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Article

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The role of artificial intelligence across the source-to-pay framework: Theoretical and practical aspects

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ABSTRACT

The procurement function is undergoing a significant transformation driven by the integration of Artificial Intelligence (AI) and other Industry 4.0 technologies across the Source-to-Pay (S2P) process. While prior research has acknowledged the potential of digital procurement tools, there remains a lack of clarity regarding AI's role in specific stages of the S2P framework. This study addresses that gap by examining how AI is applied across three key procurement domains: Source-to-Contract (S2C), Purchase-to-Pay (P2P), and Supplier Relationship Management (SRM). Using a qualitative approach, we conducted semi-structured interviews with procurement professionals to explore AI's practical uses, perceived benefits, and challenges. The findings show that AI enhances efficiency, decision-making, and supplier collaboration, while also driving cross-cutting advances such as orchestration, Application Programming Interface (API) integration, data governance, and new skill requirements. Beyond these process-level benefits, the study highlights practical implications for organizations, including improved cost control, agility, and stronger supplier relationships. Overall, the research contributes to the literature on AI in supply chain management and offers actionable guidance for organizations seeking to leverage digital transformation to innovate and build resilience in procurement.

Introduction

Procurement has long been recognized as a critical function within organizations, acting as a bridge between the internal needs of a company and the external market. However, this function is undergoing a profound transformation, driven by the rise of advanced digital technologies. The modern procurement landscape faces unprecedented challenges, such as increasing supply chain complexity and the necessity for greater transparency (Bode, Burkhart, Schültken, & Vollmer, 2023). These demands have been magnified during recent global crises, where disruptions underscored the limitations of traditional procurement processes. Despite its importance, procurement has been plagued by inefficiencies, with manual, repetitive tasks consuming valuable resources and hindering its ability to deliver strategic value (Strohmer et al., 2020a).

Historically, several studies have highlighted the value of digital procurement systems in improving transparency, reducing costs, and streamlining operations. For instance, Ronchi, Brun, Golini, and Fan (2010) developed a framework for assessing both the financial and

organizational benefits of IT-based procurement systems, emphasizing their strategic potential. Similarly, Toktaş-Palut, Baylav, Teoman, and Altunbey (2014) noted that while e-procurement offers major benefits, its adoption is often hindered by barriers such as poor supplier readiness and limited internal capabilities, challenges that remain relevant in the context of AI adoption today.

AI is at the forefront of this transformation, offering capabilities that extend far beyond automation. As a core pillar of Industry 4.0, AI enables procurement organizations to transition toward more intelligent, predictive, and agile supply chain operations. It has the potential to optimize procurement processes, improve decision-making, and unlock new value creation opportunities. AI's unique ability to automate tasks and provide data-driven insights empowers procurement teams to focus on high-value activities, such as supplier collaboration and strategic sourcing (Cui, Li, & Zhang, 2020). By harnessing predictive analytics, AI can forecast demand, optimize inventory, and identify potential risks, enabling organizations to act proactively rather than reactively (Bansal & Jain, 2023).

Moreover, AI introduces the possibility of hybrid intelligence, a

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model in which human expertise complements AI's computational power. This integration enables procurement professionals to leverage AI for tasks like supplier negotiations and risk assessments, while human oversight ensures strategic alignment and nuanced decision-making (Burger, Nitsche, & Arlinghaus, 2023). This shift not only enhances procurement's effectiveness but also redefines the skills required of its professionals. Future procurement roles will demand proficiency in business intelligence tools, data analytics, and even programming, reflecting the increasing digitization of the field (Mandl, 2023a).

The adoption of AI and other Industry 4.0 technologies, including Machine Learning (ML), Robotic Process Automation (RPA), Optical Character Recognition (OCR), and Natural Language Processing (NLP), also transforms procurement's operational and strategic roles. Advanced procurement technology can serve as a recommendation engine, helping teams manage supplier relationships, monitor performance, and maintain compliance (Schoenherr, 2019a). At the same time, digital procurement solutions reduce costs and improve agility by automating routine processes, enabling organizations to meet business needs more effectively and efficiently (Burger et al., 2023). As Ross (2015) already suggested, effective procurement depends on strong supplier partnerships, strategic sourcing, and the use of technology to enable agility and competitive advantage. AI builds upon these foundations by offering real-time insights and predictive capabilities. However, these benefits are contingent on overcoming barriers such as data quality issues, resistance to change, and the complexity of AI implementation (Jackson, Ivanov, Dolgui, & Namdar, 2024).

These issues reflect earlier concerns in the literature, where researchers emphasized that technological innovation in procurement must be accompanied by organizational readiness, stakeholder engagement, and system usability to drive adoption and impact (Brandon-Jones & Carey, 2011; Toktaş-Palut et al., 2014).

As procurement evolves, its focus is shifting from cost-cutting to value creation. This reorientation is crucial in a competitive global environment where procurement must not only optimize costs but also contribute to innovation, sustainability, and resilience (Mandl, 2023a). As seen in (Allal-Chérif, Simón-Moya, & Ballester, 2021), AI-powered tools enable procurement to enhance supplier relationships and integrate sustainability practices into supply chains, aligning organizational goals with broader societal expectations. These developments underline the growing strategic importance of procurement as a driver of corporate competitiveness. These developments underline the growing strategic importance of procurement as a driver of corporate competitiveness in the digital era.

Despite substantial investment in digital procurement, organizations continue to face major obstacles in achieving seamless, data-driven performance across the S2P process. Procurement activities often remain fragmented across multiple systems, with inconsistent data, low visibility, and limited process integration. Tools such as ERP systems, e-procurement platforms, and RPA have automated certain transactional tasks but largely replicate manual work without enhancing decision quality or adaptability. As a result, procurement teams struggle to move from basic automation toward intelligent, predictive, and strategic operations.

AI offers the potential to overcome these limitations by enabling predictive analytics, natural language understanding, and autonomous document processing. Yet, the extent to which AI can transform the different stages of the S2P process remains uncertain in both research and practice. Understanding these capabilities and boundaries is essential for organizations seeking to realize the full potential of AI-enabled procurement.

While prior studies have acknowledged AI's growing influence in procurement, most discuss it at a general or conceptual level, focusing on expected benefits or isolated use cases. However, the literature remains fragmented and offers limited clarity on how AI is applied across the distinct stages of the S2P framework, specifically S2C, P2P, and SRM. Existing studies tend to examine individual processes rather than

analyze procurement as an integrated, end-to-end system. Consequently, there is still no comprehensive stage-level understanding of how AI reshapes procurement workflows, decision-making, and supplier collaboration. Addressing this gap is essential to developing a coherent theoretical view of AI's role in procurement and to providing practitioners with guidance for effective adoption across the S2P cycle.

To address this gap, the present study explores the integration of AI across the S2P framework by combining insights from the academic literature with expert interviews from procurement technology providers. This qualitative approach enables a grounded understanding of how AI is already being used, where its application remains limited, and what challenges accompany its adoption. The study seeks to provide organizations with actionable insights into how AI can be leveraged for transformative outcomes. Specifically, it investigates:

1. How is AI transforming the different stages of the S2P process?
2. What are the perceived benefits and challenges associated with implementing AI solutions in S2P activities?

This research advances theoretical and practical understanding by connecting academic insights with real-world applications of AI in procurement. Building on this foundation, the study introduces several novelties for both research and practice:

- Stage-level perspective: It provides one of the first integrated analyses of how AI is being applied across the three key stages of the S2P framework (S2C, P2P, and SRM), offering a holistic view rather than examining isolated processes.
- Bridging theory and practice: It combines insights from academic literature with qualitative evidence from interviews with procurement technology providers, capturing how AI is implemented in real-world procurement environments.
- Analytical framework: It structures AI applications within the S2P stages, enabling a clearer understanding of where AI delivers value and where adoption barriers persist.
- Managerial guidance: It translates findings into actionable implications for practitioners, including how organizations can prioritize AI use cases and manage adoption challenges.
- Theoretical advancement: It contributes to the emerging body of knowledge on digital procurement by clarifying AI's transformative role and outlining the conditions required for effective integration.

Collectively, these contributions enhance theoretical understanding of AI's role within procurement while providing practitioners with evidence-based insights to guide adoption and transformation.

This research is organized as follows: Section 2 provides a comprehensive literature review, detailing how AI is being integrated into the S2P framework, including its applications in S2C, P2P, and SRM. Section 3 outlines the research methodology, including the qualitative approach, data collection methods, and analytical procedures used in the study. Section 4 presents the empirical findings derived from expert interviews, structured according to the key components of the S2P process. Section 5 discusses the implications of the findings, offering critical reflections on AI's strategic and operational impact on procurement. Finally, Section 6 concludes the study by summarizing key insights, highlighting limitations, and suggesting avenues for future research.

Literature review

The S2P framework comprises two primary phases: S2C and P2P. These phases contain the core procurement activities from sourcing and supplier selection to purchasing and payment processing. While SRM plays a role in both S2C and P2P, it is treated as a distinct section in this review due to its overarching influence across the entire procurement lifecycle. Since supplier interactions occur throughout the S2P journey,

SRM warrants a dedicated discussion to capture its extensive impact on procurement efficiency, risk management, and collaboration.

Within the context of Industry 4.0, these procurement activities are increasingly shaped by emerging digital technologies such as AI, ML, NLP, and RPA. These tools are central to transforming procurement into a more data-driven, automated, and strategically integrated function.

To ensure a coherent and comprehensive examination of existing research, the literature review is organized into three principal sub-sections: S2C, P2P, and SRM. This structure aligns with the established S2P framework and facilitates a focused analysis of how AI influences each phase of the procurement lifecycle, both operationally and strategically.

Fig. 1 visually represents the structure of the S2P framework, illustrating the relationship between S2C, P2P, and SRM and highlighting SRM's continuous role across the entire procurement lifecycle.

Source-to-contract

This part of the review focuses on the upstream phase of the S2P process, known as S2C, and examines how AI is transforming its core activities. As an integral component of Industry 4.0, AI serves as a foundational enabler of digital procurement, optimizing sourcing, contract management, and supplier evaluation through advanced data analytics and intelligent automation.

For clarity and coherence, this section is divided into three sub-sections: Spend Analytics, RFx Management, and Contract Management. Each sub-section explores how AI is being applied to improve efficiency, accuracy, and strategic value in these foundational stages of procurement.

Spend analytics

AI is revolutionizing spend analytics, a critical function in procurement, by enabling organizations to process, analyze, and leverage procurement data more effectively. AI-powered systems enhance the accuracy of spend data through automated processes such as data cleaning, classification, and clustering, which reduce manual errors and improve the resolution of data analysis (Guida, Caniato, Moretto, & Ronchi, 2023; Khadse, 2021; Strohmer et al., 2020b). These technologies enable procurement teams to categorize expenditures by supplier, geography, and category, thus providing actionable insights that support strategic decision-making and cost-saving opportunities (Burger et al., 2023; Handfield, Jeong, & Choi, 2019; Spreitzenbarth, Bode, & Stuckenschmidt, 2024a).

One significant benefit of AI in spend analytics is its ability to generate dynamic visualizations like spend cubes, which offer multi-dimensional views of historical purchasing trends (Strohmer et al., 2020b). These visualizations help procurement leaders align procurement activities with broader business goals and identify potential areas for savings. AI tools like Simfoni and Suplari further consolidate and clean spending data from diverse sources, offering enhanced classification accuracy and enabling detailed exploration of cost optimization strategies (Guida et al., 2023).

ML algorithms classify data into categories and subcategories, enabling real-time insights that optimize purchasing decisions and mitigate risks (Burger et al., 2023; Khadse, 2021). AI's ability to

integrate structured and unstructured data helps identify hidden patterns, forecast procurement needs, and enhance supplier negotiations (Buchholz Wolfgang and Grabbe, 2022; Schoenherr, 2019b; Xu, Wang, Zhong, Qin, & Cheng, 2024).

AI further automates repetitive tasks, enhances data accuracy, and supports dashboards and clustering techniques that increase spend visibility. This enables procurement teams to detect inefficiencies, fraud, and compliance issues (Constant & Berre, 2024; Singh, Modgil, & Shore, 2024). These systems learn from user feedback, leading to improved recommendations and resource allocation (Burger et al., 2023; Mandl, 2023b). By enhancing spend visibility and enabling predictive analytics, AI empowers procurement professionals to unlock value and drive efficiency in a rapidly evolving business environment.

