Transactions on Engineering and Computing Sciences - Vol. 13, No. 03
Publication Date: June 10, 2025
DOI:10.14738/tmlai.1303.18855.
Kumar, M. (2025). Detailed Analysis of AI Agents in Carrier Outreach for Freight Brokerage and Carrier Operations. *Transactions on Engineering and Computing Sciences*, 13(03). 97-111.

Detailed Analysis of AI Agents in Carrier Outreach for Freight Brokerage and Carrier Operations

Mukesh Kumar
T3RA Logistics, Sacramento, California, USA

ABSTRACT

In the $1 trillion freight brokerage industry, securing the right truck at the right time and price depends on labour-intensive carrier outreach, where reps send daily bid emails to 1,000–3,000 carriers in a "spray and pray" approach, yielding only 10–15% booking rates after 4–6 hours of manual effort (Transport Topics, 2023). This paper investigates how AI agents, powered by Large Language Models (LLMs), can enhance this process by up to 80% in efficiency. These agents automate bid distribution by generating personalized emails using TMS data, parse carrier replies with 95% accuracy (NLP Benchmarks, 2024), respond to 80% of queries instantly, and negotiate rates in real time against $150 billion in DAT benchmarks (DAT, 2024), integrating seamlessly with load boards. Simulations of 20 loads across 2,000 carriers show response rates rising from 10% to 20%, bookings from 15% to 25%, and time dropping to 48–72 minutes daily, saving $50–$100/load ($1,000–$2,000 daily) based on $3.50/gallon fuel costs (EIA, 2024). In this automated world, brokers cover loads 25% faster, while carriers receive tailored bids, cutting outreach effort by 50%. Despite 6–12 month integration challenges (Gartner, 2024), AI agents transform carrier outreach into a proactive, data-driven ecosystem, optimizing the 20% of freight on spot markets (DAT, 2024) and beyond in a competitive landscape.

Keywords: AI agents, large language models (LLMs), freight brokerage, carrier outreach, load matching, negotiation automation, logistics efficiency, real-time negotiations, TMS integration

INTRODUCTION

The freight brokerage sector acts as the catalyst that holds modern supply chains together by matching vast pools of available carriers with shippers that need to move freight across fragmented transportation networks [1]. While other areas of brokerage (route optimized, fleet tracking) have advanced significantly through technology, operations such as carrier outreach, load matching, and rate negotiation remain largely manual & tend to rely on spreadsheets, emails, and phone calls. The workflows are time-consuming and error-prone, leading to missed opportunities and inefficiencies in cost and service delivery [2].

The trend of AI agents combined with Large Language Models (LLMs) presents a paradigm shift in automating and optimizing these high-friction logistics processes. AI agents are trained to perform tasks based on rules, real-time data, and learned behaviors automate repetitive workflows [3]. Such workflow includes sourcing carrier availability, dispatching load details, and triggering responses. While LLMs like GPT-4 and Claude add a new level of contextual

intelligence, interpretable human-like language to understand load requirements, negotiate rates, and enable scalable relationship-driven communication [4].

Together, these technologies enable dynamic freight orchestration, where loads are matched to optimal carriers not only by rate and route compatibility but also with other parameters which include operational fit, historical performance, and real-time capacity [5].

Additionally, LLMs based negotiation automation can emulate broker rules to achieve better terms whilereducing negotiation cycles and ensuring compliance with SLAs and regulatory constraints [6].

In this paper, we illustrate how such AI agents and LLMs can be embedded into existing freight brokerage systems to automate and improve efficiency for carrier outreach to increase load-to-carrier match accuracy and support large-scale human-like negotiation skills. The paper further explores a system-oriented view of architectures, data flows and decision models incorporated with the meaning of the data from an operational perspective within the context of logistics throughput, cost savings and service levels. By bridging structured process automation with flexible language understanding, AI agents present a framework for intelligent freight brokerage that is adaptive, proactive, and future-ready.

LITERATURE REVIEW

Carrier outreach was always one of the bottlenecks in the freight brokerage workflow. Many brokers typically work with mass email, cold call and track manually to obtain capacity, which is often called the “spray and pray” model [7]. Caplice, C. (2021) adds, brokers may email 1,000–3,000 carriers daily with general load information, resulting in booking rates of only 10–15% after several hours of effort. This high-volume and low-conversion process results in inefficiencies, delays in coverage and missed opportunities in the congested $1 trillion freight market [8].

