Scientific Research Publishing

World Journal of Engineering and Technology, 2026, 14(2), 357-388
https://www.scirp.org/journal/wjet
ISSN Online: 2331-4249
ISSN Print: 2331-4222

Adopting Artificial Intelligence in ERP Logistics and Distribution

Thamir Oliveira Santos

ETEBA-Technical School of Bahia, Salvador, Brazil
Email: thamiroliveirasantos@gmail.com

How to cite this paper: Santos, T.O. (2026) Adopting Artificial Intelligence in ERP Logistics and Distribution. *World Journal of Engineering and Technology*, **14**, 357-388.
https://doi.org/10.4236/wjet.2026.142021

Received: January 20, 2026
Accepted: March 28, 2026
Published: March 31, 2026

Abstract

While AI has transformed various industries, its practical application within ERPs remains superficial. The market currently lacks specialists capable of architecting deep integration, leaving most demonstrations in the theoretical realm. Drawing on 30 years of experience in IT and logistics, the author proposes the "ORT" (Look, Note, Research, and Organize) framework. Inspired by military and cybersecurity methodologies—such as Red Flag and Capture the Flag—ORT aims to map risks, capture strategic data, and conduct joint exercises to produce tangible results in the short term. Historically, ERPs evolved from 1950s inventory control to the modular consolidation of the 1990s led by giants like SAP and Oracle. However, many current solutions still rely on technological "quick fixes", struggling to migrate legacy cores into 100% web-based, API-driven architectures. The real revolution occurs when AI ceases to be a mere add-on and begins to analyze the "Pandora's box" of corporate data—both structured and unstructured. By applying data science to contracts, emails, and payments, AI can identify patterns and causality, shifting from reactive to predictive management. Finally, the text emphasizes that logistics is the true nerve center of successful organizations. Global leaders treat distribution as vital infrastructure. Survival in the coming decade will depend on leaders' ability to view technology not as a cost, but as an essential engine for economic sovereignty.

Keywords

ERP, Artificial Intelligence, Supply Chain, Logistics and Distribution

1. Introduction

Artificial Intelligence has changed the way the business world works, particularly in publishing, arts, creativity, music, systems coding, artificial worlds, financial

markets, and decision trees, as well as areas such as education, healthcare, and the aerospace and military industries. However, there is a lack of detailed content on its integration with ERPs (enterprise resource planning systems), nor on how they are incorporating this technology and whether they are truly incorporating its potential into their business models. It seems that they are still in the theoretical realm, with demonstrations lacking real depth or inapplicable cases; there appears to be a lack of specialists to integrate and architect it.

After exploring Artificial Intelligence tools and specializing in logistics and distribution within the field of information technology, coupled with over 30 years of expertise in designing, implementing, and developing projects in the corporate sector with renowned ERPs and highly qualified professionals, I will present here how I believe we can chart this path professionally, consistently, and in a way that creates lasting results in the real world, allowing users to benefit from this technology in the short or medium term.

For many decades, the nations that understood the right side of development, investment, technology, and entrepreneurship, whether sustainable or not, are the ones setting the rules. They were visionaries, not just idealists; they supported individuals with promising ideas, innovative and often absurd proposals, but which proved to be the right path.

The next decade will bring significant changes; entire nations will be left behind, and poverty, hunger, and unemployment will plague entire regions simply due to the lack of vision of their leaders, who see artificial intelligence as the enemy.

If it were up to some leaders, we would still be using candles and reading newspapers on paper. The following tasks will require some effort, and we will adopt four practices and methodologies widely known in the military and cybersecurity world to define the necessary steps:

Practices:

1) Define targets
2) Develop strategies
3) Search and capture
4) Present the achievements

Methodologies:

1) Red Flag
2) CTF (Capture the Flag)
3) CSAR (Combat Search and Rescue)
4) Joint Exercises

Red Flag: Conduct advanced training to create a realistic environment and treat the lack of data and information as an enemy, establishing achievable goals, identifying existing risks and threats to the business, and adopting a proactive approach.

CTF (Capture The Flag): Create simulations where teams can work on designing strategies for capturing the data and information defined in the Red Flag goals, which can then be used in the context of CSAR.

CSAR (Combat Search and Rescue): To locate and retrieve information of substantial and strategic value in isolated and converging information areas within and outside the company.

Exercícios Conjuntos: Operations that bring together professionals from various strategic areas to simulate operations in real-world scenarios, including mapping, search, and capture.

These practices and methodologies will now be uniquely referred to as "**ORT**" (Look, take notes, research, and organize).

The issue inherent in current practices or methodologies that deviate from the proposed "ORT" framework lies in a restricted and exclusively departmental perspective, oriented toward specific needs that lack alignment with broader organizational dimensions; cases are managed as isolated silos, which obstructs or impedes the advancement, growth, and competitiveness of the business enterprise.

Utilizing the ORT methodology enables a tangible and pragmatic approach to the relationship between ERP systems and the application of Artificial Intelligence within the context of digital transformation. It comprises objectives that can be measured and technically detailed in a realistic manner through data literacy; conversely, the model currently practiced by most organizations is based on ongoing experiences and departmental needs, creating sparse enterprise-wide integration. This results in redundant data, systemic inefficiency, and even spurious or irrelevant data, as the agents involved tend to employ disparate resources rather than a relational methodology with a generative and predictive approach.

2. Historical Context and the Legacy of ERPs

When looking at the ERP market, the "golden age" has seemingly passed, leaving behind an important legacy but also a patchwork of solutions. The evolution of each platform and its vendors faced enormous challenges, whether due to regionalization—such as "localizations" for each country—tax rules, culture, legislation, and government regulations. This is not to mention the shifts driven by technology itself and its various branches. In the latter case, each vendor chose a specific technological platform to support its products; while this proved efficient initially, it eventually came at a cost.

ERP systems originated in the 1950s with a focus on inventory control, evolving conceptually through the 1980s. They reached their peak in the 1990s, when the term "Enterprise Resource Planning" was actually coined by the Gartner Group to describe the evolution of manufacturing management systems. This marked the beginning of integrating company departments into a single platform through a modular and integrated structure. Many of these were independent systems that began communicating via a shared database, though these databases were often not properly normalized or designed to handle transactions as efficiently as they do today [1].

In its recent history, looking at today's technological horizon, we could say that this all belongs to the last century—especially considering how fast technology is

evolving now. What we consume today was actually designed and created by engineers 5 or 10 years ago; yes, we are consuming "old" things. We had the EOQ model around 1913 and MRP in the 50s and 60s. This is where we find SAP in 1972, leading the evolution of integrated systems until the 90s. At that point in time, giants like Oracle, Peoplesoft, JD Edwards, and TOTVS in Brazil were the ones who ultimately managed to consolidate the concept of management—each, of course, within its own scale, global reach, and governmental constraints.

It didn't take long for ERPs to move to the cloud, driven by NetSuite acting as a Cloud ERP pioneer with over two decades of evolution in this segment. We must congratulate these companies and many others—their employees, engineers, researchers, and visionaries—for providing what we experience today through these platforms and the peripheral systems integrated by other vendors, partners, and enthusiasts along the way. From Ford Whitman Harris in 1913 to where we stand now, we have created something that operates in the shadows; it is there, yet invisible. However, only if and when it stops will people truly notice it, though they will likely remain unaware of how much actually depends on this ecosystem.

Some vendors and products today are still far from operating entirely in the web layer—not 100% at least. They feature integration layers and adapted front-ends that are essentially "quick fixes"; the applications aren't truly multi-platform, and the cores remain largely the same, merely updated with visual contours and integrations. We shouldn't crucify these ERPs or their companies—they are heroes of an era. The reality is that jumping ship from one technology to another is expensive, and established clients aren't willing to pay the price or throw their investment away. Consequently, it is often difficult to evolve, enhance, and change.

Having a 100% web-based ERP—compartmentalized, built in layers, functional via well-documented APIs, and multi-platform, alongside networked cores designed to be self-managing—is not for everyone.

Let's focus on the main theme: where Artificial Intelligence meets ERP to truly change the game. We're not talking about modular data integration, but rather enabling AI to analyze data using models and algorithms to become predictive and operate in autonomous, unsupervised, and supervised modes.

Data science can take a giant leap forward by enabling AI agents to explore data, search for patterns, causality, and logical abstraction to build entire catalogs—labeled or not. In short, let them learn by exploring your "Pandora's box" and see what they find with the right questions. This includes literally everything: not just structured data, but also unstructured data such as proposals, emails, contracts, orders, payments, manuals, and any document that can be converted numerically.

