Review article

This is the Title of the Review Article

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**Abstract:** A systematic review is a rigorous approach to gathering and evaluating research on a specific question to summarise advances and identify research gaps. This document provides guidelines for conducting a systematic review, including search strategies, study selection and data extraction, to ensure transparency and minimise bias. The abstract should briefly outline the topic, objectives, methods and key findings of the review, highlighting key trends and gaps in knowledge. Conclusions drawn from the review should suggest implications for future research. The abstract should be concise, avoiding undefined abbreviations or references, and should appeal to a wide readership. All information presented should be addressed in the main article, and should not include technical details, references, or citations. This template provides a clear structure for writing systematic reviews and promotes rigorous academic standards.

**Keywords:** keyword 1; keyword 2; keyword 3 (List three to five keywords that are relevant to the topic, separated by semicolons and a space; only use capital letters for proper nouns or acronyms; do not include abbreviations after a keyword.)

1. Introduction

A systematic review is a structured and rigorous approach to summarising research on a specific question, and is therefore essential for consolidating knowledge and identifying research gaps. Unlike traditional reviews, a systematic review follows a defined methodology to minimise bias, ensure transparency and provide a comprehensive assessment of the literature. This approach is essential to provide meaningful insights into the field of advanced manufacturing, where rapid technological advances create constant opportunities for investigation.

At the heart of any systematic review is a clear and well-defined research question. A specific and focused question narrows the scope of the investigation and guides both the literature search and the overall review process. For example, “How has additive manufacturing improved production efficiency in the aerospace industry?” A precise question ensures that the review remains relevant and avoids drifting into unrelated topics. This step is critical because it sets the stage for the subsequent stages of the review.

Establishing the context and relevance of the research topic is the next essential step in the introduction. Advanced manufacturing is a rapidly evolving field, and reviews help to synthesise what is known, while highlighting gaps in research that require further investigation. For example, if sustainability is a growing concern within the industry, but there is limited research on the environmental impact of additive manufacturing, this presents a clear opportunity for research. A strong introduction should not only provide background information, but also present a compelling rationale for the review. It is important to emphasise the importance of addressing these gaps at this time, particularly as industry adopts more advanced technologies.

After setting the context, it is important to articulate the objectives of the review. These objectives should be closely aligned with the research question and guide the reader as to what to expect from the review. For example, a systematic review might aim to assess the impact of artificial intelligence (AI)-driven manufacturing processes on production efficiency and sustainability in different industries. A clear statement of these objectives provides the reader with a roadmap for understanding the structure and purpose of the review.

Finally, the introduction could provide a brief preview of the structure of the review. Indicate that the following sections will cover the methods used to select and analyse the studies, followed by a presentation of the results, and finally a discussion of the implications for advanced manufacturing and future research. This logical progression helps the reader to follow the flow of the paper and to understand how each section builds on the previous one.

In summary, the introduction serves several important purposes: it defines the research question, establishes the relevance of the topic, outlines the objectives of the review, and may provide a roadmap for the reader. In doing so, it sets the stage for the systematic and comprehensive analysis that follows.

2. Methods

The methods section of a systematic review is essential to ensure transparency and reproducibility. This section outlines the steps required to gather, appraise and synthesise the relevant literature and explains the specific requirements for formatting and submission to the Advanced Manufacturing Students Conference (AMSC).

For this review, authors must follow the AMSC template provided. The template ensures uniformity and clarity of submissions. The text is written in **British English**. Each section has a corresponding style available in the Word Styles menu (e.g., the body text uses the style "3.1\_text").

* The **maximum length** of the review article is **four pages**, with the **fifth page reserved for references**. ("3.5\_bullet").
* The **title** should be written in capital letters with key words capitalised and should **not exceed 15 words**. Avoid using abbreviations and punctuation in the title.
* The **abstract** should be concise and **no more than 150 words**. It should not contain undefined abbreviations or references and should summarise the main topics, methods, results and conclusions of the review.
* **Figures and tables** should be used where appropriate to present data or highlight key information. They should be **clearly labelled** and placed close to where they are first **mentioned in the text**.

