



Scientometric Analysis of Material Recycling in Sustainable Construction

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Abstract

The construction sector is one of the sectors that has a great impact on the environment, and it is one of the sectors that consumes energy and resources, so it was necessary to achieve sustainable development for this sector, which is very important and vital, as the depletion of resources, carbon dioxide emissions, the development of building materials, and their high prices, With the presence of large amounts of waste resulting from demolition and replacement around the world, and most of these wastes are hazardous, their disposal may cause environmental pollution, It was necessary to research the methods that solve the problem of waste, to achieve the required sustainability, and the recycling of waste was the most important of these methods, so we did in this research a scientometric analysis, It was necessary to discuss the methods that solve the problem of waste, to achieve the required sustainability, and waste recycling was the most important of these methods, so in this research we made a cytometric analysis, which in turn is considered one of the methods of sustainability of references in this field, which in turn leads to the practical sustainability of operations Construction management and waste management, Where we have collected studies, research and articles related to the subject of recycling, from 2010 to 2022, in a table, easy to refer to, as well as the most important keywords, the most important sources of production and publication of articles and maps that explain this, In addition to presenting some of the most important construction waste and how to recycle and benefit from it, so that we have combined reference and practical sustainability and linked them to achieve sustainability in general in the field of construction management, Where we have collected studies, research and articles related



to the subject of recycling, from 2010 to 2022, in a table, easy to refer to, as well as the most important keywords, the most important sources of production and publication of articles and maps that explain this, In addition to presenting some of the most important construction waste and how to recycle and benefit from it, so that we have combined reference and practical sustainability and linked them to achieve sustainability in general in the field of construction management.

Keywords: *sustainability, publication, construction, wastes, scientometric, recycle*

1.Introduction

*Sustainability can be defined in any field as achieving the requirements of the current generation, without prejudice to the rights and requirements of future generations, Sustainability seems to span multiple significant areas and is often regarded on a global scale, to include notions including such moral considerations, laws, and principles that serve as a framework for organizational decision-making[1],Sustainability, and hence sustainable development, is often described as "development that satisfies the requirements of the present without jeopardizing future generations' ability to fulfill their own requirements [2],In 2006, the concept of sustainable development was changed to include "a long-term vision for sustainability in which economic progress, social cohesion, as well as environmental conservation go hand in hand and complement one other." Sustainability may also include vital aspects such as cleaner manufacturing, prevention of pollution, and control systems, as well as designs that support ecological features, including such structures and building architecture. In response to the constantly evolving developments, the broad dissemination and accompanying interpretations of the notion of sustainability give rise to new terms and concepts [3] Researchers condense the key parts of sustainability into a concise synthesis of ideas and link them with project activity. They define it more clearly as any human action that has an effect on the environment and should not be limited to economic considerations. Economic activity decisions should include social and environmental considerations from a sustainability standpoint,**as shown in fig (1)**the Pillars of sustainability.*

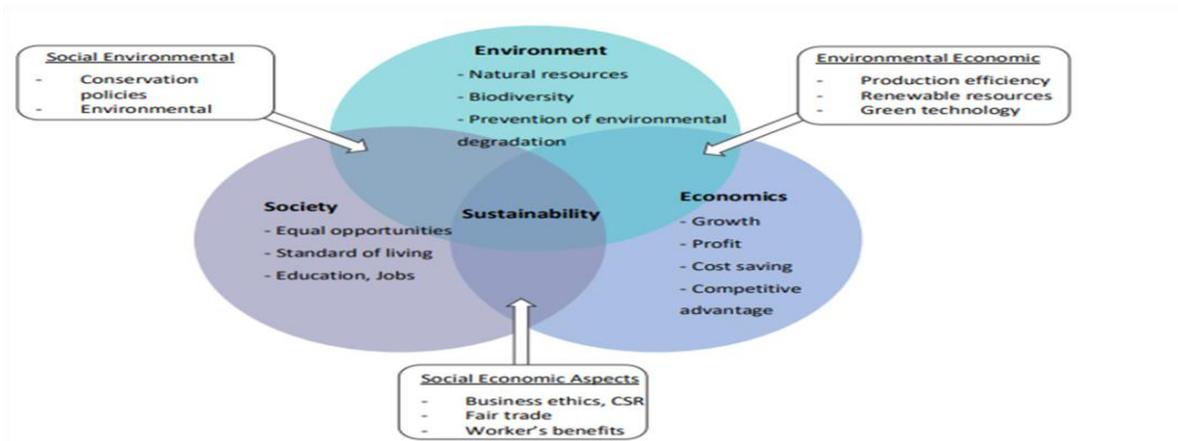


Figure 1 Pillars of sustainability[3]

Recycling of construction waste is the most important step in achieving the sustainability of buildings. For example, recycling these wastes instead of burning or burying them is, in fact, environmental sustainability. It also saves the use of natural resources that are for us and for future generations, and therefore we may have achieved sustainability. On the other hand, the recycling of waste and its use again in construction operations as an alternative to cement and others is to achieve economic sustainability.