2.1. Logistics as the Business Nerve Center

A critical corporate error is failing to recognize that Logistics and Distribution is the true core of any organization, whether for physical products, services, or information. Global leaders (Amazon, Apple, Coca-Cola) treat logistics as an "au-

ditable, simple, and functional pipeline." The product is merely the "object of desire" on the shelf; the true competitive advantage lies in the infrastructure that delivers it.

2.2. The Technology-Management Gap

A considerable number of organizations perceive technology as an operational expenditure rather than a strategic asset. Internal dynamics—specifically the preservation of individual interests, compensation structures, and hierarchical status—frequently undermine logical and rational decision-making. To achieve organizational evolution, entities must adopt rigorous standards of professionalization, compliance, and governance, conceptualizing this transformation as a "Strategic Maneuver." Ultimately, in the absence of effective execution, strategy remains a theoretical construct devoid of practical utility.

3. Objectives

In the foreground, let's determine the real objectives that organizations must adopt and why we should view this as a war exercise—where, if the battles are won, complete victory will be achieved.

Here we find a determining factor and a key question for this context:

Are organizations willing to set aside corporate and departmental preferences, exercise governance and compliance, and truly professionalize to survive the shifts the business world faces in light of geopolitics, global and climate changes, and regionalized or legal challenges?

3.1. Define Targets

In this work, we must identify and determine the targets—briefly put, where the threats, weaknesses, and opportunities lie, and how the business behaves within its ecosystems while considering external factors.

A large portion of organizations shows total disregard for technology; to them, it is a cost, not an ally. They use it only because the market forces them to, and they possess it only because there is no other effective way to work and organize.

The greatest mistake is failing to realize early on that the central point is the "Logistics and Distribution" of products, content, or services. For most business organizations, they mistakenly believe the core business is simply what they manufacture.

This is a crucial error and the point of highest relevance that is often overlooked: one must understand that the world is digital—and even if it weren't, nothing would change regarding the fundamental importance of logistics and distribution.

Companies like McDonald's, Coca-Cola, Amazon, Microsoft, Google, Meta, and Apple—among hundreds of others—beyond having incredible and high-demand products and services, invest heavily in how they manage processes, scenarios, infrastructure, and the business itself to package, distribute, and deliver the

best experience alongside the object of desire.

For these reasons, the targets we treat as threats, weaknesses, opportunities, and business behavior are, in fact, objects of meticulous study to achieve the perfect logistics and distribution for each business model.

Let's use some dialectics here: let's understand reality through the confrontation and overcoming of contradictions (thesis and antithesis) to reach a greater understanding and look toward a new reality.

From a purely academic standpoint, we can adopt certain approaches and develop an expected roadmap so that members can offer opinions, ideas, and realistic critiques. This enriches the presentation through familiarity, but—no less importantly—it allows us to compare what is being drafted with the real world. However, this is precisely where we find the key point and the weak link.

"The real world is different in terms of facts and arguments."

Whether an argument is weak or strong, mechanics often defeat logic and reason. Those involved try to protect their egos, their salaries, and the seats they occupy; organizations have suffered from this variable for centuries. Terms like professionalization, pursuing results, ensuring compliance, auditing, and revising processes and flows are not for everyone—it requires immense energy and an "absence of democracy." It's business, plain and simple.

In light of this, let's define the real targets and the points related to each of them that must be addressed. There is no "one-size-fits-all" recipe:

3.1.1. Raw Materials, Supplies and Suppliers

An analysis of the supply chain must identify the nature of raw materials and inputs, encompassing the supply base, delivery logistics, procurement protocols, and financial settlement processes.

It is essential to examine the relationship with suppliers, specifically whether a compliance-driven framework governs acquisitions and how delivery management is executed.

Furthermore, the evaluation process must scrutinize how acquisitions are qualitatively assessed and benchmarked against market standards within defined cycles—recognizing that value often transcends price metrics.

Negotiation strategies and established criteria also require rigorous definition. From a top-down strategic perspective, the capacity to transform raw data into actionable performance insights is critical.

Finally, identifying direct stakeholders is imperative to distinguish strategic partners from passive participants, ensuring the enterprise is treated as a priority and determining the necessary interventions to maintain organizational relevance.

3.1.2. Storage

Although storage is frequently associated with physical commodities, it encompasses all organizational elements, particularly information assets.

This necessitates an investigation into the protocols for receiving products, ser-

vices, and data, as well as the mechanisms for storage and asset management.

Furthermore, it is imperative to define access controls, manipulation rights, and the granularity of granted permissions. Ensuring inventory integrity and the ability to quantify the value of held assets are fundamental requirements.

Finally, the analysis must address disaster recovery capacity, organizational resilience, and the existence of established replacement and lifecycle management (recycling) plans.

3.1.3. Use and Consumption

The analysis must address the logistics of inventory movement and its subsequent internal or external distribution. It is necessary to identify the specific resources involved—encompassing human capital, machinery, services, processes, procedures, and strategic partners—and define the methodologies governing these transitions.

Furthermore, the evaluation of these movements requires a defined frequency and rigorous monitoring to ensure results are tangible and maintain full traceability. Finally, the framework should allow for the synthesis of two distinct perspectives: a value-centric view focused on economic impact and a purpose-centric view aligned with strategic objectives.

3.1.4. Delivery

The operational framework must ascertain the existence of real-time auditing mechanisms to ensure comprehensive visibility throughout the service, product, or information delivery lifecycle.

It is imperative that delivery stages are precisely delineated, specifying stakeholders, trajectories, and standardized protocols from inception to completion.

Effective management requires the maintenance of a cognitive mapping for each delivery unit to facilitate the identification of process deviations.

Furthermore, the enterprise must evaluate its execution efficacy and distinguish between various delivery modalities based on their underlying strategic intent.

Assessing the impact of delivery failures and establishing contingency planning are critical for organizational resilience.

Finally, the analysis must verify the interdependency and coexistence of multiple products, services, or information streams. Regardless of the output's nature, a logistics and distribution chain is inherently present; thus, it is mandatory to model, document, and empirically validate every operational phase through evidence-based testing.

3.1.5. Satisfied Customer

The organization must evaluate the efficacy and efficiency of its instruments for assessing customer satisfaction relative to defined deliverables.

It is imperative to acknowledge that the primary objective of such evaluations is the elicitation of data from the stakeholder's perspective. In lieu of conventional surveys or generic email inquiries, the focus should shift toward direct and realis-

tic channels capable of capturing the customer's authentic perception, particularly regarding grievances. Critical and high-demand stakeholders provide significant value, as they identify operational blind spots that favorable, non-specific feedback often obscures. Organizational differentiation is achieved by rectifying recurrent failures and prioritizing improvements that provide a competitive advantage, rather than merely sustaining baseline expectations.

The analysis must verify whether these assessment tools reach the customer objectively and if there is an established retention strategy designed to incentivize reacquisition. Furthermore, it is essential to determine if products, services, and information undergo incremental enhancements that maintain customer stability while simultaneously increasing commercial viability for future transactions.

A critical strategic consideration involves maintaining organizational neutrality regarding political, religious, and ideological issues. Such positioning is vital to prevent interference with the purchasing preferences of current and prospective customers, as well as to preserve healthy, long-term partnerships with suppliers and the broader market.

Upon identifying these critical touchpoints, the entity must assess its readiness to mobilize interdisciplinary working groups, categorize core issues, and define the thematic pillars for each development phase. This preparation involves the formalization of activities, milestones, strategic goals, and execution pathways, while maintaining a comprehensive understanding of the inherent challenges to be addressed.

3.2. Develop Strategies

A common misconception within strategic planning is the assumption that defining actions, establishing procedures, and delegating responsibilities ensures successful implementation. In reality, it is at this juncture that initiatives frequently falter. Organizational resistance, often characterized by the difficulty of internal stakeholders in accepting homegrown innovation, underscores a complex game of interests. These internal dynamics, along with the inherent challenges of systemic adjustments, can potentially undermine the overarching strategy and compromise the anticipated results.

While meticulous planning and risk assessment are fundamental, and resource availability is a critical success factor, the primary variable remains the organization's execution capacity. The central inquiry for any strategic endeavor must consistently focus on the ability to operationalize and deliver the proposed objectives effectively.

To mitigate stagnation, organizations should implement team rotation and integrate external talent possessing specialized knowledge, skills, and expertise. The primary benchmark for recruitment and performance must be the consistent ability to execute. By prioritizing delivery, it becomes possible to develop streamlined and direct strategies that yield quantifiable and substantial results, ensuring that performance is objectively measured and validated.