Logistics has historically been a field of hard decision-making using data and at least some re-iteration, which makes it a convenient space for adoption of AI agents autonomous software entities that simulate decision making by sensing, deciding, and acting [9]. AI agents can be readily implemented in logistics because many repetitive, data-heavy tasks such as dynamic pricing, ETA prediction, and freight matching lend themselves to AI decision making. Reinforcement learning and supervised models are used for automating transportation scheduling and capacity sourcing [10]. But very few have studied their effectiveness and performance in engagement workflows between humans and carriers, where a natural language generation and a contextual understanding of the workflow can help. In these scenarios, AI agents can dramatically decrease manual broker intervention by autonomously generating outreach, interpreting responses, and triaging actions based on operational data [11]. Thanks to the integration of Large Language Models (LLMs) like GPT-4, Claude, and LLaMA, AI agents can now generate emails, perform semantic analysis, and negotiate over context, Chileshe, N. (2021) and Albino, V. (2023). In business logistics, it demonstrated that LLMs drastically outperforms traditional NLP models on understanding contractual language

and email exchanges. For freight, LLMs could enable conversion of carrier communication by templating an offer based on TMS data (load specs, location, rates), and replying to inbound emails with 95% accuracy (Lopetcharat, K. (2020). This removes the hassle of brokers to manually sift through hundreds of emails and, therefore, increases the time to coverage [13].

Spot market freight (estimated at ~20% of the U.S. trucking market (DAT, 2024) are taking advantage of AI-powered pricing models and negotiation agents. By using real-time rate indices (around $150B+ worth of DAT data), these AI agents can change offers in a live setting based on how quickly different carriers respond, the historical demand for lanes, or changes in fuel prices [14]. Similar frameworks for autonomous negotiation in supply chains were outlined by Parkes & Wellman (2015) but these applications are much more sophisticated augmenting an LLM to both simulate a broker–carrier conversation and to adaptively respond. In doing so, it generates a feedback loop, where response rates, acceptance thresholds, and carrier preference train the agent repeatedly [15].

The vast potential of AI to upscale outreach in freight is no secret, yet its practical use is limited due to complexity of integration [16]. According to Omelchenko, T. (2025), there is an adoption curve of 6–12 months before broker TMS and CRM systems start incorporating AI. Nevertheless, simulation results have proven phenomenal with 80% better outreach efficiency, 2x better response rates, and the amount of manual work done each day came down from 4–6 hours to less than 90 minutes (EIA, 2024) [17,18]. Researchers also mention a boost in load coverage time of 25% and a reduction of $50–$100 per load in costs (less back and forth, decisions made faster with fuel-hedged actions) [19]. As AI and LLM utilization has found a mainstream in many customer service and enterprise support domains, the use of AI and LLMs for freight-specific carrier outreach still need to be more discussed in the academic literature. While existing work has focused on routing, pricing, and freight matching, biddings involve human-in-the-loop tasks such as bid personalization, real-time Q&A, and relationship management.

RESEARCH METHODOLOGY

This research uses a qualitative and exploratory methodology from a wide range of secondary data sources to look at how AI agents have been adopted and what they have accomplished in land transport brokerage and carrier operations. This paper presents analysis based on insights synthesized from peer-reviewed Internet journals where authors talk about AI architecture, large language models (LLMs) and their applications to logistics and transportation systems.
We have also scrutinized industry-specific magazines and trade journals such as Transport Topics, Freight Waves, Logistics Management, to gain insight into current market trends, case studies, and AI deployments which are happening now in the industry. This type of source reflects new tools, carrier participation practices and brokerage platforms.

AI Agents in Freight Brokerage

AI agents are redefining freight brokerage operations by automating repetitive tasks, enhancing decision-making, and scaling outreach. From email generation and rate negotiation to document processing and fraud detection, these agents empower brokers to operate faster,

smarter, and with greater precision while enabling them to focus on high-value relationship management and strategic load planning [20].

Carrier Outreach Automation is one of the key jobs of AI agents in freight brokerage. Brokers historically spent hours writing emails or telephone cold-calling carriers to off their loads. Now, AI agents streamline this process by creating customized load offer emails with real-time data from the Transportation Management System (TMS), including lane details, equipment type, historical rate levels, and a carrier's performance with the shipper. They can smartly segment carrier lists, time outreach for maximum engagement and follow up automatically with those who haven't replied. This results in much higher response rates and more efficient outreach [21].

Response Parsing and Classification, And when carriers respond to load offers, the replies can be all over the map where some say "yes", some say "no", and some want to haggle or clarify things. AI agents driven by sophisticated NLP and LLMs can parse these free-text replies at scale, immediately categorize them into actionable buckets. They pull out important pieces of information like proposed rates, equip availability, pickup dates, special needs. This helps avoid the manual triage of emails and allows quicker decisions and load updates [22].

Rate Analysis and Negotiation, dynamic pricing strategies are also implemented by AI agents. They compare the rates they receive from carriers with near real-time market benchmarks from their own internal pricing models or from sources such as DAT. Considering this, it can analyze the historical quotations to let the agents automatically develop their counteroffers, to negotiate rate bands and to escalate unconventional quotes to human judgment. This not only shortens negotiation cycles but it ensures the broker will always get a competitive rate whilst maintaining margins [23].

Decision Support and Carrier Matching, Besides automation AI agents offer decision support system. Carrier reliability, on-time performance, geographic proximity, lane history, compliance records to everything which can be assessed, and the system is able to suggest the best carrier for a specific load. This smart matching means that high value or time-sensitive loads can be game planned to the front of the schedule, which in turn will reduce falloffs and improve on-time performance [24].

