

AI in our industry

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Executive summary



- AI + sensor fusion + robotics unlocks **higher recovery (single-digit to double-digit % points)** from mixed or residue lines — this is the single biggest measurable commercial win.
- Typical commercial pilot metrics reported in vendor/customer materials: **+10% recovery** on targeted fractions (AMP / RDS of Virginia), **2× PET recovery** in a bottle-to-bottle case (AMP / Evergreen), and mixed-waste recovery **as high as ~74%** in a TOMRA-enabled plant (ROAF). These translate directly to incremental revenue and often rapid payback.
- Practical ROI windows reported in industry coverage and vendor summaries commonly fall in the **12–24 month** range for well-scoped robotic + AI installations; several ZenRobotics customers and industry articles cite **~12–18 months** payback for robotics-driven projects.

High-impact use cases



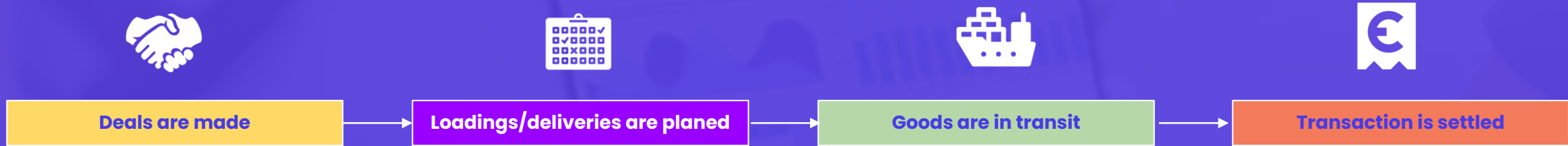
- Sensor-based **optical + NIR sorting** (classify plastics, non-ferrous metals, stainless).
- Eddy-current & induction + ML-assisted tuning for **better aluminium/copper recovery**.
- **Robotic pick-and-place** for last-chance and residue lines (high dexterity picking).
- **Predictive maintenance** for shredders, conveyors, magnets using condition data.
- **Material-stream analytics** & dynamic line control (real-time composition dashboards).
- **Safety**: AI cameras & analytics to reduce manual exposure to hazardous zones.
- **Inventory forecasting** and management
- **Price forecasting**
- **Hedging management** and execution

About Jules

Jules AI is a **trade automation software** built specifically for the recycled materials industry, with a strong emphasis on international trade.

Solution Area	AI/ML Functionality	Value to Recyclers/Traders
Trade Automation	AI-Powered Process Automation: Auto-generates tasks, perfects international trade documents (like Bills of Lading) in one click , and performs auto-control of key shipping documents (e.g., controlling BLs).	Reduces processing time by up to 7x compared to manual, paper-heavy systems, slashing back-office workload and ensuring compliance.
Risk Management	Predictive Margin Protection: Provides live position and aging reports and uses smart alerts for factors that affect margin, such as light weight loading or unexpected logistic cost increases.	Protects profitability by enabling real-time intervention to avoid costly claims and contract disputes.
Market Intelligence	AI Insights & Dashboards: Consolidates data from contracts, logistics, finance, and procurement into 150+ dashboards . Users can directly ask Jules questions in natural language.	Provides traders with real-time, consolidated business intelligence (e.g., forecasted costs down to the load level) to support faster, higher-value decision-making.
Overall Model	SaaS / Digital Supply Chain Execution	Focuses on digitizing the messy, paper-heavy workflow of the global \$1 trillion scrap industry.

Jules modules vs. transaction execution



JULES MODULES



CUSTOMER & SUPPLIER PORTAL (doc sharing, tracking communication)

LIVE REPORTS AND ALERTS (BI)

TASK MANAGEMENT

Getting a proper BL (100 to 1000x per month)

Without Jules: 60 min. Of labor

What	Step	Time
Input loading details in spreadsheet to prepare packing list & docs	Manually enter c. 360 data points	20 minutes
Prepare and send shipping instructions using email	Check booking and order details then update Excel template and Generate a PDF & send by email	5 minutes
Prepare invoice in invoicing software	60 data points and enter manually invoice header info	10 minutes
Verify Bill of Lading Draft sent as a response by forwarder	Check both PDF after printing them	10 minutes
Approve BL and send customer documents	Fill all the other docs required (3 to 7 docs) in Excel template & send	15 minutes
Total		60 minutes



With Jules: 10 min. Of labor

What	Step	Time (minutes)
Input loading details in Jules	Drag and drop PDF packing list & verify data	3
Send shipping instructions to forwarder	Click on send email, email is auto-created and attach Shipping instructions PDF	2
Verify Bill of Lading Draft sent as a response by forwarder	Drop into AI agent work queue and wait for results	2
Approve BL and send customer documents	Create the commercial invoice & click on "Share on portal"	4
Total		11 minutes

/6

Value proposition

2x back-office productivity gains

Example: Customer Weber Rohstoff who was able to divide back-office staff from 3 to 1.5 and keep same volumes.