What is needed and where to start:

An update and review schedule must be established, where each thematic area presents: the individual responsible, actions taken, achieved results, pending items, and the final completion date. The latter must be rigorously monitored during every meeting, preferably on a weekly basis.

The appointment of a Critical Leader is essential. This role involves exercising persuasion and maintaining high standards regarding deliverables and delays, with a focus on failures or non-conformities. Concurrently, this leader must propose strategic adjustments and acknowledge milestones achieved, while clearly articulating the requirements remaining for project success.

The exclusion of committees is recommended, as such structures often impede decisional agility, create confusion among teams, and lead to a loss of strategic alignment. Therefore, the formation of committees should be avoided to maintain operational clarity.

Team leaders should be granted autonomy within a defined work schedule that includes progress and delivery evaluations. Course corrections should occur in meetings prior to the formal presentation of results. Should the Critical Leader or senior management detect interpersonal or operational conflicts among team heads, objective measures must be taken.

Deadlines are not to be renegotiated; if deviations were not identified early, the misalignment must be addressed promptly.

The definition of teams and their respective leaders is mandatory. Synergy, objective meetings, and a precise definition of expected outcomes are required to enforce continuous alignment. Key performance points and routines must be established, ensuring that communication channels remain permanently open.

It is necessary for leaders to proactively engage with senior management, adopting horizontal management practices and skip-level methodologies.

3.3. Key Points in the Strategy

1) Leadership Principles;

2) Break down tasks by complexity, not sequence;

3) If there is no dependency, tackle low-complexity tasks first;

4) If there is no dependency, tackle medium-complexity tasks first;

5) Organize the remaining complex and sequential tasks;

6) Daily team checkpoints: demand a simple and direct daily report;

7) Do not negotiate deadlines—establish a rhythm. If an error occurs, catch up and fix it immediately;

8) Demand concrete evidence of progress: either show what was done, or show what was done;

9) Post it on a wall for everyone to see where we stand—make the evolution visible;

10) Some people work better alone and do in an hour what others take days to complete. Identify these individuals, value them, and assign them tasks accord-

ingly—"Ego and Reward";

11) Choose suppliers wisely;

12) Define what is feasible and separate it from what is overly complex;

13) Seek simplification—remove excess and perfectionism. Focus on what can be delivered and yields results;

14) Again, simplify;

15) MVP (Minimum Viable Product): establish the desirable, essential, expected, and necessary results;

16) Schedules are ineffective if their primary function is to document failure and necessitate constant revision. When a schedule is oriented solely toward deadlines, it is prone to failure; conversely, when it prioritizes deliverables, milestones, and execution capacity, it achieves operational success.

17) Never set a date and work backward. It might be possible to reach it, but the quality will be poor and the team will quit afterward. That is the mark of an authoritarian manager who doesn't know what their employees are capable of;

18) Reward those who reach goals, fulfill activities with excellence, and are committed—"do not create false leadership or hand out unearned power";

19) When the pressure is too high, pause. Look around and create breathing room.

3.4. Search and Capture

We have reached the point where the capacity to execute and provide information must be measured and evaluated. It happens that many companies desire information, want indicators, and demand results, yet they do not know or cannot determine if they possess the necessary data—nor are they certain if that data is consistent and reliable.

To demystify this issue, we must examine each process in every area. For instance, take the billing department and verify if the order contains all the information, if inventory management has the necessary data, as well as shipping and logistics, and—no less importantly—the financial and tax documentation stages.

With these elements established, it is necessary to develop a comprehensive inventory categorized by information type—for example: customer profiles, order and item specifications, commercial and financial terms, inventory levels, billing and logistics data, and financial or tax parameters (including pricing and fee structures). This approach applies to the current use case, but distinct organizational scenarios and processes must be evaluated accordingly. In summary, a structured data matrix should be developed (utilizing spreadsheets or specialized documentation) and submitted for evaluation by managers and senior leadership, tailored to their respective functional areas.

The evaluation process should address the following inquiries: Which data points and information assets are identified as strategically valuable, and how do they contribute to management or analytical functions? What specific Key Performance Indicators (KPIs) are required, and what is the underlying rationale for

their selection? What quantifiable results are anticipated from these analyses, and what strategic actions can be implemented to optimize performance based on these metrics?

Create a response matrix from the interview with each manager or senior executive. Separate into items each question, response, strategy, and indicator, along with relevant data for each desired analysis and the required presentation format.

It is essential to categorize the variables that carry the most significant weight for each analytical theme. Crucially, this initiative does not aim to construct a conventional Business Intelligence (BI) system; rather, it seeks to develop a learning framework—establishing pathways for exploring and retrieving information, as well as defining its capture and formatting protocols.

This process facilitates the emergence of a critical mass of data capable of self-relation and feedback. Such an architecture allows Generative AI to operate upon the dataset, producing the required output matrix while offering strategic recommendations, performing direct statistical analyses, benchmarking against market data, and evaluating key criteria for decision-making processes.

In another topic, we will present how to organize and structure information, always observing the questions below:

1) How to connect Artificial Intelligence to our data;
2) What Artificial Intelligence should read and consume;
3) What it should understand about the information provided;
4) Which problems we want to solve;
5) Whether we want to monitor something;
6) What the key indicators are;
7) How it should act and based on what information to be predictive;
8) How to continue feeding the Artificial Intelligence with more data.

3.5. Presentation of Achievements

Achievements effectively represent that the defined targets and strategy have efficiently driven search and capture efforts. If they deliver the expected results, they will pave the way for new stages; once challenges are overcome, they become processes under maintenance, and we must then evolve and diversify to the next level.

Most executives work visually—that is, through dashboards—and try to find answers in numbers, charts, and demonstrations, often without understanding the origin or knowing how to solve the issue. After all, solving a problem isn't always about finding the cause, but understanding what led to that cause in the first place.

Here, the approach is different. As Artificial Intelligence feeds executives and senior management with information, we can raise new questions and ask for examples or demonstrations. But it doesn't stop there: we can simulate scenarios, request comparisons, and even ask for suggestions for changes or adjustments in key areas. It is vital to note that there is no magic; everything depends on the quality of information and data organization, as well as the supplementary data and documents we can include in the overall map.

A supplementary digital transformation approach we want to introduce is the document repository combined with the ERP data that the AI will act upon, as they are sources of relationships and links. This includes emails, proposals, contracts, orders, invoices, payments, and other documents—in other words, both structured and unstructured data. What makes this secure and efficient is a technology known as RAG (Retrieval-Augmented Generation). It connects a Large Language Model (LLM) to the company's private data without the need for retraining.

In the case of structured data, this occurs via API (Application Programming Interface) or direct SQL data, whereas unstructured data must be stored in a vector database, which transforms text into embeddings that Artificial Intelligence understands semantically.

With this, we will have automated reporting, document analysis, projections, and predictive data, in addition to being able to identify anomalies, generate optimization, and propose automations inherent to the data and analysis of the processes read.

A critical point here is the issue of security and governance, making it crucial to prevent data leaks. To this end, it is imperative that access be limited to ensure the AI only shows the user what they have permission to see, besides being able to mask data through filters—especially strategic or personal data. Most importantly, all of this must be kept within a private network, thus preventing data from being used to train public models.

Some people will be tempted to take their BI database and connect it to an Artificial Intelligence. However, AI learns from what we provide; if the data, even if already in use, does not represent the actual goal we wish to achieve in a new approach, we have merely changed the format and the answers. It is necessary to look deeper, seeking what BI does not answer, data it lacks, or pragmatically speaking: if we are here looking at this, then BI is no longer enough. Evolve.

4. Methodology

4.1. Red Flag

Advanced training to create a realistic environment, goals that must be reached, risks, business threats, and a combat mindset.

People get comfortable and fall into routines. Being a leader is complicated because motivation within organizations often flows from the outside in; with rare exceptions, teams and their members require an external motivational factor.

With this in mind, and for the health of company, sponsor advanced training. Identify who is truly engaged and committed, where the "negatives" are, who fails to see the business as it needs to be seen, and—no less importantly—who are the people willing to learn, grow, and win together.

Analyze which expertises are lacking and identify who already possesses them. Promote targeted upskilling and a plan for evolution and visibility within the organization, alongside shared responsibility and the right incentives. Once this is

done, hire vendors who can deliver the necessary energy and knowledge to develop these skills. Use real-world use cases, data, and demonstrations; work where the complaints arise, solely as an engagement process.