It is important to maintain consistent formatting throughout the document, and authors must **avoid using field functions or macros** that could disrupt the layout. If reference management software (e.g., Mendeley, EndNote, Zotero) is used, ensure that references are converted to static text before final submission. ("3.3\_text\_after\_list")

The review must **follow the conventional structure of a systematic review**, which includes the following sections

1. Introduction: Provides background, states the research question, and explains the significance of the review. ("3.4\_itemize")
2. Methods: Describes how the literature was selected, including the search strategy, inclusion/exclusion criteria and data extraction methods.
3. Results: Summarises the findings from the literature reviewed.
4. Discussion: Interprets the findings, highlights gaps and suggests future research directions.

Authors are expected to adhere strictly to this structure. The review must present a balanced, unbiased synthesis of the literature with appropriate discussion of research gaps and future directions.

The search strategy should be carefully planned and documented. Select relevant academic databases such as Scopus, IEEE Xplore and Web of Science. Identify appropriate keywords based on the research question. For example, if the focus is on sustainability in additive manufacturing, relevant terms might include "3D printing", "sustainability" and "environmental impact".

Boolean operators (AND, OR, NOT) should be used to refine search results to ensure that the most relevant studies are retrieved. The search must cover an appropriate time period (e.g., the last ten years) and **include only articles published in peer-reviewed journals or conference proceedings**. Non-peer-reviewed literature, such as opinion pieces, should be excluded.

All searches must be documented, including the databases used, the number of results returned and any filters applied. Ensure that the search strategy is transparent and reproducible by others.

Clearly define the inclusion and exclusion criteria to ensure that only relevant and high-quality studies are included. Ensure that each article addresses the research question. It is important to keep a detailed record of why certain studies were excluded during the review process. For transparency, you could include a flow chart showing the number of studies screened, excluded and included in the review.

Once the initial search has been completed, the next step is to select the studies. Articles are screened by reviewing the titles and abstracts to determine their relevance to the research question. Duplicates and irrelevant studies should be discarded. After this preliminary screening, the remaining articles should be reviewed in full to confirm their relevance.

Keep a detailed log of the study selection process, recording the reasons for exclusion at each stage. This ensures transparency about how the final set of studies was selected and provides a clear methodology for replicating the review.

The data extraction process involves the systematic collection of relevant information from each selected study. Key details to be recorded include:

* Authors, year of publication, study objectives and research methods (e.g., case studies, experiments).
* Key findings, limitations identified by the authors and gaps in the research.

Once the data is extracted, organise it by themes related to the research question. For example, studies on additive manufacturing and AI could be categorised by industry (e.g., aerospace, automotive) or outcomes (e.g., production efficiency, sustainability). If necessary, use tables or figures to summarise the data.

The **references** section should list all sources cited in the text and **follow APA Citation Style** (7th edition). A **minimum of seven references** are required, all of which must be cited in the main text. Ensure that only cited literature appears in the reference list. The fifth page of the review should be reserved exclusively for the bibliography.

* Citation management tools (e.g., Mendeley, EndNote, Zotero) can be used to ensure accuracy and avoid duplication, but these references should be converted to static text before submission.
* **Each reference must be cited using the correct in-text citation format, e.g. (author, year), and block citations (where multiple references are cited at the end of a paragraph) should be avoided.**

The Methods section is critical to ensuring that your systematic review is transparent, reproducible and compliant with AMSC submission requirements. By following the specific formatting guidelines, conducting a rigorous literature search, applying clear inclusion/exclusion criteria, and maintaining detailed documentation of the entire process, you will ensure the quality and credibility of your review. This structured approach will provide valuable insights into the field of advanced manufacturing.

3. Results

The results section of a systematic review presents a synthesis of the key findings from the studies you have selected and analysed. It should be organised according to themes or categories that emerged from the literature. Each theme should be presented in a logical order to guide the reader through the findings and ensure coherence.

