

Review of Sustainable Supply Chain Management in Textile Industry

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Abstract

Supply Chain Management is extremely essential to any industry, and complying with environmental and sustainable norms is vital to their growth. The intent of this study is to emphasize the relevance of sustainability in supply chain management in the textile and apparel industry. The industry with a long supply chain, starting with raw materials procurement, clothes manufacturing, and its distribution has been a major source of pollutants and waste generation. With the growing importance of sustainable development, companies feel the need to follow up with environmental standards in the apparel chain to keep up with their brand image and other brands. But as companies strive to cut their cost, reduce the manufacturing and distribution time, and keep up rapidly changing trends in a volatile market, it can be a demanding task. This paper is a review resource of over 250 studies regarding similar avenues and aims to provide the reader an overview of the developments in this field and the present scenario of this issue. It also aims to generate dialogue of subsequent future scope of research. Through quantitative and qualitative analysis, it provides tangible data about the domain of this research.

Keywords: Sustainable, Supply Chain Management, Textile, Apparel, Operations Research

Introduction

In today's competitive world, cost cutting, and supply chain efficiency is of utmost importance. However along with this comes a trade-off in terms of sustainability and environmental care. Environmental degradation and rising human rights concerns are making sustainability increasingly important to many stakeholders in society. Sustainable Development (SD) is concerned with meeting the needs of today's generation while taking into account the needs of future generations (WCED, 1987). Integrating Sustainable Development along with supply chain management is described as the keyset of techniques used to create efficient value in products in movement of materials. Products are manufactured considering what products are needed, in what quantities, where and when they are needed, and distributed to the end customer (Chen & Paulraj, 2004).

The textile industry is one of the key polluters as well as revenue streams for the world economy. A number of researches have projected that the international apparel and textile sector generated an average of more than 90 million tons of waste ending in 2014, out of that, an infinitesimal quantity is net sustainable. Majority of this reaches up in discard landfills and is incinerated (Niinimäki et al., 2020).

United Nations' new sustainable development agenda which came into force in 2016, calls for initiation of 17 sustainable development goals (SDGs). They focus on ending poverty, economic growth, protection of people and so on. From the private sector, it reported that sustainable mode of business can rake in about US\$ 12 trillion worth in economic avenues of growth (UN ECOSOC, 2018).

A sustainable supply chain is one where the social, environmental and human effects of product manufacture and marketing is taken into consideration. This focuses on every aspect right from sourcing raw materials to sale and transport of finished goods.

The aim of such a mechanism is to keep the environmental damage and potential societal harm to nil. Nowadays due to massive outcry over global warming, climate change, emissions and so on has made sustainability in a business' operations a must.

Hence, hedging against contingent liabilities, sustainability and tangible results are highly vital for entities in the Textile and Apparel sector as this hampers the brand image. Thus, this paper aims to examine current situation of sustainability in the supply chain operations of the textile industry and review research conducted so far by contemporaries. It aims to give the reader a fair idea of the problems posed in the textile industry and the possible solutions as well as the road and challenges ahead.

We reviewed related literature to uncover potential factors and analyse the problems faced by entities in this domain. The scientific essence of this study is multifaceted. It adds in to the much-needed dialogue about the need for sustainability in the textile industry. It also provides a definite direction in which the past studies have been conducted and gives an idea to the reader about recent as well as past trends and opinions.

Literature Review

SCM has been traditionally explained as the “study and control of logical, tangible and financial outflow in networks of intra- and inter-organizational links collectively providing value and attaining consumer satisfaction” (Dani, 2011). Pagell & Shevchenko, 2014 defines Sustainable Supply Chain Management (SSCM) as the “designing, organizing, coordinating, and controlling of supply chains to become truly sustainable with the minimum expectation of a truly sustainable supply chain being to maintain economic viability, while doing no harm to social or environmental systems.” Environment viable practices are ensured in traditional supply chains through SSCM (Diabat et al., 2014). The relevance of SSCM is increasing and starting to gain the attention of both practitioners and scholars (Turker & Altuntas, 2014). The consideration of environmental factors and social determinants in supply chain management (SCM) has made sustainability an utmost relevant topic for researchers (Brandenburg et al., 2014).

Developing a sustainable supply chain requires following the approach of Triple Bottom Line (TBL), i.e., Profit (economic), People (social), and Planet (environment) (Arowoshegbe & Emmanuel, 2016). It focuses on a Corporate Social Responsibility perspective and not just research in social and environmental areas (Shen et al., 2017). Companies face a risk of negative publicity and might be accountable to stakeholders in cases of lack of adherence with sustainable practices (Pedersen, 2009). Drivers like management practises and stakeholder pressure encourage the thoughtfulness about socio-environmental issues in Supply Chains, whereas barriers like low supplier dedication and inadequacy of technology limit it (Walker et al., 2008). The requirement of

searching inexhaustible and recycled commodities from other first-, second- and n-order supply chains shall increase with the scarcity of resources organizations are facing now (Svensson, 2007). It is seen that companies that are pro-active and developing sustainable products and supply chains does not arise from customer demand but rather supplier development and integration (Seuring & Müller, 2008).