2. Materials and Methods

Recycling of waste, as we have already mentioned, is one of the most important steps to achieving sustainability, and we gave some examples of construction waste such as glass, plastic, concrete, as well as rubber and bricks, and how to recycle them and benefit from them economically in terms of saving money and energy, achieving economic sustainability and then achieving environmental sustainability and social, we have collected studies, research and articles related to the subject of recycling, from 2013 to 2022, in a table, easy to refer to, as well as the most important keywords, the most important sources of production and publication of articles and maps that explain this, In addition to presenting some of the most important construction waste and how to recycle and benefit from it, so that we have combined reference and practical sustainability and linked them to achieve sustainability in general in the field of construction management, We have documented these studies and research in order to be an important reference for all those interested and researchers in this subject, and of course we chose the most cited and most documented studies.

2.1 Reference sustainability



Referential sustainability is providing the requirements of current and future generations of studies and research related to this subject, by providing research which achieve the Referential sustainability by providing the requirements of current and future generations of studies and research related to this subject, by providing research, see fig(2) Which explains the stages of this type of analysis.

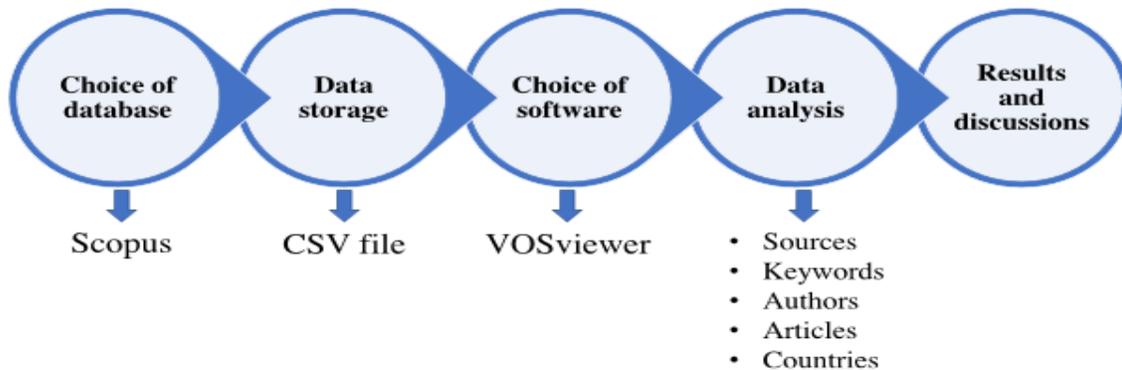


Figure (2), Sequence followed for scientometric analy. [4]

3. Result

Looking at Table No. (4), which shows the number of articles that dealt with the issue of recycling construction waste[4], We find that the number of researches related to the subject of recycling after filtering has decreased by 56%, and this indicates the extent of the randomness of the research that dealt with the subject.

Table No. (1), which shows the number of articles that dealt with the issue of recycling construction waste [4], See Table No. (1), which is part of these studies. Not only that, but we also mentioned the most productive countries for these studies. For articles, see Table No. (2).

Table (1) The most quoted and cited articles and research on the subject of construction waste recycling

Document	No Citations	year	The Title
Ngo T.D	1774	2108	Review of materials, methods and applications



			<i>and challenges in additive manufacturing Complementary cementitious material</i>
<i>Lothenbach B</i>	1213	2011	<i>Important approaches to the "low carbon dioxide" cement industry</i>
<i>Harris</i>	1163	2021	<i>Modern construction management.</i>
<i>Habert G.</i>	553	2011	<i>An environmental evaluation</i>
<i>Van Deventer J.S.</i>	394	2012	<i>Technical and commercial progress in the adoption of geopolymers cement</i>

Table(2) Top productive countries in construction waste management studies.

