The Six Sigma Method: Measuring of Empirical Studies in ASJP, A Bibliometric Analysis

منهج Six Sigma: قياس الدراسات التطبيقية في الأرضية الجزائرية للمجلات العلمية، دراسة ببيليومترية

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Abstract:

The purpose of this study is to explore the Six Sigma phenomena in Algeria during the previous decade, by tracking the evolution of different scientific papers concerning Six Sigma, via collecting all the scientific documents produced during 2010-2021 in the Algerian Scientific Journals Platform named (ASJP) which contain the term " Six Sigma " in their titles, keywords, and abstracts.

The bibliometrics analysis approach was adopted; we have concluded that The number of articles does not exceed 31 (77.42%) cases since 2015, The business area accounts for the majority of publications (87.10 %), also 87,10% of papers produced in Arabic, whereas 54,84% of researches have been used the empirical method started only in 2014; however, 76.47% of empirical studies were accomplished in Algeria.

Keywords: Six Sigma; Bibliometric; ASJP; Empirical Studies; Algeria

JEL Classification Codes: C81, C55, L15, D83

ملخص:

هدف هذه الدراسة هو فحص منهج ستة سيجما في الجزائر خلال العقد الماضي، بتتبع تطور الأوراق العلمية المختلفة لـ Six Sigma، ومن خلال جمع المقالات العلمية التي تم إنتاجها خلال 2010–2021 في منصة المجلات العلمية الجزائرية المسماة (ASJP) والتي تحتوي على مصطلح "Six Sigma" في عناوينها وكلماتها المفتاحية وملخصاتها؛ لقد تم اعتماد طريقة التحليل البيبليومتري لقياس تطور النشر العلمي لستة سيجما؛ وكشفت الدراسة أن عدد المقالات لا يتجاوز 31 (77.42٪)حالة منذ عام 2015، يشكل مجال الأعمال غالبية المنشورات (87.10٪). كما أنتجت 87.10٪ من الأوراق باللغة العربية، في حين استخدم 54.84 ٪ من البحوث المنهج التجريبي وبدأت فقط في عام 2014 ؛ وتم إنجاز 76.47٪ من الدراسات التطبيقية في الجزائر.

كلمات مفتاحية: ستة سيجما؛ ببليومتري، أرضية جزائرية للمجلات العلمية، دراسات ميدانية، ~~جزائر~~

تصنيفات JEL : C81، C55، L15، D83

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INTRODUCTION:

The company's managerial staff is committed to the product quality approach by implementing a quality policy, determining orientations and objectives. This often involves new structuring to companies, which mainly affects the organization by creating a quality structure, a quality action plan, defining the goals to be achieved, means to use, and staff involvement. Every person is a quality actor and collaborator approach objectives.

To establish product quality within the company, it is necessary to adapt the traditional management activities (planning, organizing, directing and controlling) to guarantee the tools for developing the company performance and the new philosophy representing in quality management.

Among exceptional principles of quality are increasing customer orientation, satisfying customer requirements, and continuous improvement. Also, the approach system requires identifying the company processes related to realization, management, support, and interactions; This means putting the various techniques under control, analyzing their performance, making proposals for improvement, and implementing them to contribute in company objectives. The Six Sigma method aims to reduce the variability of processes to make them more reliable, stable, and predictable, ensuring the process reproducibility "perfectly" to achieve zero defects and customer satisfaction.

Customer dissatisfaction and efficiency losses are often linked to uncontrolled processes dispersion that conducts to poor quality. The six-sigma tools allow the company to provide solutions concerning control of variations to avoid customer dissatisfaction and make the enterprise efficient to get the best economic and financial results.

The Algerian context inspires that the application of the Six Sigma approach could be minimal on the ground. But, scientific research may have dealt with this approach by presenting, criticizing, and evaluating Algerian experiences, from this prospect, we will try to measure the knowledge and consciousness in the Algerian context about Six Sigma adoption as long as scientific research accompanies every phenomenon or method and contributes at its development.

In this context, we tackle the question below:

What is the statement of Scientific Studies produced by the researchers in Algerian Scientific Journal Platform concerning the Six Sigma approach?

To cover this issue, we are discussing the following questions:

- Six Sigma approach, what does it mean?
- What is the size of theoretical and empirical studies, and in which trends are the empirical studies?

Importance of the topic:

Undoubtedly, the issue represents a growing relevance to academics and research centres because of the operational weight of Quality procedures and Six Sigma method in organizations, but the significance triggers from this study on several levels, including:

- Measuring the academician's consciousness level regarding Six sigma.
- Clarifying the Six Sigma method.
- Coming up with a new statistic.

- Making the results of this investigation available to the public.

1- Background and theoretical framework

1-1 Definition of quality and Six Sigma

1-1-1 Quality

The ISO 9000 version 2000 standard defines quality as the set of intrinsic characteristics to satisfy requirements. (Loukil Faten, 2002, p. 03)

This definition is based on three terms (characteristics, satisfaction, requirements): the product or service must satisfy the consumer's requirements (user, customer) through the features carried with an acceptable price concerning the quality offered, besides this satisfaction must be better than the competition one to ensure customer loyalty.

The American National Standards Institute (ANSI) defines quality as a set of particular attributes and characteristics of service, much likely will meet specific needs. (FUMI, 2007, p. 109)

Philip Crosby defines quality as "compliance with some specifications established by management in response to customer requests".

Globally, the meaning of quality could be understood from the producer's perspective and the consumer's perspective. Therefore, quality management covers all the functions of the organisation to design and produce quality products and services which fulfil the needs of the customers and generate ultimate satisfaction.