RFx management

AI applications are streamlining RFx management by automating procurement processes and enhancing efficiency. Modern software solutions, such as Coupa, SAP Ariba, GEP Smart, Sievo, and Synertrade, are offered through software-as-a-service and platform-as-a-service models, optimizing tendering, e-auctions, and cost modeling while supporting supplier evaluations and negotiations (Allal-Chérif et al., 2021; Mandl, 2023a). These platforms accelerate sourcing, cut manual work, and strengthen procurement strategies. ML further enhances the RFx process by automating bid analysis and evaluation, comparing proposals against deal parameters and industry benchmarks. ML leverages historical bid data to provide recommendations and improve decision accuracy (Bansal & Jain, 2023; Morgan, 2021). This reduces the risk of selecting non-compliant suppliers and ensures more competitive procurement outcomes. In a complementary approach, Emami, Seifbarghy, Abbas, Chattinnawat, and Aydin (2025) proposed a blockchain-driven business model for supplier selection and order allocation that leverages smart contracts to enhance transparency, decentralize decision-making, and automate compliance checks. Their model supports AI-powered supplier evaluation by embedding trust and accountability directly into procurement workflows, further reducing the risk of opportunistic behavior and information asymmetry.

In large organizations managing numerous RFx requests, AI automates proposal generation by transforming existing knowledge into machine-readable models. These models interpret RFx questions, match them to relevant data, and produce formatted proposals, significantly reducing manual input (Nistala, Rajbhoj, Kulkarni, Noronha, & Joshi, 2024).

AI chatbots further streamline RFx activities by automating price inquiries and supplier responses, reducing administrative effort, and accelerating procurement cycles (Cui et al., 2020). Additionally, AI-powered bundling tools consolidate requisitions across departments, unlocking cost savings and attracting competitive bids by leveraging economies of scale (Spreitzenbarth, Bode, & Stuckenschmidt, 2024b).

NLP tools assist in bid evaluation by analyzing proposals against predefined criteria, highlighting discrepancies, and ensuring faster, more accurate bid selection (Coglianese, 2023).

Earlier research by Smart (2010) showed that digital RFx platforms, catalogs, and supplier databases supported strategic sourcing and spend control. Though lacking AI's advanced capabilities, these early tools laid the foundation for today's intelligent systems by digitizing supplier engagement and enhancing transparency. AI now builds on these practices, transforming them into dynamic, data-driven processes.

While AI-powered RFx tools improve sourcing speed and evaluation accuracy, longstanding concerns remain around traditional scoring systems. Bergman and Lundberg (2013) criticized price-to-quality models in public procurement as inefficient and easily manipulated, highlighting the need for more transparent, AI-supported evaluations.

Similarly, AI's automation of pricing and proposal analysis addresses past resistance to e-auctions, which procurement professionals once viewed as risky to long-term supplier relationships (Tassabehji, 2010). AI tools offer more nuanced negotiation support and better supplier

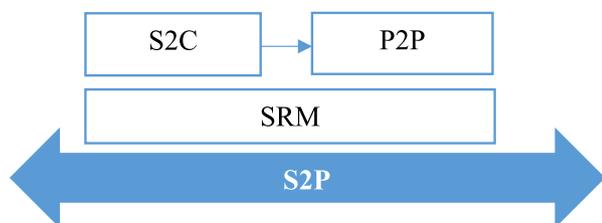


Fig. 1. Structure of the S2P Framework.

insights, easing these concerns.

Contract management

AI is transforming contract management by embedding advanced capabilities into contract management systems, automating tasks, and ensuring compliance throughout the contract lifecycle. Modern AI-driven platforms streamline processes by identifying discrepancies between purchase orders and contract terms, monitoring compliance, and integrating external data for dynamic adjustments (Allal-Chérif et al., 2021; Bansal & Jain, 2023; Buchholz Wolfgang & Grabbe, 2022; Handfield et al., 2019). These tools reduce manual oversight, flag potential risks, and continuously improve through transactional learning, fostering more responsive governance.

Platforms like Icertis enhance contract negotiations by analyzing historical data and recommending clauses, shortening drafting and review times (Cui et al., 2020; Guida et al., 2023). Tools like ChatGPT simplify repetitive drafting, but human oversight remains essential to refine language, ensure legal accuracy, and address missing clauses such as force majeure or liability limitations (Giampieri, 2025).

Smart search capabilities powered by NLP flag outdated terms or invalid provisions, enhancing accuracy and decision-making while increasing contract visibility (Constant & Berre, 2024; Morgan, 2021). Smart contracts automate execution, aligning payments with milestones and reducing disputes (Mufor, 2024; Xu, Chong, & Chi, 2021).

AI also aids renewals and renegotiations by issuing alerts and tracking key performance indicators (Bansal & Jain, 2023; Schoenherr, 2019c). Across enterprises, AI-driven systems automate clause classification, indexing, and compliance monitoring, using RPA to reduce administrative burdens (Constant & Berre, 2024). AI algorithms assess risk by analyzing past contractor performance, providing insights to procurement officers, and guiding partner selection to minimize contract failures (Coglianese, 2023).

Purchase-to-pay

This section examines the downstream phase of the S2P process, known as P2P, focusing on how AI is streamlining transactional procurement activities. To provide a structured analysis, the section is divided into three sub-sections: Guided Buying, Purchase Requisition (PR) and Purchase Order (PO), and Invoice Management. AI technologies are being integrated into P2P workflows to reduce manual effort, improve compliance, and enhance decision accuracy. Each sub-section highlights the role of AI in automating workflows, enhancing compliance, and improving operational efficiency across day-to-day procurement functions.

Guided buying

AI is revolutionizing procurement by streamlining decision-making and boosting efficiency in guided buying systems. These systems help employees make informed purchasing decisions by simplifying the process, much like the consumer experiences they are familiar with. AI enhances this experience by providing clear guidance, aligning purchases with corporate policies, and reducing complexity (Strohmer et al., 2020a).

A critical foundation for guided buying is electronic procurement (e-procurement). Vaidya and Campbell (2016) define public e-procurement as the use of information and communication technologies, especially the Internet, to automate procurement processes. Their study shows that e-procurement improves efficiency, transparency, and accountability while significantly reducing transaction times and costs, outcomes that align with the goals of guided buying systems.

Building on this, AI-powered chatbots now act as virtual assistants, supporting purchasing decisions, engaging suppliers, and even conducting negotiations. Leveraging tools such as ChatGPT and Google Bard, they facilitate market research, identify potential suppliers, and evaluate performance, while recommending purchases aligned with

policies. This reduces off-contract spending and ensures compliance (Constant & Berre, 2024; Mandl, 2023a).

NLP enables these chatbots to understand and respond to user inquiries across text, voice, or messaging. It categorizes requests and directs users to appropriate resources, while enhancing smart search so users can find information without technical knowledge (Morgan, 2021).

AI also automates P2P processes, guiding employees through catalog systems and making guided buying a standard practice. Automation, including fraud detection, improves efficiency and ensures smoother procurement operations (Constant & Berre, 2024).

Generative AI (Gen AI) refers to advanced models capable of creating new content, such as text, summaries, or tailored recommendations. In procurement, knowledge bots powered by Gen AI assist contracting officers by answering complex questions and simplifying regulatory navigation, reducing time spent on manual research (Coglianese, 2023).

Taken together, AI-powered guided buying enhances user experience, ensures compliance, supports cost control, and shortens procurement cycles. These advancements make procurement more efficient and accessible for employees and organizations (Constant & Berre, 2024; Sanchez-Graells, 2024).

Purchase requisition and purchase order

AI is transforming PR and PO management by automating processes, enhancing efficiency, and ensuring compliance. AI-driven systems streamline requisitioning and order management by automating approval workflows, controlling procurement steps, and providing real-time monitoring. This prevents delays, reduces errors, and facilitates smoother tracking across the procurement cycle (Allal-Chérif et al., 2021).

Traditionally, PRs required paper forms for goods or services. Today, electronic sourcing systems generate and transmit requisitions digitally, checking entries for accuracy and completeness to prevent costly errors. Once completed, requisitions can be approved automatically with minimal staff intervention, freeing procurement teams for strategic tasks. The integration of requisitions and POs creates a seamless audit trail that strengthens compliance and transparency (Schoenherr, 2019b).

AI further supports requisition and order management by automating the creation of purchase specifications and supplier recommendations. Bots manage the requests, ensuring they align with both internal requirements and supplier capabilities. This reduces manual input, and accelerates order processing (Strohmer et al., 2020a).

It also shifts traditional procurement practices from retrospective spend analysis to proactive requisition planning. While traditional systems rely on past POs and invoices to analyze expenditures, AI enables organizations to incorporate forward-looking requisition data. This proactive approach helps identify cost-saving opportunities earlier in the procurement cycle, leading to more strategic procurement decisions and reducing inefficiencies (Spreitzenbarth et al., 2024b).

AI-driven tools like bundling generators optimize requisition management by aggregating similar requests across departments, time periods, and categories. This reduces fragmentation and allows for the creation of larger, more consolidated POs. Fewer, larger orders improve supplier negotiations and drive economies of scale. AI identifies bundling opportunities during the requisition approval phase, streamlining the transition from requisition to PO, reducing manual errors, and enhancing accuracy and efficiency.

Overall, AI-supported PR and PO processes improve agility and visibility, reduce operational costs, and ensure procurement compliance across organizational units (Spreitzenbarth et al., 2024b).

Invoice management

AI is improving invoice management by automating key processes, reducing errors, and enhancing efficiency. A major advancement is invoice classification through text mining, which categorizes line items

into spend cube classes and identifies discrepancies such as price variances (Mandl, 2023b). AI-driven invoice price variance analysis can detect differences between supplier prices and invoiced amounts, revealing potential overpayments or pricing issues.

AI systems also undergo a learning phase, training on invoice formats to extract critical information. For example, one company reduced processing time per invoice from 23 min to one minute after sufficient training, demonstrating significant accuracy gains (Schmitz, Stummer, & Gerke, 2019).

Another development is integrating RPA with AI into cognitive RPA (cRPA), which manages complex tasks like supplier follow-ups and invoice disputes, improving speed and accuracy (Buchholz Wolfgang and Grabbe, 2022).

Modern procurement applications leverage AI to automate invoice management workflows, which not only improves data quality but also ensures compliance and reduces operational risks. For instance, AI can automate the three-way match process (matching invoices with POs and receipts), reducing manual intervention and accelerating the payment cycle (Bode et al., 2023; Strohmmer et al., 2020b).

AI technologies, such as OCR, process unstructured documents, including scanned invoices, receipts, and checks. These systems extract data from documents that are not in standard formats or connected at the system level. This allows businesses to fully automate the invoicing process, with human intervention only required for handling uncertain information (Kanakov & Prokhorov, 2022).

A practical example comes from Satherm GmbH, which faced significant challenges with manual invoice processing. By implementing AI-based solutions combined with RPA, the company achieved a 70 % automation rate, cutting down invoice processing time from 15 days to just 2–3 h per invoice. This reduction led to substantial cost savings and freed up employees to focus on more complex tasks (Danner, Maurer, Schuh, Greff, & Werth, 2021).

In conclusion, AI-driven invoice management improves accuracy, reduces payment delays, enhances supplier satisfaction, and strengthens financial governance by minimizing overpayments and fraud risks (Coglianese, 2023; Constant & Berre, 2024).

Supplier relationship management

This section focuses on SRM, a cross-cutting component of the S2P process that supports both upstream and downstream procurement activities. To capture the multifaceted influence of AI, the section is structured into four sub-sections: Supplier Discovery, Supplier Onboarding, Supplier Risk Management, and Supplier Portals and Communication Hubs. These explore how AI enhances supplier engagement, risk monitoring, and collaboration. AI-driven innovations have shifted SRM from a reactive function to a strategic enabler of value, resilience, and transparency.

Supplier discovery

AI has enhanced the supplier discovery process, making it faster and less reliant on manual efforts. Digital platforms and cloud-based systems, such as SAP Ariba, Coupa, Workday, and Ivalua, serve as digital marketplaces, connecting buyers and suppliers, improving price transparency, and simplifying engagement. Public procurement often uses dynamic purchasing systems to access pools of pre-approved suppliers for quicker processes (Mandl, 2023a).