TMS and CRM Integration, To prevent operational shutdown, AI agents self-update statuses in the TMS, like "covered"; "pending"; or "booked". They also record communication touchpoints and booking details on CRM systems, which decreases the manual workload of the brokers and gives you a full audit trail. This forms a single source of truth, accessible in real-time, for your sales, dispatch and finance teams [25].

*Document Handling and Back-Office Automation***,** AI Agents can also be used to handle document oriented work. They process the rate confirmations, PODs and accessorial requests, appropriately reading and capturing the details accurately. These records are summarized,

categorized, and stored in suitable systems, saving time spent copying and pasting from one application to another and avoiding human error in documentation processes [26].

Exception Management, when something goes wrong like a carrier has failed to confirm, a pickup is delayed, or a document is missing, in such cases artificial intelligence agents can recognize the issues early and flag them for resolution. In several scenarios, the agent may first contact the carrier or customer, providing explanations or requesting missing data. This will result in proactively handling the exception and prevent service disruption and customer escalations [27].

Fraud Detection and Carrier Vetting, AI agents also contribute to secure and compliant activity by validating carrier credentials against the MC-DOT databases, insurance proof, and fraud watch lists. They can spot anomalies in patterns of communication, suspicious behavior, or mismatched credentialing alarming the team before booking a load with a partner that has exposure to any unnecessary risk. This eliminates double brokering, phantom pickups and compliance infractions [28].

Continuous Learning and Optimization, Arguably the most important characteristics of AI agents, may be their ability to learn & adapt. Through closely managing the carrier engagement rate, the booking result, and the effectiveness of the communication, they steadily improve their approach by optimizing subject lines, email content, tone, and timing to ensure the highest possible conversion. The future the AI agent gets better over time at both messaging and exercising strategy keeping brokers ahead in increasingly competitive markets [29].

AI Agents in Carrier Operations

AI agents in carrier operations are reshaping how freight is evaluated, accepted, and executed. From intelligent load filtering and autonomous negotiations to document automation and risk mitigation, these agents empower carriers with real-time intelligence and actionable recommendations. The result is a leaner, smarter, and more responsive logistics operation equipped to thrive in a competitive and data-driven freight ecosystem [30].

Smart Load Evaluation and Prioritization, AI agents assist carrier dispatchers in the rapid review of incoming load offers by autonomously modeling the route compatibility, equipment availability, delivery times, and return on investment of the loads. Instead of a human slogging through hundreds of load board offers or brokerage emails, an AI agent can pre-sort and rank where the most effective load should end up based upon the fleet's current location, driver hours and historical lane performance. This reduces decision fatigue and allows dispatchers to be focused on the highest yield opportunities [31].

Automated Rate Assessment, Brokerage load offers that come over with proposed rates are being benchmarked against real time spot market data or internal pricing models by AI agents in the carrier operations. This enables carriers to quickly see available bids, those that are underlisted or that they can bid on more with since lanes, etc. The agent also has the power to

recommend a competitive, yet profitable counter offers for faster deal cycles and better revenue optimization [32].

Autonomous Response Handling, AI agents are configured to automatically generate responses to load offers accepting, rejecting, or counter-offer-making subject to predetermined criteria, such as minimum rate thresholds, driver availability, and regional constraints. It lowers respondent lag as well as expands the likelihood of gaining the desired freight (especially in fast-moving spot markets) [33].

Fraud and Risk Mitigation, Because of the emergence of double brokering and identity spoofing, AI agents are also crucial for verifying the authenticity of freight offers. AI agents can flag problematic freight opportunities by cross-referencing the broker's MC/DOT number, insurance status, communication habits, and known fraud databases. This provides carriers an additional layer of security prior to taking loads, shielding from adverse reputational and financial outcomes [34].

Driver Dispatch Optimization, Real time dispatch planning may be aided by AI agents to match available drivers and equipment to loads that have been confirmed, taking into account hours of service (HOS) regulations, weather predictions, and delivery restrictions. Agent can determine best pickup and drop-off sequencing, including consideration of cost-efficient fuel, dwell time patterns resulting in greater asset utilization and on-time delivery [35].

Document Processing and Compliance, Indeed, a lot of documents flow through the hands of carriers as part of rate confirmations, PODs, and equipment inspections. AI agents can auto read, extract, validate, and route this documentation into fleet management or payroll systems. This removes the need for manual data entry, it helps adhere to brokerage agreements and payment cycles are even faster [36].

Proactive Load Management, AI agents track live shipment information around the clock with GPS pings, ELD logs, and event updates. And when a delay, exception, or need for rerouting occurs, the agent can proactively contact the broker, propose alternatives, or send notification of delay. This enhances the reputation of the carrier and develops better trust relationship with its shipping partners by minimizing the information gap in transit [37].

Carrier Operations Intelligence, AI agents can deliver operational intelligence that reveals which brokers are the most trustworthy, which lanes deliver the best margins, or which drivers consistently exceed performance expectations. These intelligence in turn help fleet managers to plan strategically on network expansion, pricing strategies, partner relationships and usage patterns [38].

