Exploring the Evolution of LARG Management: A Bibliometric Analysis in the Automotive Sector

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Abstract - The LARG management concept became an important solution in the recent years. LARG principles combines lean management, agility, resilience and green applications. The recent improvements in the automotive sector has surpassed the lean management directives and currently are in need of a more sustainable and efficient transformation. At this point a comprehensive approach like LARG management gains popularity in the sector. This study conducts a bibliometric analysis between the years 2015-2023 for LARG management. As a result of this study the current standing of the literature has been identified. The most researched branches of the concept have been determined by the conducted analysis. Furthermore, this study sheds a light on the future research directions for scholars.

Keywords: LARG Management, Automotive, Bibliometric Analysis, Lean, Green, Agile, Resilient

1. INTRODUCTION:

Lean manufacturing was firstly introduced in the 1990's by Taiichi Ohno and was implemented in the Toyota Production System in Japan. The main philosophy of lean manufacturing is reducing waste and increasing productivity in a production system. After its successful implementation in Japan the lean principles spread around the manufacturing world. Consequently, the automotive sector embraced the lean management principles to become more efficient with less waste. Lean management is also seen as the first step towards a digital transformation for the companies. However, in the current context lean practices are no longer sufficient to answer the expectancy of the industry [1].

Currently, with the influence of computer programming and digital transformation, the term agility gained importance. Agility is the ability of a system to adapt to the expected and unexpected changes in its environment and to turn these challenges into advantages [2]. Especially for systems with unpredictable customer demand or operating in a VUCA (volatility, uncertainty, complexity, and ambiguity) environment, agility has become a useful solution. First introduced in the mid 1990's, agile methodology was a response to the conventional project management techniques, transforming its approach to a more iterative, transformative and most importantly more responsive to customer feedback [3], [4].

After the pandemic wave in 2019, resilience gained momentum in the industry and the literature. Resilience signifies the ability of a system to react, adapt and transform in case of an unforeseen disruption external or internal of the system [5]. Any disruption in the production system can have a significant negative effect for the company. Thus, the companies realized that their supply chains should be resistant to external and internal hindering factors. For example, a supplier in the automotive sector would face significant monetary penalties if a disruption in its production line effects the production line of the OEM (Original Equipment Manufacturer) it is supplying for. Overall, increasing the resilience of a manufacturing system has various benefits to the company such as economic, strategic and reputation [6].

Green Management stands for innovative methods aiming to reduce environmental impacts of a system by introducing waste management, mindful resource utilisation, green product design etc. Especially after the wave started by the Paris Agreement, sustainable solutions captured the interest of the automotive sector. Green management is presenting advantages regarding environmental sustainability as well as financial and competitive benefits. In the current context it is possible to say that the customer demand is evolving towards a more environmentally sustainable company image. Additionally, the industry expectations and the legal policies are changing towards more ecologic requirements. These advancement in the sector are supporting the competitive edge of the companies implementing green management initiatives to their company.

As a result of the competitive advantages and the financial benefits of waste reductions the green management results in a more profitable company structure [7], [8].

In the light of these current occurrences, a comprehensive model was born such as LARG Management. This approach aims to combine lean practices, agility, resilience and environmental sustainability to create a more efficient, robust and sustainable business structure [9]. It is important to underline the fact that LARG principles can have internal conflicts. As an example, we can state that while the lean approach advises to keep minimum stock levels with just in time production, a resilient production would need significant stock levels to resist disruptions of the system. For these reasons LARG management is a subject open to improvement and further research. Overall, this study seeks to identify the literature progress regarding LARG management, by conducting a bibliometric research which will contribute to the literature and shed a light for future research directions.

2. METHOD:

The bibliometric analysis in this study has been conducted by limiting the available data by its publication year. The study is focused on publications between the years 2015 and 2023. As LARG management includes environmental sustainability, 2015 can be seen as a milestone for sustainability research with the global influence of the Paris Agreement. Thus, it was decided that for this new LARG management approach, analysing more current publications i.e. after 2015 will be more meaningful. Using the Scopus database, the research was done within the titles, abstracts and keywords of the publications by focusing on the subject LARG management and automotive with a limitation on the publication years. The publications found through the research was then subjected to a screening process. From the 36 records obtained 18 records were excluded due to unrelated sectoral analysis. 17 reports were sought for retrieval but 5 of the records could not be retrieved. Finally, after an assessment for eligibility 10 records were chosen to be included in this bibliometric analysis. The gathered data is then uploaded to Biblioshiny software in order to create tables and illustrations from the selected publications.

2.1. Database choice:

The bibliometric analysis was done by using the Scopus database. This choice was done as Scopus database is a reliable and up-to-date scientific database.