AI-driven cognitive tools are revolutionizing supplier identification and evaluation by scanning online catalogs and analyzing supplier attributes, assisting procurement teams in making more informed decisions (Handfield et al., 2019). AI also supports sustainable supplier selection by processing extensive supply chain data, helping companies select suppliers based on sustainability standards, as seen with platforms like EcoVadis and Intelix (Boute & Udenio, 2023).

Platforms such as Silex and Scoutbee analyze large supplier databases and recommend matches based on quality, cost, and lead times,

automating discovery and reducing cycle times by up to 75 % (Allal-Chérif et al., 2021; Guida et al., 2023).

AI also adds intelligence to decision-making by analyzing market data, allowing procurement teams to identify suppliers based on factors such as pricing, reliability, and performance (Cui et al., 2020). It also promotes supplier diversity, helping companies identify diverse suppliers to create more inclusive and resilient supply chains (van Hoek, 2024).

Supplier onboarding

AI significantly enhances supplier onboarding by automating tasks such as data collection, compliance checks, and performance assessments. This improves efficiency and reduces administrative burden. One critical area where AI adds value is in supplier performance monitoring. Supplier performance modules within electronic sourcing suites store detailed records on each supplier, including background information, contract details, and risk assessments. These systems track supplier performance over time, providing valuable insights that assist organizations in making informed decisions about future supplier selections. Additionally, these platforms integrate internal data with external sources, such as risk scores and social sentiment analysis, to provide a comprehensive view of supplier performance. Suppliers can also update their own information, ensuring that organizations have the most up-to-date data (Schoenherr, 2019b).

AI algorithms further assess supplier performance by analyzing quality, delivery, cost, and compliance. This data-driven evaluation helps organizations identify suitable suppliers and reduce risks of underperformance or non-compliance (Bansal & Jain, 2023). Digital platforms that automate tasks like data collection and compliance checks streamline the onboarding process, accelerating the integration of new suppliers and ensuring they meet necessary requirements (Strohmmer et al., 2020b).

Supplier risk management

AI plays a pivotal role in supplier risk management by enabling organizations to proactively identify, assess, and mitigate risks across their supply chains. A key transformation is predictive analytics and real-time monitoring, which flag risks such as financial instability, compliance issues, and geopolitical threats. By continuously analyzing supplier performance and external data, AI provides early warnings that allow procurement teams to act swiftly (Hickok, 2024; van Hoek, 2024; Xu et al., 2024).

Text mining and web crawlers also help detect risks early. AI tools scan contracts, news, social media, and weather databases to anticipate disruptions such as material shortages, inflation, or political instability (Burger et al., 2023; Mandl, 2023a). For example, Coupa and Jaggaer analyze credit ratings, community feedback, and news sentiment to predict delays or performance issues, enabling timely interventions (Guida et al., 2023).

AI is also applied to fraud detection and compliance. By analyzing procurement data, it can flag suspicious transactions or irregular documentation, helping prevent fraud and corruption before escalation (Bansal & Jain, 2023; Ezeji, 2024). Similarly, AI technologies support organizations in addressing non-compliance issues by enhancing digitalization and improving risk assessments across procurement processes (Seyedghorban, Samson, & Tahernejad, 2020). Ahmed and MacCarthy (2022) emphasize that blockchain can complement AI by enhancing supply chain resilience and trust through decentralized verification mechanisms and immutable transaction records. Their framework positions blockchain as a foundational Industry 4.0 enabler that supports traceability, transparency, and risk mitigation in multi-tier supplier networks.

Supplier portals and communication hubs

AI-powered supplier portals and communication hubs enhance collaboration and streamline communication between buyers and

suppliers. They provide real-time procurement data, automate routine tasks, and let suppliers manage orders and updates efficiently (Schoenherr, 2019c; Strohmmer et al., 2020b).

Platforms such as Synertrade’s SRM support transparent relationships by tracking supplier performance, fostering long-term collaboration, and mitigating risks (Allal-Chérif et al., 2021). Similarly, digital sourcing platforms enhance communication and transparency, ensuring compliance and alignment with organizational goals by generating unified quotes and distributing cost details across the supplier network (Seyedghorban et al., 2020).

Furthermore, AI chatbots are increasingly used to automate procurement communication. These tools mimic human interactions, handling inquiries, requesting price quotes, and managing supplier relationships without manual intervention, significantly improving procurement efficiency (Cui et al., 2020).

E-procurement systems also consolidate procurement functions, enhance operational efficiency, and reduce expenses. By automating workflows and strengthening collaboration, these systems improve communication channels between procurement teams and suppliers, boosting supply chain coordination (Althabatah, Yaqot, Menezes, & Kerbache, 2023).

Table 1 synthesizes the literature by linking AI technologies to each S2P stage, highlighting their main capabilities.

Methodology

This study employs an inductive qualitative approach using semi-structured interviews to explore AI’s impact on procurement, particularly in the S2P process. This method enables an in-depth understanding by capturing industry professionals’ experiences and insights. Semi-structured interviews provide flexibility, allowing participants to elaborate on challenges and the perceived impact of AI in procurement (Grossoehme, 2014).

A purposive sampling strategy was used to select participants with direct expertise in AI-driven procurement, particularly in S2C, P2P, and SRM frameworks. Interviews were conducted via Microsoft Teams for around one hour each and were audio-recorded and transcribed with prior informed consent. Ethical considerations included participant confidentiality, informed consent, and anonymization of responses.

Data analysis was conducted using Taguette, applying thematic content analysis to code transcripts and identify emerging themes systematically. We used triangulation and peer discussions as they enhanced credibility by cross-referencing insights and refining interpretations (Hammarberg, Kirkman, & De Lacey, 2016). The iterative nature of this research ensured the continuous refinement of themes, aligning with qualitative research principles (Aspers & Corte, 2019).

This study also has certain methodological limitations. First, the analysis is based solely on qualitative interviews, which provide depth but limit the ability to generate statistically generalizable results. Second, the study is based on a small number of interviews, which may narrow the range of perspectives captured. Nonetheless, these expert insights offer rich contextual understanding, and by leveraging them, this methodology provides a structured yet exploratory approach to understanding AI-driven procurement innovation, addressing both theoretical and practical dimensions.

Fig. 2 depicts the research process we employed, comprising three phases.

Findings

The findings are organized to reflect both the core stages of the S2P framework: S2C, P2P, and SRM, as well as several emerging themes derived from the interview data. While the initial sub-sections focus on process-specific insights, additional sub-sections highlight broader themes that were consistently raised by participants, including AI-powered procurement orchestration, system integration through APIs,

Table 1
Capabilities of AI technologies across procurement stages.

AI Technology	S2C	P2P	SRM
ML	<ul style="list-style-type: none"> Classifies spend (Guida et al., 2023; Khadse, 2021; Strohmmer et al., 2020b) Identifies savings opportunities (Burger et al., 2023; Handfield et al., 2019; Spreitzenbarth et al., 2024a) Automates bid evaluation (Bansal & Jain, 2023; Morgan, 2021)) Recommends contract clauses (Cui et al., 2020; Guida et al., 2023) 	<ul style="list-style-type: none"> Detects invoice fraud Predicts purchasing needs Optimizes requisition bundling (Authors’ analytical interpretation from the literature) 	<ul style="list-style-type: none"> Supports predictive analytics and real-time monitoring to assess supplier performance and identify potential risks Enhances data-driven supplier selection and performance evaluation through algorithmic learning (Authors’ analytical interpretation from the literature)
NLP	<ul style="list-style-type: none"> Extracts and analyzes contract clauses (Constant & Berre, 2024; Morgan, 2021) Validates RFX documents (Coglianese, 2023) Detects inconsistencies (Coglianese, 2023; Constant & Berre, 2024; Morgan, 2021) 	<ul style="list-style-type: none"> Enables chatbots to interpret user inquiries, categorize requests, and enhance smart catalog searches (Morgan, 2021) 	<ul style="list-style-type: none"> Enables text mining and social-media/news analysis for early detection of supply risks (Authors’ analytical interpretation from the literature)
RPA	<ul style="list-style-type: none"> Automates clause classification, indexing, and compliance monitoring, reducing administrative burdens (Constant & Berre, 2024) 	<ul style="list-style-type: none"> Manages supplier follow-ups and invoice disputes (Buchholz Wolfgangand Grabbe, 2022) 	<ul style="list-style-type: none"> Automates repetitive onboarding and compliance-check tasks to accelerate supplier integration (Authors’ analytical interpretation from the literature)
OCR		<ul style="list-style-type: none"> Extracts data from scanned invoices, receipts, and unstructured documents (Kanakov & Prokhorov, 2022) 	
GenAI	<ul style="list-style-type: none"> Drafts RFPs and contracts (Giampieri, 2025; Nistala et al., 2024) Generates negotiation text (Cui et al., 2020; Guida et al., 2023) Reduces drafting time (Cui et al., 2020; Giampieri, 2025) 	<ul style="list-style-type: none"> Utilizes models such as ChatGPT and Google Bard to support guided buying and supplier evaluation (Constant & Berre, 2024; Mandl, 2023a) Assists with market research, supplier insights, and policy-aligned purchase recommendations (Constant & Berre, 2024; Mandl, 2023a) Powers knowledge bots that provide procurement guidance and simplify regulatory tasks (Coglianese, 2023) 	
Chatbots	<ul style="list-style-type: none"> Handles RFX Q&A (Cui et al., 	<ul style="list-style-type: none"> Support guided buying through 	<ul style="list-style-type: none"> Automate procurement

(continued on next page)

Table 1 (continued)

AI Technology	S2C	P2P	SRM
	2020) • Responds to inquiries (Cui et al., 2020) • Reduces workload (Cui et al., 2020; Mandl, 2023a)	virtual assistance and supplier interaction (Constant & Berre, 2024; Mandl, 2023a) • Enable efficient market research and supplier evaluation (Constant & Berre, 2024; Mandl, 2023a) • Promote policy compliance and reduce administrative workload (Constant & Berre, 2024; Mandl, 2023a)	communication by handling supplier inquiries, price requests, and relationship management, reducing manual intervention and improving efficiency (Cui et al., 2020)

data quality and governance, implementation challenges, organizational readiness, and the evolving skill sets required for modern procurement professionals. This structure enables a comprehensive understanding of AI's impact on both the functional and strategic dimensions of

procurement.

Fig. 3 illustrates the specific AI applications associated with each stage of the S2P framework, providing a visual overview of how AI technologies support key procurement activities across S2C, P2P, and SRM.

Source-to-contract

Spend analytics

AI-driven spend analytics transform procurement by automating supplier identification, transaction categorization, and data classification, reducing manual effort and human error. One procurement expert noted, "AI is helping to automate this process significantly... one of the longstanding challenges has been accurately identifying the supplier and categorizing transactions" (Manager 1).

Beyond automation, AI enhances spend visibility and data cleanliness, particularly in indirect spend categories where classification inconsistencies often arise. "Spend analysis today sees most players leveraging AI to reclassify spend... swiftly analyzing data and applying category taxonomies" (Manager 5).

AI also identifies cost-saving opportunities by detecting

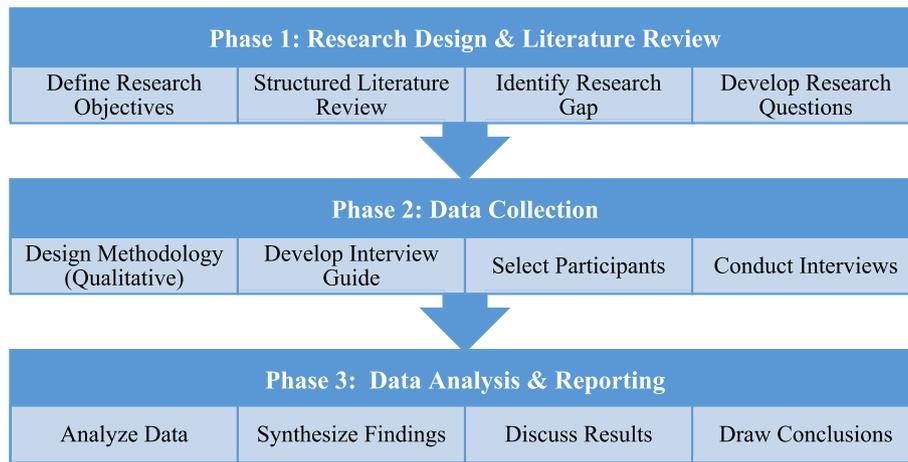


Fig. 2. Research Process.

