On the role of digital platforms for industrial asset management: an explorative study based on literature review

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Abstract: In today's evolving landscape, the effective management of industrial assets in the manufacturing industry is becoming paramount for ensuring operational efficiency, reliability and availability, and quality. To deal with such an evolution, different means can be adopted, as new business models, organizational settings or technologies. This work looks at digital platforms as an innovative lever to lead the transformation. Digital platforms have been recently identified as transformative means of interest to almost every industry and are promising for future value creation in industrial processes. This paper investigates the potential of digital platforms with specific emphasis to their adoption for enhancing the industrial asset management practice in manufacturing. Inspired by the overarching objective to figure out the role of digital platforms in this field, this paper develops an explorative study by means of a literature review with the end purpose to elucidate the key challenges faced in traditional asset management practice as well as to identify benefits, functionalities, applications of digital platforms brought in to innovate the practice.

Keywords: Digitalization, Asset Management, Digital Platform, Manufacturing

1.Introduction

Digitalization has significantly transformed production and asset control in businesses. Nowadays, networking and connectivity in modern organizations enable the development of complex systems for monitoring and managing the industrial assets (Rantala et al. 2023). In fact, digitalization enables the connection between people, machines and devices enhancing asset management strategies (Polenghi et al. 2022, Reim et al. 2023). This is at the core of the smart factories and leads to the ground where it is possible to advance the asset management practice in the manufacturing sector.

As digitalization advances, activity planning and control related to assets have grown, leading to the increased popularity of industrial asset management (AM) over their entire life cycle (Polenghi et al. 2022). Supported by international standards like ISO 55000 (2014), AM is defined as "the coordinated activities of an organization to realize value from assets." Then, digitalization leverages AM to manage assets effectively, helping companies maintain competitiveness.

The co-evolution of digitalization and AM drives the exploration of digital technologies' potential for various industrial stakeholders, including Original Equipment Manufacturers (OEMs), system integrators, and plant owners/ managers. Digital platforms are then adopted as a focus on a key artefact of digitalization to drive the exploration in this article.

As digital platforms are a key to this research, it is worth remarking the current understanding of digital platforms. The literature provides various definitions and contexts for digital platforms, such as Uber and Airbnb, which enable peer-to-peer interactions. However, in this study, digital platforms are defined as groups of hardware and software components that decompose complex systems into manageable modules (Reim et al., 2023). These platforms facilitate communication between user and stakeholder groups through connected interfaces, potentially leading to innovative business models that enhance knowledge exchange and increase product and asset value in an industrial ecosystem (Rantala et al., 2023; Reim et al., 2023).

Thus, digital platforms can foster value creation, information exchange, and collaboration among different actors, thus driving innovation and value proposition (Reim et al. 2023). Platform providers offer tools for AM actors to share information and establish collaborative processes in B2B settings, benefiting all involved (Reim et al. 2023). Therefore, these platforms can host various use cases within an industrial business, unlocking new opportunities to gain insights into assets and provider-customer relationships during and beyond the asset use phase.

The article aims to evaluate the current use of digital platforms for AM by OEMs within their business models. In particular, this paper explores the positive and negative impacts of digital platforms on industrial AM, contributing to sustained business growth and competitive advantage in the B2B environment. To achieve this, a thorough literature review focusing on the functional features, applications, benefits, and challenges of digital platforms in the manufacturing sector has been applied. The article assesses these aspects and identifies future

development opportunities, laying the groundwork for further research.

The document is organized as follows. The research questions and the expected impact of the research are provided in Section 2. The literature review methodology is outlined in Section 3, while the categories used in the analysis framework are described in Section 4. Thereafter, the review's findings are presented and discussed in Section 5. Eventually, the conclusions of this work are reported and future research directions are elaborated in Section 6.

2.Research Questions and Expected Impact

This article revolves around the adoption of a digital platform in B2B settings, with a particular emphasis in the manufacturing industry.

