



Science Based Targets and the factors contributing to the sustainable development of an organisation from a Literature review to a conceptual model

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Abstract

Sustainable development is a subject of intense discussion, mainly due to climate change, pollution, and increased waste, among other factors. The governments of various countries worldwide have been setting environmental targets for emissions and consumption to combat climate change and improve the state of our planet. Therefore, it is necessary to have an environmental policy with stakeholder engagement. The literature review method, bibliometric analysis, and visual mappings were applied to understand how these sustainable targets are formulated and used by companies to comply with the limits proposed by governments. The Web of Science platform allowed data collection about Lean and Green, Key Performance Indicators (KPI), and Science-Based Targets (SBT). The carried analyses identified the most relevant papers using the PRISMA method, including their authors, their temporal distribution, and a correlation map using the VOSviewer tool. Hence, mapping the current state of the art concerning the SBT topic. Furthermore, a novel conceptual model is proposed to integrate lean and green and create new KPI applied to the definition of SBT to give companies a path and tools to achieve the climate targets efficiently. Future research should focus on the implementation of the conceptual model in several companies to understand its impact to correct and improve the conceptual model proposed.

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1. Introduction

In recent years the pressure to become more sustainable began to rise, mainly due to various environmental problems and the need to fight against the current climate crises. Governments of various countries around the world have been setting environmental targets and policies, to control the emissions and waste produced by companies in order to create a path for a sustainable future.

For this reason, the concept of Science Based Targets began to emerge. The Science Based Targets initiative (SBTi) is a collaboration between the Carbon Disclosure Project (CDP), the United Nations Global Compact (UNGC), the World Resources Institute (WRI) and the World Wide Fund for Nature (WWF), with the objective of giving companies and financial institutions a path of how quickly they need to reduce their

greenhouse gas (GHG) emissions to prevent the worst effects of climate change (Bjorn et al., 2021).

However, the initiative is often questioned in the literature as there are few studies proving the effectiveness of SBTs in helping companies achieve their goals, stating that it needs improvement before being implemented on an even larger scale (Bjorn, et al., 2022; Giesekam et al., 2021).

The reduction of emissions is a central need in order to achieve sustainable development, however, just setting targets will not help companies to achieve this reality, it will be necessary a set of indicators that help measure the progress of the desired objective, and it is also necessary a set of tools to help companies to achieve these goals.

The aim of this article is to analyze the existing literature in order to understand which methodologies organizations use to define goals, which indicators are used to measure these goals,



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and finally, which tools are used to achieve this goal. Through this information, a conceptual model that integrates these three aspects will be proposed in order to provide a clear path for companies to achieve their sustainable objectives.

2. Literature review

A literature review was made regarding the three central aspects of research:

- What tools organizations use to achieve sustainability?
- What are the indicators used to evaluate the progress of the organization?
- What is the methodology used to determine their sustainable objectives?

2.1. Lean and Green

An analysis of the literature allowed to conclude that the most widely used set of tools to enable companies to achieve better results is the lean methodology.

Lean, initially called Toyota Production System (TPS), was developed by Toyota to reduce and, if possible, eliminate activities that did not add value to the creation of a product to generate more value for the company and customers (Bhattacharya et al., 2019; Caldera et al., 2017; Dieste et al., 2019; Francis and Thomas, 2020; Varela et al., 2019).

Although there are cases where lean can be adapted to achieve "greener" objectives, many researchers suggest that lean practices have not yet reached this level of maturity (Abualfaraa et al., 2020). To solve this problem, it is necessary the complementation with green practices to achieve the objectives related to sustainability and give equal importance to the three pillars of the Triple-Bottom-Line (TBL) (Fig. 1) that are the bases of sustainable development in organizations (Abualfaraa et al., 2020; Henao et al., 2019; Kumar et al., 2016; Leon and Calvo-Amodio, 2017).

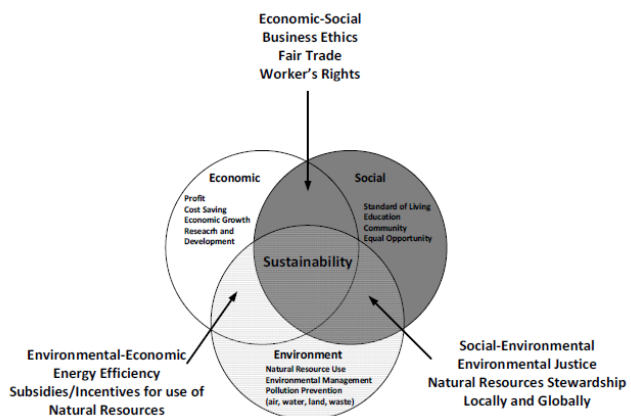


Fig. 1. Triple Bottom Line (Abualfaraa et al., 2020)

Green practices focus on reducing hazardous emissions, eliminating wasteful resource consumption, recycling, minimizing health risks throughout the manufacturing process, and minimizing the environmental footprint throughout the product life cycle.

The link between green and lean practices is the reduction of waste and everything that does not produce value to achieve better results at the business level, being green more focused on the environmental area and lean in the economic area (Abualfaraa et al., 2020; Dües et al., 2013).

In this context, it is practically unanimous among researchers and managers that neither lean nor green practices demonstrated to fully achieve the balance between economic, environmental, and social sectors when implemented individually (Cherrafi et al., 2016). Therefore, combining lean and green practices has been proposed to increase their strengths and mitigate their weaknesses to meet sustainability requirements (Abualfaraa et al., 2020; Cherrafi, Elfezazi, Govindan, et al., 2017; Souza Farias et al., 2019).

Although the integration of Lean and Green shows an increase in environmental and economic performance in companies, they do not seem to have much impact on the social aspect (Ciccullo et al., 2018; Jose Martinez-Jurado & Moyano-Fuentes, 2014), one of the pillars of sustainable development. This is due to the difficulty in implementing and measuring the improvement of social behaviours, being the implementation of social tools a possible object of study.