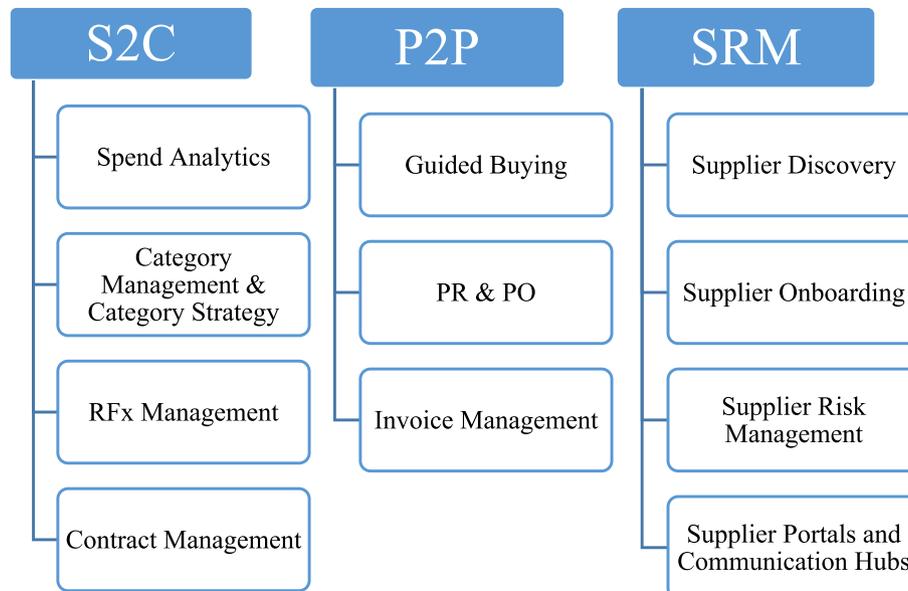


Fig. 3. AI Applications Across the S2P Framework.

inefficiencies and rogue spending patterns. It enables procurement teams to pinpoint high-cost areas, optimize supplier relationships, consolidate spending, and drive strategic value. One expert highlighted, “AI provides actionable insights, identifying new suppliers and clarifying their usage, allowing procurement teams to take strategic action” (Manager 1). Another emphasized, “AI empowers procurement to take the lead, recognizing cost-saving opportunities and addressing extended lead times for critical commodities” (Manager 6).

In addition, AI enhances proactive spend management through real-time alerts, notifying teams of price fluctuations and supplier inefficiencies, prompting timely corrective actions. One expert explained, “AI can provide alerts such as ‘Your average price per unit has increased by 10%’... prompting procurement to engage suppliers or adjust policies” (Manager 6).

Category management and category strategy

Category management is essential in procurement, enabling market entry strategies, business requirement analysis, and supply chain optimization. Interviewees highlighted the importance of integrating internal (spend data, contracts) and external (market intelligence, supplier insights) data to refine procurement strategies. One participant explained, “Category management involves defining market entry strategies, assessing internal spend and contracts, and leveraging external data to optimize procurement decisions” (Manager 5).

AI enhances data analysis, market insights, and supplier selection, allowing procurement teams to identify opportunities, track price trends, and refine category strategies more effectively. Because one expert noted, “AI plays a crucial role in analyzing market intelligence and cost models to define category strategies and understand pricing trends” (Manager 5). AI also improves supplier performance evaluation, ensuring alignment with procurement goals, according to another participant, “AI highlights suppliers that better meet quality, efficiency, and cost-effectiveness needs, improving procurement outcomes” (Manager 4).

Despite AI’s advancements, human expertise remains crucial in decision-making. AI provides insights and validates data, but it is not yet fully trusted to define critical business strategies autonomously. As one manager said, “AI supports strategy creation, but final decision-making still requires human expertise and judgment” (Manager 7). Another added, “Large organizations are not yet ready to rely entirely on AI for defining critical business strategies” (Manager 8).

RFX management

AI is transforming RFX management by automating Request for Proposal (RFP) processes, optimizing content creation, and enhancing bid evaluation. Interviewees highlighted AI’s role in handling large-scale RFPs, significantly reducing manual effort while improving efficiency. One procurement expert noted, “AI automates the distribution, collection, and optimization of RFP data, eliminating hundreds of hours of work and streamlining complex sourcing events” (Manager 1). AI-powered bots further enhance efficiency by adjusting RFP parameters and analyzing responses. As one manager explained, “The AI agent handles publishing RFPs, adjusting parameters, and suggesting award criteria based on predefined supplier metrics” (Manager 5).

AI also supports content generation and template management, ensuring structured, accurate RFPs. It automates content creation, either from scratch or based on templates, making procurement requests more standardized. One participant noted, “AI creates RFP content and structures it into standardized event formats” (Manager 3). It also refines supplier selection by recommending vendors based on predefined specifications. “AI suggests technical specifications and relevant suppliers, extending beyond existing lists” (Manager 5). Furthermore, AI simplifies template management, ensuring accurate procurement data collection. “AI automatically identifies necessary columns and fields, streamlining the RFP template process” (Manager 2).

Beyond automation, AI enhances bid evaluation and decision support through scenario analysis. It enables procurement teams to assess

multiple bid outcomes, ensuring optimal award decisions. “AI intuitively handles bid analysis and execution, delivering highly accurate scenario results” (Manager 2). AI optimizes award strategies and minimizes procurement risks by analyzing supplier bids across multiple criteria. “AI-driven scenario analysis identifies the most effective approach, optimizing awards and reducing potential sourcing inefficiencies” (Manager 7).

Contract management

The integration of AI into contract management has streamlined traditional labor-intensive processes, reducing inefficiencies associated with manual review and interpretation. Procurement experts highlighted how AI enhances contract analysis, risk assessment, and drafting, replacing reliance on basic word-processing tools. One participant emphasized the inefficiencies of traditional contract management, noting, “Contracting is one of the biggest pain points... it’s all done manually with redlines and edits in Word” (Manager 1).

AI automates document analysis and summarization, extracting key contract details such as payment terms, expiration dates, and renewal clauses, making contracts more accessible and reducing the time required for review. One procurement specialist stated, “AI reads, interprets, and highlights major clauses, helping procurement teams quickly understand critical contract details” (Manager 1). Another expert highlighted the ability of AI to organize extracted information into structured formats: “AI can summarize complex contracts and identify key clauses, significantly improving efficiency” (Manager 2).

Beyond document interpretation, AI enhances metadata extraction, ensuring key contract elements are accurately labeled and cataloged. It automates the identification of termination clauses, liability limitations, and compliance conditions, facilitating contract management. As one interviewee explained, “AI excels at extracting metadata and accurately labeling contractual clauses, streamlining analysis and integration into organizational systems” (Manager 3).

A critical function of AI in contract management is semantic risk analysis, allowing organizations to identify and mitigate contractual risks. AI flags high-risk clauses, deviations from standard contract terms, and liabilities exceeding thresholds, ensuring compliance. One expert noted, “AI analyzes contracts against a company’s library of accepted terms, flagging clauses that introduce potential risks or non-compliance” (Manager 3). Another added, “AI highlights contracts with short cancellation periods or high liability thresholds, allowing for proactive risk management” (Manager 7).

AI also plays a transformative role in contract drafting and redlining, automatically generating tailored contracts, refining clauses, and ensuring compliance with company policies. It can autonomously redline contracts, focusing on critical clauses while minimizing manual intervention. One participant described how AI simplifies negotiations: “AI can redline contracts, ensuring key clauses like indemnification and payment terms align with company standards, reducing the need for human involvement” (Manager 4). Another expert emphasized AI’s role in smart contract drafting, stating, “AI drafts agreements tailored to specific procurement needs, flagging deviations from industry or company standards” (Manager 6).

Purchase-to-pay

Guided buying

Guided buying within the P2P process leverages AI to streamline procurement, enhance decision-making, and enforce policy compliance. AI-powered tools, including chatbots and Gen AI, assist users by automating purchase requests, identifying suitable suppliers, and directing requisitioners to optimal sourcing options.

One procurement expert explained, “If someone types in what they’re looking to purchase, the AI system fills out the request, identifies the right suppliers, and fully automates the process” (Manager 1).

AI also acts as a real-time advisor, ensuring requisitioners select the right channels, suppliers, and prices while continuously monitoring for

better deals. “AI facilitates guided buying by directing users to the right supplier and price, while continuously checking for better quality, pricing, or lead times. Our chatbot Navy guides users through the sourcing process based on real-time data and constraints” (Manager 4).

Beyond automating transactions, AI serves as a process orchestrator, helping users unfamiliar with procurement complexities navigate purchasing decisions. It suggests appropriate actions, recommends contracts, and simplifies supplier selection. As one expert noted, “Casual buyers often struggle with procurement decisions. AI steps in as an intelligent assistant, recommending actions and guiding users through contract renewals or supplier selection in a chat-like experience” (Manager 5).

Purchase requisition and purchase order

AI is transforming PR and PO management by automating data entry, optimizing requisition creation, and detecting anomalies, ensuring greater efficiency and accuracy in procurement. One participant highlighted AI’s role in mitigating data entry inaccuracies, stating, “One of the primary challenges with PRs is inaccurate data entry, which impacts spend management and demand planning. AI intervenes by suggesting the correct category based on past data and extracting structured information from attachments, ensuring accurate routing for approval” (Manager 6).

Beyond requisition accuracy, AI automates PR and PO creation, minimizing manual steps and streamlining supplier communication and invoice processing. “AI agents automate PRs management by generating POs based on requisition details, facilitating supplier interactions, and managing invoice processing” (Manager 5). Another expert emphasized AI’s role in improving order matching and reducing errors, explaining, “If an item is covered under an established contract, AI can directly send the order to the supplier, improving matching rates and accelerating processing” (Manager 8).

AI also enhances fraud detection in POs, identifying false orders and mitigating risks such as internal theft or supplier fraud. One manager explained, “AI scans POs for inconsistencies, flagging anomalies such as mislabeled packages or fraudulent transactions that could indicate internal theft” (Manager 2).

Invoice management

AI is revolutionizing invoice management, transforming how organizations handle invoice processing, verification, and compliance. Interviewees highlighted AI-driven technologies such as OCR and Gen AI as key advancements in streamlining invoice handling. AI enables automated data extraction, invoice matching, and fraud detection, significantly improving accuracy and efficiency.

The transition from manual invoicing to digital processing has been accelerated by OCR technology, which automates data extraction from paper and PDF invoices, reducing manual entry errors. One procurement expert explained, “Twenty years ago, invoices were mailed, then emailed as PDFs, requiring manual retyping. Now, OCR technology enables true electronic submission, eliminating manual input and improving processing speed” (Manager 6). Another emphasized the role of AI in understanding invoice context, noting, “OCR is more than text recognition; it interprets invoice details, identifying amounts, PO references, and payment terms, which enhances automatic matching rates” (Manager 7).

Beyond OCR, Gen AI enhances invoice processing by filling in missing details, particularly for non-PO invoices that lack structured data. One interviewee highlighted, “Gen AI helps by backfilling PO details, ensuring accurate approvals, and categorizing invoices correctly. It even extracts data in non-Latin character languages, improving global invoice processing capabilities” (Manager 3).

AI also strengthens fraud detection and compliance oversight, identifying duplicate invoices, supplier risks, and non-compliant transactions. As one manager explained, “AI flags fraudulent activities such as duplicate invoicing and suppliers failing compliance checks, ensuring procurement decisions align with company policies” (Manager 4).

Supplier relationship management

Supplier discovery

AI is transforming supplier discovery by automating the process of finding and evaluating potential suppliers. Traditionally, procurement teams manually searched for, assessed, and shortlisted suppliers, relying on extensive research, Requests for Information (RFIs), and interviews. AI now streamlines supplier identification by crawling supplier databases, analyzing certifications, and recommending matches based on predefined criteria, significantly reducing the time and effort required for supplier scouting.