Reduced errors

Example: one customer reduced their Demurrage and Detention charges by 50% from 2023 to 2024

Better decisions

Example: customer Helco Trade increased their domestic sales contract fulfillment rate from 92% to 98%, generating an extra \$40,000 in margin for the year (based on an annual sales volume of 120,000 MT). This improvement was achieved thanks to live Jules alerts and reports



Improving back office

\$3/t to \$10/t back-office cost

Back-office overhead cost eat ~ 50% of the margin post logistics & documentation between \$3/t to \$10/t



70%–90% of transaction can be automated

From Jules data on more than 2,000,000mt traded annually only 10% of volumes go through long claim process or major route changes



1 billion tons traded annually

According to the BIR, recycled commodities represent 40% of global supply and 1,200 million tons. As a result, the overall consumption of industrial commodities (recycled and virgin) is 3,000 million tons out of which at least 30% is traded.



\$2.1Bn to \$9bn

of financial loss per year due to back-office inefficiencies

Summary



- Complete software to **record every step of the transaction** including order, logistics, documentation
- For **all modes and types**: bulk, containers, trucking, fixed/spot etc.
- AI powered **automation for data entry** (orders, packing list, bookings..) **and documentation verification** (BLs, LCs...)
- **AI agents** performing certain business processes such as sending invoice
- Automated reporting, alerting, dashboarding, container tracking
- Accounting integrations

Note:

What is most important to enable AI automation and agents is having a lot of context and **having clear boundaries to avoid mistakes**, so having them **operate like “interns”, “junior employees”** in a structured software with clear permissions **is the only way to actually deliver results that are predictable**. This context piece is the most important and a lot of the work is to improve the user interface and the background behind the application to make it AI agent friendly

Current focus is really on the lowest value tasks such as data entry, doc verification, email writing, and some interactivity through chat and natural language. Later on Jules AI will automate allocations and in all areas of the trading business.

AI in our industry

Key players



	AI/ML Solution	Scrap Metal Use Case
AMP Robotics	AMP Vision™ (AI/Computer Vision) & AMP Delta (Robotics)	High-speed Robotic Sorting: Robots identify and pick high-value materials like aluminum, copper, and brass from mixed scrap streams (e.g., ASR – Automotive Shredder Residue) at high speeds and accuracy. They have a system recovery rate of 90%+ without human intervention.
ZenRobotics	ZenBrain™ (AI) & Heavy Picker/Fast Picker (Robotics)	Heavy Scrap Sorting & Purification: Heavy Picker robots are deployed in challenging environments like steel scrap yards. They use AI to identify and remove contaminants such as copper "meatballs," wires, and trash from ferrous metals, ensuring the purity of recycled steel (a critical task to meet purity standards like <0.1% copper).
TOMRA Sorting	Deep Learning/Sensor Fusion	Advanced Metal Separation: Integrates deep learning into their sensor-based sorting machines (e.g., using X-Ray Transmission, NIR, and LIBS) to identify complex or previously non-sortable metal fractions and alloys, significantly enhancing recovery from waste streams like zorba (shredded non-ferrous metals).
Steinert	FINDER / UniSort BlackEye	Sensor-Based Sorting: Utilizes sensor-based systems, increasingly integrating AI and deep learning to identify and separate a wide array of metals and materials, even difficult-to-sort "black" plastics from the metal stream, enhancing the overall quality and value of the recycled output.
Danieli	AI for Smelting/Melt Optimization	Operational Intelligence (Non-Sorting): Focuses on using AI to optimize downstream processes. Their AI systems analyze scrap input quality and plant conditions to optimize the electric arc furnace (EAF) melting process, leading to reduced energy consumption and improved final metal quality .
MSS Optical	Optical Sorters with Deep Learning	Precision Alloy Separation: Deploys optical sorters with machine learning to achieve highly accurate, single-pass separation of non-ferrous metals (like different grades of aluminum) at high throughputs, maximizing the value of each sorted stream.