2.2. Key Performance Indicators

The importance of lean and green practices for the sustainable development of an organisation was previously mentioned. However, to measure current performance and formulate new methodologies to improve the company's activities continuously, it is necessary to measure the performance of organisations through KPI.

One of the problems with using KPI is, as can be observed in the literature, a need for KPI standardisation, mainly because of the wide range of indicators. For example, different KPI are used in finance, operations, and resource performance (e.g., water, energy, non-renewable resources, and waste). Given that KPI rely on industry type (Morella et al., 2020), regarding this information it is possible to create two solutions:

- Create a methodology that adapts to the different sectors
- Create a standard methodology that uses normalized KPI despite the sector

The most viable solution seems to combine the two options, use standard KPI to evaluate the sustainability of a certain company despite their sector, and use specific KPI to better evaluate companies from a specific sector.

The use of indicators is an important element in determining an organization's efficiency. However, nowadays, the air pollution is the most assessed criterion for sustainability, and others, such as water and energy consumption (Morella et al., 2020) and from the articles retrieved about KPI (Marotta et al., 2021; Matlock et al., 2021; Pignatelli et al., 2023), it is possible to conclude that the financial, and social aspects of sustainability are being overlooked, due to the current focus on the environmental policies. The financial KPIs because they are well established, and the social KPIs because it is difficult

to measure social stats, mainly due to them being more subjective and less quantifiable (von Geibler et al., 2006).

2.3. Science Based Targets

With the growing demand from companies to align themselves with the objectives of the Paris conference, there has been a need to set sustainability targets to control the level of emissions produced by companies. As a result, the private sector is increasingly seeking to develop targets and join the "mainstream" of sustainable development.

To define sustainability goals, several initiatives were created, both public and private, to help companies to fulfil the proposed sustainability goals. According to some studies (Faria and Labutong, 2020)) the use of platforms to control emission targets generates a win-win relationship between the commitment to reduce greenhouse gases and the company's financial performance. That is, reducing emissions without sacrificing the company's income is possible.

As referred in the introduction, the Science Based Targets initiative (SBTi), created in 2015, is a joint initiative between the World Wide Fund for Nature (WWF), the World Resources Institute (WRI), the United Nations Global Compact (UNGC) and the Carbon Disclosure Project (CDP) (Giesekam et al., 2021). The initiative consists of setting targets that reduce greenhouse gas (GHG) emissions to meet the measures proposed by the Paris agreement and to keep global warming below 2°C above pre-industrial levels (Giesekam et al., 2021). Its implementation impacted the sustainability theme, and since its foundation, an increasing number of companies have been setting environmental targets (Bjorn et al., 2021).

The environmental scopes (Fig. 2) are a crucial theme for the SBTi, as follows:

- Scope 1: Emissions directly produced by the company, resulting from its operations.
- Scope 2: Indirect emissions produced as a result of the company's energy consumption.
- Scope 3: emissions which occur because of the organisation's activities, in sources which do not belong or are not controlled by the company, but rather in its supply chain.

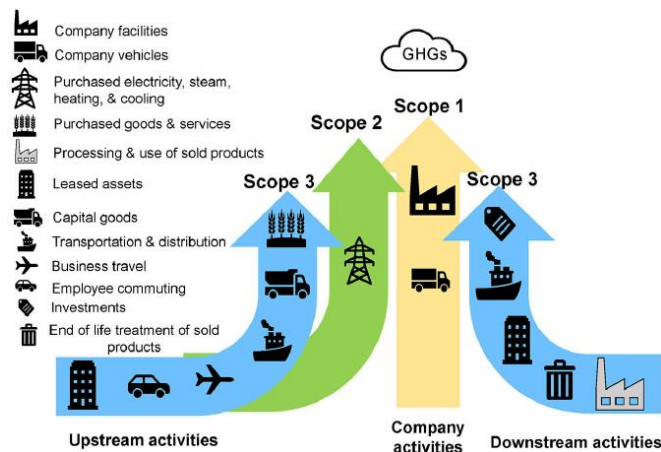


Fig. 2. Environmental scopes (Reavis et al., 2022)

This initiative has shown promising results regarding the definition of targets. Many companies, including large multinationals, have been joining this initiative to meet the conditions proposed by the Paris agreement (Bjorn et al., 2021). The following figure (Fig. 3) shows the increasing number of companies that have defined Science Based Targets. These targets are divided into three, the most conservative at 2°C and the most ambitious at 1.5°C, symbolizing the increase in global temperature since pre-industrial levels.

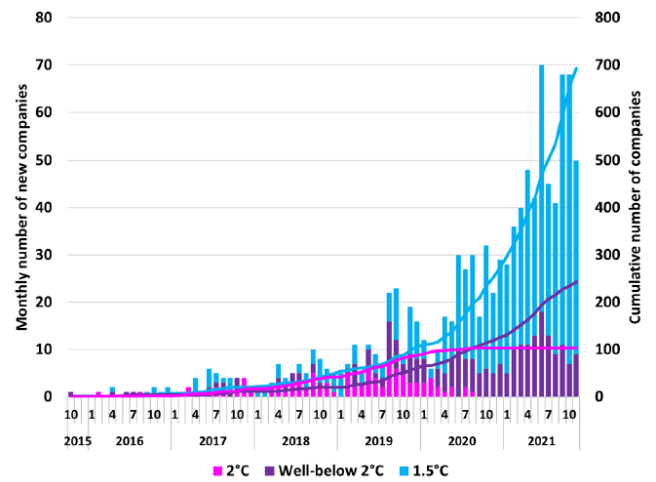


Fig. 3. Growth in adherence to SBTi (Bjorn et al., 2021)