Sustainability to increase the quality of life been recognized globally has affected the innumerable strategies and stringent governing regulations to obtain a higher level of TBL sustainability (Gopal & Thakkar, 2015).

Economic, Social and Environmental are the three dimensions that define sustainability (Ihlen & Roper, 2014; Lu et al., 2017). As stated by (Elkington, 1998), the environment shows sustainable ecological practices; social implies the having commercial practices that are justifiable and effective for people. Economic is concerned with the financial and monetary aspect of the entity (Elkington, 1998).

Figure 1 (Carter & Easton, 2011) displays the performance model of sustainable supply chain consisting of four parts: Dimensions, Aspects, Indicators and Measures.

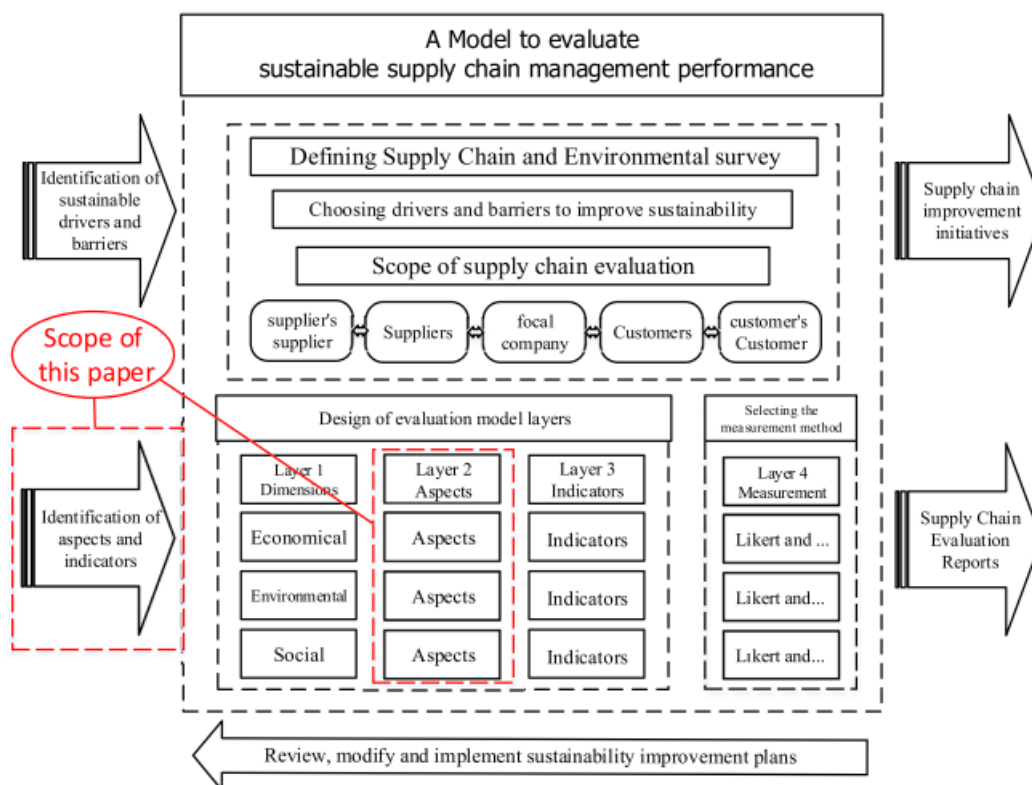


Figure 1

The factors affecting the supply chain can be classified into 3 different categories –

1. Reduction in risk and financial performance up gradation;
2. Governmental orders and municipal pressures;
3. Persuading the consumer who concerned for sustainability (Narimissa et al., 2020).

Recent trends in economics and globalization have formed supply networks that are extremely complex and their design, organisation, connections, and competencies have become major issues (Varma et al., 2006). SCM is hence considered of high relevance both for successfully competing in the market of today and promoting ethical behaviour throughout the entire chain (Ashby et al., 2012).

The quintessential usher for rapid improvement of SCM is economic stability based on the fact that efficient and integrated supply chain help in reducing money related risks and rising profits. SCM represents expanding and avenues of study and consequence (Ashby et al., 2012).