When writing this section, avoid reporting the results of individual studies in detail. Instead, focus on summarising the overall trends and patterns identified in the studies. Where appropriate, include figures, tables and equations to help visualise the data and make complex findings more accessible. Below is a fictional example of how to structure this section. It demonstrates the correct use of subsections, visual aids and equations. It also shows how to synthesise findings into coherent themes without overwhelming the reader with excessive detail. Remember that this is only an example for illustrative purposes - your results section should reflect your own findings and analysis.

3.1. Impact on waste reduction (“2.2\_heading2”)

Several studies have shown that additive manufacturing significantly reduces material waste compared to traditional methods. This reduction is particularly evident in industries that require high precision, such as aerospace and medical device manufacturing. For example, Author A (2020) and Authors B et al. (2021) reported an average waste reduction of 25%, while Author C (2019) highlighted up to 30% waste reduction in prototype development (Figure 1).



**Figure 1.** Comparative waste reduction between traditional and additive manufacturing methods in selected industries. (The figure itself uses “5.2\_figure” and the caption “5.1\_figure\_caption”. Figures are centered. Schemes follow the same formatting.)

To quantify the improvement, the waste reduction efficiency 𝑊eff can be calculated using the following equation:

|  |  |
| --- | --- |
|  | (1) |

where 𝑊traditional represents the waste generated in traditional manufacturing, and 𝑊additive represents the waste generated in additive manufacturing (Author B, 2021). This formula provides a standardised measure to compare efficiency across different sectors. (Please remove the frame from the auxiliary table that was used to place the equation and the number correctly by selecting the table and choosing “no frames”.)

3.2. Energy efficiency concerns

Although additive manufacturing reduces material waste, energy consumption remains a challenge. The reviewed studies showed conflicting results in terms of overall energy efficiency. Author D (2021) and Author E (2020) reported higher energy consumption in additive manufacturing, especially in high-volume production, while Author F (2022) found that energy savings are possible in low-volume, highly customised production. Based on data from Author G et al. (2019), an overview of energy consumption and material waste in different manufacturing processes was obtained (Table 1).

**Table 1.** Comparison of energy consumption and material waste for traditional and additive manufacturing. (This is a table. Tables are centered. Tables should be placed in the main text near to the first time they are cited.)

|  |  |  |
| --- | --- | --- |
| Manufacturing Method (“4.4\_table\_header”) | Energy Consumption (kWh) | Material Waste (kg) |
| Traditional Manufacturing (“4.2\_table\_body”) | 150 | 25 |
| Additive Manufacturing (low-volume) | 120 | 5 1 |
| Additive Manufacturing (high-volume) | 180 | 5 |

1 Tables may have a footer. (“4.3\_table\_footer”)

The overview shows that while additive manufacturing offers clear benefits in terms of waste reduction, energy consumption can be higher depending on the volume and type of production.

3.3. Variability across industries

Adoption of additive manufacturing varies across industries. The automotive and aerospace sectors have embraced the technology due to its efficiency in prototyping and customisation. In contrast, the healthcare industry has been slower to adopt, largely due to regulatory constraints and the high cost of initial set-up. Author H (2020) notes that despite slower adoption, the healthcare industry has seen rapid growth in the use of additive manufacturing to create personalised implants.

This variability in industry adoption highlights the contextual benefits and challenges of additive manufacturing. Figure 2 illustrates the adoption rates across key industries, providing a clear visual comparison.

|  |  |
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|  |  |
| (**a**) | (**b**) |

**Figure 2.** This is a figure. Schemes follow another format. If there are multiple panels, they should be listed as: (**a**) Description of what is contained in the first panel; (**b**) Description of what is contained in the second panel. Figures should be placed in the main text near to the first time they are cited. A caption on a single line should be centered. Please remove the frames from the auxiliary table that was used to place the images correctly by selecting the table and choosing “no frames”.

3.4. Conflicting results and bias

Some studies, particularly those funded by industry, reported more favourable results regarding the energy efficiency of additive manufacturing. Author I (2020) and Author J (2021), both funded by additive manufacturing companies, concluded that energy consumption was comparable to or lower than traditional methods. In contrast, independent studies such as Author K (2021) found that energy consumption was significantly higher in high-volume production.