1-1-2 Six Sigma

Six Sigma can be defined as a systematic approach for strategic process improvement that relies intensely on statistical tools and the scientific method to reduce customer-defined defect rates. (Brady E & Theodore T, 2006, p. 336)

"Six Sigma is a program combining the most effective statistical and non-statistical methods to do overall business" (Pearson, 2001, p. 37)

Also, defined as quality improvement essentially based on facts and data, in which the prevention of defects takes precedence over their detection.

This approach leads to customer satisfaction and operational results by reducing variation and waste, resulting in acquiring a competitive advantage (Volck, 2009).

Six Sigma is a structured method that uses technical and statistical tools to improve processes; These tools are based on project management principles to improve customer satisfaction and achieve company objectives.

The Six Sigma is based on a structured approach based on both customer voice, a study of the customer's real needs, and measurable, reliable data; One of the basic principles of Six Sigma is the reduction of variability. (Nicolas, 2010).

This well-established methodology aims to detect and remove flaws, errors, or failures in business processes or systems by concentrating on those process performance characteristics essential to consumers' satisfaction. (Albliwi, Jiju, & Sarina, 2015). Statisticians use the method to decrease variance in any process, cut down costs in manufacturing and services, save money on the bottom line, enhance customer happiness and reduce defects to 3.4 parts per million opportunities. (Albliwi, Jiju, & Sarina, 2015, p. 667).

"Six Sigma is an extremely disciplined process that assists us to focus on developing and delivering near-perfect products and services. The basic idea behind Six Sigma is to measure

how many defects we have in our process. It allows us systematically figure out how to eliminate them and dress as close to zero defects" (General Electric, 2020)

1-2- Background:

1-2-1 Six Sigma method and variation control

In 1980 Robert Galvin, CEO at Motorola, realised the importance of working systematically with variance reduction as the Japanese had done for an extended period. Collaborating with Bill Smith, Mikel Harry and Richard Schroeder, he made up an improvement program that was taken the name Six Sigma.

In 1988, Due to Six Sigma, Motorola reduced their costs and variation in many processes and was a hero of America's Malcolm Baldrige National Quality Award. They announced a profit from the program of 700 million $ for 1991 alone (DeLuzio, 2019). In the 2000 General Electric Annual Report, chief executive officer Welsh said: "My 40 years at GE have never seen anything like Six Sigma's intensity has brought to our organisation". The vast savings reported from Six Sigma in GE certainly interested many leaders. As a result, the interest in Six Sigma grown during 1990s.

The name Six Sigma refers to the capability of the process to deliver units within the set limits. The Greek letter σ or 'sigma', corresponding to 's', Standard deviation (SD) is a notation for variance.

This distance should be at least six times the standard deviation of the process output for a stable process. Nevertheless, the process mean is also permitted to fluctuate over time in a small but significant way.

On average, 3.4 defectives per million will occur if the output is normally distributed, assuming the process runs at most 1.5 off the goal value.

It is one of the recent continuous improvement approaches which are applied in the best-in-class companies. Seize-use Sigma's is expanding, and it's no longer limited to manufacturing, now It is being used in various business domains, including services, transactions, administration, research and development, sales, marketing and others.

1-2-2 The Six Sigma Foundations

We could sum up the Foundations as follow:

- To consider the performance from the customer's point of view;
- Understanding the process;
- Decisions Taking based on measurements and their analysis;
- Focusing on the essential variables;
- Use statistical analysis;
- Monitoring variations process;
- Practicing a standardised methodology;
- Selecting projects according to their financial impacts;
- Including Six Sigma in governance;
- Entrust the implementation to senior management. (Nicolas, 2010)

1-2-3 Control of variability in the manufacturing process

Several factors influence the product quality during production, including the production line, machines and tools used, raw materials and components, and the machine operator through his experience and respect for working methods. In addition, any manufacturing process can have variations; the number of defects produced by the line may vary from one day to the next. These variations could be due to other variations such as raw materials, equipment, and others.

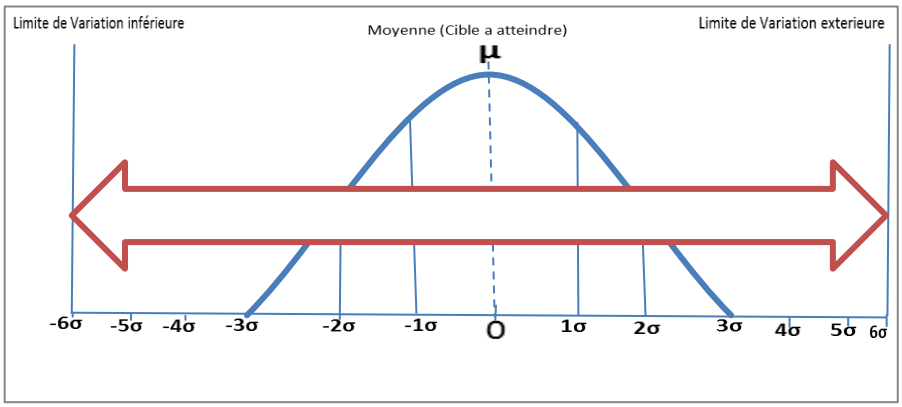
A manufacturing process with only accidental causes variation results in values located on either side of a centerline. Therefore, this process is considered to be in a state of statistical control if the manufacturing operation output does not vary randomly.

In this case, there would also be variations resulting from specific causes, which might be taken the form of a trend, with results changing continuously either upwards or downwards. This change could be generated from using a new raw material supply (supply function) or changing the adjustment of machines (Maintenance function).