3. RESULTS:

A total of 36 publications were analysed on LARG management for this bibliometric analysis. At the end of the screening process 10 publications were selected to be included in this analysis. The selection criteria being the availability for retrieval, sectoral compatibility with the analysis and content coherence.

The bibliometric variables applied in this study are as follows:
1. Cluster Frequency Analysis
2. Annual Scientific Production on LARG management between the years 2015 and 2023.
3. The most cited papers published on LARG management.
4. The most frequent keywords.
5. The most used research methods.

3.1. Cluster Analysis:

In the Table 1 it is possible to see the cluster frequency analysis. We can see that terms such as competition, innovation, supply chain management and sustainable development were the most used subjects within the analysed research articles. It is important to highlight that the supply chain management is the most frequently researched path in the LARG management literature.

Table 1: Cluster Frequency

Cluster	Cluster Frequency
competition	2
supply chain management	7
sustainable development	5
innovation	2

3.2. Annual Analysis of the Evolution of Publications:

Figure 1 shows the total annual publications on LARG Management between the dates 2015 and 2023. The trend shows that between the years 2019 and 2021 there was an abundance of publications in this area. As a more detailed analysis we can divide the graph into several sections. First section will be between the years 2016 and 2017 where the publication amount was moderately high. Then, there was a fall between 2017 and 2018 which was recovered until 2019. A third stage will be between the years 2019 and 2021. This stage is where most of the articles were published. The increasing interest in the LARG management concept in these years can be explained by the post-pandemic evolution of the industry and the increasing sustainable awareness. The next one-year period is again consisting of a fall in the number of publications. The fifth and the final stage is after 2022 where the publication amount found an equilibrium point of moderate number of articles.
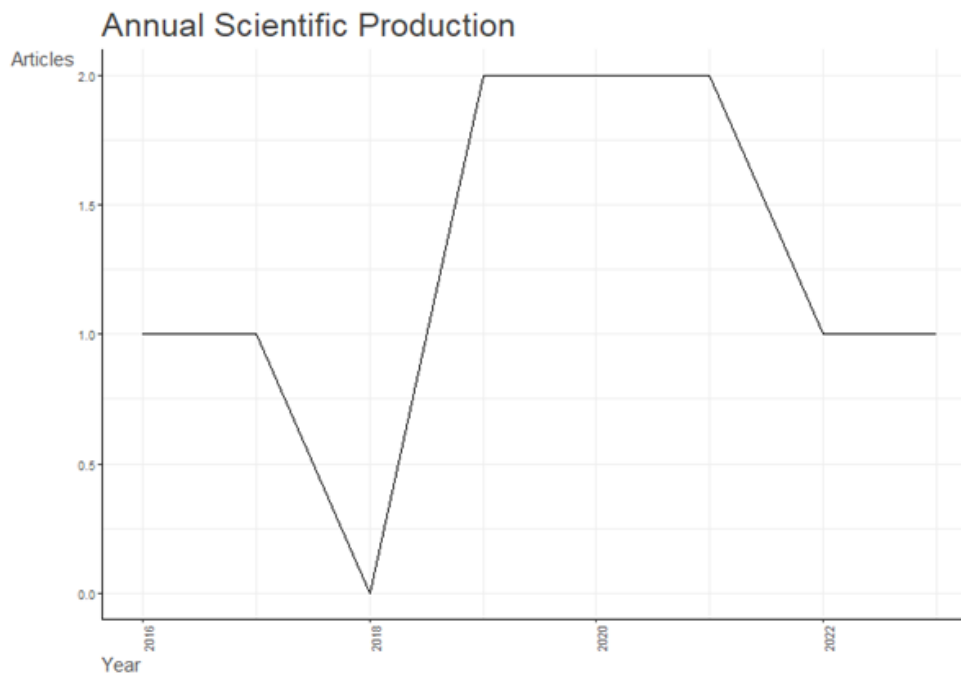

Figure 1: Yearly total publications between 2015-2023

1.1   3.3. The Most Cited Publications:

In Figure 2 it is possible to see the most cited documents between the selected 10 publications. According to the analysis the most cited article is named Big Data Analytics as a mediator in Lean, Agile, Resilient, and Green (LARG) practices