Now, with tools, people, knowledge, and skills put to the test, let's develop a consistent strategy. Do not lose sight of the targets—from this point forward, keep moving while constantly reviewing them.

4.2. CTF (Capture the Flag)

Work on designing strategies to capture data and information, applying the lessons learned from the Red Flag training.

It's possible to develop simple strategies with extraordinary results. Below, I'll present some examples to help you build and strengthen the model, making the project a success.

4.2.1. People

Identify the individuals with the greatest mastery over data and information;
Identify those with the highest execution capacity;
Find those who are emotionally balanced and those who are not;
Define the leaders;
Keep it horizontal, as hierarchy can and will get in the way;
The information flow knows no hierarchy; therefore, the team must flow.

4.2.2. Resources and Tools

Choose the right tools based on the data to be processed;
If necessary, buy the tool;
Invest in infrastructure—do not underestimate this topic;
Establish a funding horizon;
Tool vs. People: it has to work.

4.2.3. Intrinsic Knowledge

Keep in mind that not everything can be solved with books, internet searches, or even so-called "experts".

Some people possess unparalleled knowledge; they are veritable living archives who can identify exactly where something will go wrong, no matter how well you do everything. Rely on these people and their intrinsic knowledge. It could even be a "WhatsApp aunt," to use a rather peculiar example. The business model is not sustained solely by strategic vision, management, and organizational structure; there are people who make the difference and are always attentive to details that are often ignored—the human factor.

Here's a simple example: a company is modern, with excellent products and satisfied customers, always at the forefront of innovation and betting high on technology. Yet, in a meeting with a major future client, what a secretary mentioned is ignored: "Put Mr. Bernardo in Hotel XX; he loves it there because it has a pool for his therapy." Heaven knows how she has that information, but if Bernardo

arrives at the meeting indisposed, in pain, or uncomfortable, everything changes. There are "non-strategic" people who know more than the "strategic" ones in senior management. Give this the attention and importance it deserves.

4.2.4. Current Experience

Everything exists for a reason, and if it's there, someone put it there—be sure of that. I have seen corporate cases where someone decided to remove something because they didn't understand it or thought it was unnecessary, without seeking to understand why it existed. The result? The entire company ground to a halt; generalized chaos. They put it back, and everything started working again.

Listen to those who actually do the work—those who get their hands dirty every day. Listen with care, take notes, and give your employees the importance and value they deserve. Open up interesting conversations, create constructive dialogues, and foster a friendly and kind environment. Delicately explore every item that arises; record it, map it, and be humble enough to ask for help.

"People need to feel important and that they are part of something."

Here, we need people with interpersonal skills—those who know how to talk, who can "get blood out of a stone" without breaking the stone or spilling a drop.

Build and review a "map of things"—yes, "of things"—because until now, almost nothing has been properly documented. In most companies, not everything will be organized and filed. We are living in a new era where we can join the universal consciousness of information. Until now, it was "ask and receive a list"; now, it is "feed it, ask it, and participate in the process." Artificial Intelligence is here for exactly that: to integrate us all into an ecosystem that was once static and listed, but is now open, connected, and intelligent.

Each item must be correctly recorded and cataloged:

1) What it is and when it started being used;
2) Who currently uses it and in what way;
3) When it is used, for what purpose, and what result it yields;
4) The degree of management, secrecy, importance, and relevance;
5) What the inputs, outputs, and frequency are;
6) If it stops, what is affected;
7) Which data it operates with.

4.3. CSAR (Combat, Search and Rescue)

To locate and retrieve information of substantial and strategic value.

Knowing that we are ready to begin the fight, we will conduct the searches and rescue what we intend to work with. At this crucial stage, it must already be known what we have in hand, as well as how we will organize what we find. Here, we will work in a more organized manner—dealing with structured and unstructured data—and begin utilizing storage, whether cloud-based or on-premises.

For unstructured data—such as documents, emails, contracts, invoices, manuals, and every relevant document—we can make use of vector databases. Here are some examples:

Pinecone, Milvus, ChromaDB, Weaviate, ElasticSearch.

As for structured data, we can rely on APIs (Application Programming Interfaces) from system ERPs—such as SAP, Oracle, TOTVS, CONEXOS, and others. However, we can also create specific databases containing only the necessary information, avoiding the bloat of excessive data. By focusing on data specialization, we provide Artificial Intelligence with objective and well-classified information.

Do not fall into the trap or the temptation of thinking that BI (Business Intelligence) is the ultimate solution. Biased data without contextualization can lead to AI interpretation failures. Many people simply take their BI and plug it into an unsupervised AI; sometimes they build entire projects just because someone ran a basic simulation and said, "Look how amazing this is!"

So, this is how things work: data, context, intrinsic and current experience, revised processes, and an information map viewed through a new model—that is what will work. The history of technology and business processes is full of promised successes and untold failures, but they are there.

The substantial and strategic value will be reflected in the organization of the data that was searched and rescued using the right tools.

4.4. Join Exercises

Gather professionals from various areas and run operational simulations in real-world scenarios, including mapping, searching, and capturing data.

Create class models and algorithms that can represent both structured and unstructured data, and apply these models to analyses and evaluations.

Do not rush the process of analyzing, testing, simulating, reconstructing, filtering, and sanitizing data; it is a time-consuming task, especially data sanitation. Ensure that all departments critically review the data together, promote sanitation, and simplify the datasets—provided the "backbone" is maintained without losing information.

The defined models and algorithms must be tested relentlessly—once or 50 times if necessary—until the desired result is achieved. However, define the cycle: if expectations are consistently unmet after several tests, change the model.

4.4.1. Structured Data

Structured information organized in a relational database can be tested in practical models, ranging from simple SQL, Pivot Tables, and static Queries simplified by aggregators, to merging information into associative data views.

With a few simplified demonstrations, it will already be possible to adopt essential analyses.

4.4.2. Unstructured Data

Even while still in the document folder stage, by using certain resources—for example, ElasticSearch—it will already be possible to cross-reference semantic data and perform simple text searches to validate information retrieval.

5. How to Operationalize the ORT

An important step in using the ORT methodology is understanding how to implement each of its phases, so we will describe a model that can help in this understanding and in the work.

5.1. Define Targets

5.1.1. Inputs

Every organization is fundamentally structured and characterized by a specific business and operational model; consequently, it is at this juncture that focus must be directed toward the input data required to sustain the application and practice of this methodology.

1) List the existing structures, in other words, how the company is organized;

2) For each structure, list the entities, roles, or agents involved;

3) Extract from the business model how it presents itself, its purpose, and characteristics;

4) From the operation, create a path, build a sequence of facts and events, in short, define a map;

5) And finally, identify the key points that connect the items above.

6) The utilization of diagramming tools is essential to identify and delineate the scope of work and strategic objectives, thereby ensuring conceptual clarity. This process facilitates the formal presentation of projects to C-level executives and leadership teams, providing a robust framework for strategic alignment and the definition of a clear roadmap for organizational execution.

5.1.2. Outputs

1) The path that connects the organization, its structure, business, and operation;

2) Regarding item 1), defining what will be targeted for the main objectives;

3) Clear map of the points that need attention;

4) Identification of the agents or points of greatest interaction.

5.1.3. Concrete Deliverables

1) Structural map of the organization linked to the business and operational model;

2) Strategy and action plan for extracting and relating data;

3) Relevant agents and points of intersection or relationship.

5.2. Develop Strategies

5.2.1. Inputs

Use the target deliverables and develop strategies based on integrating and relating data from different sources, give greater relevance to the points of greatest attention, and connect the entire chain of events.

1) Identify where the data for each point on the map is located;

2) Identify what each agent produces and where it is stored;

3) Collect information on intersection points and relationships.

5.2.2. Outputs

1) Data and information sources;
2) Volume and scope of data;
3) Data with greater sensitivity.

5.2.3. Concrete Deliverables

1) How and where to connect the data and information;
2) Complexity of the volume and size of the data;
3) Relationship of the sources that need to be connected.

5.3. Search and Capture

5.3.1. Inputs

Based on the deliverables developed in the strategy, it is necessary to connect the data sources and origins and create the models.

1) Data and information sources;
2) Repositories;
3) Providers;
4) Access data and credentials;
5) Connection routes.

5.3.2. Outputs

1) Connection scheme;
2) Connectivity scripts and standards;
3) Connectors, permissions, and extraction frequency.

5.3.3. Concrete Deliverables

1) Structured and unstructured databases;
2) Modeling;
3) Creation of models to apply filters;
4) Environment for simulation and validation;
5) Review of the model, filters, and connections.