The observation number increases continually for the process that should pursue a normal law, and the measuring instrument's accuracy grows indefinitely. The frequency polygon tends to turn into a continuous curve; this normal probability distribution has a mean μ which measures the central tendency, and a standard deviation σ which measures the dispersion. These values are theoretical values applicable to theoretical distribution. For the experimental distribution, its mean or standard deviation must be evaluated from the observations, the estimated mean denoted by X and the standard deviation calculated by σ. The normal probability distribution has the following qualities symmetrical to the mean μ; 68.3% of the population is between - σ and +σ;95.5% between -2σet +2σ; and 99.7% between -3σ and +3σ (see figure 01).

Technically, each segment is called a standard deviation, or standard deviation from the mean. The symbol for the standard deviation is the Greek letter Sigma wrote in lower case. Simply put, the technical concept of Six Sigma measures current performance and determines how many Sigma can be counted from the average before dissatisfying customers. If we consider customer dissatisfaction as a defect, Six Sigma means that there will be, for every million opportunities, only 3.4 defects, which depicts the closest perfection (George, 2006).

Fig (1): Normal distribution of probability and Six Sigma



Source : http://www.leanmachinequare.com/category/sixsigma

(Pourquoi la rentabilité est si faible en France? La lecture industrielle)

The method secret is to ensure that all elements resulting from the process under study are

within an extent less than 6σ from the overall average of the features coming out of this process. (Justine, 2014)

By reducing the variability of the product in the process, the risk of having rejected product by the customer for not meeting specific expectations will be enormously cut down.

As a result, Customer satisfaction brings an increase in profitability to the company with the following cumulative effects:

- Reduction of scrap, alterations, and globally non-quality costs;
- Improvement of machine availability and return rate;
- Achievement of a significant market share.

2- Literature review and previous studies

Study of (Niñerola et al., 2019) entitled "***Six Sigma literature: a bibliometric analysis"***, it has reported that a corporate management method known as Six Sigma is utilized in a wide range of sectors to enhance quality. It is the goal of the study to undertake a bibliometric and relational investigation on Six Sigma research indexed in two well-known databases, Scopus and the Web of Science, respectively. Between 1990 and 2017, researchers examined 798 publications from 392 scholarly journals for their findings. Methodology, authorship (type and country of association), research field, and keywords all played a role in the categorization process (co-occurrence and trend). The results demonstrate that business and management, followed by engineering and medicine, dominate the literature on Six Sigma. In terms of publications, citations, and co-authorships, the United States dominates this field. Although surveys in the field of business and management are on the rise, case studies and conceptual papers remain the most widely employed approaches. For example, based on the articles' keywords, Lean Six Sigma appears to have overtaken established terminology such as Total Quality Management or Continuous Improvement in recent years. Further survey studies are required to develop the area, as it has been theoretically thoroughly investigated.

In the same way, the study of (Efimova et al., 2021) entiled "***A bibliometric analysis of the evolution of Six Sigma in the context of Industry 4.0",*** the researchers have reached, with the complexity of today's world, with its ever-increasing rate of change and technological advancement, makes it difficult for businesses to keep up. This resulted in a shift in numerous techniques. As new technologies emerge, practitioners and academics are looking for methods to improve existing processes. Six Sigma is one of the approaches that has always been associated with the technology required for data collecting and analysis. Technology advancements might either help or hinder Six Sigma. Industry 4.0 technologies and the Six Sigma techniques have been studied in this report to see how the research output has changed over time. Based on a bibliometric study, this work is presented. Six Sigma technique and Industry 4.0 technology have been shown to have positive potential, although not all of the technologies have been examined in the process of study.

But the studies about lean six sigma using the same tools, took the major part of recent studies such (da Silva et al., 2018; De Oliveira et al., 2019; Prakash et al., 2021; Puram & Gurumurthy, 2021).

Critical and research gap

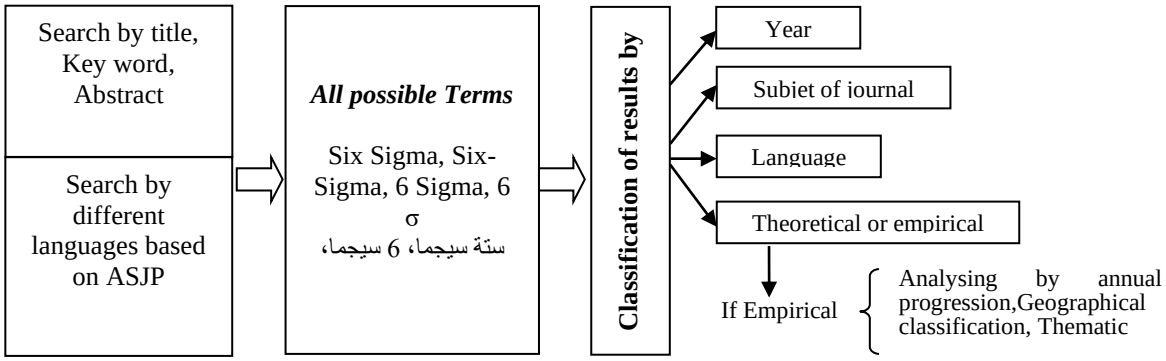
The studies above cited focus on measuring the evolution of scientific publishing regarding Six Sigma using a bibliometrics analysis in international databases like Scopus and WOS where the study space is significant. However, the bibliometric measuring of six Sigma in local Databases (ASJP) deserves appreciation and studying; simultaneously, the literature most relevant to the bibliometrics analysis about any phenomena in ASJP remains limited number that left us a spatial and empirical gap to fulfill.

