



AGENTIC AI IN SUPPLY CHAIN MANAGEMENT

AUTONOMOUS INTELLIGENCE, MULTI-AGENT SYSTEMS,
AND ENTERPRISE INTEGRATION
FOR THE NEXT-GENERATION SUPPLY CHAIN



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RAJENDAR DOMMETI

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About the Author



Naidu Paila

Naidu Paila is a seasoned SAP Supply Chain Management professional with over fifteen years of deep expertise in implementing, configuring, and supporting complex planning solutions across global enterprises. As a Business Systems Lead Analyst at Zimmer Biomet—one of the world's leading medical device companies—he brings a rare practitioner's perspective to the intersection of supply chain operations and cutting-edge artificial intelligence. His comprehensive experience spans the full spectrum of SAP planning platforms, including Integrated Business Planning (IBP), Advanced Planning and Optimization (APO), Ariba, and ECC, with specialized proficiency in Demand Planning, Supply Planning, Inventory Optimization, and Global Available to Promise (GATP).

A certified SAP IBP professional and SAFe 4 Certified Practitioner, Naidu possesses deep hands-on expertise in master and transaction data integration between ECC and IBP via SDI and CPI-DS, as well as integration with SAP S/4HANA for order-based and time-series planning. His ITIL Foundation V3 certification further underscores his disciplined approach to incident, change, and problem management in high-stakes production environments. Throughout his career, Naidu has supported all phases of the project lifecycle—from blueprint design and development to testing, implementation, and post-implementation support—earning a reputation for delivering high-quality, scalable solutions under pressure. His unique combination of technical mastery, agile methodology expertise, and frontline experience in regulated medical device supply chains makes him uniquely qualified to write this definitive guide on agentic AI.

About the Author



Rajendar Dommeti

Rajendar Dommeti is a distinguished Supply Chain Solution Architect with over nineteen years of techno-functional expertise in SAP Supply Chain Management. As a seasoned leader in planning and optimization, he has spent his career bridging the gap between complex business strategy and robust system architecture, helping global enterprises build resilient, insight-driven planning ecosystems. His deep mastery spans the full SAP IBP suite—including Control Tower, S&OP, Demand, Inventory, Supply & Response, and CI DS—as well as extensive hands-on experience with SAP APO modules such as DP, SNP, PP/DS, and GATP.

Beyond his functional leadership, Rajendar brings a rare technical edge with over three years of hands-on ABAP development experience, allowing him to guide complex custom developments and troubleshoot cross-functional integration challenges with precision. He has successfully led multiple full-cycle implementations, upgrades, rollouts, and AMS engagements, consistently delivering high-quality solutions in high-pressure, time-sensitive environments. A trusted advisor and collaborative team player, he excels at translating intricate business needs into practical, scalable SAP solutions while leading onsite-offshore teams with clarity and purpose. His commitment to continuous learning and operational excellence makes him uniquely qualified to write this definitive guide on agentic AI in supply chains—offering readers not just theoretical frameworks, but the battle-tested insights of a practitioner who has spent nearly two decades shaping the future of intelligent planning systems.

DEDICATION

To every supply chain professional who has spent sleepless nights reconciling demand forecasts, chasing supplier confirmations, and managing stockouts with spreadsheets and intuitionthis book is for you.

And to the researchers and engineers building the intelligent systems that will make those nights a thing of the past.

FOREWORD

Supply chains have always been the invisible infrastructure of civilization. From the Roman grain trade to the modern semiconductor supply chain, the ability to move the right goods to the right place at the right time has determined the fate of empires, companies, and communities. Yet for all their strategic importance, supply chains have long been managed through a combination of rigid software systems, manual spreadsheet work, and hard-won human intuition.

The emergence of Agentic AI artificial intelligence systems capable of autonomous goal-directed action, continuous learning, and multi-step planning represents a fundamental shift in what is possible. For the first time, we have the technological foundation to build supply chain systems that don't merely report on what happened, or even predict what will happen, but that autonomously act to make the supply chain better continuously, at scale, and with increasing intelligence over time.

This book arrives at precisely the right moment. SAP's Integrated Business Planning (IBP) platform, now deeply integrated with AI Core and Azure Machine Learning, has created an enterprise-grade foundation for agentic supply chain systems. Cloud data platforms like Snowflake, combined with event-driven integration via SAP CPI, provide the real-time data fabric these agents need. And advances in large language models, reinforcement learning, and multi-agent systems have given us the algorithmic tools to build agents that can handle the complexity, uncertainty, and dynamic nature of real supply chains.

Naidu Paila brings a rare combination of deep technical knowledge and hands-on practitioner experience to this subject. Writing from the perspective of a Business Systems Lead Analyst at Zimmer Biomet one of the world's leading medical device companies he understands not just the theory of agentic supply chains, but the practical realities of implementing them in regulated, high-stakes environments where a stockout can delay a patient's surgery.

I commend this book to researchers, practitioners, and students who want to understand not just what Agentic AI is, but how to build it, deploy it, and govern it in the world's most complex and consequential supply chains.