Highlights



AMP Robotics (AMP Cortex & Neuron): High-speed robotic arm system, proving AI's scale-up capacity with up to **120 picks per minute at 99% accuracy**.

ZenRobotics (Heavy Picker): AI and robotics to separate ferrous and non-ferrous metals with high precision, notably removing copper contamination from steel scrap.

TOMRA Sorting (Deep Learning Integration): Uses Deep Learning to analyze X-ray, NIR, and visual data, enabling the separation of highly complex metal materials and granular alloys, maximizing recovery rates.

WeSort.AI (High Granularity): Identifies **7 million + product types** and detects high-risk contaminants like **lithium-ion batteries**, significantly reducing facility fire risk.

EverSteel (Computer Vision): Uses AI to classify scrap metal into **20+ alloy categories**, filtering out impurities at the start of the recycling process.

Case study: Robotic sorting AMP

Metric	Case Study	Impact
% Recovery	A facility using AMP Robotics' systems achieved a 90%+ recovery rate of targeted materials (like specific aluminum alloys) from a mixed stream previously reliant on less effective mechanical separation.	Recovery of high-value non-ferrous metals dramatically increased, creating a new, consistent revenue stream from material previously sent to landfill or low-grade outputs.
Time Saved / Throughput	The robot systems process material at speeds 3-4 times faster than human sorters (e.g., 150+ picks per minute versus 40-60).	The overall processing time for a given volume of scrap metal was significantly reduced, allowing the facility to handle a greater total capacity .
Costs Reduced / ROI	A typical installation for high-speed robotic sorters can yield a Return on Investment (ROI) in as little as 12 to 24 months through the combined effect of higher revenue from purer metals and significant cost savings from reduced labor and disposal fees.	The deployment created a strong financial argument by moving from a cost-center activity (manual sorting, disposal) to a high-margin recovery operation.

AI in the yard



AI/ML implementation in the scrap metal industry extends far beyond the sorting line, integrating into operational control, quality assurance, logistics, and upstream processing.

Company	AI/ML Solution	Scrap Metal Use Case & Impact
Tecnoap / SCRAPYARD	SCRAPYARD Platform (AI/Computer Vision)	Intelligent Yard Management & Inbound Quality: Uses AI and vision analytics to classify incoming scrap into over 20 categories, verify truckload weights and load density, and accurately document material location in the yard. <i>Impact:</i> Reduces uncertainty and human bias in scrap grading at the gate, which is critical for accurate purchasing and planning.
Recycleye	RecycleOS (AI-Powered Computer Vision)	Material Classification and Data Analysis: While covering all waste streams, their AI provides highly granular material characterization. This detailed data helps scrap metal facilities constantly optimize their sorting processes and report accurate purity levels. <i>Impact:</i> Provides auditable, real-time purity metrics essential for meeting stringent downstream customer specifications.
Greyparrot	Greyparrot Analyzer (AI Waste Analytics)	Real-time Waste Stream Audit: Uses AI to monitor and audit the composition of material on the conveyor belts, especially in the residue stream. <i>Impact:</i> Helps recyclers identify valuable metals being lost to the residue stream and immediately adjust sorters, quantifying the dollar value of the loss to drive continuous process improvement.

Impacts of AI



1. Economic Benefits (Profitability & Cost Reduction)

- **Maximizing Material Value:** AI-powered sorting achieves **higher purity fractions** (e.g., cleaner steel, purer aluminum), which command a significantly **higher market price**.
- **Reduced Labor Costs:** Automation minimizes the need for manual sorters in often difficult and hazardous conditions, leading to **lower operating expenses**.
- **Higher Throughput:** Robotic sorters work **24/7 without fatigue**, processing materials at speeds of **over 150 picks per minute** (compared to 40–60 for a human sorter), drastically increasing facility capacity.
- **Minimized Contamination:** Higher accuracy sorting reduces the cost of reprocessing or disposal of rejected, contaminated batches.

2. Operational Excellence (Efficiency & Quality)

- **Continuous Improvement:** ML algorithms constantly learn from new data and material streams, improving sorting accuracy over time without manual reprogramming.
- **Real-Time Data & Analytics:** AI provides immediate insights into material composition, allowing operators to make **instant, data-driven decisions** to optimize performance and forecast material recovery.
- **Process Optimization:** AI models in areas like smelting (Danieli) optimize energy use and chemical additives based on real-time scrap composition, improving final product quality and efficiency.