3- Methodology:

This study evaluates the progression of Six Sigma research, which defines the height in publishing, contribution and impact of Six Sigma research by the Algerian researchers at Algerian Scientific Journals Platform named (ASJP). A bibliometric analysis was used for responding to the search problem by collecting all the scientific documents produced during 2010-2021 in ASJP, extracted in January 2022. We gathered a list of all publications with the term "Six Sigma" in their titles, keywords, and abstracts (Appendix 1). The study employed bibliometrics analysis as one of the most powerful techniques for identifying all trends; the authors have applied the following criteria.

- Growth of Six Sigma publications by year.
- Areas or subject covered.
- Language of a document published on Six Sigma.
- The approach used, either Theoretical or empirical.

Fig (2): Methodology framework of Bibliometric process about Six sigma in ASJP



Source: Elaborated by the researchers

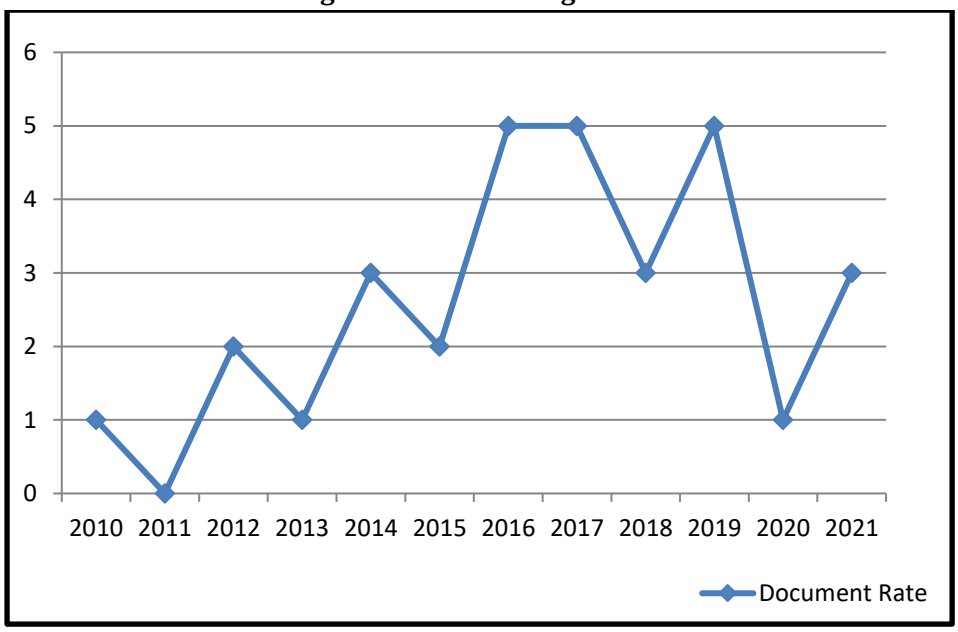
4- Results and discussion

The Algerian Scientific Journals Platform has 721 journals in 29 fields, allowing to researchers present their papers in 07 Languages; at the moment, ASJP contains 170 599 articles. Despite this massive amount of research, we have met only 31 papers on Six Sigma, after searching by all possible terms with available languages. Using the bibliometric method, we have reached the following results:

4-1 Analysis by year

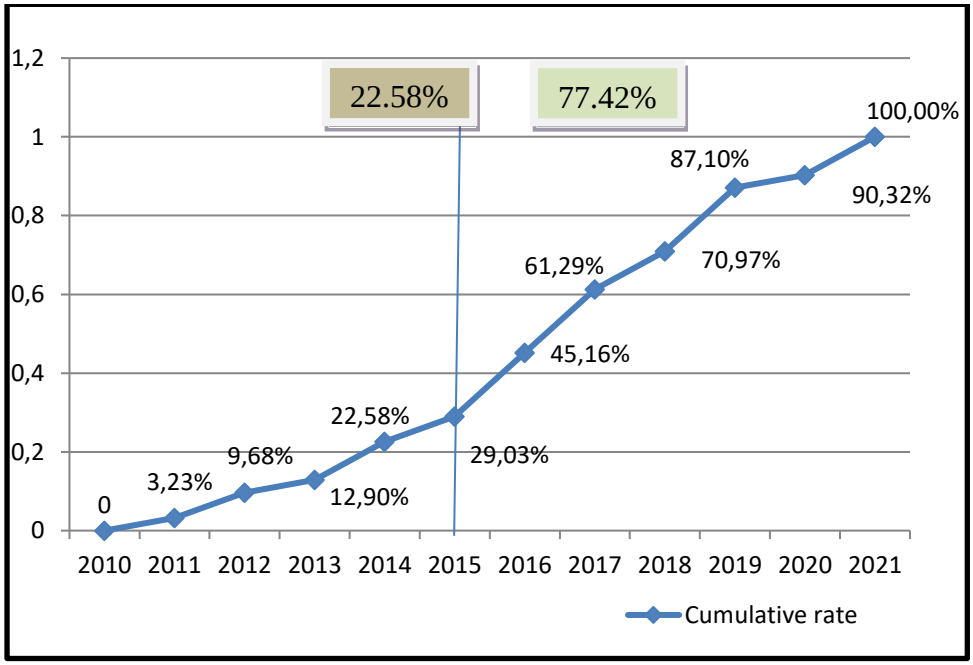
The production of most publications is growing since the beginning of the 2010, this is why we select this period to analyze.

