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CHALLENGES OF COUNTERFEITING IN PACKAGED FOODS

The Role of Authentication, Traceability and Forensics in Detection, Enforcement and Conviction

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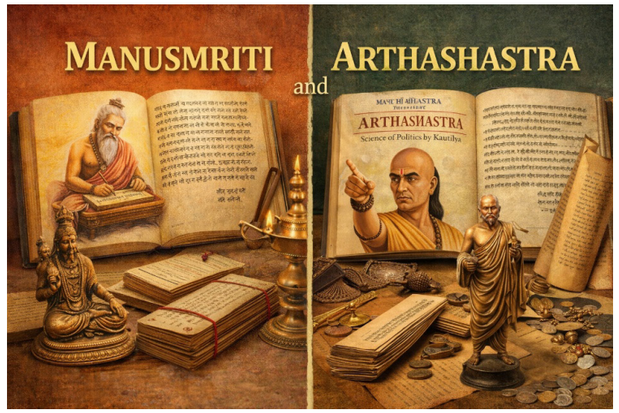
Introduction

Food adulteration and counterfeit packaged foods in India are no longer marginal regulatory issues; they constitute a structured, profit-driven form of organised economic crime with profound public health consequences. Across the country, adulterated milk, spices, edible oils, sweets and packaged foods continue to enter markets through clandestine manufacturing units and well-organised distribution networks that span wholesale mandis, transport corridors, and increasingly, online platforms. While seizures and sample failures are frequent, enforcement outcomes remain weak because investigations rarely extend beyond routine sampling, and prosecutions often stop at the last visible retail or transport link. This persistent disconnect between detection and deterrence has allowed adulteration and counterfeiting networks to operate with relative impunity.

From an industry and brand-protection perspective, food adulteration and counterfeit packaged foods represent a dual failure of market authentication and supply-chain traceability. While forensic science is indispensable for investigation and prosecution, preventive systems such as authentication, traceability, and consumer verification technologies are critical for early detection, deterrence, and scale prevention. ASPA members operate precisely at this preventive layer, strengthening the ecosystem before forensic intervention becomes necessary.

A Long Historical Perspective

Notably, concerns about food adulteration are deeply embedded in Indian governance thought. In the **Arthashastra**, attributed to **Kautilya**, adulteration and market fraud were treated as offences against public welfare and economic order, with **clearly specified punishments**: **Book IV, Chapter 2** provides that the **adulteration of grains, oils, salts, alkalis, scents, and medicinal articles with inferior substances** shall be punished with a **fine of 12 panas**, while selling **inferior goods as superior, adulterated articles, or deceitful mixtures** attracts a **fine of 54 panas plus restitution of the loss**; complementary provisions in **Book II** mandate strict supervision of **grains, weights, measures, and storage**, imposing further fines for fraud or diminution, together constituting one of the earliest systematic legal frameworks against food adulteration.



Similarly, the Manu Smriti, regarded as one of the earliest Indian legal texts, emphasises the purity and sanctity of food, and in Chapter 5, verse 5.123, expressly condemns the contamination

or corruption of food, reinforcing the idea that adulteration is not merely a commercial wrong but a moral and social offence with consequences for both individual well-being and societal order.

Magnitude of the Problem: Public Health, Economic, and Systemic Impact

The counterfeit and adulterated packaged food crisis in India represents a profound structural failure within the food supply ecosystem, extending far beyond issues of quality control or regulatory non-compliance. The rapid expansion of branded and packaged food consumption—driven by urbanisation, changing lifestyles, and widening retail penetration—has created high-volume markets that amplify the consequences of adulteration. As adulterated products increasingly infiltrate branded segments, the resulting harm is no longer localised or episodic but systemic in nature.