One expert explained the inefficiencies of traditional supplier discovery, stating, “Finding the right suppliers used to be incredibly time-consuming. Googling options, reviewing RFIs, and evaluating capabilities. AI now accelerates this process by providing real-time data and supplier recommendations based on historical performance, cost, and compliance metrics” (Manager 1). Another participant highlighted AI’s ability to automate supplier searches, adding, “AI crawls supplier networks and the web to identify potential vendors, easing the burden on procurement teams” (Manager 5).

Beyond fundamental discovery, AI enhances supplier qualification by extracting relevant details such as certifications, diversity classifications, and strategic fit, reducing the reliance on manual data entry. “AI scrapes the web for supplier certifications and other qualifications, improving data accuracy and reducing the need for suppliers to manually submit information” (Manager 7).

AI-powered supplier recommendation engines further refine the selection process by analyzing category strategies and historical purchasing data. As one expert noted, “AI-driven recommendation systems analyze past procurement history and category strategies, delivering optimized supplier matches” (Manager 6).

Once AI has identified suitable suppliers, the next step is supplier onboarding, where AI ensures efficient integration, verification, and compliance processes, eliminating manual bottlenecks in bringing suppliers into the system.

Supplier onboarding

After identifying potential suppliers, the next step is supplier onboarding, which focuses on integrating them into procurement systems, verifying credentials, and ensuring compliance with company policies. AI automates supplier verification, document processing, and policy enforcement, accelerating supplier qualification and reducing manual effort.

AI ensures compliance by enforcing corporate sourcing policies, such as including diverse suppliers in sourcing events. One participant noted, “AI helps enforce corporate policies by recommending diverse suppliers for sourcing events, ensuring compliance without relying on manual tracking” (Manager 6).

Beyond policy adherence, AI automates supplier qualifications by consolidating key data and verifying certifications to ensure a seamless onboarding experience. “AI accelerates onboarding by consolidating supplier information, verifying certifications, and summarizing key details, replacing manual document review with automated validation” (Manager 5).

AI also assists in supplier data collection and due diligence, checking credit scores, fraud risks, and regulatory compliance. One procurement expert explained, “AI streamlines due diligence by automatically assessing supplier financial stability, fraud risks, and compliance, ensuring organizations onboard reliable vendors” (Manager 8).

Additionally, AI enhances supplier risk assessment by summarizing performance data, compliance records, and financial indicators to help procurement teams make informed onboarding decisions. “AI aggregates data from multiple sources: financial reports, social media, and news, to generate actionable supplier risk ratings” (Manager 3).

By leveraging AI-driven automation, compliance enforcement, and risk assessment, supplier onboarding becomes faster, more accurate, and

strategically aligned, ensuring seamless supplier integration and minimizing onboarding delays.

Supplier risk management

Managing supplier risk is a critical aspect of procurement, requiring continuous monitoring, real-time risk detection, and proactive mitigation strategies. Traditional risk assessment methods rely on periodic evaluations, making detecting emerging threats in real time difficult. AI enhances these processes by identifying financial instability, compliance violations, and operational risks before they disrupt supply chains.

One of AI's key functions in risk management is risk signal detection and integration. AI consolidates diverse risk indicators, generating real-time risk scores that help procurement teams assess supplier vulnerabilities. One expert explained, "AI crawls external sources to assess supplier risk, evaluating financial, governmental, and operational factors to generate risk scores. It ensures alerts are triggered based on predefined thresholds for proactive risk management" (Manager 5).

AI also supports continuous supplier monitoring, tracking fraud risks, compliance violations, and reputational threats by analyzing news mentions, financial disclosures, and regulatory updates. One procurement expert emphasized, "AI continuously monitors suppliers for issues like child labor violations or environmental breaches, providing real-time alerts to procurement teams to mitigate risks early" (Manager 4).

Beyond alerts, AI enhances supplier risk scorecards, integrating news reports, legal filings, and external risk events to create a comprehensive supplier risk profile. AI-powered platforms detect bankruptcy risks, bribery allegations, and operational disruptions, helping procurement teams make informed decisions. One participant noted, "AI flags supplier-related incidents such as lawsuits, factory disruptions, or financial instability, assessing their impact and feeding them into supplier scorecards" (Manager 7).

Supplier portals and communication hubs

Supplier portals and communication hubs have transformed how businesses interact with their suppliers by centralizing information exchange and automating communication workflows. These platforms enhance collaboration by providing a structured interface for suppliers to engage with procurement teams, submit required data, and participate in sourcing processes.

A centralized supplier portal serves as the primary touchpoint for supplier communication, streamlining interactions and improving visibility across procurement operations. One expert explained, "Our supplier portal acts as a hub where we collect information from suppliers and facilitate communication with them" (Manager 5). Another highlighted the scale and accessibility of supplier platforms, stating, "Our platform connects with 10 million suppliers, enabling seamless buyer-supplier communication" (Manager 4).

Beyond basic engagement, supplier portals are increasingly integrated with sourcing tools and automated messaging systems, allowing procurement teams to manage supplier onboarding, sourcing events, and document exchanges in a unified interface. One procurement leader emphasized, "Our vendor portal is interconnected with sourcing tools, featuring a communication center that enables automatic messaging between buyers and suppliers, streamlining the entire sourcing process" (Manager 3).

AI-powered procurement orchestration and intake processes

AI-powered procurement orchestration and intake processes are emerging as a new capability in procurement solutions, transforming how organizations manage procurement workflows. In this context, orchestration refers to connecting and coordinating procurement activities such as sourcing, contracting, purchasing, and compliance into one integrated workflow, rather than managing them as separate silos. This centralized coordination ensures that information, approvals, and actions flow seamlessly across systems and teams.

Intake processes, by contrast, focus on the initial request stage of

procurement. At this stage, AI validates, routes, and manages procurement requests, reducing manual effort and improving compliance.

Procurement orchestration is becoming an essential capability, moving beyond traditional S2P systems, which structured procurement into distinct sourcing, contracting, and purchasing steps. Modern orchestration tools integrate these functions into a unified procurement interface, improving efficiency and visibility. One expert noted, "Orchestration is about responding to procurement demands, such as requisitioning, supplier updates, or sourcing events, through a seamless interface. It connects multiple systems in the background, simplifying processes for users. These tools are becoming the next-generation platform for procurement." (Manager 9).

AI enhances intake processes by ensuring procurement requests are accurately categorized, routed, and approved, reducing manual intervention and ensuring compliance. "AI simplifies intake by guiding users step by step, ensuring compliance without overwhelming them with policies." (Manager 6).

Beyond request handling, AI improves workflow automation, extracts procurement data, assesses risks, and directs approvals efficiently. One expert explained, "AI helps extract key procurement information, assess risks, and streamline approvals for smooth processing." (Manager 3).

AI-powered intake-to-procure workflows further improve efficiency by automatically routing procurement requests based on urgency, category, and business policies. AI-driven assistants interact with users via chat platforms like Slack or Teams, answering procurement-related questions and ensuring requests follow the correct process. "AI applies company policies to recommend the correct procurement process, reducing errors and ensuring compliance." (Manager 3).

Enhancing procurement efficiency through AI and API integration

The integration of AI and APIs is transforming procurement by enabling seamless data exchange, system interoperability, and workflow automation. Modern procurement solutions rely on API connectivity to integrate sourcing, contract management, and procurement execution tools, allowing organizations to build flexible, efficient, and scalable procurement ecosystems.

A key challenge in procurement has been connecting disparate systems and eliminating inefficiencies caused by siloed platforms. AI-driven integration solutions simplify data synchronization, ensuring smooth communication between different procurement tools. One expert highlighted, "Integration is crucial because traditional P2P suites often fail at connecting components effectively. AI can help pull together data from disconnected systems, reducing friction and improving functionality" (Manager 1).

APIs also offer plug-and-play flexibility, allowing companies to integrate specialized procurement tools rather than relying on a single provider. One procurement leader emphasized, "We focus on open API integration, enabling companies to connect our solution with their existing tools like SAP or contract management platforms. This avoids the cost and complexity of switching entire systems" (Manager 2). Another expert added, "Many of our customers use different providers for sourcing, contract management, and P2P. API integration ensures these systems work together efficiently without requiring a full-suite replacement" (Manager 6).

AI enhances system interoperability by enabling automated data routing and real-time information sharing between procurement platforms. This ensures procurement teams can access the most relevant data without switching between systems. One expert explained, "We complement SAP with over 60 prebuilt integrations, allowing real-time data exchange and seamless procurement execution" (Manager 3).

Data quality and AI effectiveness

Ensuring high-quality data is fundamental to leveraging AI effectively in procurement. Poor data quality can lead to inaccurate AI outputs, increased errors, and inefficiencies, making structured and well-

maintained datasets essential for AI-driven insights and automation. The success of AI depends on the quality and reliability of the data it processes, as one expert emphasized, *“The effectiveness of AI hinges on the quality of the data it processes. If you’re working with poor or insufficient data, the AI’s performance will be limited”* (Manager 1). Without strong data governance and disciplined processes, AI cannot fix underlying data issues but instead risks accelerating mistakes, as noted by another expert: *“AI will simply automate bad data faster. AI is not magic; it depends on clean and reliable data to function properly”* (Manager 6). To mitigate these risks, organizations must prioritize data cleansing and centralization, ensuring datasets are structured, accessible, and free of inconsistencies before applying AI solutions. One expert noted, *“The first step is cleaning up data as thoroughly as possible. AI tools can help manage large datasets, but foundational data quality is crucial for AI success”* (Manager 1). AI further enhances data quality by normalizing, validating, and filling in missing data, reducing manual data processing efforts, and enabling more accurate insights. One procurement leader explained, *“AI can automatically update supplier data based on new triggers or external sources, reducing reliance on manual updates and improving procurement insights over time”* (Manager 7).

Limitations and challenges of AI

Despite AI’s advancements in procurement, its adoption presents challenges related to hype, decision-making, privacy, and change management. Organizations must navigate these limitations to ensure effective and secure integration.

AI is often overhyped, leading to inflated expectations. One expert noted, *“AI is a big buzzword, but many companies are still figuring out how to use it effectively”* (Manager 4). Another added, *“ML is written in Python, but AI is often written in PowerPoint. The way it’s presented can be misleading”* (Manager 6).

While AI can analyze large datasets and provide insights, final procurement decisions require human oversight. One expert explained, *“AI should function as an analytical tool, but the final decision should always remain with humans”* (Manager 3). Another added, *“I wouldn’t rely entirely on AI for critical decisions. It’s an advisor, not a replacement for human judgment”* (Manager 2).

Privacy and security concerns arise with data protection and open-source AI models. Organizations must ensure compliance with security protocols. One expert highlighted, *“Many companies use free AI services without realizing the risks of data exposure”* (Manager 6); additionally, another warned, *“AI tools like ChatGPT can store data, creating potential security threats”* (Manager 4).

Successful AI adoption also requires change management, as employees may resist automation due to job security concerns. One procurement leader noted, *“Employees often fear AI will replace them, but the challenge is to show how it supports their roles, not eliminates them”* (Manager 6).

Recommendations and considerations for companies

To successfully integrate AI into procurement, organizations must strategically assess their processes, prioritize high-impact use cases, and rigorously evaluate AI solutions. Experts emphasize the importance of aligning AI initiatives with strategic goals, ensuring data readiness, and adopting a phased approach to implementation.

A crucial first step is to assess current processes and identify areas where AI can provide the most value, particularly in automating manual tasks. One expert advised, *“Start by analyzing where AI can add the most value, focusing on highly manual processes will maximize impact”* (Manager 1). Organizations should then define clear use cases, beginning with manageable applications before expanding. *“Start small and gradually scale up rather than rushing into broad AI adoption”* (Manager 4).

Aligning AI adoption with strategic priorities ensures sustained momentum and maximizes long-term benefits. One expert noted,

“Instead of chasing new AI technologies, companies should align AI initiatives with business objectives such as cost savings or process visibility” (Manager 6). Additionally, understanding organizational maturity is key, as companies often attempt to implement AI without a solid foundation in data quality, digital processes, and skilled personnel. *“Many companies jump into AI too soon without assessing their process maturity. Strong foundations must come first”* (Manager 5).

Focusing on specific, high-impact use cases rather than evaluating all AI options at once leads to more effective implementation. One expert cautioned, *“Many organizations create large committees to explore AI solutions, only to waste time. Instead, narrowing the focus to targeted use cases yields more meaningful results”* (Manager 1). Selecting the right AI solutions is also critical, as not all AI tools are suited for every procurement function. *“Identify which AI solution aligns with your specific needs, whether in contract management, supplier relations, or strategic sourcing optimization”* (Manager 2).