5.4. Present the Achievements

5.4.1. Inputs

At this point, we must have all the ORT practices and methodology applied, with their inputs, byproducts, and generated products, in addition to the environment created for validation and/or already approved.

1) Develop issues identified on the map and intersecting routes;
2) List aspects of the structure, organization, business model, and operation;
3) Build an interview template;
4) Develop a response format;
5) Create an operational method.

5.4.2. Outputs

1) Tested model and translated data;
2) Answers that fit the map;

3) Extrapolated data.

5.4.3. Concrete Deliverables

1) Applied and in-depth business intelligence;

2) Interconnected information, processes, and organizational structure in the answers;

3) Consistent answers based on mapped sources and origins;

4) Efficient diagramming that reflects the data.

6. Pratical Case

Case Presentation: CARDPAY

To illustrate the "ORT" framework and demonstrate its empirical application, this study utilizes the use case of "Logistics and Distribution of Credit and Debit Card Terminals." This case refers to a client for whom I served as the lead solution engineer and architect, overseeing the development of a greenfield project; the company's identity will be withheld and referred to herein as "CARDPAY".

CARDPAY is a Brazilian company, part of a larger business group, that decided to enter the credit and debit card terminal market. From that point, the company developed the product, hired suppliers and manufacturers, created a visual identity, and met all corporate, governance, legal, and regulatory requirements. Beyond market-entry challenges, the company sought a product and solution provider to manage its warehouse—handling receiving, storage, picking, distribution, returns, and overall logistics management to get each card terminal into the hands of customers across the entire Brazilian territory.

Generally, we are talking about bakeries, general vendors, department stores, street market vendors, Uber drivers, and taxi drivers—essentially any person or business requiring a payment method so their customers can pay by debit or credit card.

The project failed due to tool selection, a lack of understanding of the logistics involved, and a flawed solution design. The product required too many adjustments and adaptations; it simply wasn't ready for this type of management. The fault did not lie with the vendor, but with the project choice itself and the lack of proper mapping.

As a result, the initial scope now aimed to develop a robust platform to optimize core supply chain functions—specifically warehousing, picking, dispatch, collection, and reverse logistics. Furthermore, the framework integrated the mitigation of operational shrinkage, the establishment of KPIs, and productivity enhancements, while prioritizing stringent security protocols given the sensitive nature of the financial interface, billing, and banking flow equipment.

Following the strategic interventions and the deployment of the new architecture, the project's completion yielded immediate outcomes that surpassed the baseline requirements. During the initial week of operation, a substantial backlog reduction was achieved, alongside an outbound logistics agility that exceeded pro-

jections and enhanced asset protection. Notably, the systemic implementation fostered a cross-functional understanding of the end-to-end workflow, empowering the workforce with the technical versatility necessary to execute tasks across the entire operational spectrum.

I joined the project to understand the situation. To simplify matters, I presented my findings, proposed solutions, and timelines to senior management. As expected, my proposal was accepted, and the key points are listed below:

1) The current system does not meet our needs;
2) Everything we spent financially is a loss;
3) We are significantly behind schedule, and this will damage the brand;
4) I have a complete mapping of exactly what we need;
5) What we require is far simpler than what was originally contracted;
6) I will create a platform strictly limited to our actual needs;
7) Once we are operational, we can then focus on evolution.

6.1. Define Targets

6.1.1. Inability

To store incoming products from suppliers in a way that allows for rapid retrieval once the shipping chain—triggered by a terminal sale—begins;

Exceeding storage capacity due to a purchasing process that is misaligned with terminal sales demand;

Shipping the wrong terminal model, leading to returns, lost sales, commission errors, and dissatisfied customers;

Theft of terminals and diversions during customer delivery;

Failure to supply the customer with the thermal paper rolls needed to print sales receipts;

Inability to identify which models are in stock, where they are stored, or their current quantities.

6.1.2. Weaknesses & Operational Challenges

Managing teams and shifts, while utilizing unskilled personnel for tasks that require specific training;

Inadequate control over volume labeling during the shipping process;

Failure to consolidate terminal volumes for the same recipient;

Security protocols: terminals must remain sealed; warehouse personnel must not have access to open boxes upon arrival from the supplier or at any time during storage;

Shipping queue delays when the carrier arrives to collect the terminals, as well as discrepancies between the destination checklist and the actually shipped units.

6.1.3. Opportunities

Create a structured warehouse map with aisles and tiers to strategically store products, aiming for the most efficient picking and shipping routes and high-access models;

Organize the inbound, picking, and storage flow with minimal resources and maximum efficiency;

Label terminals immediately upon receipt, thereby optimizing shipping turnaround time;

Create shipping lists with a D-1 (one day in advance) forecast to better manage team shifts;

Use shipping lists to perform fraud analysis and reconcile terminal orders with payments and delivery addresses;

Forecast the best delivery routes to negotiate lower freight costs, assisting the carrier and ensuring proper FIFO (First-In, First-Out) management;

Pre-issue shipping invoices, welcome kits, and daily shipping lists, as well as pre-sorting the paper roll kits for each terminal;

Implement a dashboard to monitor operations in real-time, featuring alerts for delays, backlogs, and KPI (Key Performance Indicator) targets.

6.1.4. Behavior

Monthly sales reports;

Purchase orders (PO) and Sales orders (SO);

Shipping lists;

General indicators and documents (sales, shipments, collections, dispatch, operational efficiency, emails, manuals, contracts, personnel, shifts, and security reports);

This entire inventory—the company's asset—must be stored in both structured and unstructured formats. Only then can Artificial Intelligence navigate, locate, and format the information we seek and require.

6.2. Develop Strategies

1) Structured warehouse map with aisles and tiers to receive products appropriately for the expected volume;

2) Monitor storage capacity;

3) Shipping according to orders and terminal models, generating advance shipping lists;

4) Delivery tracking to prevent theft and customer dissatisfaction;

5) Maintain printing paper stock levels above demand;

6) Manage teams according to shifts, demand, and shipping queues based on seasonality;

7) Label products at inbound/receipt rather than outbound;

8) Consolidate volumes before shipping and develop a verification process;

9) Ensure equipment security, especially during the return process (Reverse Logistics);

10) Manage the terminal repair queue;

11) Constantly monitor the shipping queue and forecast delays;

12) Constantly negotiate freight agreements and maintain multiple carriers;

13) Pre-issue shipping invoices (NFe) to save time and optimize dispatch;

14) Store all documentation in an unstructured vector database (Pinecone, Milvus, ChromaDB, Weaviate, ElasticSearch);

15) Maintain all structured information in the cloud with historical data;

16) Create a management dashboard ("monitor") that presents real-time progress and provides predictive analytics.

6.3. Search and Capture

Considering the defined targets and strategy, we can implement "search and capture" by leveraging access to a structured MySQL Server database—with modeled and relational information—alongside unstructured data stored in tools like ElasticSearch [2] [3].

6.3.1. Unstructured Database

We will use ChatGPT as our tool, implementing a RAG (Retrieval-Augmented Generation) scenario connected to ElasticSearch as a vector or lexical knowledge base. We have the following ways to achieve this [4] [5]:

1) Officeial MCP Connector

Elastic has released a connector based on the Model Context Protocol (MCP) that allows ChatGPT to connect directly to an Elasticsearch cluster (version 8.x or higher). To implement this, you will need an 8.x+ cluster and an API key.

You can download the Elasticsearch MCP server from GitHub, then configure the MCP client configuration file as follows [6]:

ELASTICSEARCH_URL

ELASTICSEARCH_USERNAME

ELASTICSEARCH_PASSWORD

To configure the MCP client configuration file (such as Claude Desktop) to connect to Elasticsearch using ELASTICSEARCH_URL, ELASTICSEARCH_USERNAME, and ELASTICSEARCH_PASSWORD, you must edit the MCP JSON configuration file and define the environment variables within the env field.

a) Configuration file location

macOS: ~/Library/Application Support/Claude/claude_desktop_config.json

Windows: %APPDATA%\Claude\claude_desktop_config.json

b) Example configuration (JSON)

Add the following entry to the mcpServers section in claude_desktop_config.json file. Note that the required environment variables are ES_URL, ES_USERNAME, and ES_PASSWORD (the standard used by most Elasticsearch MCP server implementations).