A defining feature of the problem is its transformation into an organised and professionalised criminal activity. Food adulteration has evolved from sporadic, small-scale practices into structured enterprises involving dedicated manufacturing units, packaging operations, logistics networks, storage facilities, and distribution channels. These operations increasingly mirror other organised economic crimes, benefiting from comparatively low penalties, limited investigative depth, and weak deterrence, which together render food counterfeiting a high-profit, low-risk activity.

From a systemic perspective, the persistence and scale of food adulteration also reflect the absence of embedded authentication and traceability mechanisms across large segments of the food supply chain. In the absence of product-level verification, batch traceability, and real-time visibility, counterfeit and adulterated foods can circulate widely before any forensic trigger is activated. This reinforces the need for preventive authentication systems as an essential complement to enforcement-led forensic action.

The public health implications are severe and largely invisible in their progression. Counterfeit and adulterated foods often contain toxic synthetic dyes, industrial chemicals, non-food-grade oils, expired or recycled ingredients, and harmful preservatives, typically produced under unhygienic conditions. Unlike acute poisoning events, the health consequences are frequently chronic and cumulative, contributing to cancers, liver and kidney damage, gastrointestinal disorders, compromised immunity, and widespread food-borne illnesses. The delayed onset of symptoms makes causation difficult to establish, allowing offenders to operate for extended periods while exposing large populations to sustained health risks.

Economically, the impact is equally damaging. Legitimate manufacturers suffer brand dilution, loss of consumer trust, erosion of market share, and increased compliance costs, while counterfeit operators evade safety standards, taxation, and accountability. Over time, this imbalance undermines confidence in regulatory institutions, weakens the formal food economy, and discourages investment in quality, safety, and innovation. Collectively, these effects establish food adulteration as a systemic threat to public health, economic integrity, and governance credibility.

Scale of the Problem: Evidence from Markets, Consumers, and Enforcement

Official surveillance and enforcement data demonstrate the extensive and persistent reach of counterfeit and adulterated packaged foods across India. Annual sampling conducted by the Food Safety and Standards Authority of India (FSSAI) consistently indicates that

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approximately 25–33% of food samples tested nationwide are non-conforming or unsafe, with recent exercises recording **over 30,000 failures from nearly 1.5 lakh samples**. Targeted enforcement campaigns at the state level—particularly in commodities such as milk, spices, and edible oils—frequently report even higher non-compliance rates, sometimes **exceeding 50%**, especially during festive periods marked by demand surges.

Market data further underscores the breadth of exposure. India's FMCG market, valued at approximately **₹4,500 billion in FY 2021**, derives nearly half its volume from packaged foods. The **CRISIL–ASPA State of Counterfeiting in India 2022** report estimates counterfeit penetration at **25–30% in FMCG and packaged food segments**. Consumer surveys reveal that **around 42% of consumers have knowingly purchased counterfeit FMCG products**, while **35% of consumers exposed to counterfeit goods were unaware at the time of purchase**, highlighting the depth of market penetration and routine consumer deception.

Judicial findings reinforce these indicators. In *In re: Public Health — Protect the Present and Safeguard the Future from Food Adulteration* (2024 SCC OnLine Raj 1752), the court cited reports indicating that **over 20% of food in India is adulterated or substandard**, with **nearly 70% of milk samples containing adulterants** such as water and detergents. The court linked this widespread prevalence to enforcement gaps, weak implementation, and insufficient scientific capacity, while affirming the constitutional obligation of the State to ensure food safety under Articles 21 and 47.

Independent investigations align with these conclusions. A Kanpur-based probe reported **nearly 70% adulteration in mustard oil samples**, while extensive adulteration has been documented in ghee, premium tea, spices, salt, flour, sugar, milk, and drinking water. Geographically, reported incidents are most concentrated in **Uttar Pradesh, Bihar, and Rajasthan**, accounting for roughly **45% of recorded cases**, followed by **Madhya Pradesh, Jharkhand, Haryana, Punjab, West Bengal, Maharashtra, and Odisha**, indicating both regional clustering and nationwide spread.

