Image: SandStar

Deploying a strong AI vending machine: 5 rules to follow

By **Steve Arel** | Contributing writer, Vending Times

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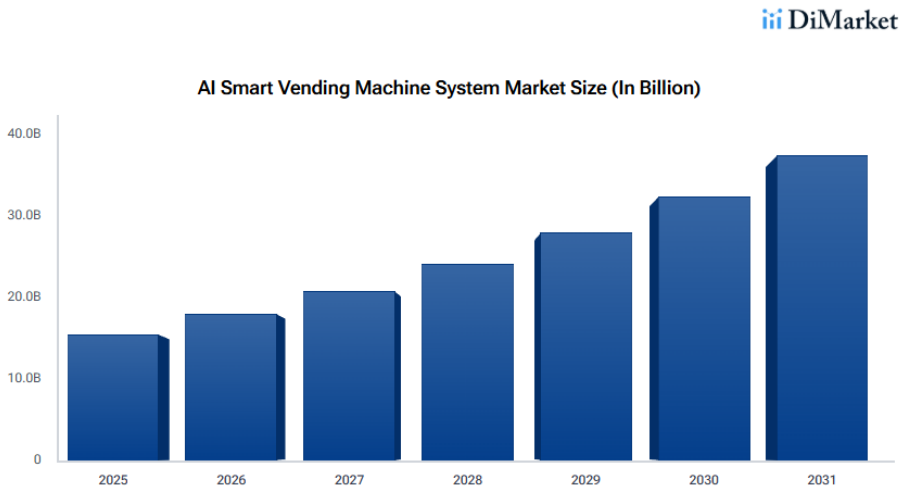
It used to be just a few years ago that discussions around artificial intelligence centered on what the technology could do eventually. Those quickly morphed into conversations about what AI will do. Today, talk is all about what AI is doing.

In the vending industry, innovative companies are combining artificial intelligence with self-service to make a once futuristic idea to expand convenience and profitability into a revolutionary reality.

Traditional vending machines have long been valued for their simplicity, but they also come with limitations such as restricted product variety, rigid pricing and limited insight into customer behavior. AI vending machines address these challenges by expanding those boundaries.



Source: DiMarket

AI-enabled vending automates transactions and provides operators with real-time visibility into sales, inventory and shopper behavior.

AI-powered vending machines are reshaping users' experience. Capitalizing on computer vision, smart sensors or cloud-based intelligence, the machines usher in frictionless shopping for consumers, lower operating costs for deployers and valuable consumer insights for strategists. However, as adoption accelerates, not all AI vending solutions deliver what deployers and consumers want.

Increasingly, AI Vending machine brands appear in markets with different types of technologies and special benefits to operators. However, many operators discover too late that accuracy issues, unstable systems, high ongoing fees, uninspiring design or theft vulnerabilities can erode margins and user trust. Deploying the right AI vending machine demands discipline as much as it does excitement about the technology.

"As consumers increasingly choose self-service, the quality of the AI experience becomes the brand experience," said Mike Kiser, president of SandStar, a leading smart retail developer. "A well-designed AI vending machine doesn't just dispense product — it delivers trust, speed and personalization.

"The AI vending evolution has opened up an array of new opportunities across offices, hospitals, residential communities, transportation hubs and retail establishments."

Image: Adobe

Innovation alone does not guarantee reliability or profitability. The measure of a good AI vending machine hinges on how it performs consistently in real-world environments. Following five simple rules – the "A" rules, if you will, solidify a foundation for evaluating AI vending solutions and ensuring long-term success.

Rule 1: Accuracy

Accuracy forms the foundation of any self-service solution, especially when it comes to an AI vending machine. AI vending relies on precise product recognition and correct transaction processing.

Customers expect to be charged correctly every time, and operators depend on accurate data to manage inventory and revenue.

