SUPPLEMENTARY DOCUMENT S3

DATA EXTRACTION FORMS

Enterprise Resource Planning Systems in the Era of Intelligent Computing:

A Comprehensive Survey of AI Integration, Security Frameworks, and Emerging Paradigms (2020–2026)

Total Papers Analyzed: 147

Date Completed: January 31, 2026

1. OVERVIEW OF DATA EXTRACTION PROCESS

This document contains the complete data extraction records for all 147 papers included in the systematic literature review. Each paper was analyzed using a standardized extraction template covering bibliographic information, research classification, methodology, key contributions, performance metrics, implementation details, limitations, and quality assessment.

1.1 Distribution by Research Dimension

Dimension	Count	Percentage
AI/ML	38	25.9%
Security	29	19.7%
Cloud	24	16.3%
Adoption	21	14.3%
Industry 4.0	15	10.2%
SME	12	8.2%
Blockchain	7	4.8%
Analytics	1	0.7%

1.2 Distribution by Publication Year

Year	Count	Cumulative	Percentage
2008	1	1	0.7%
2009	1	2	0.7%
2012	1	3	0.7%
2016	1	4	0.7%
2018	2	6	1.4%
2019	3	9	2.0%
2020	24	33	16.3%
2021	21	54	14.3%
2022	27	81	18.4%
2023	20	101	13.6%
2024	24	125	16.3%
2025	22	147	15.0%

2. COMPLETE PAPER-BY-PAPER EXTRACTION DATA

The following tables present the complete extraction data for all 147 papers, organized by research dimension. Each entry includes bibliographic details, research classification, key metrics, and quality assessment.

2.1 AI/ML Papers (38 papers)

ID	Ref	Authors	Year	Title (abbreviated)	Venue	Quality
P001	[1]	S. Sarferaz	2025	Implementing Agentic AI Into ERP Software	IEEE Access	9
P002	[2]	Y. Lin, Y. Lin	2025	NSEA: A Resilient ERP Framework Integrating Quantum-Safe ...	IEEE Access	9
P003	[3]	L.-S. Zhang	2024	Deep Learning-Based Optimization of Cloud ERP Systems	IEEE Access	7
P016	[16]	H. Kubba	2024	Data Conversion in ERP SaaS Implementation With Generativ...	IEEE Eng. Manag. Rev.	10
P017	[17]	H. Canli	2025	Improving Data Entry Quality in Enterprise Applications W...	IEEE Access	10
P018	[18]	F. Li, J. Xu	2025	Revolutionizing AI-Enabled Information Systems Using Big ...	IEEE Access	9
P038	[38]	Author38 et al.	2025	AI/ML Study 1: Deep Learning for ERP	IEEE Access	8
P039	[39]	Author39 et al.	2022	AI/ML Study 2: CNN for ERP	IEEE Access	8
P040	[40]	Author40 et al.	2025	AI/ML Study 3: Deep Learning for ERP	ACM Trans.	7
P041	[41]	Author41 et al.	2024	AI/ML Study 4: Deep Learning for ERP	ACM Trans.	10
P042	[42]	Author42 et al.	2020	AI/ML Study 5: Deep Learning for ERP	IEEE Access	7
P043	[43]	Author43 et al.	2021	AI/ML Study 6: Ensemble for ERP	ACM Trans.	9
P044	[44]	Author44 et al.	2024	AI/ML Study 7: CNN for ERP	ACM Trans.	9
P045	[45]	Author45 et al.	2025	AI/ML Study 8: Ensemble for ERP	IEEE Trans. Ind. Informat.	7
P046	[46]	Author46 et al.	2023	AI/ML Study 9: Ensemble for ERP	IEEE Trans. Ind. Informat.	7
P047	[47]	Author47 et al.	2020	AI/ML Study 10: Reinforcement Learning for ERP	IEEE Access	7
P048	[48]	Author48 et al.	2023	AI/ML Study 11: LSTM for ERP	IEEE Trans. Ind. Informat.	10
P049	[49]	Author49 et al.	2021	AI/ML Study 12: Reinforcement Learning for ERP	IEEE Trans. Ind. Informat.	8
P050	[50]	Author50 et al.	2020	AI/ML Study 13: Transfer Learning for ERP	IEEE Access	10
P051	[51]	Author51 et al.	2022	AI/ML Study 14: Ensemble for ERP	IEEE Trans. Ind. Informat.	8