Globally, counterfeit trade is estimated at **US$509 billion**, constituting about **3.3% of world trade**. Although food fraud remains underrepresented in international seizure data, India stands out due to its high domestic prevalence, driven by a vast unorganised wholesale sector and deep penetration into tier-II and tier-III markets. This places India among the most affected countries in terms of internal consumer exposure.

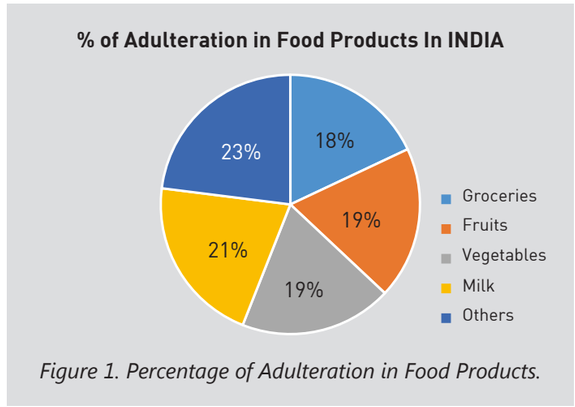

Figure 1. Percentage of Adulteration in Food Products.

*[Source: Agrawal, U., Bawane, N., Alsubaie, N. et al. Design & development of adulteration detection system by fumigation method & machine learning techniques. Sci Rep **14**, 25366 (2024).]*

Crime Statistics: A Paradox of Mass Harm and Low Registration

Despite its widespread impact, food adulteration remains strikingly underrepresented in formal crime statistics. While **5–6 million cognisable crimes** are registered annually under the IPC and Special & Local Laws, offences relating to food adulteration and sale of adulterated food or drugs are recorded only in the **hundreds or low thousands** nationwide. Conviction rates for IPC offences average **50–57%**, whereas food adulteration cases show highly inconsistent and generally low conviction outcomes.

The National Crime Records Bureau (NCRB) categorises these offences under "Adulteration or Sale of Food/Drugs." The most recent consolidated national data (2022) records approximately **4,600 cases**, concentrated largely in a limited number of states and urban centres—particularly **Telangana (Hyderabad)** and **Andhra Pradesh**—where routine IPC registration is more common. In many other states, enforcement relies primarily on administrative action under food safety laws, which falls outside NCRB crime reporting, resulting in significant undercounting.

Year	Cases Registered	Crime Rate
2020	5,165	0.4
2021	8,320	0.6
2022	4,694	0.3

[Source: NCRB report 2022 on Food Adulteration]

Judicial outcomes further illustrate this paradox. Although food laws impose strict liability, courts frequently acquit accused persons due to procedural lapses, sampling errors, or evidentiary deficiencies. Supreme Court observations have repeatedly noted that food adulteration cases are often lost on technical grounds, unlike conventional crimes supported by mature investigative pipelines. The result is a stark contradiction: a crime causing mass, chronic harm to millions remains inconsistently registered, weakly prosecuted, and rarely culminates in sustained criminal convictions.

Challenges in Detection

Authentication and traceability solutions represent a critical first line of defence against food adulteration and counterfeiting. Technologies such as secure packaging design, overt and covert security features, unique non-clonable identifiers, QR- and mobile-based consumer authentication, track-and-trace systems, RFID/NFC, and blockchain-enabled supply-chain visibility directly address existing detection gaps by enabling real-time verification and source identification. These tools reduce dependence on post-facto sampling and significantly increase the operational risk and cost for counterfeiters. ASPA member technologies operate precisely at this detection gap—creating friction for counterfeiters at every node of the supply

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chain and generating verifiable data that can later be leveraged by forensic investigators and enforcement agencies.

Detection under conventional enforcement mechanisms remains limited. Counterfeit and adulterated packaged foods are deliberately designed to be visually indistinguishable from genuine products, with high-fidelity replication of labels, colour schemes, holograms, barcodes, batch numbers, and expiry markings. Consequently, visual inspection—even by trained personnel—offers limited reliability. This challenge is compounded by uneven market surveillance, constrained manpower, inconsistent inspection coverage, and limited oversight across wholesale markets, rural haats, transport hubs, and storage facilities.