3. Environmental & Safety Impacts

- **Increased Recovery Rates:** AI enables the recovery of materials that were previously too complex, small, or low-value for manual or traditional mechanical sorting.
- **Safer Work Environment:** Automating the sorting of hazardous materials (e.g., sharp metals, potentially toxic e-scrap components) moves humans away from dangerous tasks, **significantly reducing workplace incidents**.
- **Lower Carbon Footprint:** By enabling the production of higher-purity recycled metals, AI reduces the energy-intensive processing required for primary metal production, supporting circular economy goals.

AI in downstream processing



	AI/ML solution	Scrap Metal Use Case & Impact
ArcelorMittal	Internal AI Models for Scrap & Quality Control	Scrap Optimization and Recipe Planning: Develops AI models to predict the chemical composition of different scrap blends. The AI helps optimize the "scrap mix" charged into the Electric Arc Furnace (EAF) to meet final steel specifications while minimizing the use of costly virgin materials or additives. <i>Impact:</i> Leads to cost-effective scrap utilization and improved final steel quality (e.g., controlling trace elements like copper). Yard-to-Melt Optimization: Collects process data from the scrap yard (e.g., crane movements, charging records) and uses AI to evaluate it. The system provides real-time guidance to crane operators to fill scrap containers with the precise recipes and weights required for the mill. <i>Impact:</i> Enhances efficiency per ton of scrap used and reduces the variability in the charging process, improving overall steel production efficiency.
SMS Group	Scrap Management Suite (AI & Mathematical Models)	

AI in predictive maintenance



	AI/ML solution	Scrap Metal Use Case & Impact
TSR Recycling (with Bosch Rexroth)	CytroConnect PREDICT	Equipment Uptime Assurance: Deploys sensors and ML algorithms on critical, heavy-duty equipment like scrap shears and shredders . The AI analyzes data (vibration, temperature, pressure) to predict motor or hydraulic failures days or weeks in advance. <i>Impact:</i> Avoids costly, unplanned downtime for mission-critical machinery. For a large shear, downtime can cost hundreds of thousands per day, making this a high-value application.

Measurable Win:

Unlocking Value from Previously Non-Separable Material Streams and Contaminants.

The successful deployment of AI/ML allows recyclers to **monetize material that was previously classified as waste or low-value residue.**

Example (ZenRobotics/USConveyor):

The AI-powered Heavy Picker's ability to remove fine **copper wires and meatballs** from shredded steel scrap is critical. This process ensures that scrap meets the demanding **<0.1% copper purity** required by steel mills.

Without AI, meeting this standard manually is hazardous and inaccurate. The win is the **conversion of low-grade, contaminated scrap into high-value, mill-ready premium feedstock**

AI in software



	Core AI/ML Solution	Scrap Metal Use Case & Impact
Visia.ai	Material Intelligence Platform (Multimodal AI)	Inbound Quality & Auditing: Uses modular hardware (X-ray, Camera, NIR) and field-tested AI models to provide detailed, real-time data on material types and contamination. Essential for accurate pricing and compliance reporting.
Jules AI	AI-Powered Trade Automation & NLP	Supply Chain Automation & Risk: Uses AI and Natural Language Processing (NLP) to automate complex international trade documentation and provide predictive margin alerts against logistics changes or light-weight loading. Cuts back-office processing time significantly.
VALIS Insights	VALI-Sort & VALI-Melt (Integrated AI Analytics)	Quality Control & Melt Optimization: Integrates sorting equipment data with melt facility needs. VALI-Melt uses AI to analyze scrap samples and recommend the most profitable scrap blend recipes for furnace charging, ensuring consistent final metal quality.
AMCS Group	AMCS Vision AI & Route Optimization (ML)	Contamination Detection & Efficiency: Uses Computer Vision and ML on collection vehicles (Vision AI) to identify contamination in material streams at the source. Also uses ML for dynamic route optimization to cut fuel costs and time.
Greenspark, ReMatter	Impact-as-a-Service (IaaS) Platform	ESG & Sustainability Reporting: Uses an API-driven platform to automatically calculate, track, and report on a company's environmental impact (e.g., CO2 offset, plastic removal) based on their volume of recycled material.