To adopt digital platforms, manufacturing companies are required to adjust their operations to a digital ecosystem environment, marking a shift from the traditional business environment to more digitally-based business models (Rantala et al. 2023). Cloud computing, big data analytics, digital twins, and other cutting-edge technologies then offer the technological framework that enables the digital platforms to introduce completely new business models and distribution channels, which in turn makes it easier to develop mechanisms for value co-creation between the different types of actors present along a B2B relationship (Rantala et al. 2023, Reim et al. 2023).

Thus, digital platforms could revolutionize manufacturing by introducing new interaction and collaboration methods, fundamentally changing company operations (Reim et al. 2023). Given this industrial viewpoint, this research focuses on reviewing literature from an engineering design perspective and subsequent use cases, particularly in industrial asset management practices.

Given this context, a major research question drives the entire work: "*what kinds of impact a digital platform can bring when it comes to the industrial asset management perspective?*" In particular, focusing on the perspective of OEMs, who play a crucial role throughout the lifecycle of industrial assets, especially through digital services. The research question is then particularized as such: "*what use cases, benefits and challenges a digital platform can bring when it comes to the industrial asset management perspective, in the light of an OEM and its interaction with the other parties?*" Therefore, this investigation aims to establish a foundation for understanding future possibilities in OEMs' business models through digital platforms in AM processes.

In fact, implementing digital platforms, particularly in manufacturing, is challenging due to the need to share sensitive data and large financial investments (Rantala et al. 2023). Therefore, this study focuses on value creation and co-creation as key drivers to enhance understanding of how digital platforms can generate value in industrial settings, specifically impacting AM processes in industrial organizations.

3.Methodology

A Systematic Literature Review (SLR) was carried out to address the research objective of this article. The SLR uses the PRISMA method, as shown in Fig 1. To select the eligible papers the keywords used are the followings: *("Platform") AND ("Manufacturing" OR "Production") AND ("Digital" OR "Smart" OR "internet 4.0" OR "IoT") AND ("Servit*" OR "Product Service System" OR "PSS") AND ("Asset" OR "Capital Goods" OR "Machine" OR "Industrial")* to restrict the study to the OEM's interest and the potential of digital servitization obtaining a selection of 18 eligible papers.

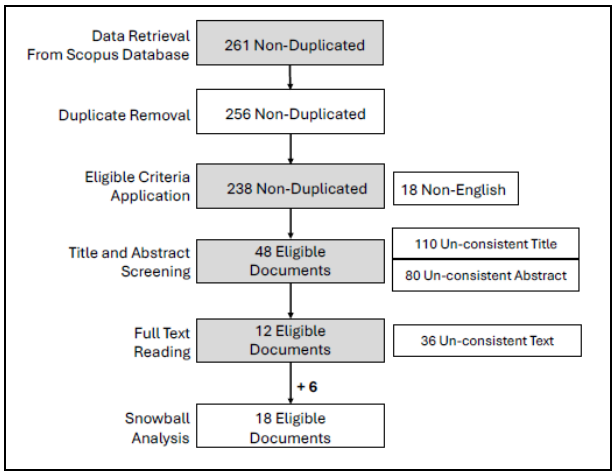

Figure 1: PRISMA method representation

4.Analysis Framework

Several engineering design-related articles were evaluated in an attempt to identify potential uses of digital platforms for AM processes. The aim was to ascertain the challenges and benefits, in addition to the functional features and the applications, when utilizing a digital platform. Then, the following categories were adopted for the categorization in the analysis phase: they represent high-level categories for such analysis.

- Asset Management challenges (shortly indicated as AM challenges): This category focuses on what are the challenges for implementing AM in a manufacturing company, which may lead to the adoption of digital platforms for AM.
- Digital Platform functionalities (shortly indicated as DP functionalities): This category focuses on the various ways industrial organizations can create value through the management of their industrial assets using digital platforms.
- Digital Platform applications (shortly indicated as DP applications): This category deals with the ways digital platforms are utilized in production and industrial sectors to ensure interoperability, stakeholder cooperation, and easy management of the industrial asset information and data, thus facilitating the user collaboration and decision-making processes.