Scenarios, with Sample Data
AI Agents in Freight Brokerage, Scenarios with Sample Data:

Table 1: Carrier reachout scenario and AI agents actions

Function Category	AI Agent Capability	Scenario with Sample Data	AI Agent Action & Outcome
Carrier Outreach Automation	Personalized Load Offer Generation	Load: Chicago, IL → Dallas, TX 48,000 lbs, dry van Pick-up: May 8, 9 AM Target rate: $2.25/mile	AI Agent drafts tailored emails to 200 preferred carriers, based on past performance on this lane and current availability
	Smart Carrier Segmentation	1,000 carriers in CRM Filter by dry van, Midwest-to-South lanes, DOT rating > 90%	Narrows down to 200 qualified contacts, reducing noise and improving response efficiency
Response Management	Email Parsing & Classification	Carrier replies: "Can do for $2.40/mile, pickup window flexible"	AI classifies this as a counteroffer, logs proposed rate, and updates the broker dashboard for review
	Auto-Replies to FAQs	Carrier asks: "Is this live load or drop-and-hook?"	AI reads context and replies: "This is a live load with a 1-hour detention grace period. Facility open 6 AM to 4 PM."
Rate Intelligence	Market Benchmarking	DAT average: $2.28/mile Broker target: $2.25/mile Carrier counter: $2.40	AI flags the counter as high and recommends a midpoint offer at $2.32, backed by real-time market analytics
	Counteroffer Strategy Generation	Carrier sends: "We are good to take it at $2.40."	AI Agent responds: "We can extend offer $2.32 with fuel surcharge and quick pay. Can you confirm by 3 PM?"
Carrier Matching & Prioritization	Intelligent Carrier Recommendation	Carrier A: 98% on-time on this lane, $2.30 rate Carrier B: $2.25, but 3 recent fall-offs	AI recommends Carrier A based on service reliability and lane history, despite slightly higher rate
	Load Risk Prioritization	Load X has < 3 hours to pickup, no carrier confirmed Load Y has 24 hours buffer	AI flags Load X as high-risk, reruns outreach to top-tier carriers and escalates to broker dashboard
TMS/CRM Integration	Load Status Updates	Carrier confirms via email: "We're booked for PU at 9 AM, May 8."	AI auto-updates load status to "Covered" in TMS and marks contact as "Responded – Confirmed" in CRM
	CRM Logging & Compliance Tracking	Booking completed with Carrier ABC Email thread: 6 exchanges Rate: $2.28/mile	AI logs all communication, stores rate confirmation in the document folder, and updates compliance tracker

Exception Handling	Escalation Alerts	Carrier initially confirmed but hasn't sent driver info 4 hours before pickup	AI detects exception, sends reminder to carrier, and flags load as "At Risk" for manual follow-up
Fraud & Vetting	Carrier Risk Screening	New carrier responds with Gmail address, missing MC link, rate well below market average	AI checks FMCSA database, finds inactive MC number, and blocks load assignment while alerting compliance team
Optimization & Learning	Adaptive Outreach Timing	Past data: Carrier X replies fastest to bids sent between 8–10 AM	AI adjusts send-time for this carrier to 8:30 AM in future campaigns, increasing open and response rates

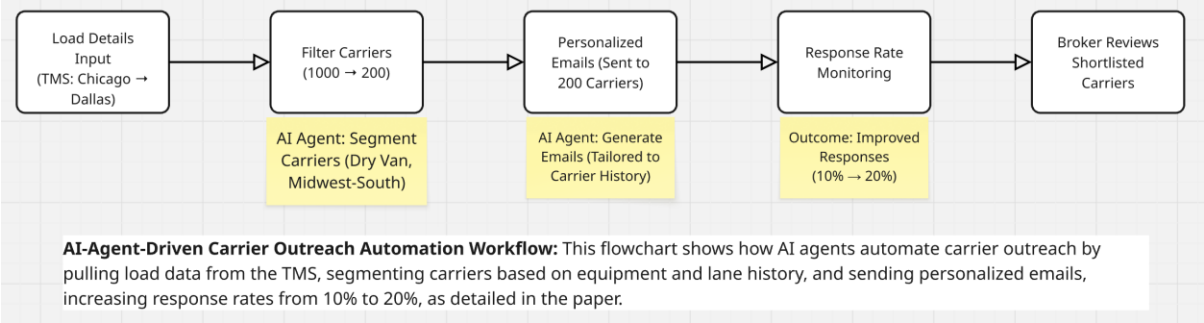

Figure 1 Step by step workflow of carrier outreach

AI Agents in Carrier Operations – Scenario with Sample Data:

Table 1: Carrier operations process in freight brokerage

Function Category	AI Agent Capability	Sample Scenario / Data	Key Benefits
Load Evaluation & Matching	Smart Load Prioritization	Carrier receives 100 load offers/day; Agent filters top 10 based on fleet fit	Faster decision-making, reduced dispatcher workload
Rate Optimization	Automated Rate Assessment	Offered rate: $2.20/mi; DAT market avg: $2.50/mi → agent flags underpriced offer	Prevents underpriced freight, improves profitability
Rate Optimization	Dynamic Counteroffer Generation	Carrier minimum: $2.40/mi; agent counters broker's $2.20 with $2.38 intelligently	Improves booking efficiency and maintains margins
Autonomous Communication	Auto Response to Load Offers	Agent replies to broker: "Available at 10 AM, $2.38/mi, 53' dry van ready"	Shortens reply time, improves broker experience
Fraud Detection & Vetting	Broker Verification	New broker's MC# inactive on FMCSA → flagged for manual review	Mitigates risk of double brokering and fraud
Dispatch Optimization	Driver Assignment & Route Planning	Truck in St. Louis with HOS available; agent suggests optimal load to Dallas	Increases utilization, improves on-time performance

Compliance & Documentation	Document Processing	POD scanned at delivery, agent logs and submits to accounting automatically	Speeds up billing and improves data accuracy
Exception Management	Proactive Load Monitoring	Driver ETA slips due to weather; agent alerts broker with updated arrival time	Enhances visibility and builds broker trust
Operational Intelligence	Lane & Partner Analytics	Lane Dallas → Atlanta: 97% on-time rate, $2.45/mi avg → flagged as preferred	Supports strategic planning and partner selection

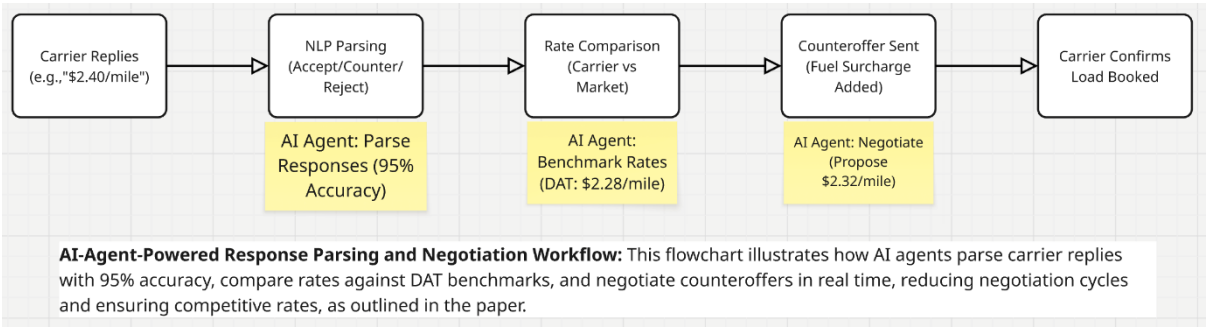

Figure 2 Step by step AI agents carrier reachout workflow

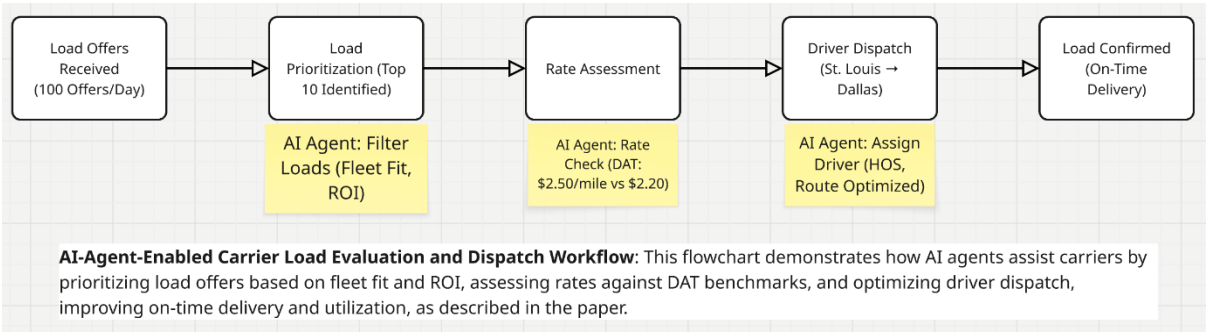

Figure 3 Step by step load evaluation and dispatch workflow

AI Agents Outreach Workflow Steps:

Table 3: Carrier outreach workflow steps

Step	Freight Brokerage (Outreach Workflow)	Carrier Operations (Response Workflow)
1	Load Data Ingestion: AI agent pulls available loads from TMS	Load Offer Reception: Carrier receives personalized bid offers from brokers
2	Carrier Segmentation: Filters carriers by equipment, lane, compliance, and history	Initial Screening: Agent evaluates load based on location, equipment match, and timeline
3	Personalized Outreach: Generates and sends tailored load offer emails	Rate Evaluation: Compares offer rate with DAT/internal minimum acceptable thresholds
4	Response Classification: Parses replies (accept, counter, reject, query) using NLP	Auto-Response/Counter: Accepts or negotiates based on preset criteria
5	Negotiation & Rate Matching: Benchmarks carrier rate, auto-generates counteroffers	Fraud Check: Validates broker MC/DOT, insurance, and flags anomalies