Before full-scale adoption, organizations must conduct rigorous testing to ensure AI systems function effectively under real-world conditions. One expert emphasized, *“Push AI systems to their limits during testing to identify weaknesses. Don’t rely on controlled demos, use live data and assess real-time performance”* (Manager 3). Companies should also avoid falling for AI hype, ensuring that tangible benefits rather than market trends drive adoption. *“AI is overhyped, and companies should adopt it based on its real value, not just because it’s trending”* (Manager 1).

Finally, keeping up with technological advancements is essential, as AI-driven procurement is rapidly evolving. Organizations that fail to act risk falling behind competitors. One expert explained, *“If you’re still evaluating AI without concrete implementation plans, you’re already behind. Your competitors have likely already started adopting AI solutions”* (Manager 1).

Based on this research’s findings, [Table 2](#) presents the key recommendations derived from the expert interviews for organizations seeking to integrate AI into procurement processes successfully.

Essential skills and competencies for modern procurement professionals

The rise of AI is reshaping procurement, requiring professionals to adapt to new technologies while maintaining critical human skills. Success in this evolving field depends on technological awareness, strategic thinking, and strong interpersonal competencies.

Embracing change and technology adoption is essential for procurement professionals. One expert emphasized, *“Being open to technology and embracing change are crucial. The velocity of change today is unprecedented, and those who succeed are the ones willing to adapt and influence this evolution. Change management is becoming more important than many traditional skills”* (Manager 1).

Table 2
Recommendations for Successful AI Adoption in Procurement.

Step	Recommendation	Details
1	Assess current processes	Identify areas where AI can automate manual tasks. Focus on high manual effort zones.
2	Define specific use cases	Start small with manageable applications; scale gradually.
3	Align with strategic goals	Match AI initiatives to business priorities (e.g., cost savings, visibility).
4	Ensure organizational maturity	Build a strong foundation in data quality, digital tools, and skilled people before adoption.
5	Narrow focus	Avoid broad AI explorations. Target high-impact areas first.
6	Select the right AI solutions	Choose AI tools that fit specific procurement needs (e.g., contracts, supplier management).
7	Test under real conditions	Stress-test AI systems with live data to uncover weaknesses.
8	Avoid AI hype	Adopt AI based on practical value, not trends.
9	Act quickly	Move forward decisively to stay competitive in AI-driven procurement.

Alongside adaptability, familiarity with AI is now a fundamental requirement. Procurement professionals must understand AI's capabilities and limitations to apply it effectively. One leader noted, "Knowing how to leverage AI and understanding its limits will be crucial. As automation increases, human skills like negotiation, relationship management, and leadership will become even more valuable" (Manager 3).

Understanding advanced AI concepts such as ML and Gen AI is also key, even if deep technical knowledge is not required. One expert explained, "Procurement professionals don't need to be programmers, but they should understand when AI fits a use case and when it doesn't. Strategic application of AI is critical for making informed decisions" (Manager 6).

Discussion

As AI continues to reshape core business functions, procurement has emerged as a domain of rapid digital transformation. This study contributes to existing research by offering insights from technology providers on AI's role as a cyber-physical enabler across the procurement lifecycle. While confirming benefits such as intelligent automation, real-time data visibility, and improved decision-making, the findings also reveal practical complexities and evolving use cases. This chapter discusses key themes in relation to literature, highlighting areas of alignment, divergence, and advancement to clarify the strategic implications of AI and broader Industry 4.0 adoption.

Source-to-contract

The S2C phase has seen substantial transformation through AI-powered tools, as reflected in both the literature and field findings. In spend analytics, existing research highlights AI's role in enhancing data accuracy, classification, and real-time visualization to support strategic decisions (Burger et al., 2023; Guida et al., 2023; Strohmer et al., 2020b). Interviewees confirmed these advantages, emphasizing AI's ability to reclassify spend, detect inefficiencies, and provide real-time alerts, particularly in indirect spend where data is often inconsistent. This alignment confirms AI's growing value in enabling proactive and data-driven procurement management, a hallmark of Supply Chain 4.0.

While literature often embeds category management within broader sourcing discussions, practitioners emphasized it as a distinct AI-supported function. They described AI's contribution to integrating internal and external data, tracking pricing trends, and assessing supplier performance. Although AI informs strategy, participants stressed that final decisions still rely on human judgment, indicating a gap between technical potential and organizational trust, a common issue in Industry 4.0 implementation maturity.

In RFX management, literature describes how AI automates bid analysis, template creation, and supplier evaluation (Bansal & Jain, 2023; Mandl, 2023a). This was reinforced by interviewees who noted AI's role in managing large-scale RFPs, structuring content, and performing scenario analysis to optimize awards. While these capabilities align closely, practitioners provided more detailed insights into AI agents dynamically adjusting parameters and suggesting criteria, highlighting a level of real-world application that extends beyond what is typically captured in academic studies.

Contract management findings also aligned with the literature, which recognizes AI's ability to automate clause extraction, risk identification, and contract drafting (Allal-Chérif et al., 2021; Giampieri, 2025; Handfield et al., 2019). Interviewees confirmed these uses, particularly in summarizing terms and flagging deviations. However, they also noted that human oversight remains essential for legal accuracy and compliance, reflecting literature concerns about the limits of AI in complex legal contexts (Constant & Berre, 2024; Cui et al., 2020).

Purchase-to-pay

The P2P process has similarly benefited from the integration of AI

technologies, which act as key enablers of cyber-physical systems, as confirmed by both literature and interview data. In guided buying, literature emphasizes AI's ability to simplify purchasing through virtual assistants, policy enforcement, and user-friendly interfaces (Constant & Berre, 2024; Strohmer et al., 2020b). This is closely reflected in practice, where interviewees described AI systems that fill out requests, identify suitable suppliers, and guide users in real time. These smart assistants, often powered by NLP and integrated with cloud-based procurement ecosystems, illustrate the fusion of digital and physical workflows, central to Industry 4.0 paradigms. AI's role as an intelligent advisor and process orchestrator aligns with academic references to Gen AI and NLP-powered chatbots supporting sourcing decisions (Mandl, 2023a; Morgan, 2021). However, field insights highlight a more interactive role for AI than most literature captures, with experts noting how AI suggests actions, recommends contracts, and continuously searches for better terms, enhancing procurement agility, a key objective of Supply Chain 4.0.

In managing PR and PO, both literature and findings agree on AI's capacity to reduce manual effort, ensure compliance, and enhance requisition accuracy (Allal-Chérif et al., 2021; Spreitzenbarth et al., 2024b). Interviewees confirmed that AI suggests appropriate categories, extracts structured data from attachments, and automates PR-to-PO conversion. They also noted AI's role in improving supplier interactions and processing speed, which supports literature claims about AI's role in creating seamless, digitally orchestrated procurement workflows. While fraud detection is discussed in the literature primarily in the context of supplier risk management (Bansal & Jain, 2023; Xu et al., 2024), interviewees highlighted how similar AI capabilities are now being applied earlier in the procurement cycle, specifically within purchase requisitions and orders. This illustrates a broader shift toward proactive, intelligence-driven risk mitigation embedded within digital procurement infrastructures, consistent with the predictive and autonomous features of Industry 4.0 systems. These insights point to an expanding role for AI in procurement governance, particularly in identifying internal risks such as mislabeling, false orders, or potential fraud at the transaction level.

Invoice management, the final phase of P2P, also shows strong alignment between academic research and practitioner insights. AI's use of OCR and cRPA to automate invoice classification, three-way matching, and compliance monitoring is well-documented (Bode et al., 2023; Kanakov & Prokhorov, 2022). Interviewees reinforced these capabilities, highlighting that AI now interprets context, auto-completes missing data, and supports global invoice processing with multilingual capabilities. These features exemplify how intelligent automation and cognitive technologies are reshaping traditional procurement routines into integrated cyber-physical loops. Gen AI was also cited as a key enabler of intelligent invoice handling, particularly for non-PO invoices, adding practical depth to literature that primarily focuses on structured invoice processing. Additionally, practitioners emphasized AI's role in detecting duplicate or non-compliant invoices and preventing overpayments, reflecting a shift from traditional transactional tasks to more strategic risk mitigation.

Supplier relationship management

The SRM phase is another area where AI is making a substantial impact, as demonstrated in both the literature and the field evidence. In supplier discovery, research shows that AI significantly accelerates identification by analyzing large databases, matching suppliers to strategic needs, and promoting sustainable and diverse sourcing (Allal-Chérif et al., 2021; Guida et al., 2023; van Hoek, 2024). These capabilities were consistently reflected in practice, where experts described how AI automates supplier searches, assesses certifications, and extracts key qualifications. The use of recommendation engines to match suppliers with category strategies and historical spend data demonstrates a level of operational efficiency that confirms the literature while offering

a more granular view of how AI is integrated into daily procurement workflows.

In supplier onboarding, literature points to AI's ability to automate data collection, compliance checks, and performance evaluations (Bansal & Jain, 2023; Strohmer et al., 2020b). Interviewees echoed these points, emphasizing how AI consolidates and validates credentials, enforces policy adherence, and enhances risk assessment by aggregating data from diverse internal and external sources. Recent studies have also applied structured decision-making methods to prioritize logistics provider selection criteria, offering practical insights into supplier evaluation frameworks (Hamlehvar & Aazami, 2025). Notably, practitioners emphasized AI's role in ensuring corporate diversity goals, which adds a layer of strategic alignment not always emphasized in the literature. These insights reveal that onboarding is not only becoming more efficient but also more compliant and aligned with environmental, social, and governance objectives. As part of Supply Chain 4.0 frameworks, these intelligent onboarding systems contribute to smarter, more adaptive procurement networks.

AI's role in supplier risk management is well-supported across academic and practitioner sources. Literature describes predictive analytics, real-time monitoring, and text mining as tools for identifying early warning signs of supplier instability (Mandl, 2023a; Xu et al., 2024). Interviewees expanded on this by describing AI's ability to generate dynamic risk scores, track legal or ethical issues, and continuously update supplier risk profiles. The practical use of AI to monitor risks such as child labor violations or factory disruptions confirms literature findings while showing how these systems function in live operational settings. AI's integration of risk events into supplier scorecards also reinforces its role in supporting strategic procurement decisions beyond compliance. These predictive and real-time risk management features reflect the digital-to-physical intelligence loop central to Industry 4.0, enabling organizations to act proactively on emerging supplier vulnerabilities.

Finally, supplier portals and communication hubs are another area of strong convergence between theory and practice. Literature emphasizes their role in centralizing information, automating interactions, and improving transparency (Allal-Chérif et al., 2021; Schoenherr, 2019c). Interviewees affirmed these benefits, noting how portals enable real-time supplier communication, centralized data collection, and seamless integration with sourcing platforms. Practical examples such as automated messaging systems and vendor communication centers further demonstrate AI's role in improving collaboration and information flow. These digitally connected communication hubs serve as foundational infrastructure for Industry 4.0-enabled supplier ecosystems, enhancing responsiveness, transparency, and coordination.

Cross-cutting technological enablers

AI is also driving broader transformation in procurement through orchestration, system integration, and intelligent intake management. While these areas are less developed in existing literature, practitioner insights point to their growing significance. Experts described how AI-powered orchestration unifies fragmented procurement steps into seamless workflows, simplifying intake, automating routing, and ensuring compliance. These tools represent an evolution beyond traditional S2P suites, offering intelligent process guidance through platforms like Slack or Teams. This reflects a shift toward embedded, responsive procurement systems, aligning with emerging trends noted in recent literature but still underexplored in depth.

AI's integration with APIs further enables flexible and scalable procurement ecosystems. Practitioners emphasized the importance of interoperability across sourcing, contracting, and P2P tools, especially in organizations using best-of-breed solutions. While literature acknowledges the technical benefits of API integration, the field data highlights AI's role in real-time data routing and eliminating friction between disconnected systems. This interoperability is a defining feature of Supply Chain 4.0 architecture, enabling decentralized

decision-making and seamless data flows across the digital supply network.

These developments suggest that integration is not just technical but also strategic, enabling organizations to avoid vendor lock-in while maintaining operational agility.