Fig (3): Yearly Evolution of publishing about Six Sigma in ASJP during 2010-2021



Source: Elaborated by the researchers

Fig (4): The cumulative annual rate of the publishing about Six Sigma in ASJP during 2010-2021

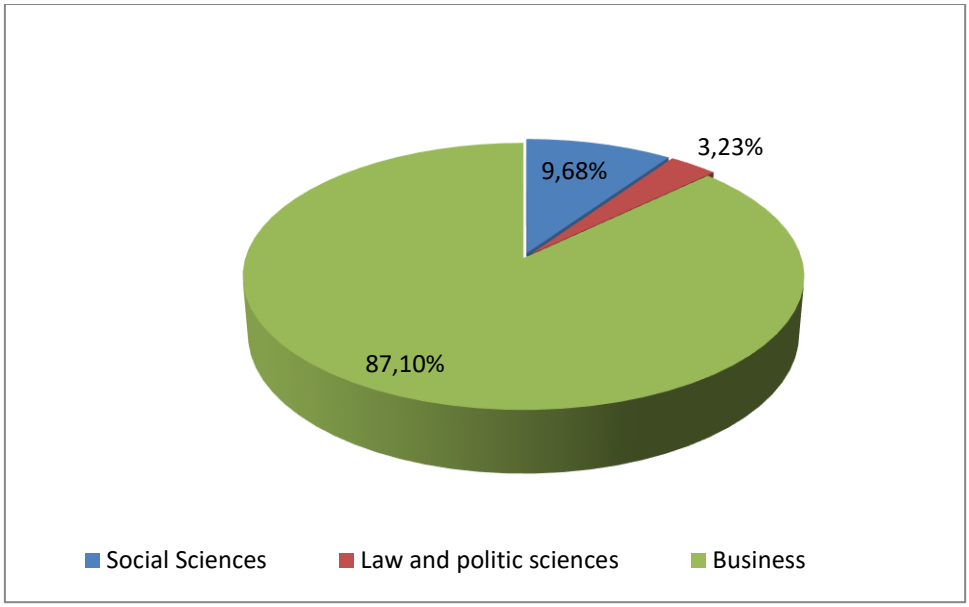


Source: Elaborated by the researchers

According to the Figure in above, annual publications have increased by 77.42% in the last Seven years (since 2015).

4-2 Analysis by Subject area

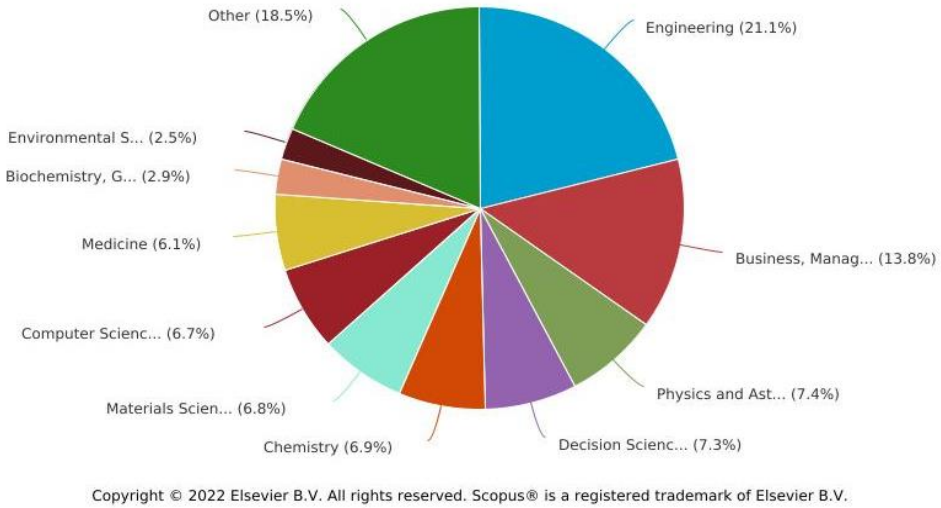
Fig (5): Classification of publishing about Six Sigma by subject area during 2010-2021



Source: Elaborated by the researchers

The journals published in ASJP on Six Sigma are from three different areas. The business area accounts for the majority of publications (87.10 %), while social sciences accounting (for 9.68. %) and Law accounting for (3.23 %). Although, Six Sigma is a multidisciplinary domain that touches a wide range of topics, for instance, when we have compared with Scopus in the same period, eleven areas have been covered as given in Fig 6.