<i>NO</i>	<i>The Country</i>	<i>NO of Documents</i>	<i>NO of Citations</i>	<i>Strength of the link</i>
<i>1</i>	<i>China</i>	<i>75</i>	<i>2427</i>	<i>16,758</i>
<i>2</i>	<i>Australia</i>	<i>43</i>	<i>1174</i>	<i>15,545</i>
<i>3</i>	<i>Hong Kong</i>	<i>38</i>	<i>1797</i>	<i>10,146</i>
<i>4</i>	<i>Malaysia</i>	<i>34</i>	<i>251</i>	<i>6228</i>
<i>5</i>	<i>Brazil</i>	<i>27</i>	<i>163</i>	<i>2256</i>



6	<i>India</i>	24	99	3029
7	<i>United Kingdom</i>	21	1098	4978
8	<i>Spain</i>	20	727	3871
9	<i>Italy</i>	16	338	1423
10	<i>Russian Federation</i>	13	35	420
11	<i>United States</i>	12	501	4060
12	<i>Iran</i>	11	285	3085
13	<i>Indonesia</i>	11	65	1137
14	<i>japan</i>	10	34	1178
15	<i>france</i>	10	30	1022

see Table No. (3), all of this was done by using scientific websites, magazines, and search engines such as Google Scholar and Scopus magazines.

Table (3)Top Keywords with the most citation bursts.

NO	KEY WORDS	Occurrences	STRENGTH
1	<i>Compressive strength</i>	2568	26599
2	<i>Concretes</i>	2413	25455
3	<i>Concrete</i>	2007	22770
4	<i>Recycling</i>	1840	21664
5	<i>Cements</i>	1513	16663



6	<i>Fly Ashes</i>	1503	16746
7	<i>Aggregates</i>	1275	15004
8	<i>Waste management</i>	1269	14291
9	<i>Supplementary cementitious material</i>	1223	11929
10	<i>Concrete aggregates</i>	1153	14027
11	<i>Portland cement</i>	1005	11197
12	<i>Mechanical properties</i>	912	9625
13	<i>Slags</i>	897	10278
14	<i>Durability</i>	832	8616
15	<i>Cement</i>	787	10791
16	<i>Waste disposal</i>	729	693
17	<i>Sustainable development</i>	705	8078
18	<i>Tensile strength</i>	643	7700
19	<i>Construction industry</i>	631	7332
20	<i>Concrete mixtures</i>	617	7157
21	<i>Water absorption</i>	586	7051
22	<i>hydration</i>	577	9360



23	<i>Construction materials</i>	517	5980
24	<i>Silica</i>	580	6009
25	<i>Environmental impact</i>	516	6163
26	<i>Demolition</i>	516	5656
27	<i>Mixtures</i>	515	6195
28	<i>Silica fume</i>	513	5383
29	<i>Solid wastes</i>	488	971
30	<i>Water absorption</i>	488	5127

4. Discussion and Conclusion

1- *recycling these wastes instead of burning or burying them is, in fact, environmental sustainability. It also saves the use of natural resources that are for us and for future generations, and therefore we may have achieved sustainability. On the other hand, the recycling of waste and its use again in construction operations as an alternative to cement and others is to achieve economic sustainability.*

2- *there are very few studies by researchers from the Middle East region, and documentation of research on the issue of recycling construction waste. Despite the existence of research and studies by Arab researchers, the percentages of documentation and citation are very, very, very few, and the required referential sustainability is hardly achieved, And since the reference sustainability is the first step towards achieving practical sustainability in the construction waste recycling facilities, sustainability in general in the field of construction waste in the Middle East region and the Arab countries in particular, is still taking its first steps towards achieving full sustainability, economically, environmentally and socially.*



3-*The randomness of the research related to the subject of waste recycling, where it was found that the number of researches related to the subject of recycling after liquidation has decreased by 56%, and this indicates the extent of the randomness of the research that dealt with the subject.*

4- *Reference sustainability is the first step on the right path towards achieving sustainability in the field of recycling construction waste.*

5- *Practical sustainability must go hand in hand with reference sustainability because each of them complements the other.*

6- *Achieving integrated sustainability in the construction sector begins with recycling waste and achieving economic, social and environmental sustainability.*

7- *Environmental, social and economic sustainability must be achieved in parallel, in order for full sustainability to be achieved.*

8- *The scientific approach and research methodology that relies on scientometric analysis are the basis for achieving referential sustainability.*

9- *The sustainability and management of the building is still at the beginning of development and in the Middle East region, despite the age of technology*

10 - *The effectiveness of modern technology in achieving sustainability in the field of construction management and waste management.*

5. Acknowledge

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