The findings also reinforced a foundational yet often overlooked insight that the effectiveness of AI in procurement is closely tied to the quality of underlying data. Both the literature and practitioner interviews emphasize that clean, structured, and accessible data is essential for AI systems to generate reliable insights. Experts cautioned that poor data quality can hinder AI's ability to produce accurate analyses, automate tasks effectively, or support informed decision-making. They underscored the importance of strong data governance practices as a prerequisite for successful AI implementation. This highlights the physical-to-digital link in the Industry 4.0 physical-to-digital-to-physical loop, where accurate real-world data capture is essential to enable meaningful digital insights and actions. Although AI tools are capable of enhancing datasets through validation and enrichment, they cannot fully correct for deficiencies in the foundational data itself. This concern was consistently reflected across both theoretical perspectives and real-world experiences.

Overall, these cross-cutting enablers indicate that AI adoption in procurement should be understood as part of a broader digital transformation. The growing use of orchestration, interoperability, and data governance reflects the principles of Supply Chain 4.0, emphasizing integration, transparency, and agility across networks. At the same time, the findings point to an evolution in procurement maturity, as AI-enabled capabilities such as dynamic orchestration and real-time integration extend beyond the traditional focus on automation and process standardization. Together, these developments show how procurement is not only digitizing but also advancing toward a more strategic and adaptive role within supply chain evolution.

Challenges and limitations of AI adoption

Interviewees acknowledged that AI remains overhyped and often misunderstood. Although AI offers substantial analytical power, it is still dependent on human oversight for critical decisions. Privacy concerns, security risks from open-source tools, and employee resistance to automation were also raised, underscoring the importance of ethical implementation and effective change management. Bienhaus and Haddud (2018) highlight that organizations face significant barriers to digital transformation, including outdated procedures that are misaligned with digital workflows, a lack of internal capabilities to manage new technologies, and insufficient leadership support to drive innovative cultural change.

A summary of the key limitations and challenges associated with AI adoption in procurement, as identified through both the literature and the expert interviews, is presented in Table 3.

Strategic recommendations and evolving skills

Experts offered several practical recommendations for organizations considering AI adoption. Rather than pursuing broad transformations, a phased, use-case-driven approach was advised. Aligning AI with business priorities, testing solutions under real-world conditions, and ensuring internal readiness were all emphasized as keys to success. This phased model reflects a core implementation principle of Industry 4.0 transformations, where integration must be tailored, agile, and guided by strategic alignment rather than technology push. This reflects a growing consensus in recent studies that AI implementation should be both strategic and incremental, focused on tangible outcomes rather than market trends.

Finally, the rise of AI is reshaping the skill set required of procurement professionals. While deep technical expertise is not necessary, a working knowledge of AI capabilities and limitations is becoming

Table 3
Limitations and Challenges of AI Adoption in Procurement.

Category	Limitation/Challenge
Data quality	AI depends heavily on clean, structured, and reliable data; poor data leads to inaccurate outcomes.
Organizational readiness	Many companies lack the digital maturity and foundational processes needed to adopt AI successfully.
Privacy and security risks	AI tools, especially open-source or free services, pose potential threats to data confidentiality and integrity.
Employee resistance	Fear of automation replacing jobs leads to resistance among procurement staff.
AI Hype and misunderstanding	Overhyped expectations cause disillusionment when real-world AI performance doesn't match the marketing promises.
Human oversight	AI cannot replace human judgment in critical decision-making processes; it serves only as a support tool.
Integration complexity	Difficulties in connecting AI with existing procurement platforms slow down adoption and reduce efficiency.
Automation of errors	Without proper controls, AI can rapidly automate and magnify mistakes if initial data or models are flawed.

essential. Professionals must combine technological fluency with strategic thinking, adaptability, and interpersonal skills. These findings reinforce the view that AI will not replace human judgment but will instead elevate the role of procurement professionals who can leverage AI intelligently to drive value in increasingly complex environments.

Limitations and future research

While this study offers valuable insights into the role of AI in procurement, a few limitations should be acknowledged. The research primarily draws on qualitative interviews, which provide in-depth perspectives but may limit the broader generalizability of the findings. Additionally, the study focused on insights from technology providers, offering a solution-oriented view of AI adoption. While this perspective is critical, future research could complement it by engaging directly with companies that have integrated AI solutions into their procurement functions. Understanding their experiences, challenges, and lessons learned would provide a more comprehensive view of real-world implementation. In particular, future studies could examine AI adoption within small and medium-sized enterprises or across different industry sectors, where adoption patterns, challenges, and opportunities may differ significantly from those of large organizations. Future studies may also consider the role of AI within broader cyber-physical procurement environments or smart supply networks, contributing to emerging understandings of Supply Chain 4.0. Quantitative methods, such as large-scale surveys or performance benchmarking, could also be employed in future studies to validate and extend the themes identified here. Moreover, longitudinal research could explore how AI adoption in procurement evolves over time, including its impact on efficiency, decision-making, supplier relationships, and organizational structure.

Conclusion

This study explored the transformative role of AI across the procurement lifecycle, offering a detailed analysis of how AI is reshaping S2C, P2P, and SRM. Drawing on insights from interviews with technology providers, the research identified how AI is not only automating procurement tasks but also enabling more strategic, data-driven decision-making. Key applications include AI-powered spend analytics, intelligent RFX and contract management, guided buying, invoice automation, supplier risk detection, and enhanced procurement orchestration.

The findings indicate a strong alignment between academic

literature and the perspectives of industry experts, particularly in terms of AI's ability to streamline workflows, reduce manual effort, and improve procurement outcomes. However, the study also highlights areas where practice is advancing ahead of theory, such as AI-driven procurement orchestration, API integration, and the emergence of new competencies for procurement professionals. Importantly, the research reinforces that AI's effectiveness is contingent on foundational elements such as data quality, interoperability, and change management.

These insights position AI not only as a digital enabler but also as a core component of broader Industry 4.0 transformations, where intelligent systems, real-time data, and automation converge to drive Supply Chain 4.0 capabilities. This transformation is also evident in recent research on closed-loop supply chains for perishables, which highlights how digital technologies are reshaping supply chain structures to enhance sustainability and responsiveness (Zarreh et al., 2024). By focusing on the perspectives of solution providers, this study contributes to a deeper understanding of the technologies enabling AI adoption in procurement. It also outlines practical considerations for organizations seeking to implement AI tools, including the importance of aligning technology with strategic goals, preparing internal systems and data, and managing the human aspects of change.

Beyond these findings, broader implications can also be drawn. In particular, the rise of AI in procurement highlights the need to adapt procurement education and workforce development. Training programs and professional curricula will need to place greater emphasis on digital literacy, data-driven decision-making, and AI-enabled tools, ensuring that future procurement professionals are prepared to thrive in increasingly technology-driven environments. At the same time, organizations will need to invest in reskilling their existing workforce, balancing technological fluency with strategic and interpersonal capabilities. These implications reinforce that AI adoption is not only a technological shift but also a driver of professional transformation.

Looking forward, the study encourages further research that includes the experiences of companies that have implemented AI in their procurement processes. Examining lessons learned from these organizations, as well as conducting quantitative and longitudinal research, will be essential to building a more comprehensive and actionable body of knowledge.

In a rapidly evolving digital landscape, procurement functions must embrace innovation while balancing technological advancement with human judgment. AI, as a pillar of Industry 4.0, is not a replacement for procurement professionals but a powerful enabler. Organizations that invest in the right tools, talent, and processes are likely to gain a significant competitive advantage as AI continues to shape the future of procurement.

CRediT authorship contribution statement

Nour Lakhali: Writing – original draft, Visualization, Validation, Software, Resources, Methodology, Formal analysis, Data curation, Conceptualization, Writing – review & editing. **Adel Aazami:** Writing – review & editing, Validation, Supervision, Project administration, Methodology, Investigation, Conceptualization. **Sebastian Kummer:** Validation, Supervision, Methodology, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

Table A
Interviewee profiles.

Manager#	Years of experience	Job Title	Company type
Manager 1	18	Vice President of Professional Services	Company A - AI-based sourcing optimization and automation company for procurement
Manager 2	9	Senior Procurement Consultant	Company A: AI-based sourcing optimization and automation company for procurement
Manager 3	8	Head of Research	Company B: Procurement orchestration Software as a Service (SaaS) platform
Manager 4	20	Chief Procurement Officer	Company C: Global leader in business spend management software
Manager 5	20	Senior Director - Digital Transformation and Value Advisory	Company D: Global procurement and supply chain consulting, managed services, and software solutions provider
Manager 6	20	Vice President of Operations	Company E: AI-driven autonomous sourcing platform.
Manager 7	20	Vice President of Direct Procurement Strategy	Company F: Global procurement software provider
Manager 8	12	Senior Account Executive - e-procurement and Supply Chain Advisor	Company G: Global source-to-pay technology provider
Manager 9	24	Partner at Kearney	Company H: Global management consulting firm specializing in procurement and supply chain

Appendix B

Table B
Abbreviations.

AI	Artificial Intelligence
S2P	Source-to-Pay
S2C	Source-to-Contract
P2P	Purchase-to-Pay
SRM	Supplier Relationship Management
API	Application Programming Interface
ML	Machine Learning
NLP	Natural Language Processing
E-procurement	Electronic procurement
RFx	Requests for Information, Quotation, and Proposal
RFP	Request for Proposal
RFI	Request for Information
OCR	Optical Character Recognition
RPA	Robotic Process Automation
cRPA	Cognitive Robotic Process Automation
PR	Purchase Requisition
PO	Purchase Order
Gen AI	Generative Artificial Intelligence
SaaS	Software as a Service

Appendix C

Table C
Interview guide.

Themes	Questions
Background understanding	-Can you introduce yourself (what is your role and responsibilities?)
Focus area: Source-To-Contract (S2C)/ Strategic procurement.	-Could you briefly describe your organization (headquarters, number of employees, etc) -In your experience, what are the key elements within the S2C process that are most impacted by AI? -Can you elaborate on how AI is transforming (specific element they mentioned)? -What are some of the challenges and benefits associated with using AI in S2C? -Building on your insights about AI's impact on S2C, can you tell me how (company name) helps its clients leverage AI to improve their procurement process?
Focus area: Purchase-To-Pay (P2P)/Operational procurement	-In your experience, what are the key elements within the P2P process that are most impacted by AI? - Can you elaborate on how AI is transforming (specific element they mentioned)? -What are some of the challenges and benefits associated with using AI in P2P? -Building on your insights about AI's impact on P2P, can you tell me how (company name) helps its clients leverage AI to improve their procurement process?
Focus area: Supplier Relationship Management (SRM)	-In your experience, what are the key elements within the SRM process that are most impacted by AI? - Can you elaborate on how AI is transforming (specific element they mentioned)? -What are some of the challenges and benefits associated with using AI in SRM?

(continued on next page)

Table C (continued)

Themes	Questions
A Guide to Implementing AI: Recommendations and Steps	-Building on your insights about AI's impact on SRM, can you tell me how (company name) helps its clients leverage AI to improve their procurement process?
Future Procurement	-For companies considering implementing AI in their procurement process, what steps would you recommend they take to get started?
AI and API integration	-In the future, what skills and competencies do you believe will be most in demand for procurement professionals? -How do you see the collaboration between humans and AI evolving in the procurement process? -How easily can your AI technologies integrate with existing procurement systems or workflows?

Data availability

Data will be made available on request.