Fig (6): Document by subject area in Scopus

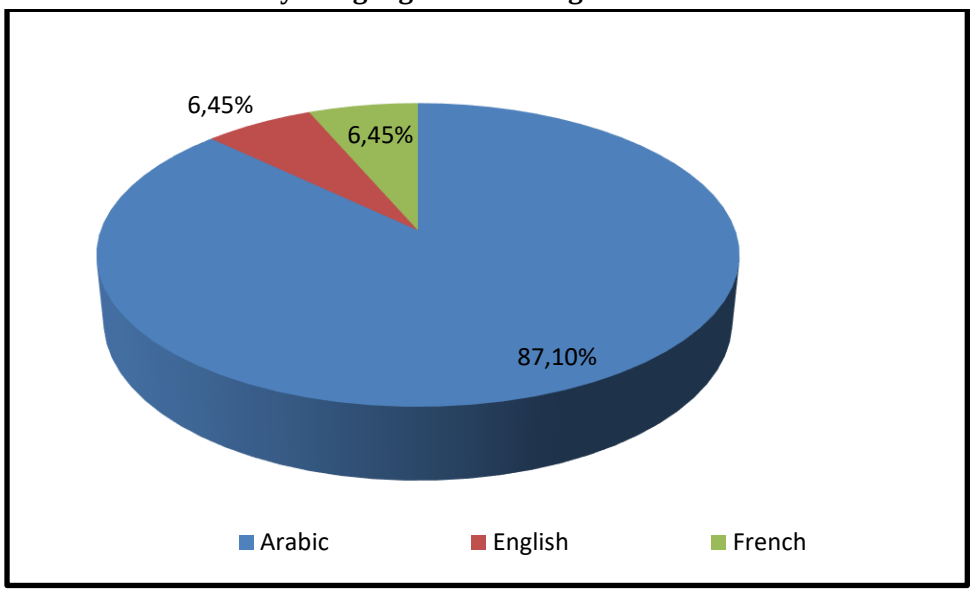


Source: Scopus into SNDL

4-3 Analysis by Language used

Fig (7): Classification of publishing about Six Sigma

by Language used during 2010-2021



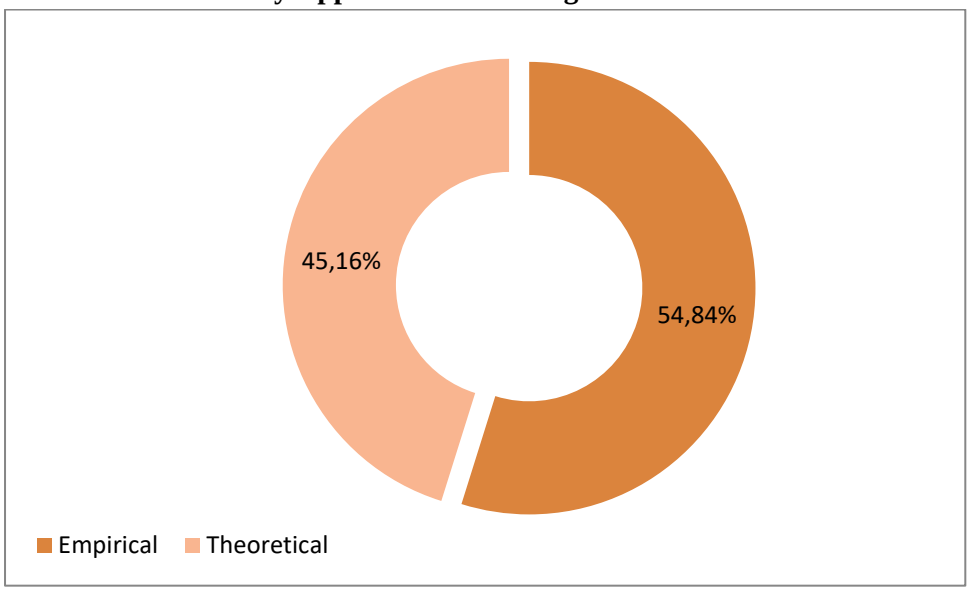
. **Source:** Elaborated by the researchers

Fig 7. This shows that 87,10% of papers produced in the native language of the Algerians, the articles with the other language does not give any favourite for the authors.

4-4 Analysis by approach used (Theoretical / Empirical)

As every scientific study can be regaled with several approaches, theoretical or empirical, on the ASJP level, 54,84% of researchers used the empirical approach, while the theoretical approach was 45.16%. Fig (8).

Fig (8): Classification of publishing about Six Sigma by Approach used during 2010-2021

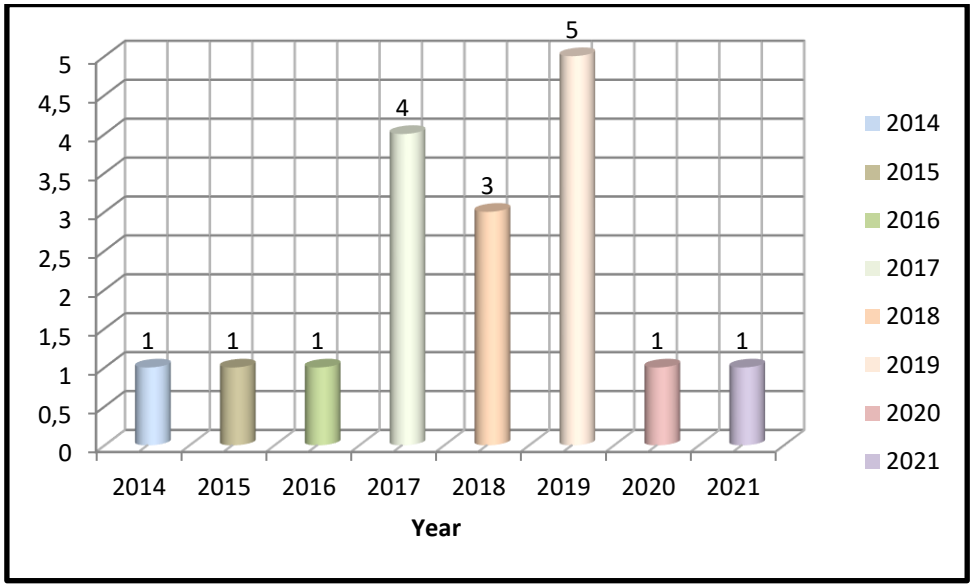


Source: Elaborated by the researchers

4-4-1 Annual progression of empirical studies:

Despite the publishing in ASJP on Six Sigma have been started since 2010, the researchers were initially limited to the theoretical approach, as it was explored, however Empirical studies started only in 2014; researches increased between 2017 and 2019 but later on decreased due to Covid 19 and home confinement in 2020 and 2021.