The key methods of SSCM can be split into nature leader, vital buying and supply, supply chain prospects, commodity-based green supply, and greening the supply method (Kang et al., 2012). A company's sustainability can be metaphorized with the operational vigour in terms of costs and profitability. Sustainability barometers were established to measure the process of supply chain process and fragility (Stonebraker et al., 2009).

A supply chain is basically a management concept which is made valid into a traditional management tool for all manufacturers who strive to and improve their product reliability, also reduce service cost and to hasten their product delivery and response time in a highly dynamic market (Mohammad Ali & Habib, 2012).

Clothing and textile are among the industries that contribute the most in consuming resources and creating pollution (Abhijit Majumdar, Syed Mithun Ali, Rohit Agrawala, 2022). Textile industries are consuming tremendous amounts of natural resources and are responsible for the highest emissions of polluting effluents and gases that can create consequential environmental and human health concerns. Combined efforts in relation to sustainable technology novel inventions, consumers' awareness and abutment of the statutory bodies are needed for efficient application of green supply practices in T&A supply chains (Majumdar & Sinha, 2019).

The textile industry has been recipient to widespread critique due to its massive impact on environment namely waste generation, pollution (Niinimäki et al., 2020). They face challenges in three aspects of sustainability (Roberts, 2012). There are significant negatory environmental and social effects in the process of changing raw materials to completed goods which includes exploitation of human resources and pollution, both air and water (Shen et al., 2017). The textile industry was touted at \$1.3 trillion in the year 2015. The textile fibre consumed was about 53 million tons, 73% of which was disposed. New clothing was made from less than 1% fibre, and more than \$100 billion in material is lost every 365 days (Ellen MacArthur Foundation, 2017). Effluents from the textile industry make water bodies unfit for consumption and disturb the balance of ecosystems.

The apparel industry is a good example of the impact of globalisation. With emergence of production bases in developing and underdeveloped countries, there is an impact on each and every supply chain. However these shifts have been very profitable as manufacturing has moved to South East and Central Asia (Nayak et al., 2019). Sustainability related impediments in Textile sector rise out of ill thought environmental standards as well as poor social planning of workforce. This however is glaringly different to the higher level of sustainability in sourcing in developed markets (Gold & Awasthi, 2015; Kobza & Schuster, 2016; Kumar et al., 2015).

Retail segment is under researched in the apparel and sustainable supply chain topics according to (Yang et al., 2017) who has pointed out the absence of sustainable retailing in Textile and Apparel industry. The paper finds green marketing and eco labelling in the industry, with counter logistics and rising retailing scope.

Textile supply chain are gaining global attention due to their high volatility apparel and cotton production due to coordination problems and yield uncertainty (Adhikari et al., 2020). Within the textile industry, inter-departmental correlations and governance collaborations have worked to highlight labour rights violations and environmentally degrading ways of production. Even though research on these has been rising, it has remained uneven (Beyers & Heinrichs, 2020). Industries are vitally required to introduce popular stakeholders to take on SSCM. This study aspires to find these popular enablers for SSCM by using Interpretive Structural Modelling (ISM) from “13 recommended enablers in five Indian textile units located in south India.” ISM findings expose that five enablers that dominate an industry's practices, are Community economic welfare, Health and safety issues, Adoption of safety standards, green practices, and Employment stability (Diabat et al., 2014).

The experts of the textile and clothing industry have conducted various interviews through which we come to know that a triple-helix framework that includes the regulatory governing body, sector and academia was pitched to develop methods for circular apparel supply chain. The circular practices assumed in the supply chains of textile industries, that are working in South Asian countries, is still developing (Abhijit Majumdar, Syed Mithun Ali, Rohit Agrawala, 2022). A study has exposed and extensively assessed the threshold of cotton crop residues to have symbiotic effects on industrial power systems by combining strategic and planned decision models into a unified model. Results show that crop residues are a productive, convenient and beneficial resource for the textile industries in terms of ample amounts of sustainable energy supply (Abbas et al., 2021).

Methodology

This systematic bibliometric literature review analysis was done to shine a light on the various issues of sustainability in the SCM presently in global textile industry pertaining to the discipline of Operation research and management. Two databases namely Science Direct and Google Scholar were put in with Boolean strings based on iterations of keywords “sustainability”, “supply chain”, “management”, “textile” and “operations research”. This paper has reviewed research as well as review papers written in English language from the year 1998 to the year 2022.

Results/Findings & Discussions

An in-depth study of the abstracts as well as research paper content was conducted in order to maintain a complete emphasis on the topic at hand. The above procedure resulted in a preliminary set of 250 research papers. The papers reviewed were installed in pdf as well as RIS formats. The reference management was performed using Mendeley Reference Management software while the analysis and word clouds, tables and data perspectivisation was performed using Vos Viewer software. The aforementioned analysis has been mentioned in the subsequent part of the bibliometric research paper.