Accuracy is a basic expectation. When accuracy fails, even occasionally, it undermines trust, increases support costs and damages brand credibility. Accuracy within a good AI vending machine is non-negotiable, delivering consistent and dependable results.

For operators, accuracy directly translates to revenue integrity, inventory accuracy and reduced operational overhead. For consumers, it is the most important factor that determines whether they will trust and reuse the machine. A single incorrect charge can erode customer loyalty permanently, while consistent inaccuracies will cripple an operator's business model.

The Critical Distinction: True AI vs. "Human-in-the-Loop" Pseudo-AI

A critical and often-overlooked truth in the industry is that not all AI vending machines actually use artificial intelligence for transaction recognition. There are two fundamentally different technical approaches in the market:

1. Human-in-the-Loop (HITL) Pseudo-AI

This approach does not rely on machine learning to identify products. Instead, it records the entire shopping process as a video, uploads it to a remote cloud-based order processing center and has human reviewers manually watch the video to determine items the customer took.

Image: Adobe

While this method can achieve high accuracy numbers, it comes with three fundamental and insurmountable flaws:

- Permanent per-transaction cost: Unlike AI, which has near-zero marginal cost per transaction, human review incurs a fixed cost for every single purchase. This cost never decreases, no matter how many transactions the machine processes, and it directly eats into operator margins at scale.
- Severe privacy risks: This approach requires recording and transmitting full video footage of every customer, including their face, body shape, clothing, and other biometric information. These videos are viewed by unknown third-party reviewers, creating significant privacy vulnerabilities and potential compliance issues with global data protection regulations.
- Unpredictable and unacceptable latency: The process of uploading video, waiting in a queue for human review and receiving the result introduces inherent delays. During peak hours or at high-traffic locations, this latency can range from three minutes to an extreme 24 hours. Customers are forced to wait for their transaction to complete, leading to frustration and abandoned purchases.

Image: Adobe

2. True Edge AI Visual Recognition

This is the genuine AI approach where all product recognition happens locally on the device's edge computing hardware using pre-trained deep learning models. No video footage is ever uploaded to the cloud for human review.

The primary challenge of true AI is the initial product learning curve. Just as a human needs time to learn to recognize a new object, an AI model requires training data to accurately identify new SKUs. This process can be slightly cumbersome for operators when introducing completely new products. However, this is a one-time investment: Once a product is trained into the global model, every machine in the network can recognize it instantly and accuracy only improves over time as the model sees more data.

True AI delivers lower long-term costs for operators, instant and frictionless checkout experiences for consumers, and the highest standards of privacy protection. While the product learning challenge remains, companies like SandStar are innovating to reduce training time and improve transfer learning capabilities, making true AI more accessible and powerful than ever before.

Rule 2: Anti-theft

Unattended retail must account for risk, so theft prevention is critical. According to a National Retail Federation report in 2023, the average shrinkage rate in U.S. retail is 1.6%, equivalent to over $112 billion in annual losses. In vending environments, the rate could be even higher.

Photo: SandStar

Normally, there are four most frequent theft cases in AI vending: violent door-pulling, lock-deception, camera-blocking and power-cut theft during door opening. Among them, camera-blocking is by far the most common and also the most difficult to prevent, especially for those relying on Human-in-the-Loop (HITL) Pseudo-AI. By the time such theft is identified in the recorded video, the incident has already occurred. Subsequent measures such as card blocking or blacklisting only restrict the payment card itself, yet the financial loss is irreversible. Therefore, A good AI vending machine incorporates anti-theft measures at both the technological and physical levels.

Among some of the prevention measures that can be incorporated into units:

- AI-based behavior monitoring and anomaly detection
- Transaction validation and audit trails
- Secure cabinet construction and locking mechanisms

Effective anti-theft design protects revenue without creating friction for honest customers. It also reduces shrinkage, minimizes disputes and increases operator confidence in deploying machines across diverse locations.