AI in forecasting



The scrap metal industry is highly susceptible to volatility due to global trade, economic cycles, and sudden geopolitical events. AI and Machine Learning (ML) solutions are rapidly becoming indispensable tools for recyclers and metal traders to **mitigate financial risk** and **maximize profitability** through predictive analytics.

The ability to accurately forecast price movements empowers recyclers to transition from reactive trading to proactive, strategic planning.

Use Case	AI Functionality	Value Proposition (Win)
Inventory Management	Predictive Inventory Optimization: AI forecasts peak demand and price moments for specific metals (e.g., Copper, Aluminum).	Recyclers can time sales to periods of anticipated price spikes, maximizing revenue, and optimize storage costs by reducing unnecessary inventory holding during low-price periods.
Purchasing Strategy	Smart Bidding/Pricing Systems: AI analyzes market trends and local supply data to provide real-time recommendations for buying prices at the gate.	Increases profit margin by ensuring the company doesn't overpay for inbound scrap while remaining competitive enough to secure the material.
Risk Management	Anomaly Detection & Early Alerts: AI models detect significant deviations from expected patterns (e.g., sudden increase in price volatility).	Provides early price alerts for major market shifts (e.g., impending trade tariff or economic downturn), allowing companies to hedge risk or adjust long-term contracts <i>before</i> the market moves.

Company examples

Aurubis AG (Germany) – predictive scrap purchasing

- **Use:** internal AI models forecasting copper scrap spreads & premiums.
- **System:** ML model trained on global copper spreads, smelter utilization, freight, energy, and scrap-grade differentials.
- **Outcome:** reported ~20% improvement in purchase timing accuracy and reduced overstock/underbuy events.
- **Impact:** improved margin control by €2–4M annually (company reports, industry interviews).

Sims Metal Management (Australia/Global)

- **Use:** AI-enabled demand forecasting and metal price prediction (part of Sims Lifecycle's digital twin strategy).
- **Model:** gradient-boosted trees combining macro and transactional data for steel, copper, and aluminum scrap.
- **Outcome:** 25% improvement in forecast accuracy (internal benchmark vs. econometric baseline).
- **Impact:** better timing of exports and purchasing, reducing hedging losses.

Metric	Improvement with AI Forecasting	Real-world example
Forecast accuracy (RMSE reduction)	+15–30% vs. traditional models	Sims Metal & Aurubis
Gross margin (from better purchase timing)	+3–7%	JulesAI / VALIS pilots
Inventory turnover	+10–15% faster	Sims Metal
Hedging efficiency	+20% (lower over-hedging cost)	PillarHQ-type AI users
Melt yield / cost reduction	4–6%	VALIS Insights

AI in classification



These companies leverage AI/ML to manage and optimize business processes, quality control, and downstream manufacturing.

Company	AI/ML Solution	Successful Deployment/Impact
Integrated Recycling Technologies (IRT)	Circuit Board Classification App (Deep Learning)	Automated grading and pricing: Developing a deep-learning app that identifies and analyzes 75 board characteristics to classify PCBs into 53 categories by precious metals content. Automates the grading and valuation process at the supplier side.
Tecnoap	SCRAPYARD Platform (Vision Analytics)	Inbound scrap management: Uses AI, sensors, and machine learning to optimize operations, including advanced vision analytics for organizing, verifying weight, and classifying scrap metal upon receipt.
Sony	AITRIOS Edge-AI Sensing Platform	Real-time industrial vision: The edge-AI platform is deployed to perform real-time vision analytics for material identification, designed to improve the accuracy and efficiency of material sorting.
ABB	ABB Ability™ & Predictive Maintenance AI	Industrial process optimization: Deploys AI/ML in its digital solutions, including ABB Ability™ Smart Melt Shop and Genix Industrial Analytics and AI Suite , to predict steel melt temperature in the Electric Arc Furnace (EAF) and optimize energy use.

Why now?



The Problem (Before AI):

- **Low Purity:** Reliance on manual or basic sensor sorting leads to high contamination, lowering the price of recycled metal.
- **High Risk & Cost:** Manual sorting is slow, hazardous, and expensive due to labor costs and high turnover.
- **Complexity:** Traditional methods fail on fine, complex, or composite materials (e.g., copper wires in steel scrap).

The AI/ML Solution: Intelligent Automation. AI models learn, adapt, and make real-time decisions, transforming scrap into premium commodity feedstock.

Any questions or feedback?

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