- Digital Platform benefits (shortly indicated as DP benefits): This category considers how digital platforms offer numerous benefits to businesses, particularly when managed properly, from an asset and process perspective, finally enhancing efficiency and productivity.

These high-level categories are broken down into specific categories grouping the observed findings from literature, as reported in the next sections.

5.Results and Discussion

This section presents the results of the literature review concerning the use of digital platforms for AM processes. Thus, after the screening and eligibility phases have been carried out, the 18 papers were selected for their complete analysis. The method described in (Saldaña et al., 2016) was utilized for the said analysis. This consists of assigning descriptive keywords (that is: codes) to text excerpts from each paper that could present an answer to the research question, to then organize the keywords into meaningful categories. The grouping of the keywords into meaningful categories, along with the explanation and analysis of such categories, is presented in the following sections (see Appendix A for the tables with the references).

5.1. AM Challenges

The first element investigated in the literature was focused on the identification of the challenges associated with the use of AM in the manufacturing industry. The resulting frequency of each category is depicted in table 1. Next, a description of each group is presented:

- High expenses: The implementation of AM methodologies presents a challenge due to the high expenses associated with the significant investments and amount of resources required for asset condition monitoring (Martins et al. 2023; Turkin et al. 2023).
- System Integration: Companies often have industry sets and operations with distinct equipment, also deployed outside controlled factories, with their own control software and maintenance practices (Corradi et al. 2019; Li et al. 2022). This makes it challenging to view the system as a whole, thus including the interdependencies and connection between assets.
- Data Overload and Scattering: Asset managers may face challenges due to the large amount of heterogeneous data, which can cause poor interoperability and finally hinder collaboration effectiveness (Li et al. 2022; Masrom et al. 2022).
- Lack of performance: AM processes in manufacturing industries are challenging to deploy due to their broad range of applications and the absence of precise guidelines (Polenghi et al 2022). Therefore, AM processes, like risk management and asset condition monitoring and prediction, can be challenging to implement and may not always yield the best results due to the complexity of today's companies.
- Lack of collaboration: Companies often struggle to build a collaborative practice especially due to data-sharing concerns and ownership ambiguity, which finally lead to a lack of trust (Reim et al. 2023).

Table 1: AM Challenges

AM Challenges	Number of Papers
System Integration	8
High Expenses	5
Lack of Performance	4
Overload and Heterogeneity in Data Management	4
Lack of Collaboration	3

Each selected article explored the challenges related to the introduction of AM processes in manufacturing.

Integration is a key concept in most research on digital platforms for AM. Many papers highlight the difficulty of connecting various actors, like assets, stakeholders, and machines, within manufacturing organizations. In fact it is noted in (Baraldi et al. 2020; Corradi et al. 2019; Li et al. 2022; Martins et al. 2023) that businesses often operate with diverse equipment, creating heterogeneity and complicating the understanding of interdependencies and decision impacts. This challenge is exacerbated by the need to integrate different data and digitalization tools to monitor machines. Other challenges include poor performance and high costs associated with AM policy implementation, as per reference (Gnoni et al. 2020; Velmurugan et al. 2022; Turkin et al. 2023), making methods like maintenance planning or others resource-intensive and potentially suboptimal.

5.2. DP functionalities

An analysis is now conducted on the DP functionalities. The frequency of each category is shown in table 2. Herein, a description of each category is presented:

- Data to Information Transformation: Data is processed to create knowledge, information, and wisdom. A digital platform can disseminate precise, timely information on industrial assets or manufacturing processes, supporting informed decision-making (Corradi et al. 2019, Martins et al. 2023).
- Heterogeneous Data Structuring and Integration: Digital platforms collect diverse data from asset operations, fostering interoperability and creating a common ground for subsequently interpreting and understanding heterogeneous data (Masrom et al. 2022; Kuruppuarachchi et al. 2023).

