

**APPLICATION OF INDUSTRY 4.0 TECHNOLOGIES IN THE TEXTILE SEGMENT - A  
COMPARISON WITH THE AUTOMOTIVE INDUSTRY****ANA DIAS**

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**ABSTRACT**

Industry 4.0 (I4.0) has been bringing substantial digital transformations to all sectors, including the textile chain, which is considered a traditional segment and still presents resistance to applying the technologies arising from this revolution. In this sense, this study aimed to survey the scenario of the implementation of disruptive technologies of the so-called fourth industrial revolution in the textile sector through a literature review and to perform a benchmark comparison of the implementation in Industry 4.0 with that of the automotive industry. To carry out this study, some elaboration steps were followed that involved the definition of the research questions, the designation of the search strategy, the search for documents in the literature, the assessment of the quality of the studies, the critical analysis of the papers and the discussion of the results. After defining the research question, the Scopus and Web of Science databases were determined for the search, and the Rayyan application was used for document screening. Once the search strategies were defined and applied to the databases, 2432 records were found. Each information retrieval was organized by the "most relevant" criterion. The metadata of the 120 studies were screened in search of duplicates, and the titles and abstracts were read. After this process, 40 studies proceeded to compose this review. After a critical reading of the papers, it was possible to confirm that the automotive sector is one of the most technologically advanced and that the textile industry has been successfully applying some level of digital transformation.

**Keywords:** Digital Transformation; Fourth Industrial Revolution; Systematic Review.

## 1 INTRODUCTION

There is an ongoing transition in business and society as a whole that has been seen as a model that will establish new means of production and consumption, which will profoundly modify the main industrial systems: the so-called fourth industrial revolution (BERTOLA; TEUNISSEN, 2018). The textile sector, which has always played an important role in industrial revolutions, has been deeply impacted and pressured due to the digitization of the manufacturing sector brought about by the advent of Industry 4.0 (I4.0) (WANG; HA-BROOKSHIRE, 2018). On the other hand, the automotive industry and its suppliers are already making extensive use of Industry 4.0 technologies, connecting within a cyber-physical system to improve production efficiency, product quality, and safety in factories (SILVA *et al.*, 2018). In this sense, this study aimed to contribute to the textile segment by comparing these industrial sectors through a systematic review of the literature, identifying the "Industry 4.0" technologies most used in their production chains and their stages of implementation.

## 2 METHODOLOGY

The methodology section exposes the implications of the path chosen to learn a given reality about the object of study (LIMA; MIOTO, 2007). The methodology chosen for this investigation was a systematic literature review. A systematic literature review provides researchers with subsidies to carefully assess the research carried out in a given field of studies, allowing them to map the publications and, thus, produce a synthesis of the results obtained up to a specific point in time (BRERETON *et al.*, 2007). To carry out the present study, some elaboration steps were followed that involved i) the definition of the research questions, ii) the election of the screening protocol to be followed, iii) the definition of the search strategy, iv) the search and eligibility of documents in the literature, v) the assessment of the quality of the documents, vi) the critical analysis of the studies, vii) the presentation of the review, and viii) the discussion of the results. To obtain a satisfactory literature review, the initial step is to devise the research question (GIL, 2017). For this study, the guiding question was: "What is the panorama of the adoption of technologies arising from I4.0 in the textile segment?", as shown in Table 1.

Table 1 – Research question

Question	Question description
Q.1	What is the current stage of the adoption of Industry 4.0 technologies by the textile sector?

Source: The Authors (2023)

For the document screening step, the Rayyan application was used, a freely available online tool developed by the Qatar Computing Research Institute to streamline the process of systematic reviews (FOSTER; DEARDORFF, 2017). From then, the search strategy was devised using keywords taken from the research questions. The Scopus and Web of Science databases were chosen for the bibliographic survey of this study. The search strings regarding the textile and automotive industries are shown in Figure 1.