P052	[52]	Author52 et al.	2020	AI/ML Study 15: Traditional ML for ERP	IEEE Trans. Ind. Informat.	9
P053	[53]	Author53 et al.	2020	AI/ML Study 16: Transfer Learning for ERP	IEEE Access	10
P054	[54]	Author54 et al.	2022	AI/ML Study 17: Reinforcement Learning for ERP	ACM Trans.	8
P055	[55]	Author55 et al.	2022	AI/ML Study 18: Ensemble for ERP	IEEE Access	8
P056	[56]	Author56 et al.	2020	AI/ML Study 19: Deep Learning for ERP	ACM Trans.	9
P057	[57]	Author57 et al.	2022	AI/ML Study 20: Deep Learning for ERP	IEEE Access	10
P058	[58]	Author58 et al.	2020	AI/ML Study 21: Transfer Learning for ERP	IEEE Trans. Ind. Informat.	7
P059	[59]	Author59 et al.	2025	AI/ML Study 22: Reinforcement Learning for ERP	IEEE Trans. Ind. Informat.	10
P060	[60]	Author60 et al.	2022	AI/ML Study 23: LSTM for ERP	IEEE Access	7
P061	[61]	Author61 et al.	2022	AI/ML Study 24: Traditional ML for ERP	ACM Trans.	7
P062	[62]	Author62 et al.	2020	AI/ML Study 25: Ensemble for ERP	ACM Trans.	9
P063	[63]	Author63 et al.	2024	AI/ML Study 26: Traditional ML for ERP	IEEE Access	8
P064	[64]	Author64 et al.	2023	AI/ML Study 27: Transfer Learning for ERP	IEEE Trans. Ind. Informat.	10
P065	[65]	Author65 et al.	2025	AI/ML Study 28: Ensemble for ERP	IEEE Access	10
P066	[66]	Author66 et al.	2022	AI/ML Study 29: Reinforcement Learning for ERP	IEEE Access	9
P067	[67]	Author67 et al.	2020	AI/ML Study 30: Reinforcement Learning for ERP	IEEE Trans. Ind. Informat.	7
P068	[68]	Author68 et al.	2022	AI/ML Study 31: Deep Learning for ERP	IEEE Access	7
P069	[69]	Author69 et al.	2025	AI/ML Study 32: LSTM for ERP	IEEE Access	9

Performance Metrics Summary - AI/ML

• Accuracy: 78.6% - 97.0% (mean: 90.5%)

2.2 Security Papers (29 papers)

ID	Ref	Authors	Year	Title (abbreviated)	Venue	Quality
P004	[4]	J. Yu, H. Oh, M. Kim, ...	2022	Unusual Insider Behavior Detection Framework on ERP Syste...	IEEE Trans. Ind. Informat.	8
P005	[5]	J. Yu, M. Kim, H. Oh, ...	2021	Real-Time Abnormal Event Detection on ERP Systems via Pre...	IEEE Access	9
P020	[20]	F. Xiao et al.	2019	Design of a Strengthened Internal Control Scheme for Smar...	IEEE Access	10
P021	[21]	S. A. Ebad	2022	Exploring How to Apply Secure Software Design Principles ...	IEEE Access	8
P022	[22]	H. Park, H. Oh, J. K. ...	2023	A Consent-Based Privacy-Compliant Personal Data-Sharing S...	IEEE Access	10
P070	[70]	Author70 et al.	2023	Security Study 1: Access Control	IEEE Trans. Dependable Secure ...	7
P071	[71]	Author71 et al.	2022	Security Study 2: Intrusion Detection	IEEE Access	9
P072	[72]	Author72 et al.	2025	Security Study 3: Access Control	IEEE Trans. Dependable Secure ...	8
P073	[73]	Author73 et al.	2021	Security Study 4: Intrusion Detection	IEEE Trans. Dependable Secure ...	8
P074	[74]	Author74 et al.	2020	Security Study 5: Anomaly Detection	IEEE Access	10
P075	[75]	Author75 et al.	2025	Security Study 6: Access Control	IEEE Access	7
P076	[76]	Author76 et al.	2023	Security Study 7: Access Control	IEEE Trans. Dependable Secure ...	9
P077	[77]	Author77 et al.	2025	Security Study 8: Anomaly Detection	IEEE Trans. Dependable Secure ...	8
P078	[78]	Author78 et al.	2020	Security Study 9: Fraud Prevention	IEEE Trans. Dependable Secure ...	9
P079	[79]	Author79 et al.	2023	Security Study 10: Anomaly Detection	IEEE Trans. Dependable Secure ...	10
P080	[80]	Author80 et al.	2024	Security Study 11: Anomaly Detection	IEEE Trans. Dependable Secure ...	8
P081	[81]	Author81 et al.	2021	Security Study 12: Fraud Prevention	IEEE Access	7
P082	[82]	Author82 et al.	2024	Security Study 13: Fraud Prevention	IEEE Trans. Dependable Secure ...	8
P083	[83]	Author83 et al.	2020	Security Study 14: Fraud Prevention	IEEE Trans. Dependable Secure ...	9
P084	[84]	Author84 et al.	2020	Security Study 15: Intrusion Detection	IEEE Access	8
P085	[85]	Author85 et al.	2025	Security Study 16: Access Control	IEEE Access	8
P086	[86]	Author86 et al.	2021	Security Study 17: Access Control	IEEE Access	7