effects on sustainable supply chains. 94 citations are a significant number compared to the other articles in similar contexts. Written by Rakesh D. Raut, Sachin Kumar Mangla, Vaibhav S. Narwane, Manoj Dora, Mengqi Liu; this article combines the LARG principles with Big Data Analytics. The article includes a survey consisting of 297 participants of Indian manufacturing firms. It provides managers an important result which is several factors affecting the implementation of big data analytics to a supply chain system founded with LARG principles. The second most cited document is named Integration of Lean, Agile, Resilient and Green Paradigms in a Business Model Perspective: Theoretical Foundations written by Maria do Rosário Cabrita, Susana Duarte, Helena Carvalho, Virgílio Cruz-Machado. This article with 38 citations, aims creating a business model canvas constructed by taking into account the LARG principles. A literature review was conducted in order to define the key internal motivation points of a business to include LARG principles into their business model. This article concludes that the executed research contributes in the literature by analysing how the LARG principles can be integrated into a business model, which is an important indicator for evolving firms by accepting LARG principles.
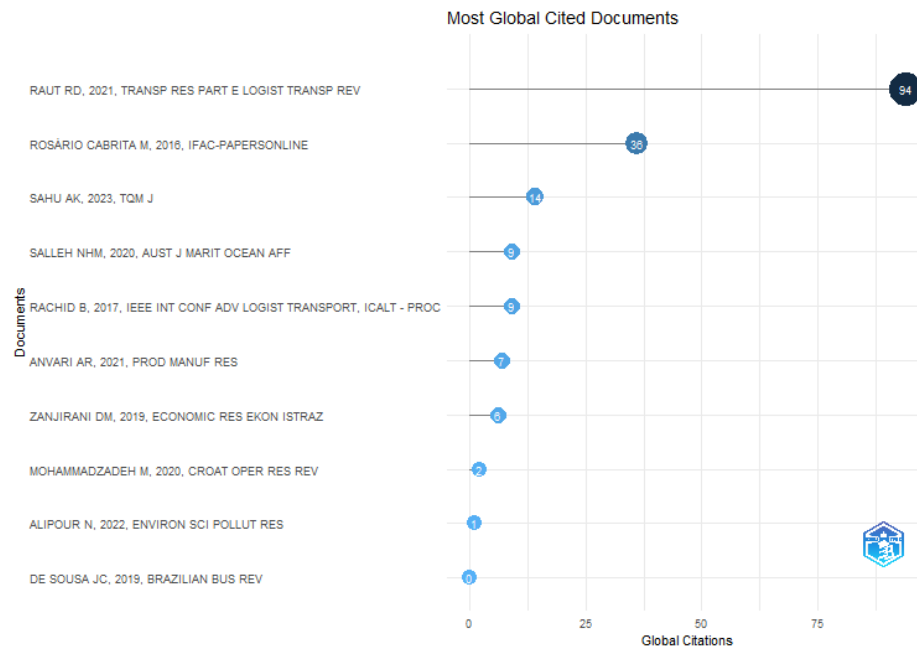

Figure 2: Global citation amount of the analyzed articles

3.4. Keyword Analysis:

In the keyword analysis represented in Figure 3, it is possible to see the highlighted topics from the articles about LARG management. Sustainable development, supply chain management, manufacturing and decision making are the most used keywords in the analysed articles. Sustainable development is the most used keyword in these studies. As LARG management was born by combining the more conventional approaches such as lean management, agility and resilience with newly emerging sustainable approaches, the fact that sustainable development was highly researched is only a natural consequence.
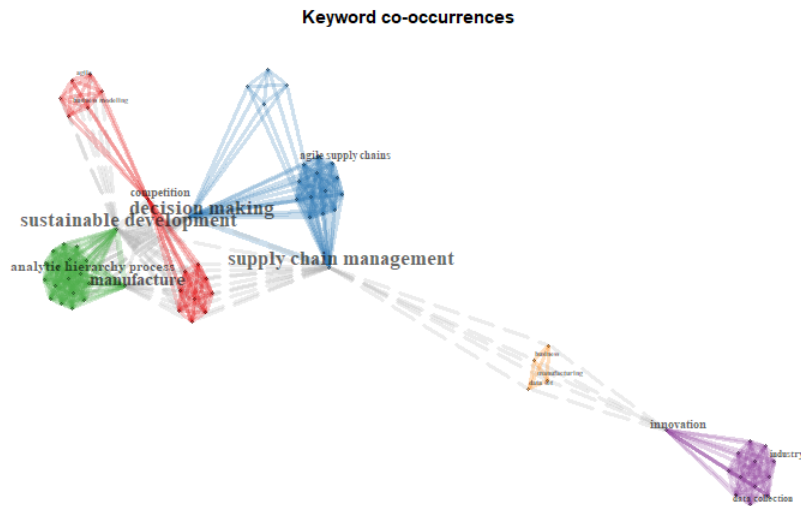
Figure 3: Keyword Analysis Representation

3.5. Method Analysis:

In Table 2 the methods used by the collected publications are listed. As it can be seen from the table the most used methods are literature review and surveys. As LARG management is a newly introduced subject to the industry, there was a higher need to gather information by conducting literature reviews in order to improve the collective knowledge on the subject. Consequently, real-life applications are significantly low in number. Out of ten analysed publications only one article included an application in its research. This result affirms that there is a literature gap in the LARG management concept regarding its applications in the manufacturing systems.