3. Experimental

This study is supported by the literature review method, bibliometric analysis, and visual mappings. A Literature review aims to reflect the state of knowledge in a specific subject supported by a methodical behaviour (Tranfield et al., 2003) and supports the identification of the field's conceptual content and therefore contributes to theory development (Seuring and Müller, 2008). Furthermore, a Bibliometric analysis was applied to encompasses citation patterns and themes, highlighting the subject meaning and research activity and trends (Viglia et al., 2022). Adopting a rigorous methodological process of a Bibliometric literature review methodology with visual mappings (Such as Vos Viewer) contributes to a reliable review of the knowledge on the research subject and the related theory-practice gap. The visualizing similarities (VOS) approach provides a low-dimensional visualization in which objects are arranged in such a way that the distance between any pair of objects most accurately reflects their similarity (van Eck and Waltman, 2010). VOSviewer emphasises the graphical representation of bibliometric maps, consequently particularly helpful for illustrating large bibliometric maps in an easy-to-interpret way (Arici et al., 2022).

The present article research was carried out based on the information obtained from the databases of Web of Science (WoS), this is due to the following factors:

- Being an open access platform.
- Being easy to use.

- Allows the creation of lists in order to better organize the selected articles.
- Allows the analysis of the articles defined according to their specifications.
- Being a renowned platform used as a source of information by several scientific article writers.

For the selection method of the articles was used the PRISMA methodology (Moher et al., 2009).

3.1. Search Criteria

This present investigation was followed by the analysis of the topics related to the research questions asked before:

- What tools organizations use to achieve sustainability? Lean and green
- What are the indicators used to evaluate the progress of the organization? Key Performance Indicators
- What is the methodology used to determine their sustainable objectives? Science Based Targets

From each research question was selected a set of keywords and were applied different criteria according with the topic being researched.

1. Search by author keywords and by Topic.
 - Lean and Green and Literature Review (Topic).
 - Sustainab* and Key Performance Indicator* (Author Keyword).
 - Science Based Target* (Author Keyword).
2. Definition of search date.
 - Lean and Green and Literature Review (2010-2023).
 - Sustainab* and Key Performance Indicator* (2020-2023).
 - Science Based Target* (1900-2023).
3. Selection of articles belonging to journals in the Q1 or Q2 quartile.

Table 1. Authors from the articles used in the literature review

| Theme | N° | Authors |
|----------------|----|--|
| Lean and Green | 27 | (Abualfaraa et al., 2020; Bhattacharya et al., 2019; Caldera et al., 2017; Cherrafi, Elfezazi, Garza-Reyes, et al., 2017; Cherrafi, Elfezazi, Govindan, et al., 2017; Cherrafi et al., 2016; Chugani et al., 2017; Ciccullo et al., 2018; Dhingra et al., 2014; Dieste et al., 2019; Dües et al., 2013; Francis and Thomas, 2020; Garza-Reyes, 2015a, 2015b; Hallam and Contreras, 2016; Henao et al., 2019; Johansson and Sundin, 2014; Jose Martinez-Jurado and Moyano-Fuentes, 2014; Khan et al., 2021; Kumar et al., 2016; Leon and Calvo-Amodio, 2017; Mollenkopf et al., 2010; Sangwa and Sangwan, 2018; Sharma et al., 2021; Siegel et al., 2019; Souza Farias et al., 2019; Varela et al., 2019) |
| KPI | 51 | (Becchetti et al., 2022; Cipolletta et al., 2022; Contini and Peruzzini, 2022; Cooper et al., 2020; de Bortoli et al., 2022; Egas et al., 2021; Gackowiec et al., 2020; Goncalves and Silva, 2021; Govindan et al., 2021; Gunduz and Abu-Hijleh, 2020; Gunduz and Lutfi, 2021; Guo and Wu, n.d.; Hristov et al., 2022; Janjua et al., 2020, 2021; Karahasanovic et al., 2020; Karnitis et al., 2021; Kassem and Trenz, 2020; Ma et al., 2020; Marotta et al., 2021; Marrucci and Daddi, 2022; Matlock et al., 2021; Matos et al., 2021; McGinley et al., 2022; Mektadir et al., 2021, 2020; Molavi et al., 2020; Morella et al., 2020, 2022; Mosca and Perini, 2022; K. K. Naji, 2021; K. K. Naji, Gunduz, and Hamaidi, 2022; K. K. Naji, Gunduz, and Naser, 2022; Nawaz et al., 2020; Othman et al., 2022; Patidar et al., n.d.; Patil and Javalagi, 2020; Patrao et al., 2020; Perroni et al., 2020; Pignatelli et al., 2023; Pribicevic and Delibasic, 2021; Radovanovic et al., 2020; Rahman et al., 2022; Romeni et al., 2020; Schipper et al., 2021; Sun and Ertz, 2021; Torabizadeh et al., 2020; Voukkali et al., 2021; Walkiewicz et al., 2021; Yilan et al., 2022; Zaripov et al., 2021) |
| SBT | 26 | (Ayoub et al., 2020; Bendig et al., 2022; Bjorn et al., 2017, 2019, 2021; Bjorn, Lloyd, et al., 2022; Bjorn, Tilsted, et al., 2022; Bringezu, 2019; Chang et al., 2022; de Silva et al., 2019; Ermgassen et al., 2022; Faria and Labutong, 2020; Feleki and Moussiopoulos, 2021; Gibassier et al., 2020; Giesekam et al., 2018, 2021; Hadziosmanovic et al., 2022; Hart et al., 2020; Immink et al., 2022; Kuo and Chang, 2021; O'Flynn et al., 2021; Reavis et al., 2022; Spanner and Wein, 2020; Stokes and Rockstrom, 2018; Walenta, 2020; Watari et al., 2021) |

4. Selection of the most cited articles in the Lean and Green theme (Top 50).

3.2. Research flowchart

A research flowchart (Fig. 4), based on the PRISMA methodology; was made to better understand the process of the selection of articles used in this literature review.