- Data Storage: The digital platform can store and organize data about industrial assets, providing a comprehensive database for strategic, tactical, and operational decision-making (Mourtzis et al. 2018; Gnoni et al. 2020).
- Asset Data Visibility and Tracking: Digital platforms enable users to focus on crucial industrial assets and variables by gathering, processing, and evaluating collected data (Gnoni et al. 2020; Martins et al. 2023).
- Information and Feedback Exchange: Digital platforms facilitate communication between users and industrial assets, enabling coordination and cooperation among players to generate value (Kuruppuarachchi et al. 2023, Li et al. 2023).

Table 2: DP Functionalities

DP Functionalities	Number of Papers
Heterogeneous Data Structuring and Integration	11
Asset Data Visibility and Tracking	11
Data Storage	10
Data to Information Transformation	8
Information and Feedback Exchange	7

The primary focus of the reviewed articles centers on data management within digital platforms. These platforms aim to facilitate machine to machine connectivity, necessitating strategies for collecting heterogeneous asset data and standardizing it to enhance machine cooperation (Li et al. 2022; Demko et al. 2023; van Erp et al. 2023). Functionalities such as *Asset Data Visibility and Tracking, and Data-to-Information transformation* become accessible once data is gathered and managed. This indicate that stakeholders on these platforms monitor specific Key Performance Indicators (KPIs) and critical production assets (Matsas et al. 2017; Baraldi et al. 2020; Demko et al. 2023), leveraging diverse data sources to evaluate equipment conditions effectively.

5.3. DP applications

This section specifically assesses the choices that various digital platform users can make for AM. The identified categories, shown in table 3, can be defined in the following way, they represent the possible applications for the digital platform users:

- Failure Prognosis and Diagnosis: This category explores risk management in AM, focusing on digital platforms for real-time monitoring and prediction of critical asset behavior, and unplanned industrial asset breakdowns (Corradi et al. 2019; Turkin et al. 2023).
- Production Process Management: This category relates to impact of AM on production planning and scheduling. In particular, the AM's decision-making is supported by analyzing asset-related or process-related data and monitoring variables to produce insights by means of Key Performance Indicators usable for process forecasting and optimization (Baraldi et al. 2020; Silva et al. 2021).
- Monitoring and Prediction of the Asset Status: Digital platforms enable stakeholders to monitor and predict manufacturing processes and asset conditions, fostering a risk culture, increasing employee insight, and enhancing predictive decision-making skills (Martins et al. 2023; Wang et al. 2023).
- Service Exchange: A service-based architecture is used to facilitate data gathering, communication, and processing within digital platforms, fostering a cooperative ecosystem for data sharing and asset-related service trading among participants (van Erp et al. 2023; Kuruppuarachchi et al. 2023).
- Asset Performance Management: This section covers asset status checking procedures, such as dashboards, cockpits, or comparable tools, to evaluate the operational reliability and availability of complex industrial assets (Baraldi et al. 2020; Demko et al. 2023).

Table 3: DP Applications

DP Applications	Number of Papers
Monitoring and Prediction of the Asset Status	10
Production Process Management	10
Failure Prognosis and Diagnosis	8
Asset Performance Management	5
Service Exchange	5

The literature underscores the critical role of digital platforms in enabling efficient communication among various stakeholders and assets for data collection and processing in risk management and industrial asset condition monitoring. This facilitates informed decision-making processes such as the *Monitoring and Prediction of the Asset Status, Failure prognosis and Diagnosis*, *Asset Performance Management* and *Production Process Management*. This includes the real-time monitoring and prediction of crucial asset behavior (Velmurugan et al. 2022; Martins et al. 2023) or supports decisions on scheduling maintenance interventions or actions to enhance asset performance and

production processes (Baraldi et al. 2020; Demko et al. 2023; Silva et al. 2021). Additionally, digital platforms are noted for their ability to facilitate communication between industrial assets and platform users, particularly in the category of *Service Exchange*. This capability enables collaborative efforts among platform actors, enhancing understanding of production processes and promoting service sharing to improve machinery interoperability (Li et al. 2022; van Erp et al. 2023; Kuruppuarachchi et al. 2023).