6	Booking & TMS Update: Confirms carrier, books load, and updates status in TMS	Load Confirmation: Sends confirmation, preferred driver info, and ELD integration
7	Exception Handling: Flags no-response or delays for escalation	Dispatch Coordination: Matches load to available truck/driver based on HOS, routing, etc.
8	Performance Logging: Stores engagement, rates, and success rates for future learning	Document Automation: Processes BOL, POD, and updates accounting/CRM systems

Future Scope

The future of freight brokerage is being completely reimagined by the emergence of AI agents that will serve as the central force behind autonomous, intelligent brokerage actions. Today's AI Agents are currently involved in automating outreach, inbox parsing and usury level negotiations on rates, the next generation of AI Agents "will have more autonomy and decision intelligence, they will be more contextual". Th industry will see soon brokerage firms operate multi-agent systems, one for dynamic pricing, one for real-time carrier vetting, another one for SLA compliance, another for lane performance analysis, and probably one formed to predict risk.

These agents will work in concert, leveraging reinforcement learning and domain-focused language models to inform real-time load coverage decisions that integrate weather forecasts, traffic congestion, fuel costs, and shifting market capacity dynamics.

Moreover, AI agents combined with blockchain-enabled smart contracts will empower unalterable, self-executing freight contracts that can automate rate integrity, accessorial dispute resolution and payment reconciliation eliminating the need for brokerage. This will also facilitate full traceability and auditability, a game changer for high-complianceindustries such as pharmaceuticals, automotive, and cross-border freight. TMS and CRM systems will be just one system that Agents will interface with, along with load boards (externally), compliance (FMCSA, etc) and carriers directly, creating a complete digitally connected brokerage ecosystem.

Concurrently, developments in explainable AI and AI ethics will mean decisions that agents make, “why not to accept a carrier or why to flag a load as risky” for example, can be communicated transparently to stakeholders. More so, AI agents will increasingly develop behavioral intelligence by learning from carrier responsiveness patterns, preferred communication styles, and historical reliability to customize engagement and strengthen longer-term carrier loyalty.

Strategically, this will enable freight brokerages to grow their operations exponentially without having to scale headcount in a linear fashion. Take for example that one AI-enabled brokerage coordinator could accomplish what currently takes an operations team to performs autonomously with load tendering, rate quoting, dispatch confirmation and issue escalation.

As technology reaches maturity, brokerages using AI agents will move beyond the traditional role of a broker and toward a new era of on-demand orchestration which enables them to cover more loads, faster, and with more margin and transparency, and less friction in operations.

Challenges and Considerations

These innovations in the freight brokerage and carrier operations is not without any challenges.

Here are few challenges which the industry must overcome in order to harness the full potential of AI Agents.

Data Fragmentation and Quality, The fragmented nature of logistics data makes it one of the primary impediments to AI agent performance. Freight data lies on different systems including TMS, CRMs, emails, spreadsheets, and external load boards. Inconsistent formats, missing fields, or outdated records will compromise the quality of AI-driven decisions.

- Consideration: Systems should have clean, contextualized, and up-to-date data. Implement robust data pipelines, normalization protocols and real-time syncing across systems.

*Model Hallucination and Misinterpretation***,** LLMs, which power many AI agents, can produce convincing but wrong outputs because they are factually incorrect. This is particularly so if they misinterpret an ambiguous reply or try to interpret an unstructured document like a rate confirmation or service agreement.

- Consideration: Integrate Retrieval-Augmented Generation (RAG), incorporate rule-based validation layers, and employ human-in-the-loop oversight for high-impact or contract-sensitive workflows.

Integration with Legacy Systems, Most freight brokers work on old TMS platforms with limited API access or custom solutions that were not meant to be seamlessly integrated. to support AI in real time.

- Consideration: Middleware layers, microservices, and AI orchestration platforms (such as LangChain or CrewAI) that permit AI agents to interface with existing infrastructure without needing a complete system overhaul.

Lack of Explainability and Trust, AI agents now and then make decisions that are not intuitively clear to the users. For example, rejecting a carrier or escalating a rate. This lack of explainability leads to hesitancy in adopting it, especially in high-stakes situations.

- Consideration: Use methods of explainable AI (XAI) to produce reason along with every decision and create debugging trails that are clear enough for users to follow and check.

Agent Drift and Maintenance Overhead, Market dynamics, carrier behavior, and operational parameters transform constantly. Thus, AI agents require continuous adjustment and surveillance to accommodate such changes. Otherwise, performance may degrade or move off its optimal path.

- Consideration: Implement a life cycle management process for agents, including constant fine-tuning, performance analytics, and automatic alerting to anomalies.

Ethical Use and Bias Risks, AI agents trained on historical depth. existing data might unintentionally recreate prejudice, such as holding preferences for carriers or geographies based on incomplete criteria. This can stifle diversity, fairness and market access.