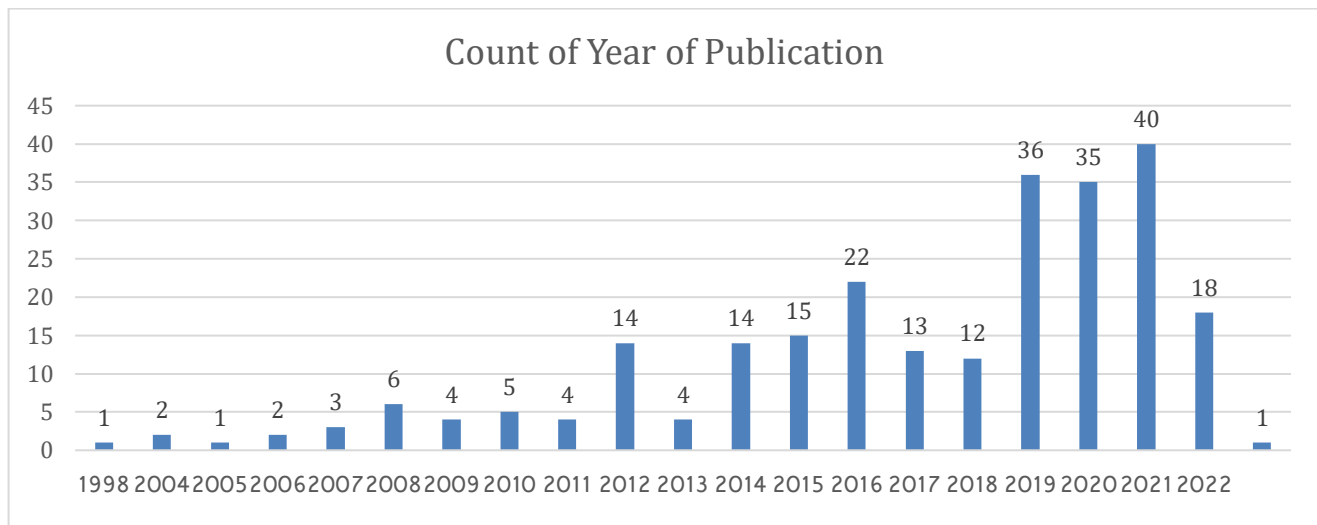


Figure 2: Count of Year of Publication

The number of articles written from 1998 to 2022 is depicted in Figure 2. It can be observed that researchers started publishing an increasing number of articles from 2016, with the count being 22. The numbers increased substantially from 2019, with the count being 36, 35 and 40 in the subsequent years. From our observed research papers, the highest numbers of papers published have been in 2021, i.e., 40.