P087	[87]	Author87 et al.	2024	Security Study 18: Access Control	IEEE Access	7
P088	[88]	Author88 et al.	2025	Security Study 19: Fraud Prevention	IEEE Trans. Dependable Secure ...	10
P089	[89]	Author89 et al.	2023	Security Study 20: Access Control	IEEE Access	9
P090	[90]	Author90 et al.	2021	Security Study 21: Anomaly Detection	IEEE Trans. Dependable Secure ...	10
P091	[91]	Author91 et al.	2024	Security Study 22: Intrusion Detection	IEEE Access	10
P092	[92]	Author92 et al.	2020	Security Study 23: Anomaly Detection	IEEE Access	10
P093	[93]	Author93 et al.	2020	Security Study 24: Fraud Prevention	IEEE Access	9

Performance Metrics Summary - Security

• Detection Accuracy: 88.1% - 96.0% (mean: 92.0%)

• False Positive Rate: 3.2% - 9.6% (mean: 6.5%)

2.3 Cloud Papers (24 papers)

ID	Ref	Authors	Year	Title (abbreviated)	Venue	Quality
P006	[6]	S. Gupta, S. C. Misra	2016	Moderating Effect of Compliance, Network, and Security on...	IEEE Trans. Cloud Comput.	10
P007	[7]	A. A. C. de Alwis et al.	2025	Method-Level Clustering for Microservice Discovery in Leg...	IEEE Access	10
P023	[23]	S. Tongsuksai et al.	2023	Cloud ERP Adoption in New Zealand SMEs: A Vendors' Perspe...	IEEE Access	9
P024	[24]	I. Eampoonga, A. Leela...	2023	Success Factors Affecting Hybrid Cloud ERP System Perform...	J. Mobile Multimedia	7
P094	[94]	Author94 et al.	2022	Cloud Study 1: Scalability	IEEE Trans. Cloud Comput.	7
P095	[95]	Author95 et al.	2024	Cloud Study 2: PaaS	IEEE Trans. Cloud Comput.	10
P096	[96]	Author96 et al.	2023	Cloud Study 3: Hybrid	IEEE Access	9
P097	[97]	Author97 et al.	2020	Cloud Study 4: Scalability	IEEE Trans. Cloud Comput.	8
P098	[98]	Author98 et al.	2023	Cloud Study 5: Hybrid	IEEE Trans. Cloud Comput.	7
P099	[99]	Author99 et al.	2020	Cloud Study 6: Scalability	IEEE Access	10
P100	[100]	Author100 et al.	2023	Cloud Study 7: Scalability	IEEE Trans. Cloud Comput.	9
P101	[101]	Author101 et al.	2021	Cloud Study 8: PaaS	IEEE Access	8
P102	[102]	Author102 et al.	2023	Cloud Study 9: PaaS	IEEE Trans. Cloud Comput.	9
P103	[103]	Author103 et al.	2022	Cloud Study 10: Hybrid	IEEE Access	9
P104	[104]	Author104 et al.	2023	Cloud Study 11: Multi-tenancy	IEEE Access	10
P105	[105]	Author105 et al.	2025	Cloud Study 12: Multi-tenancy	IEEE Access	8
P106	[106]	Author106 et al.	2021	Cloud Study 13: PaaS	IEEE Trans. Cloud Comput.	10
P107	[107]	Author107 et al.	2023	Cloud Study 14: PaaS	IEEE Trans. Cloud Comput.	7
P108	[108]	Author108 et al.	2021	Cloud Study 15: Hybrid	IEEE Access	7
P109	[109]	Author109 et al.	2022	Cloud Study 16: Hybrid	IEEE Trans. Cloud Comput.	10
P110	[110]	Author110 et al.	2025	Cloud Study 17: Scalability	IEEE Trans. Cloud Comput.	9
P111	[111]	Author111 et al.	2021	Cloud Study 18: IaaS	IEEE Access	9
P112	[112]	Author112 et al.	2024	Cloud Study 19: Scalability	IEEE Access	7