Early interception is further hindered by the absence of standardised, interoperable authentication and traceability systems across the food supply chain. Existing digital tools—such as QR-based verification, blockchain tracking, and mobile authentication—are often voluntary, fragmented, or inconsistently implemented, allowing counterfeit products to traverse multiple supply-chain nodes with minimal resistance.

Laboratory testing remains essential for enforcement but is constrained by uneven forensic food laboratory capacity, accreditation gaps, and procedural delays, leading to backlogs and weakened evidentiary value. Technology-enabled authentication and traceability solutions complement laboratory testing by facilitating early detection, rapid source attribution, and targeted enforcement action.

The fragmented and multi-tiered structure of food supply chains, involving numerous intermediaries, repackaging points, and cross-jurisdictional movement, further complicates timely detection and accountability. End-to-end authentication and traceability systems are therefore essential to improve supply-chain visibility, enable rapid intervention, and prevent adulterated and counterfeit foods from circulating extensively, thereby strengthening consumer safety and regulatory effectiveness.

Why Enforcement Outcomes Remain Weak

Despite frequent seizures, often running into hundreds of tonnes and crores of rupees in estimated value, convictions remain disproportionately low. This failure is largely structural. Food adulteration in India is still treated primarily as a compliance violation, not as an organised-profit-driven crime. Food safety authorities, police, laboratories and prosecutors often function in silos, resulting in fragmented investigations, weak evidence chains and predictable enforcement patterns that offenders exploit.

The absence of authentication and traceability systems further weakens enforcement outcomes by depriving investigators of reliable upstream data. Without batch histories, movement records, or consumer verification logs, enforcement agencies are forced to rely disproportionately on post-seizure laboratory results, limiting their ability to demonstrate scale, intent, and organised continuity.

Cases commonly collapse due to procedural lapses, inadequate forensic depth, poor chain-of-custody documentation and limited prosecutorial preparation rather than the absence of adulteration itself. Unlike conventional crimes, food cases frequently rely on a single laboratory report without broader corroboration, making them vulnerable to technical challenges in court.

In addition to the stated issues, FSSAI has defied the Supreme Court. In the case of 3S and Our Health Society v. Union of India Writ Petition (Civil) No.437/2024, order dated 09-04-2025, the Supreme Court ordered that warning labels on high-fat, sugar and salt (HFSS) products ("front-of-pack nutrition labelling") must be implemented within three months. FSSAI refused to share 14,000 public comments and an expert committee report, citing "trade secrets", thus, regulator prioritising industry interests over public health; transparency deficit.

In Swami Achyutanand Tirth v. Union of India (2016) 9 SCC 699, a public interest litigation brought to the Supreme Court highlighted the alarming scale of "synthetic milk" being sold across India, containing hazardous substances such as urea, detergent and oil; the Court relied on a 2011 FSSAI survey which revealed that 68.4% of milk samples tested nationwide were adulterated, with certain states including West Bengal and Odisha recording 100% non-conformity, and, recognising this as a grave threat to public health, the Supreme Court issued stringent directions to both the Union and State Governments, calling for enhanced punishment by amending the Food Safety and Standards Act and the Indian Penal Code to make food adulteration punishable with life imprisonment—on the lines of amendments already enacted by Uttar Pradesh, West Bengal and Odisha—mandating continuous surveillance through identification of high-risk areas and periodic snap surveys rather than one-time inspections, and directing states to upgrade food testing infrastructure and ensure NABL accreditation of laboratories.