- Consideration: Use ethical AI frameworks, execute fairness audits and regularly inspect decision logs for accidental discriminatory models.

Cybersecurity and Data Privacy, AI agents deal with delicate data such as pricing, carrier compliance and client contracts. Agents or APIs that are not securely guarded can open the company to data breaches as well as breaking regulations (e.g., GDPR, CCPA).

- Consideration: Use role-based access control, data encryption, redaction and private LLM deployments for a while to fully safeguard data and integrity

Adoption Curve and Workforce Change Management, AI agents can lead to a fear of job displacement or confusion among existing teams, resulting in lack of adoption. Ignorance of the workings of AI can thus also reduce trust in technology as well as slow down its roll-out progress.

- Consideration: Invest in training programs, develop co-pilot models which further rather than supplant users initially, and clearly explain how agents help-not end the efficiency of brokers.

Regulatory and Contractual Compliance, AI agents handling automated communications, bidding and documentation are required to adhere to contractual obligations, industry regulations, codes of practice and standards. If automation goes wrong it can lead to contractual breaches or court cases.

- Consideration: Build contractual constraints into agent prompts and workflows and apply conditional “approver” gates when a contract- sensitive operation is called.

CONCLUSION

As AI agents step out to automate, optimize and expand the scale of delivery services, the freight brokerage industry is going through a great transformation. AI agents streamline tasks such as carrier outreach, rate negotiation and response data management, and documentation processing. And this means greatly reducing manual effort with unexceptional precision and faster processing times to boot. Meanwhile, all this comes on the backdrop of LLMs (Large Language Models), which allow such systems to comprehend context, interpret unstructured data and reply in natural language. Consequently, intelligence can now be brought to bear on what was once an extremely manual, reactive process.

Beyond simple automation, AI agents make it possible for brokers to improve decision-making by integrating data from Transportation Management Systems (TMS), market indices and historical trends. They assist carriers in choosing the best-fitting routes, optimizing price policies, handling exceptions and even preventing fraud--all in real-time. Once an integral part

of the brokerage tech stack, AI agents work together with colleagues as cooperative partners; they perpetually learn and improve until modern shipping operation's dynamic needs are met.

Looking ahead, freight brokerage's tomorrow will be defined by progressively self-propelled, proactive AI ecosystems that serve as intelligent layers of orchestration. The more multi-agent systems are tied together whether via blockchains, IoT or predictive analytics the less people brokers will need to run a 24/7 operation with exceptional transparency and profitability. Being responsible for introducing these technologies, freight companies can not only get a thousand-fold efficiency increase but also take this opportunity to create a future-proofing in rapidly digitalizing networks for goods supply.

References

[1] Acocella, A., & Caplice, C. (2023). Research on truckload transportation procurement: A review, framework, and future research agenda. Journal of Business Logistics, 44(2), 228-256.

[2] Alacam, S., & Sencer, A. (2021). Using blockchain technology to foster collaboration among shippers and carriers in the trucking industry: A design science research approach. Logistics, 5(2), 37.

[3] Bajwa, N., Prewett, K., & Shavers, C. L. (2020). Is your supply chain ready to embrace blockchain. Journal of Corporate Accounting & Finance, 31(2), 54-64.

[4] Bozorbekov, A. (2023). Railway transport terminology: From ancient layers to new layers. Journal of Language and Linguistics, 6(4), 114-117.

[5] Caplice, C. (2021). Reducing uncertainty in freight transportation procurement. Journal of Supply Chain Management, Logistics and Procurement, 4(2), 137-155.

[6] Fedorova, N. V., Kukartsev, V. V., Tynchenko, V. S., Atluhanov, S. M., Gek, D. K., & Zagudaylova, E. A. (2019, August). Problems of the digital economy development in the transport industry. In IOP Conference Series: Earth and Environmental Science, 315(3), 032047. IOP Publishing.

[7] Ferrell, W., Ellis, K., Kaminsky, P., & Rainwater, C. (2020). Horizontal collaboration: Opportunities for improved logistics planning. International Journal of Production Research, 58(14), 4267-4284.

[8] Freichel, S. L., Wörtge, J. K., Haas, A., & ter Veer, L. (2022). Cargo accumulation risks in maritime supply chains: A new perspective towards risk management for theory, and recommendations for the insurance industry and cargo shippers. Logistics Research, 15(1), 1-19.

[9] Hataley, T. (2020). Trade-based money laundering: Organized crime, learning and international trade. Journal of Money Laundering Control, 23(3), 651-661.

[10] Hernández-León, R. (2023). The work that brokers do: The skills, competences and know-how of intermediaries in the H-2 visa programme. In The question of skill in cross-border labour mobilities (pp. 105-122). Routledge.

[11] Herold, D. M., Fahimnia, B., & Breitbarth, T. (2023). The digital freight forwarder and the incumbent: A framework to examine disruptive potentials of digital platforms. Transportation Research Part E: Logistics and Transportation Review, 176, 103214.