PREFACE

0.1 Why This Book?

I wrote this book because the book I needed did not exist. When I began working on agentic AI implementations for supply chain management, I found excellent resources on machine learning for forecasting, solid textbooks on supply chain management, and emerging papers on multi-agent systems but nothing that brought these disciplines together with the practical enterprise architecture knowledge needed to actually build and deploy these systems in SAP environments.

This book is my attempt to fill that gap. It is written for three audiences: industry practitioners who need practical implementation guidance; researchers who want to understand the state of the art and identify open problems; and PhD students who are looking for a rigorous introduction to the field that connects theory to practice.

0.2 The Gap This Book Fills

Most supply chain AI books focus on either the algorithmic side (machine learning models, optimization algorithms) or the enterprise system side (SAP configuration, ERP integration) but rarely both. This book deliberately bridges that gap, presenting mathematical models alongside SAP IBP configuration tables, and academic research alongside real-world case studies.

0.3 How to Use This Book

The book is organized in seven parts, each building on the previous. Parts I and II establish foundationssupply chain management concepts and agentic AI theory. Parts III and IV cover applications and enterprise architecture. Part V addresses risk, ethics, and governance. Part VI presents case studies and simulations. Part VII looks at future research directions. Readers with strong supply chain backgrounds may skim Part I; those with strong AI backgrounds may skim Part II.

0.4 A Note on Terminology

The field of agentic AI is evolving rapidly, and terminology is not yet standardized. Throughout this book, I use 'agentic AI' to refer to AI systems characterized by autonomous goal-directed behavior, continuous learning, and multi-step action capabilities. I use 'multi-agent system' (MAS) to refer to architectures comprising multiple coordinating agents. Where SAP-specific terminology is used, I follow SAP's official documentation.

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Part I

FOUNDATIONS OF SUPPLY CHAIN MANAGEMENT AND ARTIFICIAL INTELLIGENCE

Chapter 1

Evolution of Supply Chains: From SC 1.0 to SC 5.0

1.1 Introduction

Supply chains are the circulatory system of the global economy, moving raw materials, components, and finished goods across continents to deliver value to end customers. From the earliest merchant trade routes to today's hyper-connected global networks, supply chains have continuously evolved in response to technological innovation, competitive pressure, and customer expectations. Understanding this evolution is essential context for appreciating why Agentic AI represents not merely an incremental improvement, but a fundamental transformation in how supply chains operate.

This chapter traces the evolution of supply chain management through five distinct generations SC 1.0 through SC 5.0, examining the technological enablers, organizational models, and performance characteristics of each era. We conclude with a detailed analysis of the Bullwhip Effect, one of the most persistent challenges in supply chain management, and examine how Agentic AI offers new approaches to its mitigation.

1.2 Supply Chain 1.0: The Industrial Foundation (Pre-1970s)

The first era of supply chain management was characterized by physical logistics and manual coordination. Before the advent of computers, supply chains were managed through paper-based systems, telephone communication, and the accumulated experience of skilled logistics professionals. The dominant paradigm was push-based: manufacturers produced goods based on production schedules and pushed them through distribution channels to retailers and end customers.

Key characteristics of SC 1.0 included: long, fixed lead times driven by transportation constraints; high inventory buffers to compensate for demand uncertainty and supply variability; limited visibility beyond the immediate upstream and downstream partners; and decision-making based primarily on historical experience and simple rules of thumb.

Era	Period	Key Technology	Planning Approach	Primary Challenge
SC 1.0	Pre-1970s	Paper, telephone	Manual, experience-based	Physical logistics coordination
SC 2.0	1970s–1990s	MRP, ERP, EDI	Batch planning, MRP logic	System integration, data quality
SC 3.0	1990s–2010s	Internet, WMS, TMS, e-commerce	Real-time visibility, S&OP	Demand volatility, globalization
SC 4.0	2010s–2020s	IoT, big data, cloud, ML	Predictive analytics, digital planning	Complexity, cyber risk, sustainability
SC 5.0	2020s–Present	Agentic AI, LLMs, digital twins	Autonomous, self-optimizing	Human-AI teaming, ethics, resilience

"An essential read for both business and technical leaders. Authors navigates the intersection of high-stakes medical device supply chains and cutting-edge AI with clarity and authority. They provides the necessary frameworks to ensure that the pursuit of autonomy does not come at the cost of control, making this book a cornerstone for anyone serious about resilient supply chain architecture."

-Dr P K Rajput, Ex- Sr. VP, Cadilla Pharma, India



"The authors has written the missing manual for the cognitive supply chain. By focusing on how agentic systems can autonomously plan, execute, and adapt, he offers a viable path to overcoming the latency and fragility of traditional systems. Their work is a vital contribution to the field, proving that true supply chain intelligence lies in action, not just analysis."

-Dr Govind Shinde - Professor, Mumbai University, Mumbai



"The authors has delivered a masterclass in operational AI. This book masterfully bridges the theoretical promise of autonomous agents with the gritty reality of enterprise systems like SAP IBP and Azure ML. For any supply chain leader looking to move beyond predictive analytics into prescriptive, self-healing operations, this is the definitive guide."

-Dr Kishor Jagtap, Director, Pune University, Pune



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