Food Adulteration Testing Laboratories in India

Food adulteration testing in India is carried out through a nationwide network of laboratories recognised under the Food Safety and Standards Act, 2006 and coordinated by the Food Safety and Standards Authority of India (FSSAI). As of recent official disclosures, India has over 220 FSSAI-recognised food testing laboratories, comprising State Food Laboratories in most States and Union Territories, central and regional government labs**,** around 20 specialised Referral Food Laboratories for complex and confirmatory analysis, and a large number of NABL-accredited private laboratories. These labs are geographically distributed across all major metros, state capitals and several district headquarters, with strong concentration in states such as Maharashtra, Gujarat, Uttar Pradesh, Tamil Nadu, Karnataka, Kerala, Delhi, West Bengal and Telangana. In addition, FSSAI and State governments have deployed mobile food testing laboratories and are expanding district-level microbiology and food-drug labs to improve last-mile access. While this infrastructure provides broad national coverage for chemical, microbiological and contaminant testing, enforcement outcomes continue to depend not just on lab availability but on sampling quality, chain-of-custody integrity, forensic documentation and effective prosecution.

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PREVENTION + FORENSICS MODEL

The forensic-led enforcement model advocated in this paper is most effective when integrated with robust authentication and traceability systems. Preventive technologies generate digital and physical evidence trails—batch-level data, transaction logs, consumer scan records, and movement histories—that directly strengthen forensic reconstruction, organised-crime mapping, and prosecutorial success. In this integrated model, authentication and traceability act as force multipliers for forensic science, rather than alternatives to it.

The Central Role of Forensic Science

While forensic science forms the backbone of prosecution and conviction, its effectiveness is significantly enhanced when supported by preventive authentication and traceability systems that generate early signals, preserve evidence trails, and enable structured investigation.

Serious food adulteration must be addressed as a **public health crime** rather than a routine regulatory lapse, requiring a decisive shift from basic sampling to **criminal-grade investigation**. Forensic science is central to this transformation, as advanced chemical profiling, isotopic analysis, microbiology, packaging examination, forensic engineering, and supply-chain reconstruction convert ordinary food samples into **legally sustainable evidence**. These methods establish intent, demonstrate continuity and scale of operations, link geographically dispersed seizures to common sources, and withstand judicial scrutiny during prosecution.

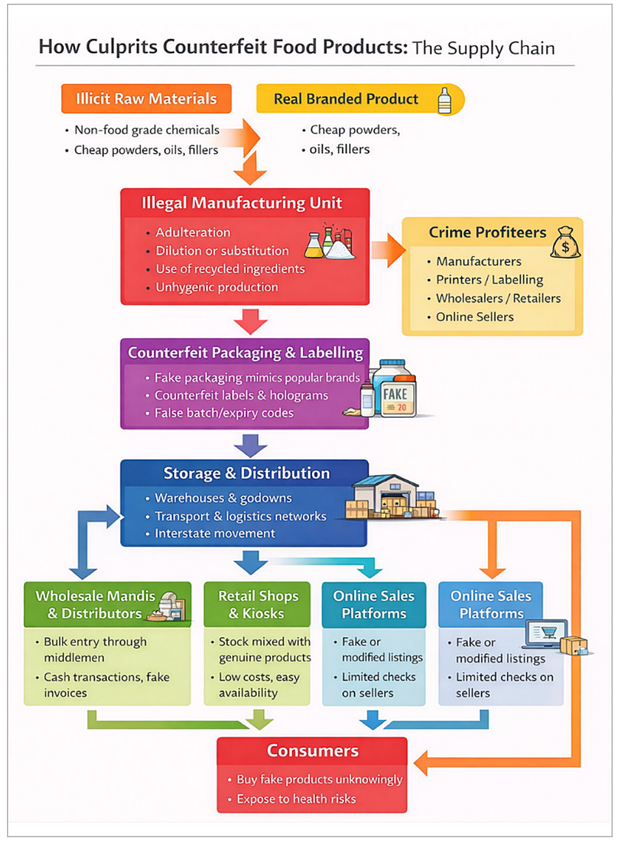
In cases involving counterfeit or misbranded packaged foods, forensic science enables enforcement agencies to move beyond intercepting retail-level violations toward dismantling organised criminal operations. Packaging forensics distinguishes genuine from counterfeit labels, seals, holograms, inks, substrates, and batch codes; chemical and isotopic profiling connects multiple seizures through common adulterant signatures; and forensic engineering reconstructs production capacity, frequency, and geographic reach. Together, these techniques allow investigators to demonstrate that offences are **systematic and organised**, rather than isolated lapses.