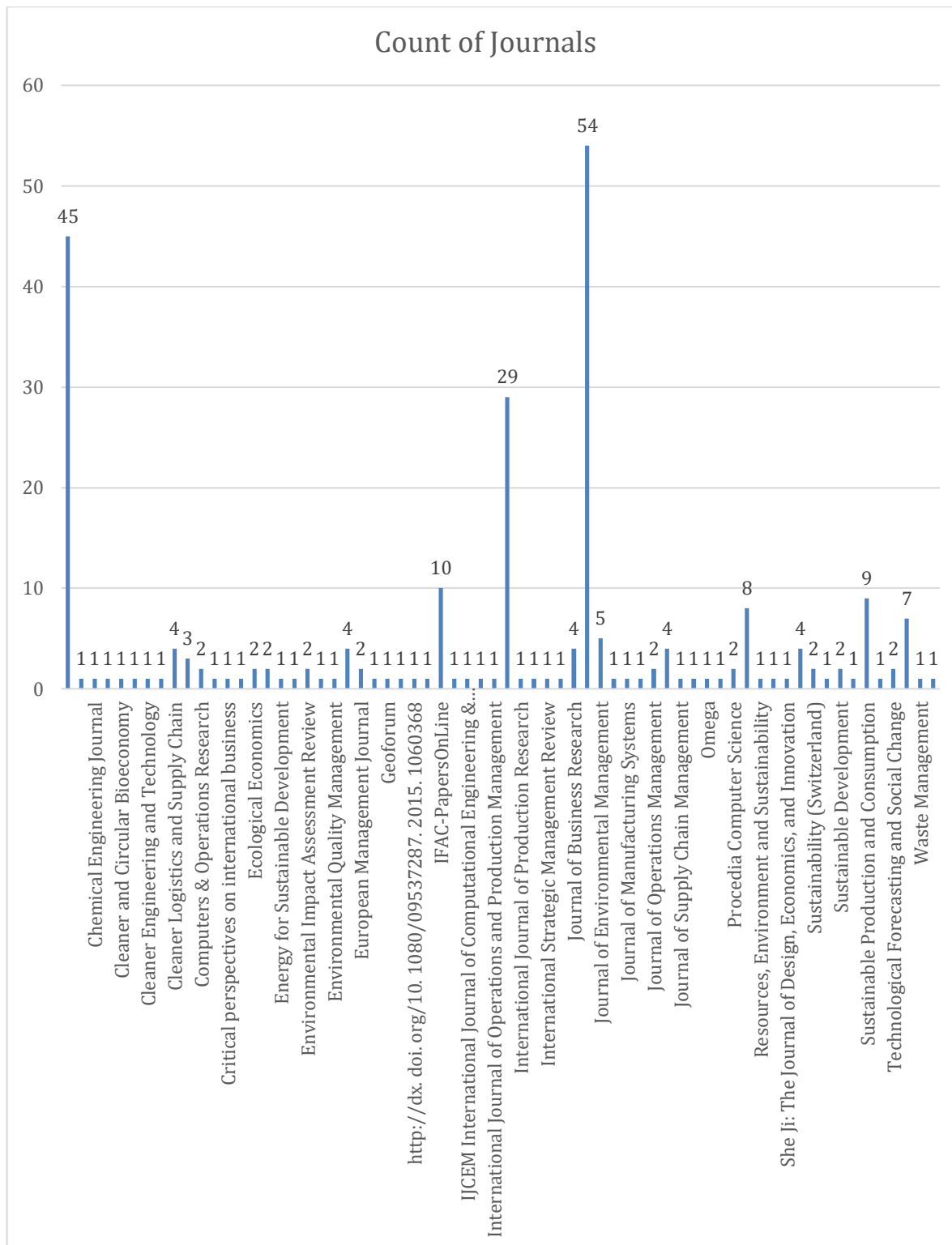


Figure 3: Count of Journals publishing the selected research papers

Figure 3 shows the Count of Journals publishing the selected research papers. It can be seen that Journal of Cleaner Production has published the largest quantity of articles, i.e., 54, followed by International Journal of Production Economics.