JSON EXAMPLE:

```
{
  "mcpServers": {
    "elasticsearch": {
```

```
            "command": "npx",
            "args": [
              "-y",
              "@elastic/mcp-server-elasticsearch"
            ],
            "env": {
              "ES_URL": "https://seu-cluster-url:9200",
              "ES_USERNAME": "user",
              "ES_PASSWORD": "password"
            }
          }
        }
      }
```

Important Details:

Authentication: The server uses ES_USERNAME and ES_PASSWORD for Basic Authentication;

SSL: If you are using HTTPS with self-signed certificates, you may need to add "ES_SSL_SKIP_VERIFY": "true" within the "env" block;

Alternative with API Key: Instead of username/password, you can use "ES_API_KEY": "your-api-key";

Restart: After saving the file, you must restart Claude Desktop for the new configuration to take effect.

Verification:

After restarting the client, verify if the Elasticsearch server appears in the list of connected tools (the plug icon in the chat) and try asking questions such as: “What indices do I have?”

Entering data into Elasticsearch:

Inserting documents (emails, contracts, orders) into Elasticsearch is performed by sending data in JSON format to a specific index. This can be done via REST API (using curl or Kibana Dev Tools) or through client libraries (Python, Node.js, etc.) [6].

The basic process involves indexing the data, which creates an efficient search structure known as an Inverted Index.

Insert a Single Document (POST):

Use the POST method if you want Elasticsearch to generate an automatic ID.

Example of entering a sales order:

```
POST /pedidos/_doc
{
  "pedido_id": "1001",
  "customer": "João Silva",
  "date": "2023-10-27T10:00:00",
  "items": ["item1", "item2"],
  "amount": 150.50
```

```
}
```

Example of entering an email:

```
PUT /emails/_doc/1
{
  "sender": "rh@company.com",
  "subject": "Contract update",
  "body": "The contract is attached....",
  "date_sent": "2023-10-27"
}
```

Example of inserting a document into Word:

Use the “Ingest Attachment Processor” plugin to convert the binary file into searchable text.

- In the Elasticsearch directory, run: “bin/elasticsearch-plugin install ingest-attachment”
- Restart Elasticsearch after installation

Now create an ingestion pipeline; this can be done with Python in this example:

```
PUT _ingest/pipeline/attachment_pipeline
{
  "description": "Pipeline para extrair dados de documentos Word",
  "processors": [
    {
      "attachment": {
        "field": "data",
        "indexed_chars": -1,
        "indexed_chars_field": "max_size"
      }
    }
  ]
}
```

where:

- data: The name of the JSON field that will contain the Base64 file;
- indexed_chars: −1 means there is no limit to the number of characters extracted (default is 100,000)

Convert Word document to Base64:

Elasticsearch does not accept binary files directly, so you must convert the .docx file to a Base64 string.

base64 arquivo.docx

Python:

```
import base64
with open ("documento.docx", "rb") as f:
    encoded_string = base64.b64encode(f.read()).decode('utf-8')
```

Insert the Document:

Use the indexing API, passing the Base64 string and using the created pipeline:

Example:

```
PUT /meu_indice/_doc/1?pipeline=attachment_pipeline
{
  "filename": "document.docx",
  "data": "UEsDBAoAAAAA...<string_base64_aqui>..."
}
```

Check and Search:

After insertion, Elasticsearch creates an attachment field with the extracted text.

Example:

```
GET /meu_indice/_search
{
  "query": {
    "match": {
      "attachment.content": "palavra-chave"
    }
  }
}
```

6.3.2. Structured Database

We will use ChatGPT as a tool by implementing a MySQL relational database scenario, allowing for data analysis, automated reporting, and the creation of chatbots based on real-world information. We will adopt the No-Code method (Automation Platforms), which eliminates the need for programming; we can use integration platforms that connect MySQL to the OpenAI API. We have the following ways to achieve this :

1) Platforms

a) Latenode

b) Albato

c) Appy Pie

d) n8n [7]

2) How is works

a) Create an account on the selected platform.

b) Select the MySQL connector and enter your credentials.

c) Select the OpenAI/GPT Chat connector.

d) Define "triggers" (e.g., new line in MySQL) and "actions" (e.g., send to GPT Chat).

Optionally, you can use specialized tools (Chat with Database).

There are ready-made tools focused on "chatting with your database" that simplify the connection:

AskYourDatabase: It allows you to connect via "connection string" and ask questions in natural language directly in the chat.

BlazeSQL: Focused on security for data analysis, it doesn't train with your data.

LangChain/Vanna AI: Recommended for engineering teams that want to build a more robust, customized solution.

3) Important Safety Precautions

a) Do not expose credentials

Never enter your bank username and password directly into ChatGPT prompts.

b) Use users with limited permissions

Create a user in MySQL with read-only (SELECT) access to the GPT Chat, preventing them from accidentally deleting or altering data.

c) Secure Connection

Use SSL/SSH connections to ensure that data is transmitted in encrypted form.

6.4. Presentation of Achievements

Assuming you have created your ChatGPT account, acquired the necessary connectors and modules, set up and configured your structured and unstructured databases, and—of course—uploaded enough documents for a test, we can now begin presenting achievements and results.

To do this, use your ChatGPT prompt to run targeted tests on the content stored in databases. However, it is essential to verify if you are truly ready.

The practices below will ensure that everything is ready to present your achievements effectively:

Red Flag: Conduct advanced training to create a realistic environment where you can assess the threats, weaknesses, and opportunities described earlier; foster a combative mindset. To do this, hire experienced professionals and committed companies to train you to ask the right questions based on your specific data and information.

CTF (Capture The Flag): Once trained, create simulations where teams can work on designing strategies to capture data and information, establishing exactly how they should be presented and delivered.

CSAR (Combat Search and Rescue): At this stage, the organization must be prepared to identify and retrieve information of substantial and strategic value from both isolated and converging functional areas. It is at this juncture that tangible results emerge, as complex queries and data searches transform raw datasets into a strategic scope oriented toward evidence-based decision-making.

Joint Exercises: Conduct operations that gather employees from various strategic areas to simulate real-world scenarios, including mapping, searching, and capturing. It is crucial to cross-reference the information obtained and evaluate the results as a group, knowing that you can then pose new, more mature questions.

7. Results and Discussion

What we have presented here is a work methodology and a set of consistent, reliable practices focused on logistics and distribution applied through Artificial Intelligence. We have demonstrated the process stages, designs, and common challenges of the business environment. We illustrated how ERPs were integrated into our lives, their relevance, and how their added value transformed decades of en-

terprise into tangible results, fundamentally changing the way we work.

Equally important, we reinforced the Logistics and Distribution scenario as the nerve center of every company—not only regarding products but services and information as well. Global leaders such as McDonald's, Coca-Cola, Amazon, Microsoft, Google, Meta, and Apple focus on this understanding, combined with exceptional marketing.

On websites like those listed below, you can find relevant information about the logistics and distribution market:

1) Mordor Intelligence

2) Trading Economics

3) Trade.gov

The relevant aspect here is understanding how we can align Artificial Intelligence with company's ERP, integrating information in a structured and consistent manner, training teams, and creating a practical and realistic working model. This must be done while following established work methodologies and utilizing industry-proven practices to achieve the expected results and fulfill our core objectives.

Below, we illustrate the current state of the U.S. logistics market with key data and implications as shown in the charts.

Our approach's key points must be reconsidered and reformulated whenever necessary, relying on the continuous improvement of search and capture methods with clear and well-defined targets.

Always work with joint exercises involving multidisciplinary teams; keep an eye on the Red Flags and maintain a combative stance in searching for and rescuing information.

Create a culture of organizing information and applying tools that are easy to use yet highly specialized. These tools must connect to ensure the company's assets are always protected, accessible, and capable of demonstrating realistic results regarding the company's health, behavior, and information flow.

In our "CARDPAY" case study, the solution was to restructure the company's core business management platform through internal development, augmented by AI technology to promote the management of information assets.

Find more information and references at:

Supply Chain Digital: Global trends and technology in supply chains [8].

Logistics Management: Market news and industry reports [9].

Gartner Supply Chain: Strategic research and the famous "Magic Quadrant" [10].

Inbound Logistics: Focused on efficiency and best practices in transportation and warehousing [11].

7.1. Mordor Intelligence

United States Contract Logistics Market Size & Share Analysis—Growth Trends and Forecasts (2024-2029)

The United States Contract Logistics Market is segmented by Type (Outsourced and Insourced) and by End-User (Manufacturing and Automotive, Consumer Goods and Retail, High-Tech, Healthcare and Pharmaceuticals, and Other End-Users (Energy, Construction, Aerospace, etc.)). The report provides market size and forecasts in US Dollars (USD) for all the segments mentioned above [12].