Judicial jurisprudence has consistently reinforced that **forensic discipline is foundational** to successful food adulteration prosecutions. In relation to primary foods such as milk, curd, and paneer, courts have repeatedly held that proper stirring, churning, and homogenisation prior to sampling are scientific imperatives, not procedural formalities. Where these steps are not demonstrably followed, analytical results lose evidentiary value. Courts have further ruled that convictions cannot rest solely on uncorroborated testimony of Food Inspectors when statutory safeguards—such as independent witnesses—are absent or compromised. These rulings underline that scientific rigor is inseparable from legal sustainability.

Complementing forensic investigation, modern enforcement increasingly relies on **integrated preventive and response technologies**. Front-of-Pack Warning Labels (FOPL) function as early risk indicators for consumers and inspectors; real-time digital traceability systems enable rapid identification of adulteration sources across supply chains; and automated Rapid Recall mechanisms ensure swift market withdrawal of unsafe products. These tools ensure

that forensic detection translates into **timely, system-wide enforcement**, closing the gap between laboratory findings and public health protection.

Identifying the People Behind the Crime Using Forensics



Contemporary food adulteration and counterfeit packaged food operations function as **organised crime businesses**, involving manufacturers, packaging units, logistics operators, distributors, financiers, and facilitators who deliberately insulate themselves from frontline enforcement. Laboratory detection merely establishes that a product is unsafe or counterfeit; it does not identify responsibility. Effective enforcement therefore requires a shift from **product-centric regulation to person-centric, forensic-led investigation**, examining people, processes, communications, infrastructure, and financial flows across the supply chain.

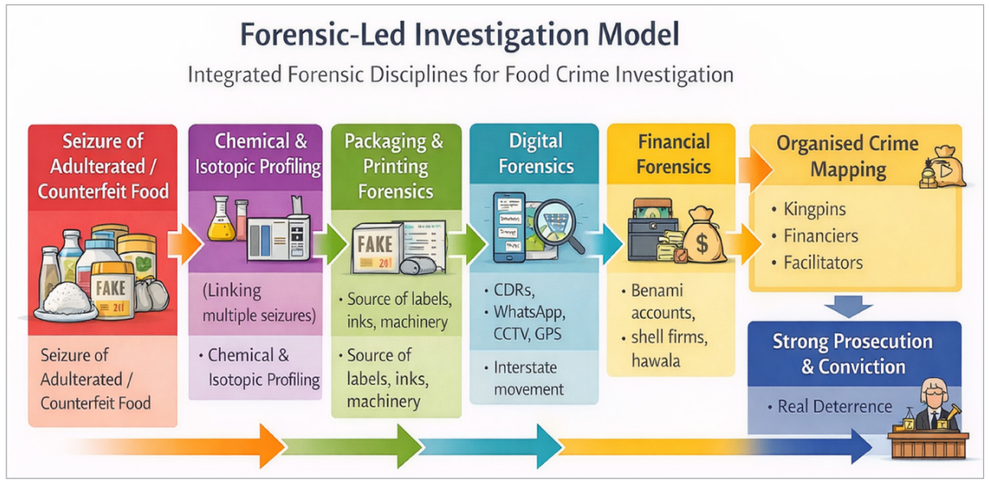
A primary entry point for attribution lies in **forensic examination of counterfeit packaging and labelling materials**. Detailed analysis of inks, printing techniques, fonts, holograms, batch codes, seals, adhesives, substrates, and security features allows investigators to link multiple seizures to common printing presses, packaging vendors, or specific machinery. Microscopic defects, die-cut patterns, ink composition, and alignment errors often act as unique identifiers, enabling source-level attribution and guiding investigators upstream to clandestine packaging units that typically service multiple counterfeit operations simultaneously.