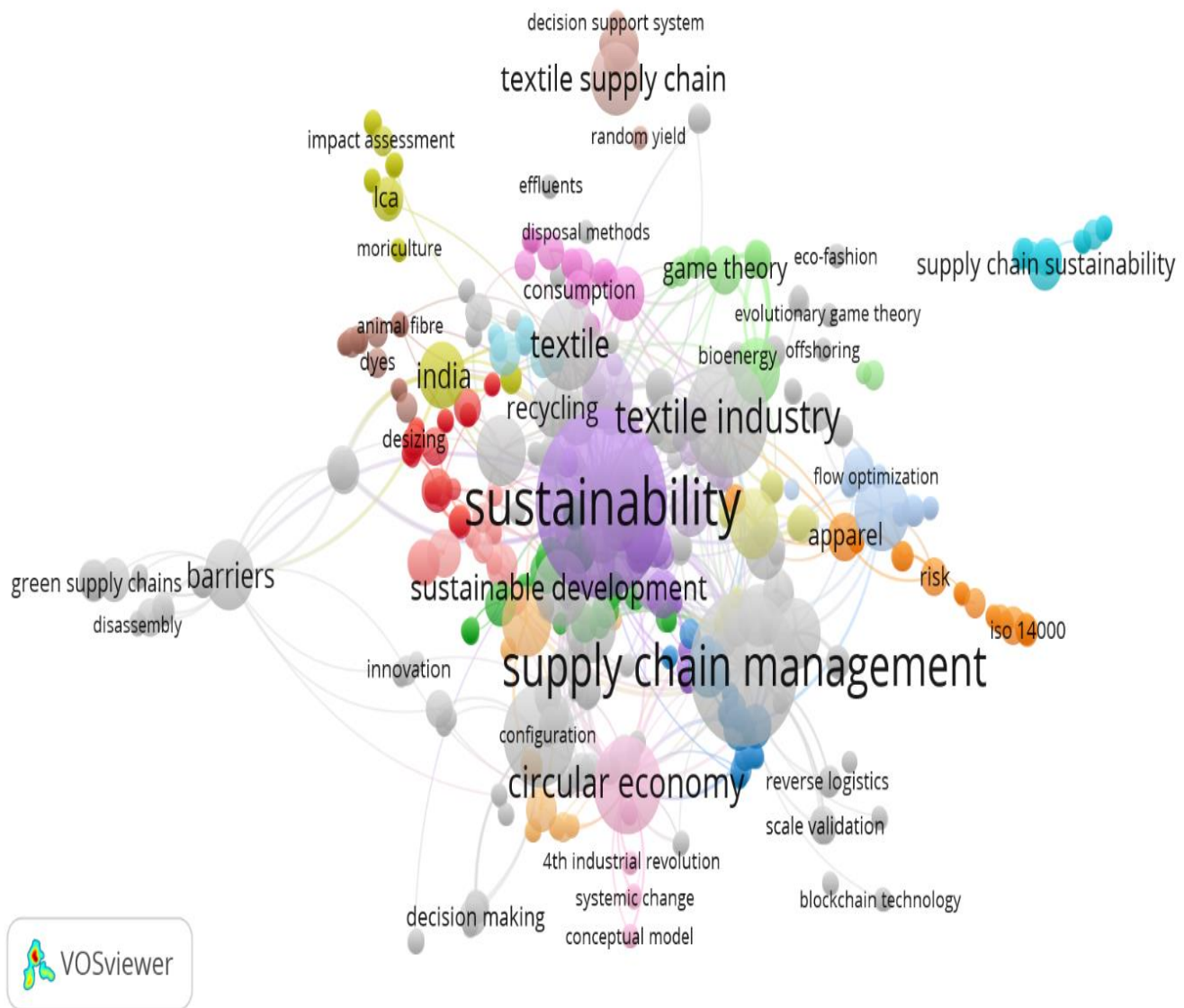
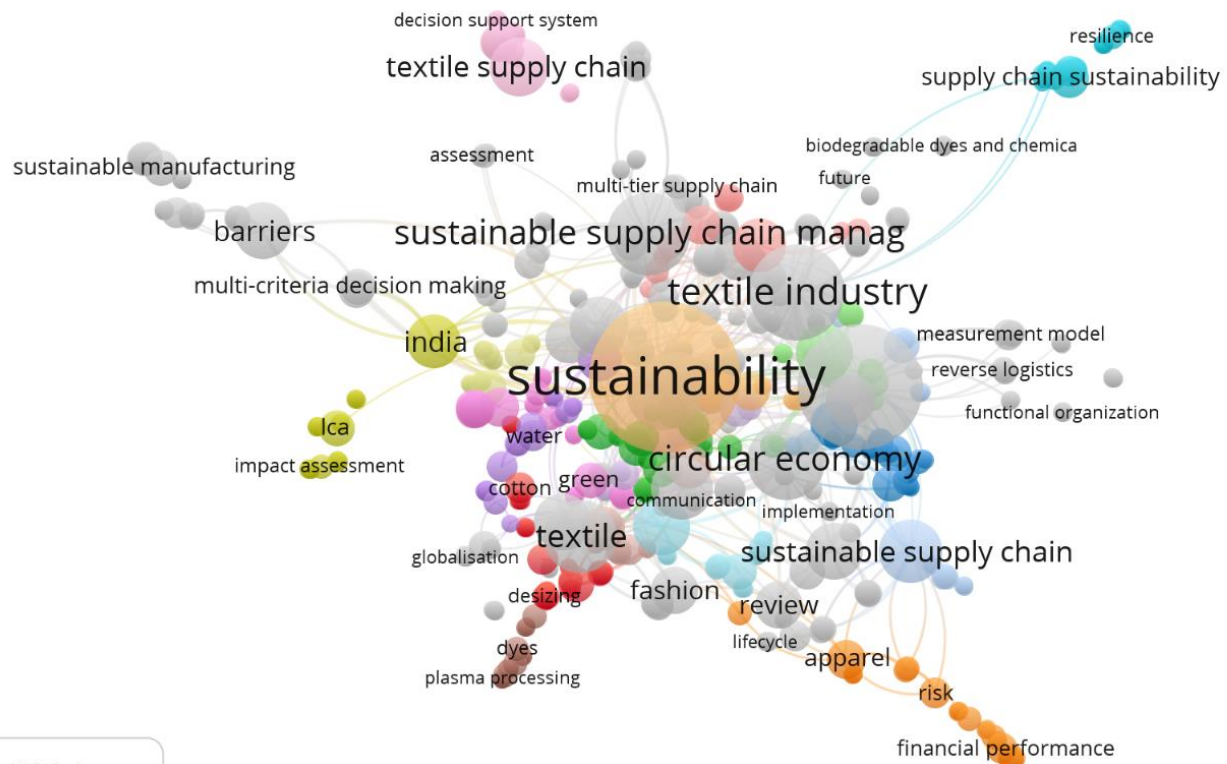


Figure 4: Keywords used with full counting (source: VOSviewer)



VOSviewer

Figure 5: Conjunction of keywords used with fractional counting (source: VOSviewer)

The above two figures represent a bibliometric analysis of sustainable and supply chain management. In total, 250 contributing articles, Figure 4 shows the keywords as a network from the research articles. It can be seen that sustainability, supply chain management, textile industry, circular economy are the top keywords. Figure 5 shows the fractional keywords as a network from the research articles. The top keywords from this network are sustainability, circular economy and textile.