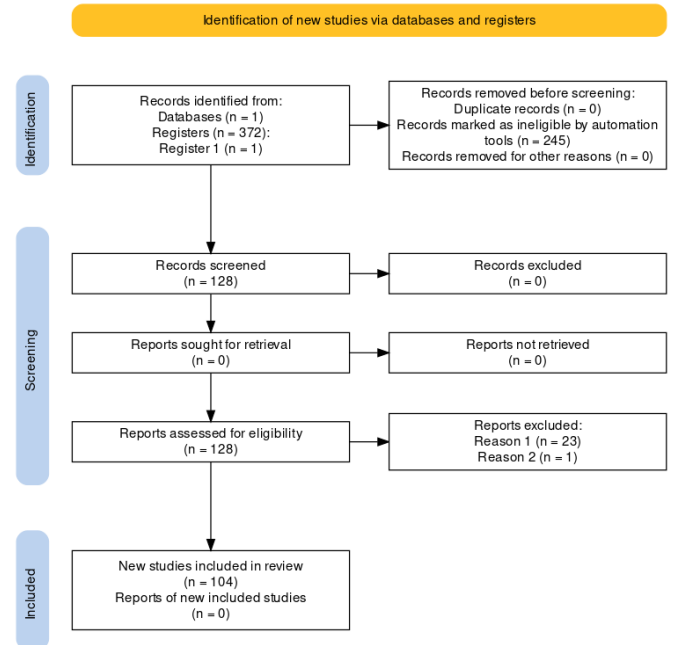


Fig. 4. PRISMA methodology (Haddaway et al., 2022)

From the 104 articles retrieved 27 were from Lean and Green, 51 from the Key Performance indicators and 26 from the Science Based Targets. The table below (Table 1) indicates the quantity of the articles and the authors from each topic.

4. Results and discussion

According to the data retrieved from WoS, it was identified that the topics being studied are relatively new. The articles related to the Lean, Green and Key Performance indicators have diversified dates, mainly because these are themes being studied for a while. However, articles related to the Science Based targets are very scarce because they are a recent tool that many people, companies and governments need to be aware of. Two analyses were made:

- A global analysis that contains the distribution of citations, journals, and articles, as well as VOS viewer study.
- An analysis made on the current state of the art of the Science Based Targets theme, where will be studied the contents of all articles that have this theme in their keywords, and it will be analysed the distribution per country and per sector of the companies that are aligned with this initiative.

4.1. Global analyses

As for average citations (Blue line), and publications (Purple columns) per year, as indicate in (Fig. 5), it can be verified increase in recent times, showing that these topics will continue to grow in the coming years.

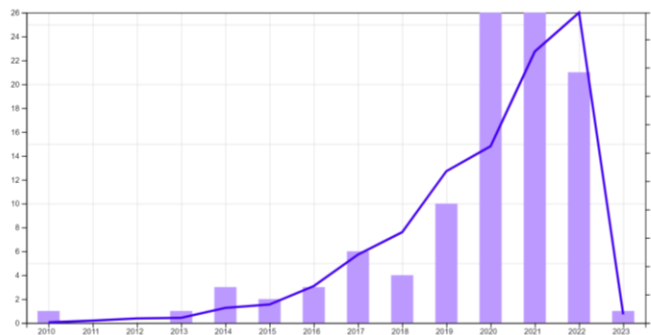


Fig. 5. Publications and Citations of the article searched

As for the journal where more articles were published (Fig. 6), the Journal of Cleaner Production was the most recurrent, followed by the Sustainability journal. Furthermore, it should be mentioned that the column designated as “Others” represents journals that had only one publication.

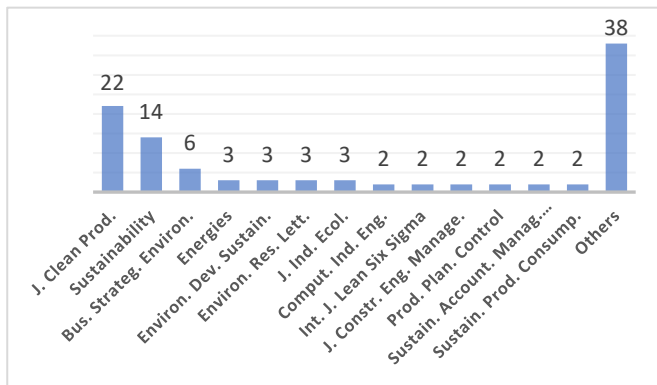


Fig. 6. Journal distribution

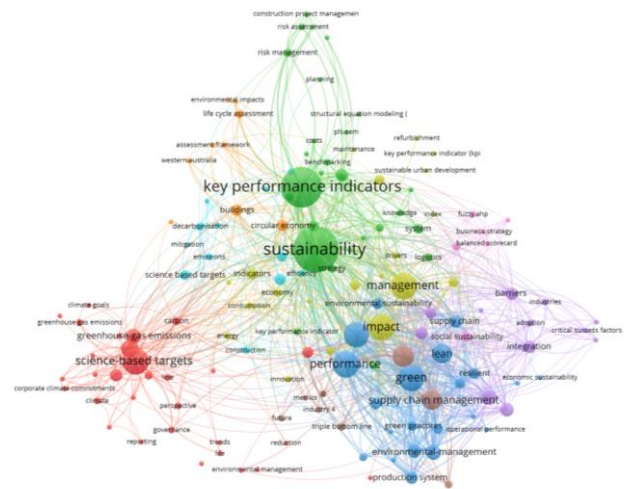


Fig. 7. VOS viewer analyses

To study the connection and junction between the different articles, an analysis was performed using the VOSviewer tool (Fig. 7). For this the keywords that appeared at least twice in each article were considered. After performing the analysis, it was possible to conclude that the main clusters represented in green, which mainly address the sustainability and KPI categories, and the cluster represented in red, which addresses the Science Based Targets, as well as other themes related to this topic.