Fig (9): Yearly progression of empirical studies about Six Sigma in ASJP

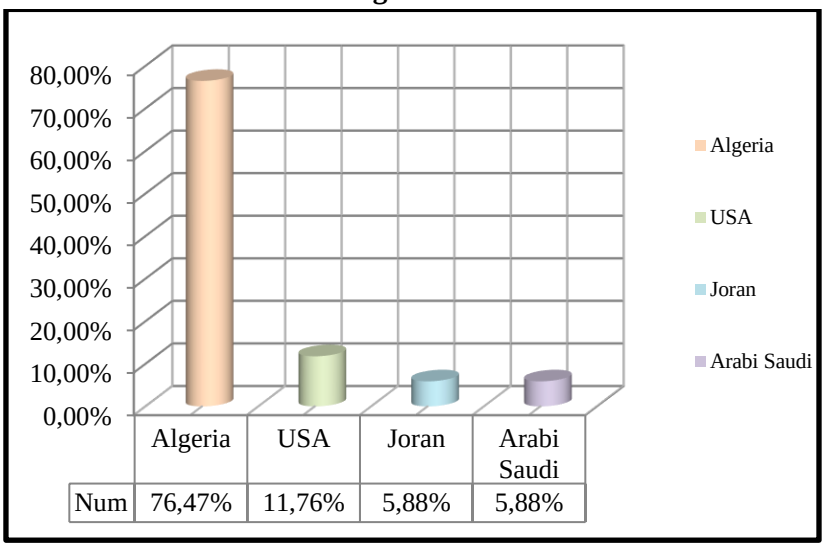


Source: Elaborated by the researchers

4-4-2 Analyze by Country of empirical study

The researchers have conducted their empirical contributions into four countries, the majority of empirical studies have accomplished in Algeria.

Figure (5) Geographical classification of publishing about Six Sigma during 2010-2021



Source: Elaborated by the researchers

4-4-3 Analyze by method used in empirical studies

We did not find any study that attempts to present or evaluate Six Sigma in a company that has already applied it before. Still, most of the studies are an attempt by researchers to measure the applicability of Six Sigma to these companies, they used statistical tools such as mean and standard deviation, confirmatory or exploratory factor analysis, the majority of studies collected their data by the survey tool in different sectors.

Table (1): The sectors hosting empirical studies

Sector	Number
Industrial	6
Services	5
Education	3
Public Sector	2
Macro theme	1
Sum	17

Source: Elaborated by the researchers

5- Conclusion

It is noted from these studies that we monitored on the ASJP (Algerian scientific journal platform) related to studying the Six Sigma topic in various sectors since the platform function that researches on the one hand:

- Representing a small group and its number does not exceed 31 cases; Annual publications have increased by 77.42% in the last Seven years (since 2015).
- Their citation in other studies is almost no-exist
- On the other hand, the studies included in the platform focus their attentions exclusively on specific fields; they covered mainly, Business, Social Sciences and law, The business area accounts for the majority of publications (87.10 %).
- 87,10% of papers produced in Arabic (the native language of the Algerians)
- 54,84% of researchers used the empirical approach. Empirical studies begun only in 2014 and increased between 2017 and 2019, however, 76.47% of empirical studies have carried out in Algeria.

Recommendations

Here are some of our main recommendations

- the legal and management aspect of journals should be revised, which among impose three authors at most for every study, this state hinders the research spread.
- Specialization of journals and their diversity will be necessary, in a way that allows and highlights the use of Six Sigma in different areas ،for example ،hospital, computer science, quality and so forth.
- The Algerian economy is small and underdeveloped thus enhancing and benefiting from empirical researches is highly required.
- mobilizing Supporting incentives and possibilities (promotions, rewards, research centres,…) dedicated to researchers for boosting research in general.

Prospects of the study(the authors are still studying the following)

- Measurement of Six Sigma with bibliometrics in other databases.
- Measurement of Six Sigma in ASJP using different method.
- Assessment of other phenomena (TQM, Lean Six Sigma) using the same tool in ASJP.

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(Appendix 1)