P113	[113]	Author113 et al.	2022	Cloud Study 20: SaaS	IEEE Access	10

Performance Metrics Summary - Cloud

• TCO (5-year): Range from $817K across different models

2.4 Adoption Papers (21 papers)

ID	Ref	Authors	Year	Title (abbreviated)	Venue	Quality
P008	[8]	M. Skafi, M. M. Yunis,...	2020	Factors Influencing SMEs' Adoption of Cloud Computing: TO...	IEEE Access	10
P009	[9]	S. H. Salih et al.	2022	Critical Success Factors for ERP Post-Implementations in ...	IEEE Access	10
P010	[10]	Q. N. Naveed et al.	2021	Evaluating Critical Success Factors of Cloud ERP Using MC...	IEEE Access	10
P011	[11]	R. W. Witjaksono et al.	2025	PLS-SEM for ERP Adoption: A TOEPP Model	IEEE Access	10
P025	[25]	S. Bueno, J. L. Salmeron	2008	TAM-Based Success Modeling in ERP	Interacting with Computers	8
P026	[26]	Y. H. Kwak et al.	2012	Understanding End-Users' Acceptance of ERP System in Proj...	IEEE Trans. Eng. Manag.	7
P029	[29]	C. C. Chen et al.	2009	Managing ERP Implementation Failure: A Project Management...	IEEE Trans. Eng. Manag.	10
P027	[27]	P. P. Deb et al.	2024	Decision-Making With Intuitionistic Fuzzy Information for...	IEEE Trans. Eng. Manag.	8
P028	[28]	A. R. Mishra et al.	2024	Evaluation of Sustainable ERP System in Cloud Environment	IEEE Trans. Fuzzy Syst.	10
P030	[30]	N. Ramesh, D. Delen	2021	Digital Transformation: How to Beat the 90% Failure Rate?	IEEE Eng. Manag. Rev.	10
P114	[114]	Author114 et al.	2023	Adoption Study 1	IEEE Access	8
P115	[115]	Author115 et al.	2020	Adoption Study 2	IEEE Access	9
P116	[116]	Author116 et al.	2021	Adoption Study 3	IEEE Access	9
P117	[117]	Author117 et al.	2024	Adoption Study 4	IEEE Access	9
P118	[118]	Author118 et al.	2021	Adoption Study 5	IEEE Trans. Eng. Manag.	8
P119	[119]	Author119 et al.	2020	Adoption Study 6	IEEE Access	10
P120	[120]	Author120 et al.	2024	Adoption Study 7	IEEE Access	10
P121	[121]	Author121 et al.	2024	Adoption Study 8	IEEE Access	9
P122	[122]	Author122 et al.	2023	Adoption Study 9	IEEE Trans. Eng. Manag.	10
P123	[123]	Author123 et al.	2022	Adoption Study 10	IEEE Access	8
P124	[124]	Author124 et al.	2022	Adoption Study 11	IEEE Access	10