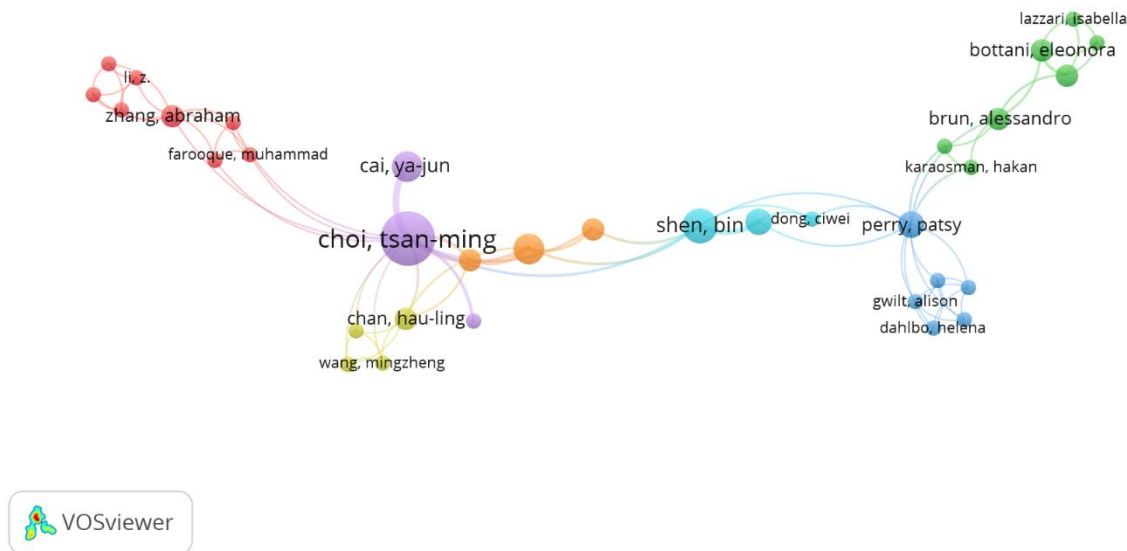


Figure 6: Conjunction of authors of research papers with fractional counting (source: VOSviewer)

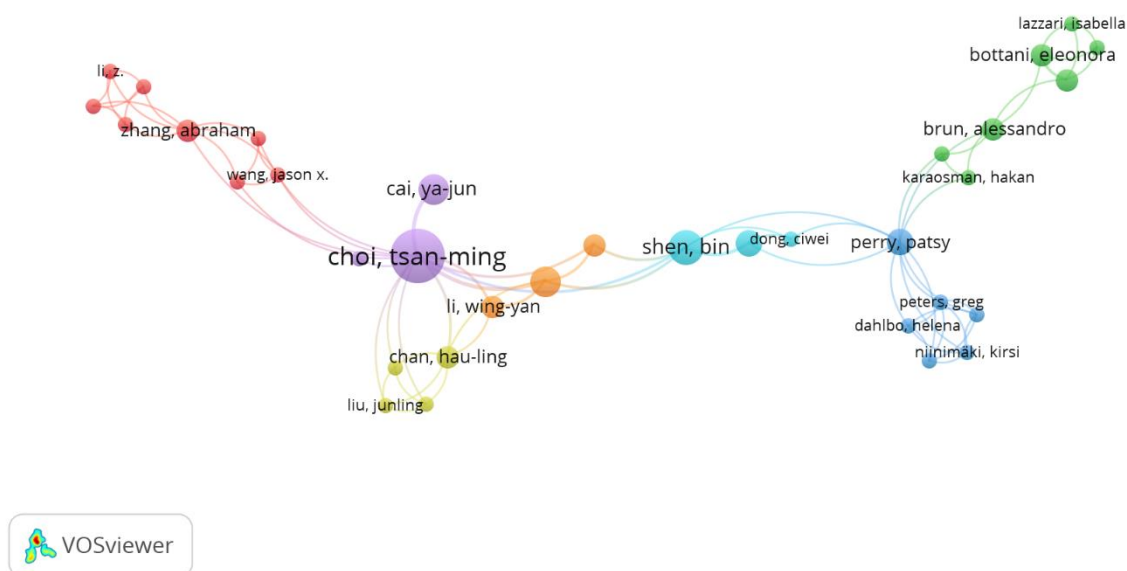


Figure 7: Conjunction of citation net from authors of the selected research papers with full counting (source: VOSviewer)

The above two figures, i.e., Figure 6, Figure 7 represent a bibliometric analysis of the authors done using VOSViewer. Out of the total 250 contributing articles in this bibliometric analysis, Figure 6 presents the author network obtained from the name of all the various authors of each of the contributing articles. We can see that (choi, tsan-ming), (shen, bin), (cai, ya-jun) and (perry, patsy) are the highest contributing authors in this analysis. Some other substantial contributions were made by other authors evident in the figure. Figure 7 presents the fractional author network obtained from the name of all the various authors of each of the contributing articles.