5.4 DP benefits

This section specifically addresses the benefits that digital platforms may offer from both an asset and a process perspective.

From a process perspective, two categories have been individuated in which digital platforms adds value to businesses, the resulting frequency of each category is illustrated in table 4. A description of each category follows:

- Performance: Digital platforms for AM can enhance manufacturing systems' performance, optimizing production capabilities and enhancing capacity and adaptability, leading to more efficient production (Li et al. 2022; Velmurugan et al. 2022).
- Information management and integration: Digital platforms enhance information management and integration in the industrial organizations, finally supporting asset-related decisions and improving the production processes by enabling interaction between different industrial assets and avoiding the commonly mentioned "silo approach" (Li et al. 2022; Kuruppuarachchi et al. 2023).

Table 2: DP benefits – process viewpoint

DP Benefits (Process)	Number of papers
Information management and integration	11
Performance	5

For what concern the asset perspective, three categories have been defined, whose resulting frequency is illustrated in table 5. A description of each category follows:

- Performance: Digital platforms can enhance asset reliability by monitoring asset status using industrial asset data, thereby increasing also the availability (Baraldi et al. 2020; Demko et al. 2023).
- Risk: Digital platforms can enhance asset maintenance by reducing risk in the industrial processes, namely by reducing downtime, and improving planning, and enhancing control inspection of dangerous equipment and working environments (Velmurugan et al. 2022; Turkin et al. 2023).
- Cost: Digital platforms can reduce asset utilization costs by facilitating cooperation, prioritizing tasks, and using updated data, thereby reducing capital and operational expenses associated with asset malfunctions or operations (Masrom et al. 2022; Martins et al. 2023).

Table 5: DP benefits – asset viewpoint

DP Benefits (Asset)	Number of papers
Performance	8
Risk	8
Cost	4

Overall, digital platforms enhance performance in industrial settings by increasing availability, improving production process efficiency, and enhancing product and service quality (Gnoni et al. 2020; Silva et al. 2021; Wang et al. 2023). They also mitigate risk by enhancing operator safety and using digital technologies to monitor critical asset behavior, thereby minimizing sudden failures and downtime of critical subsystems during manufacturing operations (Velmurugan et al. 2022; Martins et al. 2023; Turkin et al. 2023). Digital platforms may also facilitate effective information management, providing access to real-time asset status and production performance data. This capability enables visualization of Key Performance Indicators (KPIs), supports maintenance procedures, and facilitates informed decision-making (Li et al. 2022; Kuruppuarachchi et al. 2023). Moreover, digital platforms contribute to cost reduction by minimizing both capital and operating expenses, extending asset lifespan, and optimizing resource utilization (Masrom et al. 2022; Martins et al. 2023).

5.5 Discussion

Some general evidence can be identified building on the conducted literature study's results. These are discussed in the present section.

The analyzed papers are categorized into two main groups based on their applications of digital platforms. The first group focuses on prototypes or proof of concept applications, testing the platform's feasibility in laboratory settings for potential industrial use. The second group comprises case studies or specific applications of digital platforms within industrial settings. These case studies (e.g., Demko et al. 2023, Martins et al. 2023) typically highlight the platform's application for individual machines without extensive consideration of broader asset connections and interdependencies. A smaller subset of papers (e.g., Corradi et al. 2019, Li et al. 2023) discusses digital platforms in industrial settings where a systemic approach is adopted, emphasizing communication among platform actors to generate value for the company.