Furthermore, the country is the largest contributor to the contract logistics market in North America. Market growth is driven by the increasing demand for integrated services and the advanced implementation of IoT and logistics automation. Additionally, the retail sector is one of the primary end-users in the market, followed by the high-tech and automotive industries.

Meanwhile, most market players are focusing on adding autonomous elements to their existing infrastructure and systems to transform the fulfillment process without disrupting the supply chain. This is intended to meet the growing demand from end-users. Contract logistics companies are also becoming more productive by using technologies such as drones, robots, augmented reality, and virtual reality in their operations. Consequently, the rise in retail and e-commerce sales, coupled with the adoption of innovative technologies, will propel the contract logistics sector in the country (**Figure 1**).

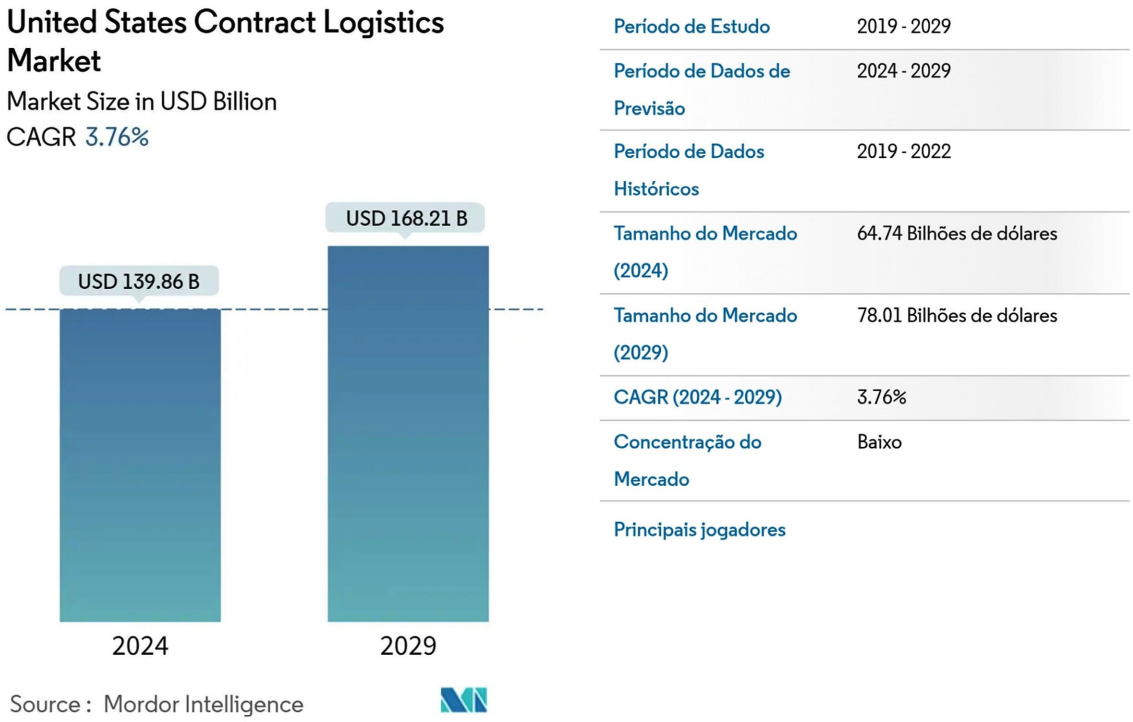


Figure 1. United states contract logistics market, between 2019-2019.
https://www.mordorintelligence.com/pt/industry-reports/united-states-contract-logistics-market

The growth of the contract logistics market is supported by the fact that the country possesses a strong warehouse network. Furthermore, since 2010, the

number of warehousing and storage companies has grown at an increasing rate each year. Also, in 2021, there were more than 20,000 warehousing and storage companies, representing a 4% increase over the previous year.

Shifts in consumer behavior toward new and hybrid shopping patterns were the main drivers of the significant growth in e-commerce sales in 2022.

Moreover, since 2010, the number of warehousing and storage companies has grown at an increasing rate each year. By 2021, there were over 20,000 such companies, marking a 4% increase compared to the previous year (Figure 2).

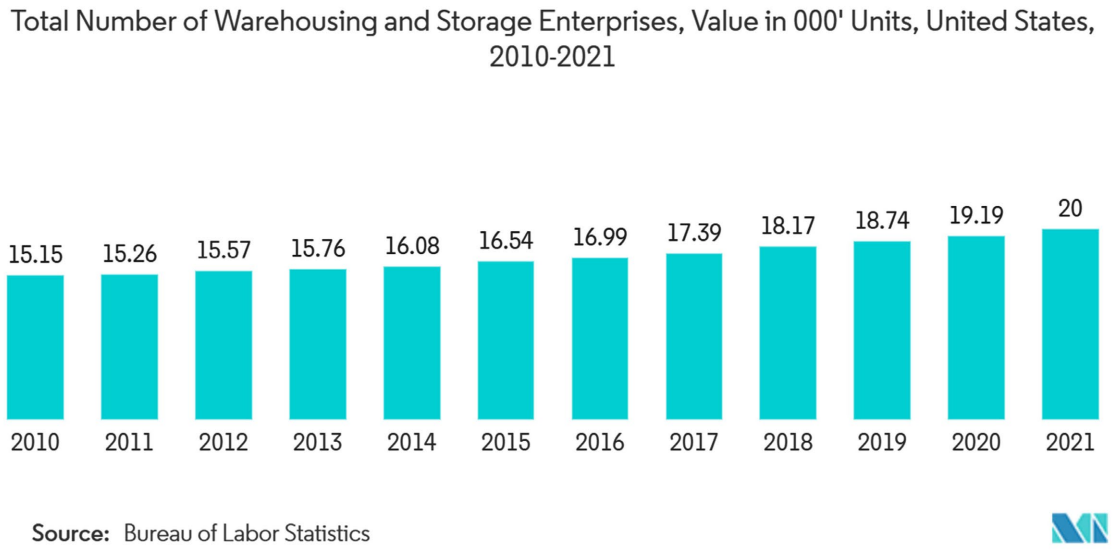


Figure 2. Total number of warehousing and storage enterprises, between 2010-2021.
https://www.mordorintelligence.com/pt/industry-reports/united-states-contract-logistics-market

7.2. Trading Economics

U.S. Logistics Growth Accelerates

The U.S. Logistics Manager's Index (LMI) rose to 59.6 in January 2026, the highest in seven months, compared to 54.2 in December. The reading indicated a faster expansion rate in the logistics sector, largely due to a shift back toward more moderate restocking to start the year. Inventory levels recovered from contraction (up +18.8 to 53.9), although the increase is relatively moderate compared to what is typically seen in January when companies are actively engaged in replenishment [13].

Inventory levels expanded at roughly the same pace as the previous period (53.8 vs. 53.9), while inventory costs moderated (67.8 vs. 71.3). Warehousing capacity remained unchanged (50 vs. 50), but warehousing utilization increased (60.3 vs. 54.4), and warehousing prices slowed down (62.6 vs. 64.8). Meanwhile, transportation utilization increased at a faster rate (61.9 vs. 58.1), but transportation capacity fell further (41 vs. 47.1), contributing to higher transportation prices (76.7 vs. 71.4) (Figure 3).