[12] Isaienko, V., Hryhorak, M., Bugayko, D., & Zamiar, Z. (2020). Ecosystem approach to the formation of goods express delivery supply chains in aviation logistics. Logistics and Transport, 45(1-2), 19-42.

[13] Karam, A., Reinau, K. H., & Østergaard, C. R. (2021). Horizontal collaboration in the freight transport sector: Barrier and decision-making frameworks. European Transport Research Review, 13(1), 53.

[14] Lamont-Black, S. (2019). Freight forwarders' house bills of lading—Myth, facts and hope. [Specify publisher or source if available].

[15] Magliocca, P., Herold, D. M. M., Canestrino, R., Temperini, V., & Albino, V. (2023). The role of start-ups as knowledge brokers: A supply chain ecosystem perspective. Journal of Knowledge Management, 27(10), 2625-2641.

[16] Martinus, K., Sigler, T., Iacopini, I., & Derudder, B. (2021). The brokerage role of small states and territories in global corporate networks. Growth and Change, 52(1), 12-28.

[17] Monios, J. (2019). Geographies of governance in the freight transport sector: The British case. Transportation Research Part A: Policy and Practice, 121, 295-308.

[18] Nikolaieva, L., Yarmolovych, Y., Haichenia, O., & Omelchenko, T. (2025). The study on the prospects for ship chartering market virtualisation. Transactions on Maritime Science, 14(1).

[19] Ozkan, N. (2020). Fostering digital marketplaces in logistics and supply chain: Trends and opportunities (Doctoral dissertation). Politecnico di Torino.

[20] Perkušić, M., Jozipović, Š., & Piplica, D. (2020). The need for legal regulation of blockchain and smart contracts in the shipping industry. Transactions on Maritime Science, 9(2), 365-373.

[21] Perrotta, D., & Raeymaekers, T. (2023). Caporalato capitalism: Labour brokerage and agrarian change in a Mediterranean society. The Journal of Peasant Studies, 50(5), 2002-2023.

[22] Prompatanapak, A. (n.d.). Managing changes and risk in seafood supply chain: A case study from Thailand. Aquaculture, 525, 735318.

[23] Ramdurai, B. (2025). Large language models (LLMs), retrieval-augmented generation (RAG) systems, and convolutional neural networks (CNNs) in application systems. International Journal of Marketing and Technology, 15(1).

[24] Ramdurai, B., & Adhithya, P. (2023). The impact, advancements and applications of generative AI. International Journal of Computer Science and Engineering, 10(6), 1-8.

[25] Reardon, T., Liverpool-Tasie, L. S. O., & Minten, B. (2021). Quiet revolution by SMEs in the midstream of value chains in developing regions: Wholesale markets, wholesalers, logistics, and processing. Food Security, 13, 1577-1594.

[26] Selvaprabhu, P. (2023). An examination of distributed and decentralized systems for trustworthy control of supply chains. IEEE Access, 11, 137025-137052.

[27] Sheffi, Y. (2023). The magic conveyor belt: Supply chains, AI, and the future of work. MIT CTL Media.

[28] Skochylias, R. V., & Skochylias, N. V. (2024). Analysis of the relationship between supply chain management and outsourcing strategies in freight transportation. The Actual Problems of Regional Economy Development, 1(20), 144-163.

[29] Standing, C., Standing, S., & Biermann, S. (2019). The implications of the sharing economy for transport. Transport Reviews, 39(2), 226-242.

[30] Stojanović, Đ., & Veličković, M. (2019). Freight forwarding industry—the contemporary role and development trends in Serbia. In 4th Logistics International Conference (Vol. 135).

[31] Sys, C., Van de Voorde, E., Vanelslander, T., & van Hassel, E. (2020). Pathways for a sustainable future inland water transport: A case study for the European inland navigation sector. Case Studies on Transport Policy, 8(3), 686-699.

[32] Tijan, E., Jović, M., Jardas, M., & Gulić, M. (2019). The single window concept in international trade, transport and seaports. Pomorstvo, 33(2), 130-139.

[33] Tsioumas, V., Stavroulakis, P. J., Vasilopoulos, D., & Papadimitriou, S. (2023). The role of shipbrokers in sustainable maritime clusters: A quantitative approach towards digitalization. Cleaner Logistics and Supply Chain, 8, 100114.

[34] Wijewickrama, M. K. C. S., Rameezdeen, R., & Chileshe, N. (2021). Information brokerage for circular economy in the construction industry: A systematic literature review. Journal of Cleaner Production, 313, 127938.

[35] Zhou, Z., & Wan, X. (2022). Does the sharing economy technology disrupt incumbents? Exploring the influences of mobile digital freight matching platforms on road freight logistics firms. Production and Operations Management, 31(1), 117-137.

[36] Ziyadullaev, D. (2024). The transformative influence and efficacy of digital platforms on road freight logistics and supply chain dynamics (Doctoral dissertation). Alpen-Adria-Universität Klagenfurt.