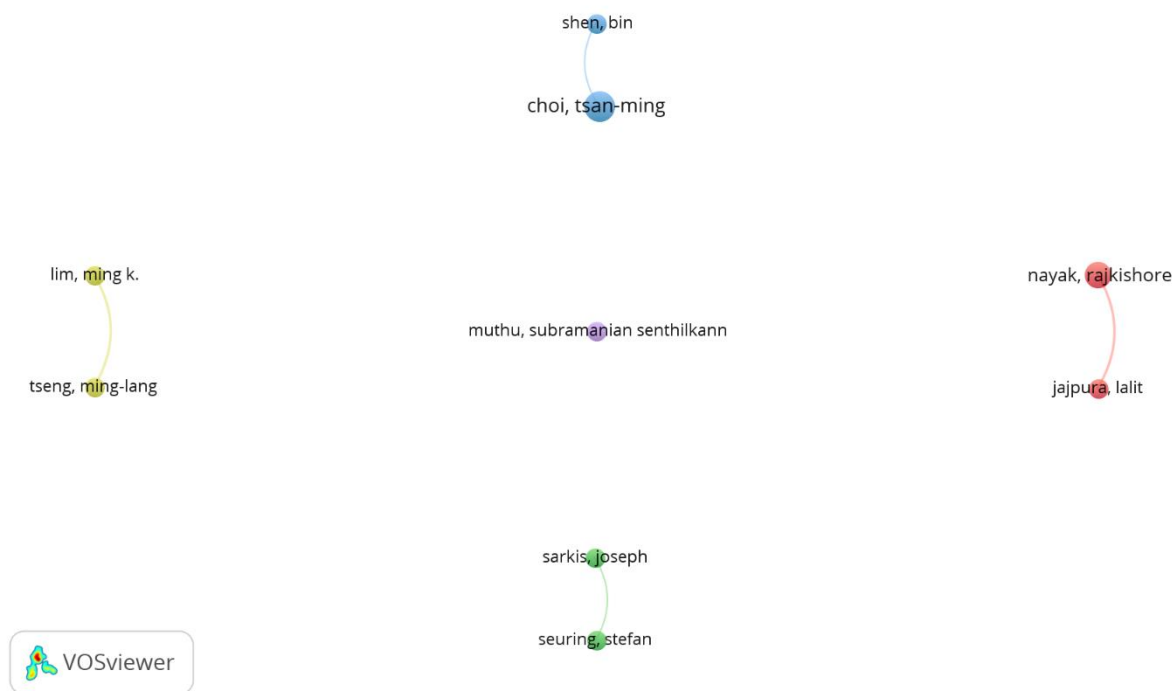


Figure 8: Conjunction of citation net from authors with a minimum of 5 research papers (source: VOSviewer)

Figure 8 shows a resultant analysis of authors who have presented studies and papers on topics revolving around sustainability, supply chain management and the textile industry. The analytic was designed using VOSViewer with limiting threshold criterion set at 5 papers.

9 authors met this threshold. They either in individual capacity or in cohorts with other co-authors have presented a minimum of 5 papers on the given topic of discussion in the last 20 years.

Conclusion & Future work

This paper presented a literature review on SCM (supply chain management) and Textile & Apparel industry. There have been many papers published regarding the same but only few of them are reviewed. In conclusion we would like to throw a light on some study limitations, proposal and some future research directions. The research was limited to the papers published in English exclusively thus, likely excluding local contributions expurgated in other languages.

Findings reveals the following important aspects and learnings of previous studies:

1. The operational strength in terms of costs and profitability can be used as a trope for a company's sustainability.
2. Environmental regulations and meagre employee associations are the root causes of sustainability-related barriers in the textile industry.
3. Result reveals that crop wastes are a convenient resource for the textile industry, providing an abundant supply of sustainable energy.

Currently few studies depict eco-labelling, counter planning, and enlarging retailing as trends in the sector. In the future a triple-helix framework including governing body and other sectors method could be applied for the extension of circular apparel supply chain. It would be interesting to develop decision-making tools using the above and other various methods to analyse different aspects of supply chain sustainability in the context of developed and emerging countries.

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