Next, the keywords with the most occurrences and their respective link strength were mentioned (Table 2).

Table 2. VOS viewer keyword strength

| Keywords | Occurrences | Strength |
|------------------------------|-------------|----------|
| sustainability | 20 | 289 |
| impact | 20 | 182 |
| performance | 20 | 180 |
| green | 20 | 180 |
| model | 19 | 169 |
| management | 20 | 155 |
| key performance indicators | 36 | 148 |
| framework | 15 | 138 |
| supply chain management | 13 | 128 |
| lean | 13 | 123 |
| 6 sigma | 9 | 91 |
| science-based targets | 20 | 90 |
| environmental management | 9 | 88 |
| operations | 8 | 88 |
| implementation | 8 | 81 |
| production system | 7 | 74 |
| integration | 7 | 72 |
| resilient | 6 | 72 |
| supply chain | 7 | 70 |
| barriers | 7 | 64 |
| sustainable development | 7 | 62 |
| literature review | 6 | 60 |
| climate change | 11 | 59 |
| agile | 5 | 58 |
| systematic literature review | 5 | 57 |
| social sustainability | 5 | 56 |
| environmental performance | 6 | 55 |
| design | 6 | 52 |

| Keywords | Occurrences | Strength |
|---------------------------------|-------------|----------|
| decision-making | 7 | 51 |
| environmental sustainability | 6 | 51 |
| green practices | 5 | 51 |
| eco-efficiency | 4 | 47 |
| environment strategies | 5 | 47 |
| corporate social-responsibility | 6 | 46 |
| greenhouse-gas emissions | 9 | 45 |
| methodology | 4 | 44 |
| optimization | 5 | 44 |
| circular economy | 6 | 42 |

4.2. SBT Analysis

In this section, the publications retrieved have been summarised (Table 3) to better understand their contribution to the SBT theme.

Table 3. SBTi articles summary

| Authors | Field | Summary |
|-------------------------------|--------------|--|
| (Bjorn et al., 2017) | Theoretical | Study conducted to analyse the ecological limits presented in the sustainability reports of various companies, 40000 reports of 12000 companies from 2000 to 2014 were analysed. |
| (Stoknes and Rockstrom, 2018) | Theoretical | Study looking at sustainable growth in the Nordic countries. |
| (de Silva et al., 2019) | Theoretical | Article that analyses the indicators used by companies at the level of biodiversity, checking whether they are in fact based on scientific data. |
| (Bjorn et al., 2019) | Theoretical | Definition of a methodology for applying absolute environmental targets (EASA) to companies |
| (Giesekam et al., 2018) | Construction | Study of the impact of sustainable methodologies in the UK construction sector |
| (Walenta, 2020) | Theoretical | Article that analyses the implementation of environmental methodologies in the private sector, more specifically the SBTi |
| (Giesekam et al., 2021) | Theoretical | Article that verifies if the Science Based Targets initiative is actually beneficial for companies. It concludes that most companies meet their sustainability targets, however most of these targets are short term, with few companies making a long term commitment. |
| (Bjorn et al., 2021) | Theoretical | Through the application of the 7 SBTi methodologies, a study was carried out aiming at the efficiency of each methodology. For the experimental calculation 8 fictitious companies were created whose data would enter in the calculation of the result of the targets. They concluded that the best possible methods were the SDA and the CSO, but they pointed out that there was still a lot of |

| Authors | Field | Summary |
|----------------------------|---------------------|--|
| (Faria and Labutong, 2020) | Theoretical/ Energy | research to be done in this area, including the need to carry out this study on a large group of real companies. Study that analyses four methodologies belonging to SBTi. They are subsequently applied based on the data of a company (EDP) and the benefits and limitations of each tool are assessed. |
| (Hart et al., 2020) | Food Industry | An innovative methodology was presented to help the food industry make its operations more sustainable through better management of refrigeration systems. Refrigeration systems were chosen for optimisation as refrigerant leakage is the second largest source of carbon emissions in the UK food industry. |
| (Ayoub et al., 2020) | Commerce | Modelling a sustainable framework to reduce the carbon footprint of commercial industries at low cost by installing low carbon technologies such as biomethane engines and photovoltaic systems. Two KPIs were defined, CAPEX for capital expenditure and OPEX for operating expenses and reduced carbon emissions. The methodology was applied to 60 companies of this sector in the United Kingdom, and they concluded that if the measures were implemented and considering normal conditions in the next years, several environmental targets would be met in the year 2030. |
| (Gibassier et al., 2020) | Theoretical | Article based on a review of the current literature on climate change and carbon accounting. Based on the research prepared the authors proposed four possible avenues for future research, these being: climate change as a systemic and social problem, the multi-layered transition apparatus for climate change, climate vulnerability and the future of carbon accounting. |
| (Bringezu, 2019) | Theoretical | Discusses the key aspects to consider in the sustainable consumption of resources. It states that consumption of available resources must meet basic human needs but must not exceed planetary limits. It also states that in order to assess and make decisions related to sustainability, it is necessary to monitor current impacts using indicators based on current science and knowledge. |
| (Watari et al., 2021) | Metal-mechanics | Article describing the metalworking industry today and how important it is to improve the sustainability of this sector, based on scientifically based objectives. A methodology was elaborated that relates the production of |