The U.S. Logistics Manager's Index rose to 59.6 in January 2026

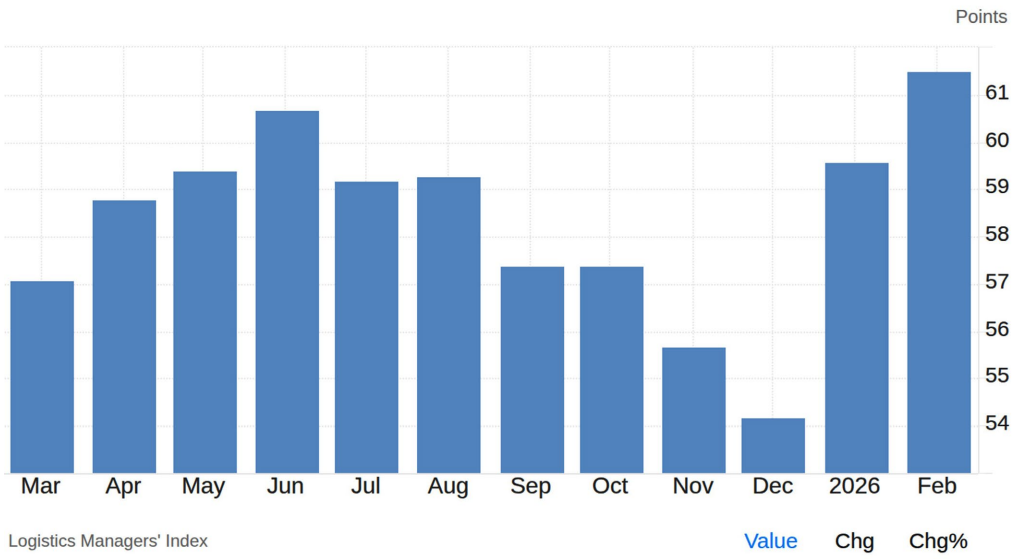
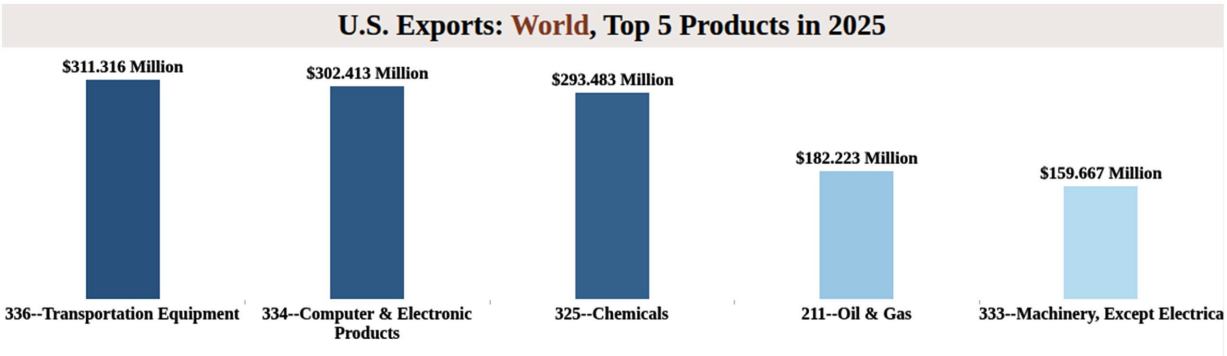


Figure 3. The U.S. Logistics Manager's Index rose to 59.6 in January 2026.
https://pt.tradingeconomics.com/united-states/lmi-logistics-managers-index-current/news/522605

7.3. Trade GOV

Logistics and Transportation Industry

The logistics and transportation sector in the United States is highly competitive. Domestic and international companies in this industry benefit from a highly skilled workforce and relatively low costs. Business logistics costs in the United States reached $2.3 trillion in 2023, representing 8.7% of the GDP that year. In 2023, foreign direct investment (FDI) in the sector totaled $155.4 billion [14] (**Figure 4**).



Source: TradeStats Express-U.S. Trade by Product.

Figure 4. U.S. Exposts: word, Top 5 Products in 2024.
https://www.trade.gov/selectusa-logistics-and-transportation-industry
https://www.trade.gov/data-visualization/tradestats-express-us-trade-products

The logistics and transportation industry in the United States plays a crucial role in facilitating goods across the United States. The industry's strengths include an extensive domestic transportation network and access to both the Atlantic and

Pacific coastlines, which support trade with Europe and Asia.

U.S. port infrastructure supports cargo distribution and transportation both domestically and internationally. In 2023, the top 150 U.S. ports by trade volume handled 2.61 billion tons of cargo. The United States also has 12,000 miles of navigable inland and intercoastal waterways, including major systems like the Mississippi River, which are vital for the country's freight network.

Railroads, which move 40 percent of U.S. long haul freight, are a critical link in supply chains as well. Each year, U.S. freight railroads transport about 1.5 billion tons of goods across nearly 140,000 miles of railroad tracks.

8. Conclusions

This methodology integrates Artificial Intelligence with the company's ERP to transform the Logistics and Distribution "nerve center" into a strategic asset. By aligning structured SQL data with unstructured documents through RAG and Vector Databases, organizations can move beyond static dashboards to achieve predictive insights. Success depends on a combative leadership culture, using Red Flag and CTF simulations to train multidisciplinary teams in data "search and rescue."

Developing an environment anchored in Artificial Intelligence architecture and integrating the organization's ERP system—leveraging both structured and unstructured data through vector-based Retrieval-Augmented Generation (RAG)—enables the cross-referencing of information and the establishment of interconnected data links. This synthesis yields realistic, substantive outcomes that pragmatically represent the organizational data landscape, providing leadership with a transparent view of data lineage, business behavior, and actionable insights for optimization and growth.

This framework ensures high-fidelity data retrieval from authoritative sources, adhering to standardized formats and layouts. Consequently, it accelerates verification processes and augments human decision-making by delivering strategic, structured insights. Furthermore, the integration of automated anomaly detection for identifying errors or deviations reinforces analytical rigor, fostering a culture of continuous improvement.

As demonstrated in the CARDPAY case, the goal is to replace complex, failing systems with lean, AI-augmented platforms that ensure information is protected and actionable. Ultimately, this approach prioritizes intrinsic human knowledge and operational agility to deliver realistic, high-impact business results.

Keep in mind that renowned or innovative methodologies and practices are allies; in the era we live in, data and information are your greatest asset. Do not, under any circumstances, underestimate the use of technology itself; companies worldwide are investing heavily in it and dedicating substantial time to ensure their business's survival.

It is not enough to use technology in your core business; it must permeate and be integrated into whatever connects products, service, or information to the final

customer—in the best format, through the best path, and in a transparent manner, achieving satisfaction and progressive results.

Gaining market loyalty is difficult and requires a set of essential factors. However, some companies are discovering this path; they have realized that the product is the object of desire on the shelf, but it must be delivered to the consumer through an auditable, simple, and functional pipeline.

Allied to this, preserving information assets, enriching the knowledge base, and developing new areas, teams, and infrastructure capable of paving the way will yield results that please customers, employees, and shareholders alike.

Results must be visible and tangible.

The use of Artificial Intelligence opens a new era—a new path that we must embrace, pave, and sustain so that our future is fulfilled.

To deny this would be like deciding between 1960 and 1990 that ERP systems were useless, that a smartphone was unnecessary, or even worse, that the internet was something trivial.

"Enter a new era now."

Acknowledgements

To Alessandra Lassmann, my little star: this achievement would not have been possible without your unwavering support. To my mother, Iracema Alves, who raised me in the path of integrity and virtue.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

[1] Genius ERP, a Brief History of ERP, ERP, Industry News. https://www.geniuserp.com/resources/blog/a-brief-history-of-erps/

[2] Digitan Ocean, How to Install MySQL. https://www.digitalocean.com/community/tutorials/how-to-install-mysql-on-ubuntu-20-04-pt

[3] Elasticsearch, What Makes Elasticsearch a Search, Analytics, and AI Powerhouse. https://www.elastic.co/elasticsearch

[4] OpenSearch, Ingest-Attachment Plugin https://docs.opensearch.org/latest/install-and-configure/additional-plugins/ingest-attachment-plugin/

[5] Elastic, Searching Attachment Content with Ingest Attachment Plugin. https://www.elastic.co/elasticsearch

[6] JoshMock, Elasticsearch MCP Server. https://github.com/elastic/mcp-server-elasticsearch

[7] N8N, How to Connect MySQL and OpenAI. https://n8n.io/integrations/mysql/and/openai/

[8] Supply Chain Digital, Global Trends and Technology in Supply Chains, Choosing

Your Supply Chain Technology Partner.
https://supplychaindigital.com/news/csco-insights-choosing-your-supply-chain-technology-partner

[9] Logistics Management, Today on Logistics Management, Market News and Industry Reports. https://www.logisticsmgmt.com/

[10] Gartner Supply Chain, Strategic Research and the Famous "Magic Quadrant".
https://www.gartner.com/en/research/methodologies/magic-quadrants-research

[11] Nishith Rastogi, Focused on Efficiency and Best Practices in Transportation and Warehousing, How Agentic AI Is Redefining Route Optimization in Last-Mile 14 Delivery.
https://www.inboundlogistics.com/articles/how-agentic-ai-is-redefining-route-optimization-in-last-mile-delivery/

[12] Mordor Intelligence, United States Contract Logistics Market Size & Share Analysis—Growth Trends and Forecasts (2024-2029).
https://www.mordorintelligence.com/pt/industry-reports/united-states-contract-logistics-market

[13] Trading Economics, U.S. Logistics Growth Accelerates.
https://pt.tradingeconomics.com/united-states/lmi-logistics-managers-index-current/news/522605

[14] Trade GOV, Logistics and Transportation Industry.
https://www.trade.gov/selectusa-logistics-and-transportation-industry