4. Discussion

The discussion section of a systematic review provides a space for interpreting the findings, placing them in the broader context of advanced manufacturing and relating them to the objectives of the review. It also addresses the implications of the findings, acknowledges limitations and offers directions for future research. A detailed breakdown of the structure and writing of this section is provided below.

4.1. Summary of key findings

Start by summarising the main findings of your review, emphasising how they contribute to the field. Rather than restating the results, focus on interpreting the key trends that emerged from the research. For example, if your review examined additive manufacturing, you might highlight its benefits in reducing material waste, alongside challenges such as energy consumption. By addressing these issues, you provide a clearer understanding of how the findings answer the research question.

Avoid going into excessive detail about individual studies; instead, synthesise the findings to give a broader picture of how these findings advance current knowledge in advanced manufacturing. The aim is to provide a context for how the findings fit into ongoing developments in the industry.

4.2. Broader implications of the findings

Next, consider the wider implications of these findings. Discuss how the results either agree with or challenge existing research, and what implications this might have for both industry practice and academic research. For example, if your review highlights inefficiencies in energy use in additive manufacturing, this will highlight areas where industrial practices could be optimised. Similarly, a review of the integration of AI in manufacturing could highlight gaps in research related to energy management or sustainability.

This section is essential for translating academic findings into real-world implications. By showing how your conclusions could influence technological innovation, you demonstrate the relevance of the review not only to researchers but also to practitioners in the field.

4.3. Risk of bias and author limitations

It is important to recognise potential biases in the studies you review. Industry-funded research may bias the results in favour of positive outcomes, which could affect the overall conclusions of your review. Acknowledge this bias and explain how it might affect your interpretations. In addition, consider the methodological limitations of the studies, such as small sample sizes, short observation periods, or lack of generalisability.

You should also consider the limitations of your own review process. Were some studies excluded because of language or accessibility problems? Were there cases of publication bias where only positive results were available? Acknowledging these limitations adds credibility to your review by showing that you have critically evaluated both the literature and your methods.

4.4. Strength of evidence

Evaluate the strength of the evidence presented in the studies. Consider whether the results are consistent across different industries or contexts, or whether there are conflicting results that warrant further investigation. If there are inconsistencies, for example in the energy efficiency results for additive manufacturing, explain how differences in study design, manufacturing methods or industry contexts might account for these variations.

This section should also address the generalisability of the results. If the studies reviewed are limited to specific sectors, such as aerospace or healthcare, you should consider whether these findings can be applied more broadly. The aim is to assess whether the evidence is robust and reliable enough to inform future developments in the field.

4.5. Limitations and future research

After discussing the limitations, turn your attention to how future research can address the gaps identified in your review. This section should suggest specific directions for future studies, whether it is optimising energy consumption in additive manufacturing or exploring the long-term environmental impacts of new technologies. You may also suggest further research into emerging trends such as the integration of AI into manufacturing processes, particularly its potential to improve both production efficiency and energy use.

By providing a clear roadmap for future research, you will provide valuable guidance for subsequent studies aimed at addressing the uncertainties or gaps highlighted in your review. This forward-looking approach strengthens the impact of your review by demonstrating that it not only synthesises current knowledge, but also helps to shape the future of the field.

4.6. Conclusion and final thoughts

The conclusion of the discussion should succinctly summarise the main findings of your review and emphasise their importance. Avoid simply repeating what has already been covered. Instead, distil the key findings that will help the reader understand the overall contribution of your review to the field of advanced manufacturing.

For example, while additive manufacturing can significantly reduce material waste, its high energy consumption remains an unresolved challenge. Highlighting such areas where the technology has both strengths and limitations can provide a balanced view and encourage further research into potential solutions, such as AI-driven optimisation for energy efficiency.

Finally, make some forward-looking statements about how these findings might influence future academic research or industry practice, setting the stage for continued innovation in advanced manufacturing.

**Declaration:** In preparing this scientific paper, I followed the DFG Code of Conduct (<https://www.dfg.de/download/pdf/foerderung/rechtliche_rahmenbedingungen/gute_wissenschaftliche_praxis/kodex_gwp_en.pdf>), which describes the essential standards of good scientific practice.