| Authors | Field | Summary | Authors | Field | Summary |
|----------------------------------|----------------|--|--------------------------------|----------------|---|
| | | metals and their emissions with SBTi in order to reach the imposed climate limits. The study was carried out in the industries of the 6 most used metals (Iron, Aluminium, Copper, Zinc, Lead and Nickel) representing, by mass, about 98% of all metal production in the United States. | | | is very useful in this area because it is the first and only one that provides specific targets according to the location and type of property, and besides measuring emissions and assessing risks it also provides a guide on how to reduce these emissions. These features of the tool are very positive because they are presented in an intuitive way and also combats the lack of transparency evidenced in other tools. |
| Kuo and Chang, 2021) | Multisectorial | A study of the impact of Science Based Targets (SBT), Internal Carbon Pricing (ICP) and Carbon Management Reputation (CMR) on companies in Japan. 1,994 companies were analysed over the period 2016-2019. It was concluded that companies using SBTs and ICP show better CMR, with greater contribution to companies' environmental reputation coming from SBTs. | (Ermgasen et al., 2022) | Theoretical | Article that assesses the definition of the word nature-positive, highlighting the differences proposed by each organisation. Subsequently, four elements that serve as a basis for the definition of a nature-positive strategy are addressed. It was concluded that from 2016 until 2021 several companies have adopted SMART (Specific, Measurable, Accepted, Realistic, and Time-bound) targets regarding biodiversity and nature. |
| (Bjorn, Tilsted, et al., 2022) | Theoretical | Literature review about SBT. The number of companies that adhered to the initiative is analysed as well as its distribution by region and by sector. During the review three aspects are analysed: what motivates companies to define SBTs; are SBTs sufficient to meet the Paris agreement; will voluntary adherence to SBTi continue to grow. The study answers these questions by saying that the companies most likely to join are large organisations, because they suffer more pressure from their stakeholders and use the SBTi as a way to improve their environmental reputation. It states that 42% of the targets are behind schedule 49% are ahead of schedule and 9% are completed, and SBTi is a good platform to meet the conditions of the Paris agreement. Finally, according to the data analysed, adherence to the initiative will grow continuously in the coming years. | (Bendig et al., 2022) | Multisectorial | Study of the impact of SBTs on the financial performance of corporations, where they check whether or not it pays to go green. Hypotheses were developed that evaluated the relationship between the following components: CCP (Corporate Carbon Performance), CFP (Corporate Financial Performance) and the CEP (Corporate Environmental Performance). It was concluded that companies that belong to the SBT achieve a positive relationship between CCP and CFP, and that in general it pays to be "green", supporting the hypothesis of a win-win relationship between the economic and environmental levels. |
| (Feleki and Moussiopoulos, 2021) | Urban | Article that develops a methodology to guide cities towards a greener and more sustainable development. The methodology aims to limit GHG emissions in cities located in the Mediterranean, because according to the analysis carried out by the study, the Mediterranean region heats up 20% more than the global average, being an area of high risk regarding environmental disasters. In order to achieve the target of 1.5°C to stabilize the sea level. | (Hadzi-osmanovic et al., 2022) | Theoretical | The article presents an alternative approach to the SBT initiative, based on the cumulative allocation of carbon emissions in order to determine future budgets and limits regarding this issue. It also states that regardless of the approach selected by companies, it is necessary to mitigate the carbon footprint in order to reverse the effects caused by climate change. |
| (Spanner and Wein, 2020) | Real Estate | The objective of the study is to verify if the CRREM (Carbon Risk Real Estate Monitor) tool is efficient when it comes to measuring and evaluating the sustainability of companies belonging to the real estate sector. It was concluded that the CRREM tool | (Bjorn, Lloyd, et al., 2022) | Theoretical | Article that talks about a comment made by the Science Based Targets initiative to the article (Bjorn et al., 2021), written by the same author. The article responds to some criticism made by the initiative and also mentions that there is a great need for research on the topic of SBT. |
| | | | (Chang et al., 2022) | Theoretical | Study based on the response to the SBT initiative regarding the article (Bjorn et al., 2021), where the 7 |

| Authors | Field | Summary |
|------------------------|---------------|---|
| (Reavis et al., 2022) | Food Industry | methodologies used by SBT were analysed in more detail. Study that assesses the emissions produced by the food industry and ways to mitigate them. The sustainability reports and reports to the CDP (Carbon Disclosure Project) of the top 100 companies in the food sector were assessed. They found that despite the number of companies reporting and defining their GHG emissions, 31 of the companies analysed do not have any climate targets. |
| (Immink et al., 2022) | Theoretical | Study of the impact of SBTs on businesses. |
| (O'Flynn et al., 2021) | Universities | Article written from the perspective of a UK university, where a study is conducted on the incorporation of SBT in medium-sized companies and universities in order to achieve a path to zero emissions. A plan was drawn up to meet environmental targets, consisting of using renewable energy on and off campus, reducing energy consumption through more efficient equipment. It was also mentioned that it is important that organisations calculate all scopes one, two and three and report them properly. |

4.3. SBT Distribution

The distribution of the companies that defined SBTi targets is also relevant because it allows a better analysis of which country regions are more likely to join the initiative. Organizations with targets are the ones with objectives defined and verified by the SBTi, while committed organizations don't have a target set but are in the process of having.

It was observed that more than half of the companies that joined the initiative are based in Europe, (Fig. 8 and Fig. 9) which is the leading region, with most of the companies coming from the United Kingdom, followed by North America, whose principal and almost absolute contributor is the United States of America, followed by Asia, with the primary representative in the initiative being Japan.