Security is not an add-on – it is an integral part of system design. Beyond robust hardware, dual-sensor lock protection and backup battery safeguards, SandStar's true real-time edge AI can effectively defend against camera-blocking theft — the most common and hardest-to-prevent threat in AI vending. With four diagonally mounted HD cameras providing near-360-degree coverage, the system instantly detects obstruction and immediately triggers high-frequency alarms, flashing handle warning lights and on-screen theft alerts to actively stop malicious behavior in real time. This level of instant intervention is only possible with on-board AI recognition, whereas Human-in-the-Loop (HITL) Pseudo-AI can only identify theft after the loss has already occurred.

"Theft is more than a line-item loss for vending machine operators," Kiser said. "It erodes margins, disrupts operations, increases insurance and maintenance costs, and ultimately threatens long-term sustainability. Without proactive security strategies, even small, repeated incidents can compound into significant financial and operational strain."

Rule 3: Affordability

Affordability goes beyond the initial purchase price.

A good AI vending machine must be financially sustainable over time. Total cost of ownership includes:

- Upfront hardware costs
- Ongoing SaaS or platform fees
- AI-related usage or recognition fees

Operators should evaluate how recurring fees scale with usage and expansion. Low-entry pricing may be enticing but can end up being misleading if ongoing costs shrink margins as transaction volume grows.

Providers like SandStar charge no algorithm fees, no hidden costs and no markup on transaction processing fees. Its true AI-powered model is designed to let operators keep full control of their margins without being eroded by continuous usage-based charges.

Rule 4: Assurance

Good AI vending machines must be stable, reliable and fully supported throughout its lifecycle.

Downtime results in lost revenue and, oftentimes, lost customers. Systems must consistently operate smoothly within different environments, lighting conditions and usage patterns. Stability must be present in every aspect of a solution, not just with software but also in hardware durability, system integration and resilience against real-world variables.

Post-sales support is equally important. To help ensure functionality and keep machines up, operators need:

- Responsive technical assistance
- Effective maintenance and troubleshooting processes
- Software updates that improve performance without disruption

Warranty coverage reinforces deployer confidence, protecting their investment and demonstrating the manufacturer's commitment to long-term reliability. A strong support system enables operators to deploy and scale knowing their machine will perform as expected and that timely assistance is available when needed.

Photo: SandStar

SandStar builds on that assurance with advanced software and global support. Its IoT-Powered Remote Operations (via OPS and VMS) enable remote control, real-time diagnosis, OTA updates and CV tests to reduce on-site work and boost stability. It also employs a U.S.-based support center with 24/7 global response, plus an extended warranty of three to seven years to fully protect operators' investments.

Rule 5: Attractiveness

An AI vending machine is a retail storefront. As an unattended retail terminal, its appearance directly impacts customer engagement. An attractive design draws attention, encourages impulse purchases and reinforces brand credibility. A standout unit includes:

- Modern, eye-catching exterior design
- Intuitive and welcoming user interaction
- Clear product visibility and layout

Customization and branding opportunities further enhance value, allowing operators and partners to tailor machines to specific environments or audiences.

In competitive locations, attractiveness can be the difference between being ignored and being a destination. A good AI vending machine capitalizes on both technology and retail experience.

"When technology looks inviting and intuitive, people are more likely to approach it, use it and embrace the innovation behind it," Zhao said.

Conclusion

AI vending represents a powerful evolution in retail but must be executed thoughtfully. The five rules help separate proven solutions from experimental ones.

A good AI vending machine does more than showcase technology. It delivers reliability, financial sustainability, customer appeal and operational security over the long term.

For operators, retailers and investors, following the five rules helps ensure AI vending is not just innovative but viable today and in the future.

"High-performing AI vending machines do more than automate transactions — they optimize them," Kiser said. "By reducing labor dependency, minimizing errors and delivering consistent, data-driven interactions at scale, intelligent self-service solutions become powerful tools that drive operational efficiency and increased profitability."