Crime-scene forensics must extend beyond retail seizures to **manufacturing units, godowns, packaging facilities, and transport hubs**. Biological and trace evidence—such as fingerprints, touch DNA, hair, fibres, and sweat residues—recovered from mixing vessels, sealing machines, containers, tools, and discarded materials can establish physical presence, control, and continuity of activity. Environmental traces, including residue accumulation, waste discharge

patterns, and surface deposits, further support findings of sustained adulteration operations rather than accidental contamination.

Advanced chemical and isotopic profiling plays a crucial **forensic linkage role** by connecting geographically dispersed seizures through common adulterant signatures, impurity patterns, or marker compounds. These scientific linkages demonstrate that multiple cases originate from the same organised source, strengthening conspiracy and organised-crime charges. When combined with packaging and trace forensics, such profiling provides compelling proof of coordinated criminal activity.

Digital forensics has become indispensable in modern food-crime investigations. Examination of mobile phones, Call Detail Records (CDRs), WhatsApp communications, emails, images, videos, GPS data, and CCTV footage enables reconstruction of operational hierarchies and coordination mechanisms between manufacturers, transporters, warehouse operators, and wholesalers. Pattern-of-life analysis reveals command-and-control structures, role allocation, frequency of interaction, and inter-state connectivity, often identifying controllers who deliberately avoid physical contact with adulterated goods.



Documentary forensics further strengthens attribution and intent. Seized diaries, delivery registers, loose sheets, invoices, and cash records can be subjected to handwriting, ink, and paper analysis to link documents to specific individuals and establish operational continuity. Transport and route forensics—using toll plaza data, FASTag records, GPS logs, fuel trails, and vehicle movement patterns—reconstruct distribution corridors and expose the logistical backbone of adulteration networks.

Large-scale adulteration enterprises depend on **complex financial ecosystems** designed to conceal profits and ownership. Forensic accounting and financial investigations analyse bank transactions, shell entities, benami accounts, cash-based distribution systems, and hawala networks. Correlating financial trails with digital communications, transport data, and forensic

linkages enables identification of beneficial owners and financiers, facilitating asset tracing and economic disruption—an approach proven effective against other organised crime syndicates.

Forensic psychological investigation techniques, when applied in a legally compliant and scientifically informed manner, can significantly strengthen the investigation of complex and concealed crimes. These techniques do not replace conventional evidence but act as force multipliers by guiding investigators toward probative material, narrowing suspect pools, and corroborating other forensic findings.

Forensic Psychological Criminal Profiling (FPCP) involves the systematic analysis of crime scene characteristics, victimology, modus operandi, and behavioural signatures to infer the probable psychological, social, and behavioural attributes of the offender. In organised or repetitive crimes, profiling assists investigators in understanding offender motivation, level of planning, risk tolerance, and escalation patterns. This helps prioritise suspects, predict future behaviour, and design focused interrogation strategies rather than relying on random or intuition-based questioning.

Polygraph Examination measures physiological responses such as respiration, cardiovascular activity, and galvanic skin response during structured questioning. While not substantive evidence in Indian courts, polygraph results are valuable as investigative aids. They help assess deception, verify statements, and identify areas requiring deeper inquiry, particularly in cases involving denial, collusion, or fabricated narratives.

Layered Voice Analysis (LVA) evaluates micro-tremors and stress indicators in voice frequencies to detect psychological stress linked to deception. In prolonged interrogations or telephonic examinations, LVA can assist investigators in identifying moments of cognitive load or concealment, thereby refining follow-up questions and uncovering inconsistencies.