Figure 1 – Search strings

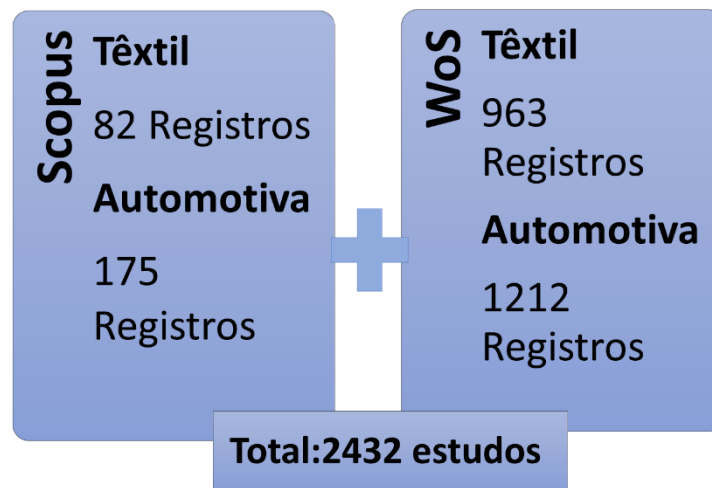
Sector	Query strings
<b>Textile</b>	("Textile" OR "Clothing" OR "Apparel" OR "Fashion" AND "Industry 4.0")
<b>Automotive</b>	("Automotive Industry" OR "Automobile Manufacture" OR "Automotive Sector" OR "Car Manufacturers" OR "Automotive" AND "Industry 4.0")

Source: The authors (2023)

## 2.1 Criteria

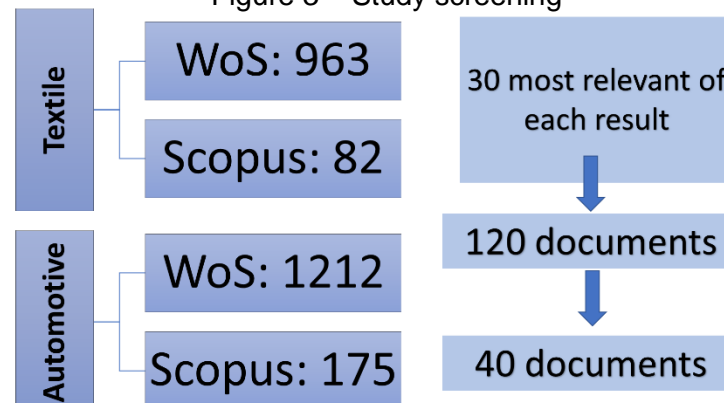
In each of the databases, records were retrieved for both industrial segments, executing the search strategies in the "advanced" search mode while adapting them to the characteristics of each system. As inclusion criteria, studies published from 2018 to 2022 in English were considered, including only "article" type documents. Inconclusive studies and other literature reviews were excluded.

Figure 2 – Total number of studies retrieved from the databases



Source: The authors (2023)

Figure 3 – Study screening



Source: The authors (2023)

### 3 RESULTS

After applying the inclusion and exclusion criteria, 2432 records were found in the databases mentioned above, shown in Figure 2. From then, we determined the choice of the 30 most relevant studies in each data retrieval according to the classification of the databases. Such studies were also the most aligned with the topics of the present study. The metadata of these 120 papers were uploaded to the online software "rayyan.ai", which screened the retrieved records. At first, possible duplications of papers were verified. Then, the titles and abstracts were read to decide on including the studies in the final analysis. After this process, shown in Figure 3, 40 documents remained to compose this review.

### 3 CONCLUSION

After the analysis of the 40 selected documents, it was surmised that, on a global scale, the panorama presented is of an early-stage adoption of I4.0 technologies by the textile segment. This industry has proved hesitant in implementing digital transformation, either due to a lack of knowledge about this strategy or of support from governments and executives, who are decision-makers. Still, some projects for applying I4.0 technologies have been inserted in the textile sector along its chain, such as Big Data/Analytics platforms. Some of the technologies used by both segments are presented in Figure 4.

Figure 4 – Technologies presented in the selected studies

Automotive	Textile
<ul style="list-style-type: none"> <li>• 3D Printing</li> <li>• Sensors</li> <li>• Artificial intelligence</li> <li>• Augmented reality</li> <li>• Digital twin</li> </ul>	<ul style="list-style-type: none"> <li>• Big data</li> <li>• Artificial intelligence</li> <li>• Deep learning</li> <li>• Machine Learning</li> </ul>

Source: The authors (2023)

Regarding the automotive industry, it was possible to observe that it is one of the most technologically advanced industries, with innovations even reaching cars connected by the Internet of Things. Studies also point to the use of Augmented Reality, Artificial Intelligence, and Sensors. Both sectors have been applying emerging technologies from the fourth industrial revolution in their

processes; however, there is a larger-scale application in the automotive industry, made evident by the technologies found in the studies.

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