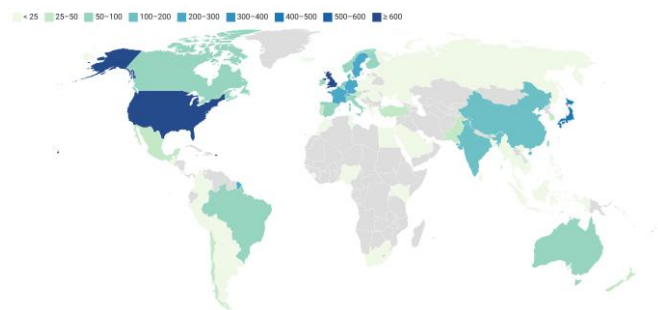


Fig. 8. Organizations committed to the SBTi (per country)

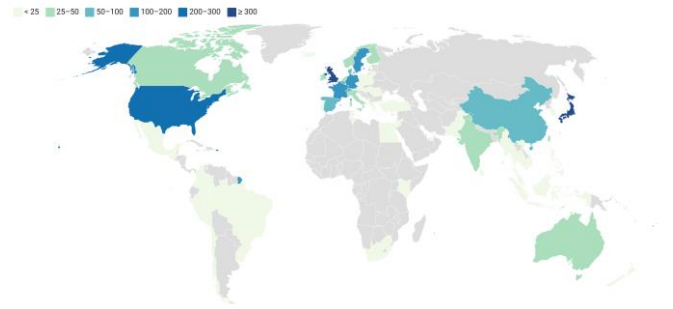


Fig. 9. Organizations with SBTi targets (per country)

In addition to analysing the number of companies that adhered to the initiative and its distribution, it is also necessary to observe the main sectors of the companies that adhere to SBTi. Hence, the companies that adhere more to the initiative are companies from the "Food Industry" and "Professional Services".

In the following images (Fig. 10 and Fig. 11), we can see the top 10 sectors of the organizations committed, and with SBTi targets.

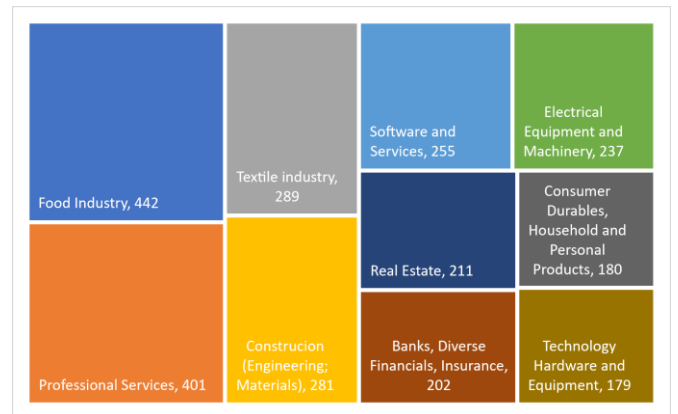


Fig. 10. Organizations committed to the SBTi (per sector)

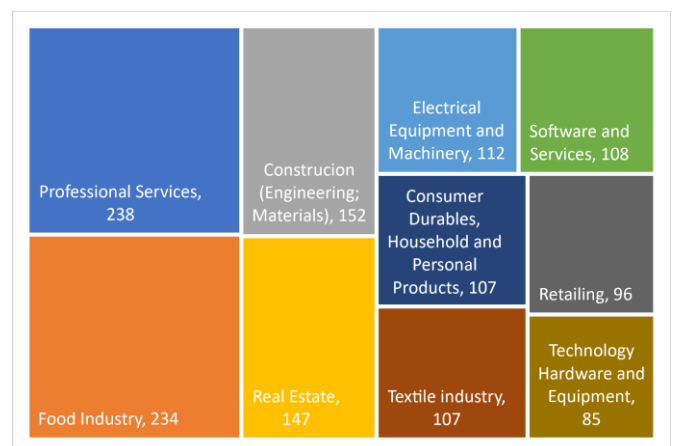


Fig. 11. Organizations with SBTi targets (per sector)

4.3. Conceptual model formulation

Based on the literature review, it was possible to observe the defects and qualities of the SBT model, and the possible integration of lean, green and KPI concepts in its model. The main contents that were addressed in this article in order to create a new model are:

- Lean and Green are great tools to use to increase a company's environmental and economic performance, however, lacks in the social aspect.
- The use of KPI to evaluate a company's performance is good, however it has two great problems: The lack of standardization and the primary focus on GHG emissions, which is important, yet the other environmental KPI aren't used as much and the social KPI are being somewhat neglected.
- The SBT initiative is a good organization to help the companies to achieve their sustainable targets but can be confusing and non-transparent, since there is not much information available on their platform about the methodologies, they use to set sustainable objectives.

Considering the above statements, a conceptual model was developed taking in regard these concerns. First, since the lean and green tools are well known and already verified in terms of efficiency, it isn't necessary to reformulate them. Second, one of the problems of the KPI usage is their difference between different organizations, so it was proposed a set of 12 base KPI (Fig. 12) that will be used by all organizations despite their sector.

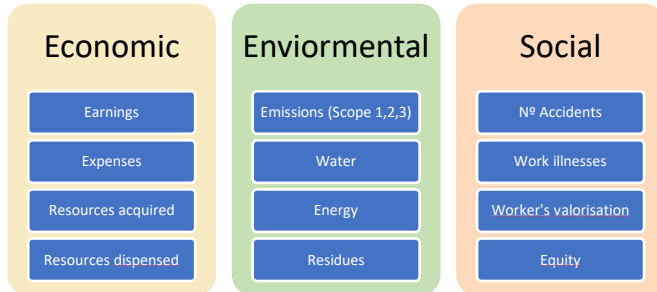


Fig. 12. Base KPI

After having analysed the base KPI, the model proposes an implementation and measurement methodology that companies can take in order to achieve sustainable development. The following figure (Fig. 13) describes the steps to be followed to achieve the proposed methodology.

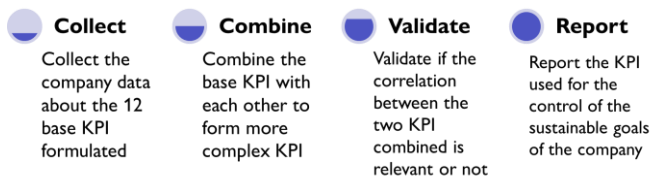


Fig. 13. Methodology for the use of KPI

Considering the above statements, a conceptual model was developed (Fig. 14) to create a future methodology to correct the current methods' problems.