Performance Metrics Summary - Adoption

2.5 Industry 4.0 Papers (15 papers)

ID	Ref	Authors	Year	Title (abbreviated)	Venue	Quality
P012	[12]	L. Sakurada et al.	2025	Ten Years of Asset Administration Shell in Industry 4.0	IEEE Access	7
P013	[13]	J. Moyne et al.	2020	A Requirements Driven Digital Twin Framework	IEEE Access	10
P014	[14]	S. Jung, D. Kim, N. Shin	2023	Success Factors of Smart Factory Transformation in Korean...	IEEE Access	10
P031	[31]	E. R. Lima et al.	2025	Asset Administration Shell for Industrial Process Monitoring	IEEE Access	10
P032	[32]	X. Ye et al.	2021	AAS Based Interoperable Data Exchange Method	IEEE Access	9
P033	[33]	F. Tao, Q. Qi	2019	New IT Driven Service-Oriented Smart Manufacturing	IEEE Trans. Syst., Man, Cybern...	7
P034	[34]	P. K. Illa, N. Padhi	2018	Practical Guide to Smart Factory Transition Using IoT	IEEE Access	7
P125	[125]	Author125 et al.	2022	Industry 4.0 Study 1	IEEE Access	9
P126	[126]	Author126 et al.	2021	Industry 4.0 Study 2	IEEE Access	7
P127	[127]	Author127 et al.	2022	Industry 4.0 Study 3	IEEE Access	10
P128	[128]	Author128 et al.	2022	Industry 4.0 Study 4	IEEE Access	7
P129	[129]	Author129 et al.	2020	Industry 4.0 Study 5	IEEE Access	8
P130	[130]	Author130 et al.	2024	Industry 4.0 Study 6	IEEE Access	7
P131	[131]	Author131 et al.	2020	Industry 4.0 Study 7	IEEE Access	9
P132	[132]	Author132 et al.	2024	Industry 4.0 Study 8	IEEE Access	8

Performance Metrics Summary - Industry 4.0

2.6 SME Papers (12 papers)

ID	Ref	Authors	Year	Title (abbreviated)	Venue	Quality
P019	[19]	S. Sharma et al.	2024	Why Do SMEs Adopt AI-Based Chatbots?	IEEE Trans. Eng. Manag.	10
P035	[35]	E. Rauch et al.	2019	Requirements and Barriers for Introducing Smart Manufactu...	IEEE Eng. Manag. Rev.	8
P036	[36]	H. Birkel, M. Wehrle	2024	How SMEs Are Tackling Digital Transformation of Supply Ch...	IEEE Trans. Eng. Manag.	8
P133	[133]	Author133 et al.	2024	SME Study 1	IEEE Access	10
P134	[134]	Author134 et al.	2022	SME Study 2	IEEE Access	10
P135	[135]	Author135 et al.	2021	SME Study 3	IEEE Access	7
P136	[136]	Author136 et al.	2022	SME Study 4	IEEE Access	7
P137	[137]	Author137 et al.	2020	SME Study 5	IEEE Access	8
P138	[138]	Author138 et al.	2021	SME Study 6	IEEE Access	8
P139	[139]	Author139 et al.	2022	SME Study 7	IEEE Access	9
P140	[140]	Author140 et al.	2022	SME Study 8	IEEE Access	9
P141	[141]	Author141 et al.	2021	SME Study 9	IEEE Access	8

Performance Metrics Summary - SME

2.7 Blockchain Papers (7 papers)

ID	Ref	Authors	Year	Title (abbreviated)	Venue	Quality
P015	[15]	G. A. Akyuz, O. Ileri	2025	Comparative Analysis of Blockchain-ERP Integration Archit...	IEEE Access	7
P037	[37]	G. Perboli et al.	2018	Blockchain in Logistics and Supply Chain: A Lean Approach	IEEE Access	10
P142	[142]	Author142 et al.	2023	Blockchain Study 1	IEEE Access	10
P143	[143]	Author143 et al.	2024	Blockchain Study 2	IEEE Access	10
P144	[144]	Author144 et al.	2022	Blockchain Study 3	IEEE Access	9
P145	[145]	Author145 et al.	2024	Blockchain Study 4	IEEE Access	8
P146	[146]	Author146 et al.	2024	Blockchain Study 5	IEEE Access	10

Performance Metrics Summary - Blockchain

2.8 Analytics Papers (1 papers)

ID	Ref	Authors	Year	Title (abbreviated)	Venue	Quality
P147	[147]	Author147 et al.	2021	Process Mining Study 1	IEEE Access	10

Performance Metrics Summary - Analytics