	Title	Journal	Year	Vol	N	area	Lang	Author1
1	تطبيقات سيجما ستة في عينة من المنظمات بولاية تبسة	المجلة الجزائرية للتنمية الإقتصادية	2021	8	2	Business	Arabic	ربوح عدلان
2	نموذج مقترح لتحسين عملية التحصيل الضريبي بتطبيق منهجية ستة سيجما)حالة في الإدارة الضريبية بولاية الأغواط	مجلة الاستراتيجية والتنمية	2020	10	5	Business	Arabic	محمد لمين حساب
3	تحديد أداء الاستثمار الأجنبي المباشر في الجزائر للفترة 2001-2017، دراسة تحليلية بتطبيق أسلوب ستة سيغما	مجلة العلوم الانسانية لجامعة أم البواقي	2019	6	2	Social Sciences	Arabic	تلبلاني فاطمة الزهراء
4	جودة التفاعل اللفظي الصفي لدى أساتذة التعليم الابتدائي باستخدام طريقة ستة سيجما دراسة ميدانية	مجلة العلوم النفسية والتربوية	2019	5	3	Business	Arabic	سلطان علاوة
5	Assessing the modernization of the civil situation in light of the Six Sigma strategy	مجلة الدراسات القانونية والاقتصادية	2019	2	1	Business	English	Somia NASRI
6	الجيود الست: تقنية حديثة للتقييم الفعال للأداء البشري حالة: مؤسسة الاتصالات وكالة مستغانم	مجلة معارف	2018	13	1	Social Sciences	Arabic	سبرينة مانع
7	محـــــــاولة تطبيق Sigma Six في تقيـــــيم جودة الخدمـــات البنـــــكية، دراســـة ميـــدانية لبنوك الجزائـــرية	مجلة الإستراتيجية والتنمية	2018	8	1	Business	Arabic	بوجنان خالدية
8	تطبيق معايير ستة سيجما في تحسين جودة التعليم العالي حالة كلية العلوم الاقتصادية والتجارية و ع التسيير بجامعة سكيكدة	مجلة العلوم الإنسانية	2017	28	1	Business	Arabic	بوغليطة الهام
9	ستة سيجما و دورها في تحسين أداء المؤسسة دراسة حالة ملبنة سيقاية	المجلة المغاربية للإقتصاد و المانجمت	2017	4	2	Business	Arabic	بياض مصطفى
10	ستة سيجما ودورها في تحسين جودة الخدمات الصحية دراسة حالة مؤسسة الصحة الجوارية بتندوف	مجلة البديل الاقتصادي	2017	4	2	Business	Arabic	مصطفى بياض
11	تحسين جودة الخدمات الصحية باستخدام منهجية الستة سيجما في المؤسسات الاستشفائية	مجلة التنمية والاقتصاد التطبيقي	2017	1	1	Business	Arabic	قشي حبيبة
12	تقييم جودة التكوين في الدكتوراه على ضوء منهجية سيجما ستة رصد النقائص لتفعيل سبل التحسين	حوليات جامعة الجزائر	2016	30	2	Law and politic sciences	Arabic	دبي علي
13	L'amélioration du processus de fabrication d'une entreprise par le niveau Sigma : cas de l'entreprise BAG (Batna)	مجلة الباحث	2014	14	14	Business	French	Athmane MECHENENE
14	أهمية استخدام منهجية ستة سيجما Six Sigma في تحسين جودة الاداء بالجمعيات الخيرية السعودية	مجلة الاقتصاد الجديد	2019	10	1	Business	Arabic	محمد جعفر
15	التكامل الكلفوي ما بين أسلوب التكلفة المستهدفة و6 سيجما للوصول لمراحل الجودة الشاملة للشركات الصناعية الاردنية المطبقة لها	دراسات في الاقتصاد والتجارة والمالية	2015	4	1	Business	Arabic	أسامة عبد المنعم
16	إدارة المعرفة كأحد ركائز استراتيجية Sigma 6 – نموذج شركة Raytheon -	دراسات اقتصادية	2019	13	2	Business	Arabic	جمعة خيرالدين
17	ستة سغما Six Sigma مدخل متميز بين الجودة والتكلفة في منظمات الأعمال عرض تجربة موتورولا	مجلة المقار للدراسات الاقتصادية	2018	2	1	Business	Arabic	زيـــاني توفيق
18	تفعيل منهجية ستة سيغما في قطاع التعليم العالي	مجلة دفاتر اقتصادية	2021	12	2	Business	Arabic	بن يحي سعاد
19	متطلبات تطبيق منهجية ستة سيجما كآلية لتحسين جودة التعليم العالي في الجزائر	مجلة الاقتصاد الحديث والتنمية المستدامة	2021	4	1	Business	Arabic	وراد حسين
20	نحو تحسين جودة العمليات بمؤسسات التعليم العالي في ظل منهجية ستة سيقما	دراسات العدد الاقتصادي	2017	8	2	Business	Arabic	محمد لمين حساب
21	فلسفة سيكس سيجما للتميز في عالم الأعمال - نظرة عامة –	مجلة معارف	2016	11	20	Business	Arabic	جلال امحمد
22	تطبيق إدارة المعرفة في مؤسسات التعليم العالي من خلال منهجية ستة سيجما	دراسات العدد الاقتصادي	2016	7	3	Business	Arabic	عبد القادر بن برطال
23	Professional bureaucracy A support for the implementation of the lean six sigma method in higher education	دراسات العدد الاقتصادي	2016	7	3	Business	English	Ahmida FERHAT
24	La méthode six sigma outil de Management par la Qualité Totale pour améliorer la production des entreprises	مجلة الحقوق والعلوم الإنسانية العدد الاقتصادي	2016	10	3	Business	French	Mohamed Laid Khatim
25	استخدام منهج Six Sigma في تحسين جودة مؤسسات التعليم العالي	المجلة الجزائرية للاقتصاد والمالية	2015	3	3	Business	Arabic	حياة طهراوي
26	استخدام ستة سيغما 6 sigma في مؤسسات التعليم العالي والرقي بالجودة إلى أعلى مستوى ممكن	مجلة الدراسات الاقتصادية والمالية	2014	7	1	Business	Arabic	مسعودة شريفي
27	طريقة Six sigmaكأداة لتحسين إدارة الجودة الشاملة (TQM)	مجلة أداء المؤسسات الجزائرية	2014	3	1	Business	Arabic	أحمد بن عيشاوي
28	معوقات تطبيق نظام Lean Six Sigma في المؤسسة الصناعية الجزائرية	المجلة الجزائرية للاقتصاد و الإدارة	2013	4	1	Business	Arabic	ويراد زواوي
29	ستة سيغما: مقاربة حديثة للتغيير و التحسين المستمر في منظمات الاعمال	مجلة العلوم الإنسانية	2012	12	4	Social Sciences	Arabic	الشريف بوفاس
30	مقاربة لإدماج مضامين إعادة الهندسة وستة سيجما في مؤسسة التعليم العالي: حالة الجزائر	مجلة العلوم الاقتصادية والتسيير والعلوم التجارية	2012	5	8	Business	Arabic	نجوى حرنان
31	للسيطرة على جودة العملية الإنتاجية دراسة نظرية و تطبيقية Sigma6 تطبيق نظام	les cahiers du mecas	2010	6	1	Business	Arabic	داني الكبير نصيرة