Overall, digital platforms have a profound impact on industrial asset management, enhancing efficiency, enabling predictive maintenance, reducing costs, facilitating data-driven decision-making, and improving collaboration. Most applications of digital platforms operate at the supervisory level, empowering asset users and operators to monitor machinery condition and performance and make informed decisions based on collected data. A smaller subset of literature explores planning-level uses of digital platforms, where OEMs equip platform actors with tools for decision-making on maintenance interventions or production planning and scheduling to optimize processes. Additionally, some articles discuss a business model where OEMs provide digital platforms for collaborative managerial decision-making among users and stakeholders across industries. This fosters cooperation and facilitates comprehensive asset management throughout their lifecycle, encompassing activities like asset redesign, repair, and disposal (Silva et al. 2021; van Erp et al. 2023; Kuruppuarachchi et al. 2023). Adopting open and interoperable digital platforms enhances communication among different actors and supports the development of robust asset management processes.

6. Conclusion

This study examines the adoption of digital platforms in AM, focusing on their collaborative approach and potential benefits, aiming to enhance knowledge availability and decision-making during the asset life. A systematic literature review has been applied and 18 papers related to digital platforms for AM were analyzed. The objective was to identify the challenges associated to AM implementation that could lead to the adoption of digital platforms, identify how digital platforms may generate value through their functionalities and applications in the manufacturing industry, and define the current benefits resulting from the implementation of digital platforms. Therefore, based on literature findings, this article led to multiple relevant outlooks.

The use of digital platforms in AM faces several challenges. Integration difficulties are prominent, particularly in managing diverse equipment types located outside regulated factory boundaries, sometimes in remote locations. Heterogeneous data dispersed across business or digital ecosystems further complicates integration, leading to poor information interoperability and hindering effective collaboration among platform actors. Technical and economic obstacles, such as inadequate performance and high costs associated with AM processes, are also acknowledged, though they are not fully explored in all studies.

Concerning the functionalities of digital platforms in AM a tendency towards data management is evident. In fact, digital platforms facilitate the gathering, sharing, and analysis of diverse data generated by platform participants to acquire relevant knowledge and enable effective monitoring of asset and production process conditions. This supports various applications, including failure prognosis and diagnosis, real-time monitoring and prediction of critical asset behavior, and coordination among actors to enhance value creation through cooperation.

Lastly, the benefits mentioned with reference to the use of digital platforms have been ascertained, also categorizing them based on how digital platforms add value in an asset management context, including information management and integration, performance, risk, and cost.

This exploratory analysis indicates that digital platforms are not fully explored in managing complex industrial assets across their lifecycle in manufacturing, prompting the need for new business models involving multiple actors to address activities like maintenance, asset redesign, repair, and dismantling. Thus, future studies should define the requirements OEMs need to develop digital platforms for comprehensive industrial asset lifecycle management. In fact, this explorative research aims to advance the comprehension of the impact of digital platforms on AM from a theoretical perspective. Consequently, further research on asset user requirements, asset data requirements for lifecycle management, and the specific requirements to facilitate collaboration between OEMs and the various actors of the digital ecosystem will be justified for the technical implementation of the digital platform. By conducting these future studies it will be possible to identify the prerequisites necessary for implementing an industrial model that integrates a digital platform for managing complex industrial assets. This model would involve machine manufacturers, clients, and other stakeholders throughout the lifecycle of industrial facilities and assets.

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Appendix A. FIRST APPENDIX

Table 3: AM Challenges with References

AM Challenges	Number of Papers	References
System Integration	**8**	Matsas et al. 2017; Maleki et al. 2018; Corradi et al. 2019; Landi et al. 2020; Silva et al. 2021; Li et al. 2022; van Erp et al. 2023; Martins et al. 2023;
High Expenses	**5**	Corradi et al. 2019; Campos et al. 2020; Velmurugan et al. 2023; Martins et al. 2023; Turkin et al. 2023;
Lack of Performance	**4**	Gnoni et al. 2020; Martins et al. 2023; R et al. 2023; Wang et al. 2023
Overload and Heterogeneity in Data Management	**4**	Mourtzis et al. 2018; Li et al. 2022; Masrom et al. 2022; Wang et al. 2023
Lack of Collaboration	**3**	Matsas et al. 2017; Torres et al. 2019; Kuruppuarachchi et al. 2023