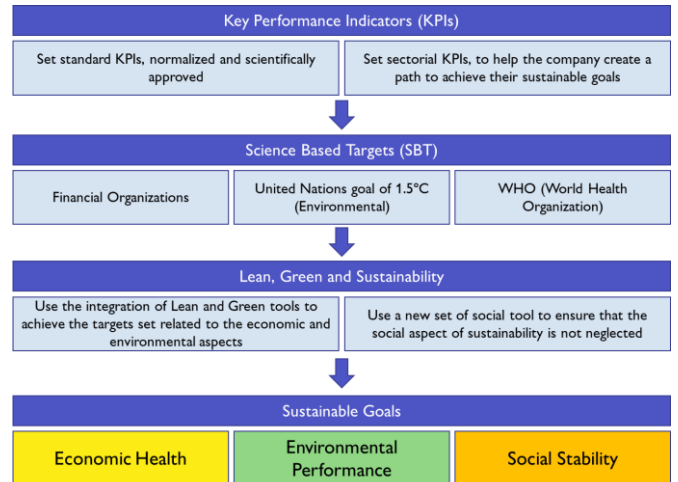


Fig. 14. Conceptual model

The conceptual model presented in this paper presents four stages:

- First stage: Use of standardised KPIs so that companies can fairly compare their results with each other. Use of sectorial KPIs so as to give more relevant ways of measuring each company's sector of activity.
- Second stage: Use the previously defined KPIs to create science-based targets, based on the main regulatory institutions for each pillar of sustainable development.
- Third stage: Use Lean and Green tools, and a new set of social tools, in order to achieve the objectives previously proposed.
- Fourth stage: Fulfilling the objectives proposed in the three areas of sustainability.

The following figure is a simplification of the conceptual model developed (Fig. 15), showing the four different stages very clearly.

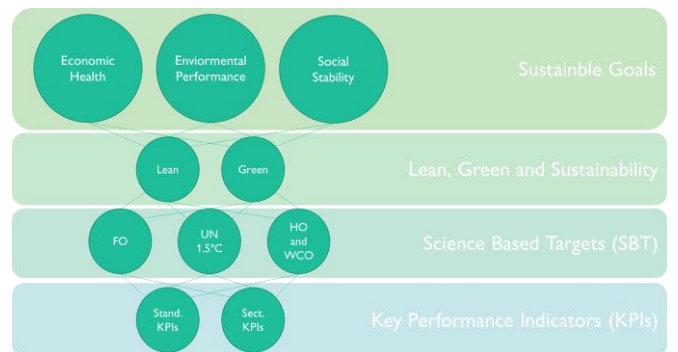


Fig. 15. Simplified conceptual model

*FO: Financial Organizations

*UN: United Nations 1.5° Objective

*HO and WCO: Health Organizations and Workers Conditions Organizations

5. Summary and conclusion

The bibliometric analysis performed in this work, according to the data of the WoS platform, allowed us to understand the similarities between Lean, Green, KPIs and Science Based Targets. This analysis also involved the draft of a map of clusters, using the VOSviewer tool, based on the connection among keywords, which allowed to capture of the connections of the themes studied.

This research is supported by a bibliometric analysis and a literature review on lean, green, KPI and Science Based Targets. This involved evaluating the targeted literature, regarding their publishing year and their annual average citations, drafting a map to observe an underlying intellectual structure, reviewing the current state of the SBT in the literature, pinpointing the most relevant publications and their categorization according to three topics in order to be developed a conceptual model formed by the integration of Lean and Green, Key Performance Indicators, and Science Based Targets following a sequential plan of action for implementation in companies to achieve their sustainable goals.

From the analysis made in the literature review it was possible to answer the proposed research questions:

- RQ1: What tools organizations use to achieve sustainability?

Yes, the use of the Lean and Green set of tools help the corporations to achieve better results when applied isolated, but when combined they can produce even better results. Although Lean and Green help to contribute to the sustainable development of organizations, in the economic and in the environmental area, the social sustainable pillar appear to be left out.

- RQ2: What are the indicators used to evaluate the progress of the organization?

The companies use a different set of KPI, being this one problem because if everybody uses their indicators, it is difficult to compare results between companies. It was also observed that the environmental indicators are exponentially rising in recent years and that the indicators that are used more are relates to GHG emissions.

- RQ3: What is the methodology used to determine their sustainable objectives?

The Science Based Target initiative are helping companies to meet their objectives and become more sustainable; however, their methodologies need to be refined so that they can be used by all types of companies from all types of sectors, and the conceptual model proposed is intended to help in the search for improvement of their method.

These analyses allowed to better understand the current state about the SBT topic, by reviewing all the current articles that include this topic in their paper keywords.

It was also made a conceptual model that can be used to implement a sustainable methodology for companies to achieve their goals.

A future research direction would be to test the validity of the conceptual model produced, either by questionnaire to companies or by implementation in the companies themselves.

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基于科学的目标和促进组织可持续发展的因素从文献综述到概念模型

關鍵詞

可持续性
倾斜
绿色的
关键绩效指标
基于科学的目标

摘要

可持续发展是人们热烈讨论的话题，主要是由于气候变化、污染和浪费增加等因素。世界各国政府一直在制定排放和消费的环境目标，以应对气候变化和改善地球状况。因此，有必要制定一项利益相关者参与的环境政策。应用文献综述方法、文献计量分析和视觉映射来了解公司如何制定和使用这些可持续目标来遵守政府提出的限制。Web of Science 平台允许收集有关精益和绿色、关键绩效指标 (KPI) 和基于科学的目标 (SBT) 的数据。进行的分析使用 PRISMA 方法确定了最相关的论文，包括作者、时间分布以及使用 VOSviewer 工具的相关图。因此，绘制有关 SBT 主题的当前技术水平。此外，提出了一种新颖的概念模型，将精益和绿色结合起来，并创建应用于 SBT 定义的新 KPI，为企业有效实现气候目标提供路径和工具。未来的研究应集中于概念模型在几家公司的实施，以了解其影响，以纠正和改进所提出的概念模型。