Table 2: Method Analysis on the selected publications

Title	Authors	Year	Method
INTEGRATION OF LEAN, AGILE, RESILIENT AND GREEN PARADIGMS IN A BUSINESS MODEL PERSPECTIVE: THEORETICAL FOUNDATIONS	ROSÁRIO CABRITA M;DUARTE S;CARVALHO H;CRUZ-MACHADO V	2016	Litterature review
BIG DATA ANALYTICS AS A MEDIATOR IN LEAN, AGILE, RESILIENT, AND GREEN (LARG) PRACTICES EFFECTS ON SUSTAINABLE SUPPLY CHAINS	RAUT RD;MANGLA SK;NARWANE VS;DORA M;LIU M	2021	Survey and result analysis by EFA, CFA, SEM
LEAN, AGILE, RESILIENT, AND GREEN HUMAN RESOURCE MANAGEMENT: THE IMPACT ON ORGANIZATIONAL INNOVATION AND ORGANIZATIONAL PERFORMANCE	ALIPOUR N;NAZARI-SHIRKOUHI S;SANGARI MS;VANDCHALI HR	2022	Survey and Structural equation modeling
SUPPLY CHAIN IMPROVEMENT IN LARG (LEAN, AGILE, RESILIENT, GREEN) CONTEXT: A RISK MANAGEMENT APPROACH	RACHID B	2017	Litterature review and simulated case study
L.A.R.G. SUPPLIER SELECTION BASED ON INTEGRATING HOUSE OF QUALITY, TAGUCHI LOSS FUNCTION AND M.O.P.A.	ZANJIRANI DM;HASHEMKHANI ZOLFANI S;PRENTKOVSKIS O	2019	Litterature review and Multi-Objective Performance Analysis
DECISION-MAKING FRAMEWORK FOR SUPPLIER SELECTION USING AN INTEGRATED MCDM APPROACH IN A LEAN-AGILE-RESILIENT-GREEN ENVIRONMENT: EVIDENCE FROM INDIAN AUTOMOTIVE SECTOR	SAHU AK;SHARMA M;RAUT RD;SAHU AK;SAHU NK;ANTONY J;TORTORELLA GL	2023	Litterature review and fuzzy sets theory
THE INTEGRATION OF LARG SUPPLY CHAIN PARADIGMS AND SUPPLY CHAIN SUSTAINABLE PERFORMANCE (A CASE STUDY OF IRAN)	ANVARI AR	2021	Litterature review
LEAN, AGILE, RESILIENCE AND GREEN (LARG) PARADIGM IN SUPPLY CHAIN OPERATIONS: A TRIAL IN A SEAPORT SYSTEM	SALLEH NHM;ABD RASIDI NAS;JEEVAN J	2020	Litterature review and survey
CLOSED LOOP SUPPLY CHAIN MATHEMATICAL MODELING CONSIDERING LEAN AGILE RESILIENT AND GREEN STRATEGIES	MOHAMMADZADEH M;SOBHANALLAHI M;KHAMSEH AA	2020	Mathematical modeling
ENVIRONMENTAL MANAGEMENT OF LARG SUPPLY CHAIN: A DIAGNOSTIC INSTRUMENT PROPOSED FOR ASSESSING SUPPLIERS	DE SOUSA JC;ALVES MB;LEOCÁDIO L;ROSSATO J	2019	Litterature review, diagnostic tools and real-life application

4. CONCLUSION:

LARG management is a newly introduced approach in the literature. For this reason, the number of publications found was limited during the bibliometric analysis. The LARG management concept has gained some momentum especially after the year 2019. The previous literature has expanded its reach beyond the lean management principles and started focusing on dimensions such as agility, resilience and sustainability. For these reasons LARG management is an important concept to be further researched and developed by scholars.

The main limitation of this research has been the small amount of collected articles. As the LARG management concept is a niche and quite new research topic, it was not possible to collect significant amount of data. At this point further research could be done by using different databases than Scopus. A research gap could be identified, with the help of the keywords analysis, as the manufacturing sector. Currently, LARG management has been mainly applied for supply chain management and sustainable development. The low number of real-life applications also shows the lack of knowledge of the industry regarding LARG management. A research consisting of the applications of LARG management principles in the manufacturing context could further contribute to the literature and to the industry development. Additionally, internal conflicts of the LARG management principles are a time-worthy research topic. Identifying a combination of these principles to create the most feasible, effective and profitable model, can be a great contribution to the literature and to the industry.

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