Table 4: DP Functionalities with references

DP Functionalities	Number of Papers	References
Heterogeneous Data Structuring and Integration	**11**	Matsas et al. 2017; Maleki et al. 2018; Torres et al. 2019; Campos et al. 2020; Silva et al. 2021; Li et al. 2022; Masrom et al. 2022; van Erp et al. 2023; Kuruppuarachchi et al. 2023; Turkin et al. 2023; Wang et al. 2023
Asset Data Visibility and Tracking	**11**	Matsas et al. 2017; Maleki et al. 2018; Mourtzis et al. 2018; Corradi et al. 2019; Campos et al. 2020; Gnoni et al. 2020; Landi et al. 2020; Li et al. 2022; Demko et al. 2023; Martins et al. 2023; Turkin et al. 2023;
Data Storage	**10**	Matsas et al. 2017; Mourtzis et al. 2018; Corradi et al. 2019; Gnoni et al. 2020; Landi et al. 2020; Velmurugan et al. 2023; Demko et al. 2023; van Erp et al. 2023; Martins et al. 2023; Wang et al. 2023;
Data to Information Transformation	**8**	Matsas et al. 2017; Corradi et al. 2019; Campos et al. 2020; Gnoni et al. 2020; Li et al. 2022; Martins et al. 2023; Turkin et al. 2023; Wang et al. 2023
Information and Feedback Exchange	**7**	Matsas et al. 2017; Torres et al. 2019; Gnoni et al. 2020; Silva et al. 2021; van Erp et al. 2023; Kuruppuarachchi et al. 2023; Velmurugan et al. 2023

Table 3: DP Applications with references

DP Applications	Number of Papers	References
Production Process Management	**10**	Matsas et al. 2017; Corradi et al. 2019; Torres et al. 2019; Campos et al. 2020; Landi et al. 2020; Silva et al. 2021; Li et al. 2022; Velmurugan et al. 2022; Kuruppuarachchi et al. 2023; Wang et al. 2023
Monitoring and Prediction of the Asset Status	**9**	Maleki et al. 2018; Corradi et al. 2019; Campos et al. 2020; Gnoni et al. 2020; Silva et al. 2021; Velmurugan et al. 2023; Martins et al. 2023; Turkin et al. 2023; Wang et al. 2023
Failure Prognosis and Diagnosis	**8**	Corradi et al. 2019; Torres et al. 2019; Gnoni et al. 2020; Landi et al. 2020; Masrom et al. 2022; Martins et al. 2023; Turkin et al. 2023; Wang et al. 2023;

Asset Performance Management	**5**	Mourtzis et al. 2018; Corradi et al. 2019; Landi et al. 2020; Masrom et al. 2022; Demko et al. 2023
Service Exchange	**5**	Matsas et al. 2017; Torres et al. 2019; van Erp et al. 2023; Kuruppuarachchi et al. 2023; Wang et al. 2023

Table 5: DP benefits – process viewpoint with references

DP Benefits (Process)	Number of papers	References
Information management and integration	**8**	Matsas et al. 2017; Maleki et al. 2018; Mourtzis et al. 2018; Torres et al. 2019; Li et al. 2022; Masrom et al. 2022; Kuruppuarachchi et al. 2023; Wang et al. 2023;
Performance	**5**	Corradi et al. 2019; Gnoni et al. 2020; Li et al. 2022; Velmurugan et al. 2022; Demko et al. 2023

Table 5: DP benefits – asset viewpoint with references

DP Benefits (Asset)	Number of papers	References
Performance	**8**	Matsas et al. 2017; Mourtzis et al. 2018; Corradi et al. 2019; Torres et al. 2019; Landi et al. 2020; Silva et al. 2021; Demko et al. 2023; Wang et al. 2023
Risk	**8**	Matsas et al. 2017; Mourtzis et al. 2018; Corradi et al. 2019; Torres et al. 2019; Landi et al. 2020; Silva et al. 2021; Demko et al. 2023; Wang et al. 2023
Cost	**3**	Masrom et al. 2022; Demko et al. 2023; Martins et al. 2023