References

- Ahmed, W. A. H., & MacCarthy, B. L. (2022). Blockchain in the supply chain – A comprehensive framework for theory-driven research. *Digital Business*, 2, Article 100043. <https://doi.org/10.1016/J.DIGBUS.2022.100043>
- Allal-Chérif, O., Simón-Moya, V., & Ballester, A. C. C. (2021). Intelligent purchasing: How artificial intelligence can redefine the purchasing function. *Journal of Business Research*, 124, 69–76. <https://doi.org/10.1016/j.jbusres.2020.11.050>
- Alhabatah, A., Yaqot, M., Menezes, B., & Kerbache, L. (2023). Transformative procurement trends: Integrating industry 4.0 Technologies for Enhanced Procurement Processes. *Logistics*. <https://doi.org/10.3390/logistics7030063>
- Aspers, P., & Corte, U. (2019). What is qualitative in qualitative research. *Qualitative Sociology*, 42, 139–160. <https://doi.org/10.1007/S11133-019-9413-7/METRICS>
- Bansal, S., & Jain, N. (2023). A study on the impact of artificial intelligence techniques in enhancing electronic public procurement system. *Int J Innov Sci Res Technol*, 8, 2787–2793.
- Bergman, M. A., & Lundberg, S. (2013). Tender evaluation and supplier selection methods in public procurement. *Journal of Purchasing and Supply Management*, 19, 73–83. <https://doi.org/10.1016/J.PURSUP.2013.02.003>
- Bienhaus, F., & Haddud, A. (2018). Procurement 4.0: Factors influencing the digitisation of procurement and supply chains. *Business Process Management Journal*, 24, 965–984. <https://doi.org/10.1108/BPMJ-06-2017-0139/FULL/XML>
- Bode, C., Burkhardt, D., Schültken, R., & Vollmer, M. (2023). *Future of Procurement. Global Logistics and Supply Chain Strategies for the 2020s: Vital Skills for the Next Generation* 261–276. https://doi.org/10.1007/978-3-030-95764-3_15
- Boute, R. N., & Udenio, M. (2023). AI in logistics and supply chain management. In *Global Logistics and Supply Chain Strategies for the 2020s: Vital Skills for the Next Generation* (pp. 49–65). https://doi.org/10.1007/978-3-030-95764-3_3
- Brandon-Jones, A., & Carey, S. (2011). The impact of user-perceived e-procurement quality on system and contract compliance. *International Journal of Operations & Production Management*, 31, 274–296. <https://doi.org/10.1108/0144357111111928/FULL/XML>
- Burger, M., Nitsche, A. M., & Arlinghaus, J. (2023). Hybrid intelligence in procurement: Disillusionment with AI's superiority? *Computers in Industry*, 150, Article 103946. <https://doi.org/10.1016/J.COMPIND.2023.103946>
- Coglianesi, C. (2023). Procurement and artificial intelligence. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.4591724>
- Constant, F., & Berre, M. (2024). *Perceived Benefits of Adopting Artificial Intelligence Technologies in Purchasing Processes. CACAIS 2024 Proceedings*.
- Cui, R., Li, M., & Zhang, S. (2020). AI and procurement. *SSRN Electronic Journal*. <https://doi.org/10.2139/SSRN.3570967>
- Danner, M., Maurer, B., Schuh, S., Greff, T., & Werth, D. (2021). Invoice automation: Increasing efficiency in the Office at Satherm GmbH using artificial intelligence. *Digitalization Cases, 2* (Mastering Digital Transformation for Global Business 45–60).
- Emami, A., Seifbarghy, M., Abbas, A. E., Chattinnawat, W., & Aydin, N. (2025). A blockchain-driven business model for supplier selection and order allocation leveraging smart contracts in supply chains. *Digital Business*, 5, Article 100128. <https://doi.org/10.1016/J.DIGBUS.2025.100128>
- Ezejio, C. L. (2024). Artificial intelligence for detecting and preventing procurement fraud. *International Journal of Business Ecosystem & Strategy*, 2687-2293(6), 63–73. <https://doi.org/10.36096/IJBES.V6I1.477>
- Giampieri, P. (2025). AI-powered contracts: A critical analysis. *International Journal for the Semiotics of Law*, 38, 403–420. <https://doi.org/10.1007/s11196-024-10137-z>
- Grossoehme, D. H. (2014). Overview of qualitative research. *Journal of Health Care Chaplaincy*, 20, 109–122. <https://doi.org/10.1080/08854726.2014.925660>
- Guida, M., Caniato, F., Moretto, A., & Ronchi, S. (2023). The role of artificial intelligence in the procurement process: State of the art and research agenda. *Journal of Purchasing and Supply Management*, 29, Article 100823. <https://doi.org/10.1016/J.PURSUP.2023.100823>
- Hamlehvar, T., & Aazami, A. (2025). Prioritizing the selection criteria of a third-party logistics company using the best-worst method citation. *International Journal of Research in Industrial Engineering*, 14(4), 651–668. <https://doi.org/10.22105/riej.2025.512328.1566>. <https://www.riejournal.com/article.226498.html>
- Hammarberg, K., Kirkman, M., & De Lacey, S. (2016). Qualitative research methods: When to use them and how to judge them. *Human Reproduction*, 31, 498–501. <https://doi.org/10.1093/HUMREP/DEV334>
- Handfield, R., Jeong, S., & Choi, T. (2019). Emerging procurement technology: Data analytics and cognitive analytics. *International Journal of Physical Distribution and Logistics Management*, 49, 972–1002. <https://doi.org/10.1108/IJPDLM-11-2017-0348/FULL/XML>
- Hickok, M. (2024). Public procurement of artificial intelligence systems: New risks and future proofing. *AI & SOCIETY*, 39, 1213–1227. <https://doi.org/10.1007/S00146-022-01572-2/METRICS>
- van Hoek, R. (2024). Insight from industry-early lessons learned about AI adoption in core procurement processes, directions for managers and researchers. *Supply Chain Management*, 29, 794–803. <https://doi.org/10.1108/SCM-02-2024-0143/FULL/XML>
- Jackson, I., Ivanov, D., Dolgui, A., & Namdar, J. (2024). Generative artificial intelligence in supply chain and operations management: A capability-based framework for analysis and implementation. *International Journal of Production Research*, 62, 6120–6145. <https://doi.org/10.1080/00207543.2024.2309309>
- Kanakov, F., & Prokhorov, I. (2022). Analysis and applicability of artificial intelligence technologies in the field of RPA software robots for automating business processes. *Procedia Computer Science*, 213, 296–300. <https://doi.org/10.1016/J.PROCS.2022.11.070>
- Khadse, K. (2021). To study role of artificial intelligence in procurement. *Published In the Journal of Oriental Research Madras with ISSN*, 22–3301.
- Mandl, C. (2023a). Introduction. In *Procurement Analytics: Data-driven decision-making in procurement and supply management* (pp. 1–12). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-43281-1_1
- Mandl, C. (2023b). Data-Driven Spend Management. In C. Mandl (Ed.), *Procurement Analytics: Data-driven decision-making in procurement and supply management* (pp. 69–97). Switzerland, Cham: Springer Nature. https://doi.org/10.1007/978-3-031-43281-1_3
- Morgan, P. (2021). The path to AI in procurement. *Journal of AI, Robotics & Workplace Automation*, 1, 6. <https://doi.org/10.69554/IHJV3564>
- Mufor, S. B. (2024). The role of Analytics solutions in revolutionizing procurement efficiency. *American Journal of Supply Chain Management*, 9, 51–63. <https://doi.org/10.47672/AJSCM.2024>
- Nistala, P., Rajbhaj, A., Kulkarni, V., Noronha, S., & Joshi, A. (2024). An industrial experience report on model-based, AI-enabled proposal development for an RFP/RFI. *Science of Computer Programming*, 233, Article 103058. <https://doi.org/10.1016/J.SCICO.2023.103058>
- Ronchi, S., Brun, A., Golini, R., & Fan, X. (2010). What is the value of an IT e-procurement system? *Journal of Purchasing and Supply Management*, 16, 131–140. <https://doi.org/10.1016/J.PURSUP.2010.03.013>
- Ross, D. F. (2015). Procurement and Supplier Management. In D. F. Ross (Ed.), *Distribution planning and control: Managing in the era of supply chain management* (pp. 531–604). New York, NY: Springer US. https://doi.org/10.1007/978-1-4899-7578-2_11
- Zarreh, M., Khandan, M., Goli, A., Aazami, A., & Kummer, S. (2024). Integrating perishables into closed-loop supply chains: A comprehensive review. *Sustainability (Switzerland)*, 16(15), 6705. <https://doi.org/10.3390/su16156705>
- Sanchez-Graells, A., 2024. Responsibly Buying Artificial Intelligence: A 'Regulatory Hallucination.' *Current Legal Problems* 77, 81–126.
- Schmitz, M., Stummer, C., & Gerke, M. (2019). Smart automation as enabler of digitalization? A review of RPA/AI potential and barriers to its realization. In P. Krüssel (Ed.), *Future telco: Successful positioning of network operators in the digital age* (pp. 349–358). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-77724-5_31
- Schoenherr, T. (2019a). Outlook to an exciting future. In T. Schoenherr (Ed.), *The evolution of electronic procurement: Transforming business as usual* (pp. 117–125). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-93985-8_8
- Schoenherr, T. (2019b). Becoming mainstream: Electronic sourcing suites. In T. Schoenherr (Ed.), *The evolution of electronic procurement: Transforming business as usual* (pp. 87–100). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-93985-8_6
- Schoenherr, T. (2019c). Why you cannot neglect electronic procurement. In T. Schoenherr (Ed.), *The evolution of electronic procurement: Transforming business as usual* (pp. 9–32). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-93985-8_2
- Seyedghorban, Z., Samson, D., & Tahernejad, H. (2020). Digitalization opportunities for the procurement function: Pathways to maturity. *International Journal of Operations*

- & *Production Management*, 40, 1685–1693. <https://doi.org/10.1108/IJOPM-04-2020-0214/FULL/XML>
- Singh, R. K., Modgil, S., & Shore, A. (2024). Building artificial intelligence enabled resilient supply chain: A multi-method approach. *Journal of Enterprise Information Management*, 37, 414–436. <https://doi.org/10.1108/JEIM-09-2022-0326/FULL/XML>
- Smart, A. F. (2010). E-procurement and its impact on supply management – Evidence from industrial case studies. *International Journal of Logistics Research and Applications*, 13, 423–440. <https://doi.org/10.1080/13675567.2010.486760>
- Spreitzenbarth, J. M., Bode, C., & Stuckenschmidt, H. (2024a). Artificial intelligence and machine learning in purchasing and supply management: A mixed-methods review of the state-of-the-art in literature and practice. *Journal of Purchasing and Supply Management*, 30, Article 100896. <https://doi.org/10.1016/J.PURSUP.2024.100896>
- Spreitzenbarth, J. M., Bode, C., & Stuckenschmidt, H. (2024b). Designing an AI purchasing requisition bundling generator. *Computers in Industry*, 155, Article 104043. <https://doi.org/10.1016/J.COMPIND.2023.104043>
- Strohmer, M. F., Easton, S., Eisenhut, M., Epstein, E., Kromoser, R., Peterson, E. R., & Rizzon, E. (2020a). The future of procurement. *Disruptive Procurement*, 19–48. https://doi.org/10.1007/978-3-030-38950-5_2
- Strohmer, M. F., Easton, S., Eisenhut, M., Epstein, E., Kromoser, R., Peterson, E. R., & Rizzon, E. (2020b). Digital in Procurement. *Disruptive Procurement*, 49–76. https://doi.org/10.1007/978-3-030-38950-5_3
- Tassabehji, R. (2010). Understanding e-auction use by procurement professionals: Motivation, attitudes and perceptions. *Supply Chain Management*, 15, 425–437. <https://doi.org/10.1108/13598541011080419/FULL/XML>
- Toktaş-Palut, P., Baylav, E., Teoman, S., & Altunbey, M. (2014). The impact of barriers and benefits of e-procurement on its adoption decision: An empirical analysis. *International Journal of Production Economics*, 158, 77–90. <https://doi.org/10.1016/J.IJPE.2014.07.017>
- Vaidya, K., & Campbell, J. (2016). Multidisciplinary approach to defining public e-procurement and evaluating its impact on procurement efficiency. *Information Systems Frontiers*, 18, 333–348. <https://doi.org/10.1007/S10796-014-9536-Z/TABLES/8>
- Wolfgang, B., Grabbe, F., E, M., L, R., & S, W. (2022). Application of digital technologies in procurement: Potential analysis based on the three-layer model. In B. Christoph, & R. Bogaschewsky (Eds.), *Supply Management Research: Aktuelle Forschungsergebnisse 2022* (pp. 243–266). Wiesbaden: Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-38350-3_11
- Xu, J., Wang, H., Zhong, Y., Qin, L., & Cheng, Q. (2024). Predict and optimize financial services risk using AI-driven technology. *Academic Journal of Science and Technology*, 10, 299–304. <https://doi.org/10.54097/6ZRQEF25>
- Xu, Y., Chong, H.-Y., & Chi, M. (2021). A review of smart contracts applications in various industries: A procurement perspective. *Advances in Civil Engineering*, 2021, 5530755.