**Conflicts of Interest:** The author declares no conflict of interest.

References

The references section is an important part of your systematic review. It ensures that you give proper credit to the studies and papers that have informed your research. In this section you will **list each source you have cited in the main text of your review**. The following are guidelines to help you compile and format your reference list correctly.

You must include at least seven references. Only works cited in the text and published, accepted for publication or available on a recognised preprint server should be included in the reference list. Unpublished or non-peer-reviewed works, such as personal communications or informal articles, should be avoided unless absolutely necessary.

Your references should be from acceptable scholarly sources, such as Peer-reviewed journal articles, conference papers, monographs, patents, standards. Ensure that references are diverse and not overly reliant on the work of a single research group or region. This will help to demonstrate a balanced and comprehensive understanding of the topic.

The reference list must follow APA Citation Style (7th ed.). Here are the key points to follow:

* Author(s): Last name first, followed by initials. If there are several authors, separate them with commas and use an ampersand (&) before the last author.
* Year of publication: The year of publication is given in parentheses immediately after the author(s).
* Title: Article titles should be in lower case (capitalising only the first word and proper nouns), while journal titles should be in upper case and italicised.
* DOI: **Include the Digital Object Identifier (DOI) for each reference, if available**. This ensures that readers can easily locate the original articles.

To avoid formatting errors and minimise the risk of duplicate entries, use reference management software such as Mendeley, EndNote, Zotero or Citavi. These tools simplify the citation process and ensure that your references are accurate. Before submitting, be sure to remove all field codes from the software and convert them to plain text.

In-text citations should follow APA format, using the author-date method. This means citing the author's last name and the year of publication in parentheses, e.g., "Additive manufacturing improves manufacturing efficiency (Smith, 2020)." or "According to Smith (2020), additive manufacturing improves production efficiency."

Multiple studies can be cited together by separating each reference with a semicolon, e.g. (Johnson, 2018; Lee, 2019; Smith & Brown, 2020). Avoid vague phrases such as "see above" or "noted previously" without proper citation. **Avoid citing a group of studies at the end of a paragraph without linking them to specific content.** Instead, make sure that each citation is clearly linked to the information it supports. Do not use vague references such as "research shows" or "many authors argue" without citing specific studies. Always include the year of publication in each citation, e.g., "Johnson states (2018) ..." rather than "Johnson states ...". Ensure diversity in your references by citing studies from different authors and regions.

Below are some sample references formatted according to APA 7th edition guidelines. (“7.1\_References”)

Burkhardt, J. M., MacDonald, M. C., & Rathemacher, A. J. (2010). *Teaching information literacy: 50 standards-based exercises for college students* (2nd ed.). Chicago, Illinois: American Library Association.

Carder, L., Willingham, P., & Bibb, D. (2001). Case-based, problem-based learning: Information literacy for the real world. *Research Strategies*, *18*(3), 181–190. https://doi.org/10.1016/S0734-3310(02)00087-3

Hohmann, T. (2014). Long Term Evaluation of Information Literacy Programme. In International Association of Technological University Libraries (Chair), *35th annual IATUL Conference,* Espoo, Finland.

Jackson, B., MacMillan, M., & Sinotte, M. (2014). Great Expectations: Results from a Faculty Survey of Students’ Information Literacy Proficiency. In International Association of Technological University Libraries (Chair), *35th annual IATUL Conference,* Espoo, Finland. Retrieved from https://mruir.mtroyal.ca/xmlui/bitstream/handle/11205/133/GreatExpectationsResultsFromAFacultySurvey%20.pdf?sequence=1

Sorcinelli, M. D. (2010). Ten Principles of Good Practice in Creating and Sustaining Teaching and Learning Centers. In K. H. Gillespie (Ed.), *The Jossey-Bass higher and adult education series. A guide to faculty development* (2nd ed., pp. 9–23). San Francisco, California: Jossey-Bass.

VDI/VDE-Gesellschaft Mess- und Automatisierungstechnik (GMA) (September 2001). *Computational Intelligence - Artificial neuronal network in automation - Terms and definitions*. (VDI/VDE 3550-1). Berlin: Beuth Verlag GmbH.