2043-10:2167) (Super)**

Codes: [FutureLine]

No memos

There is a strong need for the Private case studies to be replicated with the general cases so that results can be verified.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:36 [Authors are also planning to f..] (10:2170-10:2304) (Super)**

Codes: [FutureLine]

No memos

Authors are also planning to focus on the refinement of the extreme programming process model with the help of different case studies.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:37 [As far as the author's knowled..] (10:2307-10:2525) (Super)**

Codes: [FutureLine]

No memos

As far as the author's knowledge is concerned, Comparison of the number of hours required for maintaining the software by the developers using agile as well as some traditional lifecycle modeling has not yet conducted.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:38 [There is a strong need for cre..] (10:2528-10:2654) (Super)**

Codes: [FutureLine]

No memos

There is a strong need for creation of Automated tools for agile which can be prepared for future refinements in the projects.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:39 [The Authors observed that form..] (10:2657-10:2773) (Super)**

Codes: [FutureLine]

No memos

The Authors observed that formalized validation of the data is needed needs so that projects can be validated easily.

**P12: Albliwi, Antony, Arshed\_2014.pdf - 12:5 [The major criticism relates to..] (3:1803-3:2127) (Super)**

Codes: [FutureLine]

No memos

The major criticism relates to most of the models providing limited guidance on specific steps that should be taken in order to improve maturity levels [6]. There is also a requirement for criteria that will help

users determine the current stage of maturity and acknowledge the methodical progression to the next stage [7].

**P12: Albliwi, Antony, Arshed\_2014.pdf - 12:7 [Therefore, there is a research..] (4:3665-4:4021) (Super)**

Codes: [FutureLine]

No memos

Therefore, there is a research gap around developing a maturity model that is based on theory for subsequent testing in the real world. In fact, maturity models have always been criticised for lack of consideration for results/performance. That means it is possible to move to the next stage of maturity without any improvement in the business process [24].

**P12: Albliwi, Antony, Arshed\_2014.pdf - 12:8 [Future work will focus on deve..] (5:477-5:1130) (Super)**

Codes: [FutureLine]

No memos

Future work will focus on developing a maturity model for Lean Six Sigma. The development of this model will be an attempt to bridge the research gap which is the absence of a Lean Six Sigma maturity model. Without using a maturity model, organisations deploying Lean Six Sigma cannot assess their current maturity level. The model will be developed after an in-depth analysis of the available maturity models. The Lean Six Sigma Maturity Model (LSS-MM) will comprise a number of levels of maturity, behaviours/characteristics and scores. The model will be supported by a matrix aiming to assess the maturity of critical success factors in organisations.

.....

***Code: AuthorLimitation***

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:26 [The biggest difficulty faced d..] (5:926-5:1022) (Super)**

Codes: [AuthorLimitation]

No memos

The biggest difficulty faced during this analysis was the use of unknown and private data sets.

.....

***Code: EvaluatorLimitation***

**P 3: Singh, Singh\_2015\_Continuous improvement philosophy - literature review and directions.pdf - 3:33 [112] (39:2940-39:2942) (Super)**

Codes: [EvaluatorLimitation]

No memos

Comment:

The authors do not explain which papers they have reviewed or how they did it.

The review does not include:

- Inclusion criteria
- Explicit criteria
- Keywords
- Search strategy
- Databases or journals included in the analysis

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:30 [Sixteen journals and twenty fo..] (9:81-9:171) (Super)**

Codes: [EvaluatorLimitation]

Memos: [ME - 18/07/18]

Sixteen journals and twenty four conference proceedings have been evaluated in this review.

Memos:

**MEMO: ME - 18/07/18 (Super, 18/07/18 10:33:49)**

Type: Memo

In a section of the paper appear 40 registers, previously only 30 were mentioned.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:31 [These were published during th..] (9:173-9:222) (Super)**

Codes: [EvaluatorLimitation]

Memos: [ME - 18/07/18 [1]]

These were published during the years 2001 to 2015

Memos:

**MEMO: ME - 18/07/18 [1] (Super, 18/07/18 10:35:06)**

Type: Memo

The period was not included in the inclusion criteria.

**P 5: Tarwani, Chug\_2016\_Agile Methodologies in Software Maintenance A Systematic Review.pdf - 5:43 [] (1:1805-1:1805) (Super)**

Codes: [EvaluatorLimitation]

No memos

Comment:

The authors do not indicate the definition of “Agile Methodology” they assume in the paper. In fact, any definition of the concept is included.

**P12: Albliwi, Antony, Arshed\_2014.pdf - 12:12 [critical approach to the liter..] (1:3068-1:3110) (Super)**

Codes: [EvaluatorLimitation]

No memos

critical approach to the literature review

Comment:

Inclusion and exclusion criteria are not included.

.....

**Code: FalsePositive**

Among the five revisions reviewed in the pilot test, two of them were classified as false positives.

Initially, the work of Paranitharan et al. (2017) was included because in its abstract it indicated that it was based on several literature reviews, it was not clear if they were made in the work itself or if they were taken from other authors. In an attempt not to lose information, it was decided to include it until the deepest revision was made.

From the detailed review, it was discovered that the objective of this article was not to conduct a literature review as can be seen in the following comment:

**P 6: Paranitharan et al. 2017\_An empirical validation of integrated manufacturing business excellence model.pdf - 6:2 [research objectives were deriv..] (3:2391-3:2677) (Super)**

Codes: [FalsePositive] [Objective]

No memos

research objectives were derived.

- i) To identify and propose integration of the selected important constructs in the IMBES theoretical framework.
- ii) To ascertain the support of constructs on integration and in implementation of IMBES model.
- iii) To examine the proposed IMBES model by empirical validation using statistical analysis
- iv) To bring out the implications and unique contribution to theory and practice.

On the other hand, Glover et al.'s work (2014) indicated that their objective was to identify the critical success factors of Kaizen Event. However, when reviewed in depth, this identification was not based on a systematic review but on real experiences. Therefore, it was not a literature review.

**P10: GLOVER~2.PDF - 10:4 [Using data from a field study o..] (2:150-2:404) (Super)**

Codes: [FalsePositive]

No memos

Using data from a field study of 65 Kaizen events across eight manufacturing organizations, multiple regression was used to test hypothesized relationships and to identify the critical success factors, i.e., variables, that are the most significant predictors of work area attitude and commitment.

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