Suspect Detection Systems (SDS) integrate behavioural analysis, psychometric indicators, and response pattern assessment to flag deceptive or evasive behaviour. These systems are especially useful in screening multiple suspects, witnesses, or insiders where direct evidence is initially sparse.

Brain Fingerprinting examines brain responses to crime-relevant stimuli to determine whether specific information is stored in the subject's memory. When used with judicial permission, it can help establish knowledge of crime details known only to the perpetrator, thereby strengthening the evidentiary chain.

Narco-analysis, though highly restricted and non-evidentiary, may yield investigative leads by lowering psychological inhibitions under controlled medical and legal safeguards. Any information obtained must be independently corroborated through admissible forensic or documentary evidence.

In sum, forensic psychological techniques provide a structured, scientific framework to penetrate deception, reconstruct criminal behaviour, and guide investigators toward objective forensic evidence—ultimately improving detection, reducing investigative bias, and enhancing the probability of successful prosecution.

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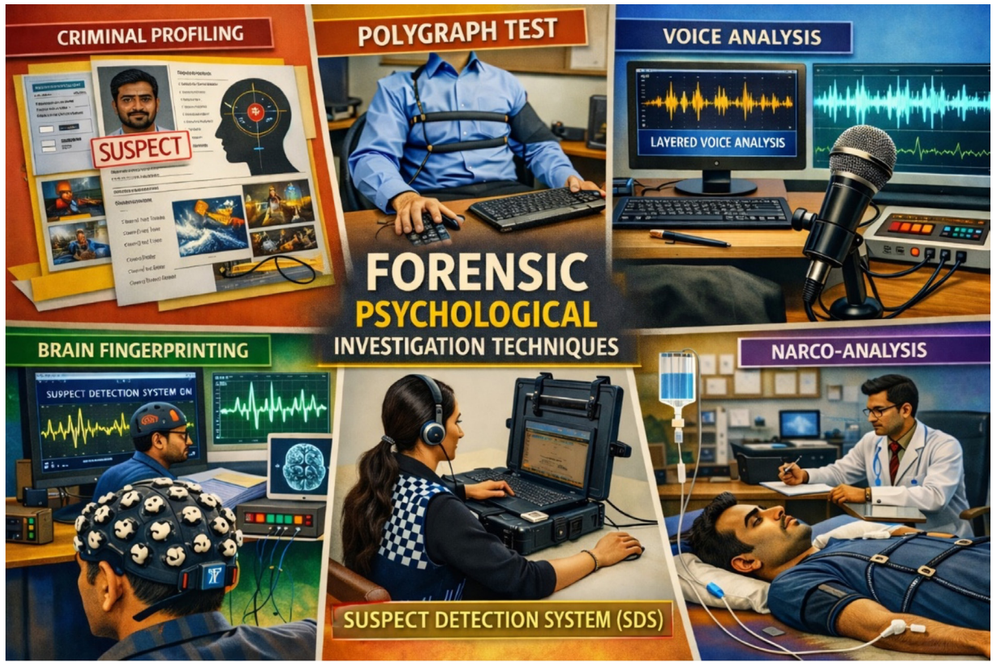

Organised Crime Mapping Approaches

The true strength of forensic investigation lies in integration. When chemical signatures, packaging defects, biological traces, digital communications, documentary records, transport data and financial transactions are analysed together, distinctive patterns emerge. This convergence enables investigators to map interconnected, multi-state criminal networks—comparable to those seen in counterfeit medicines and narcotics—and provides the evidentiary basis for invoking Section 111 of the Bharatiya Nagarik Suraksha Sanhita (BNSS), which targets continuing unlawful activity by organised syndicates for economic gain.

Large-scale food adulteration operations function through shell entities, benami storage, cash-based logistics and coordinated transport corridors, insulating controllers from routine seizures. Organised-crime mapping exposes these structures by linking recurring actors, shared infrastructure and common financial channels, enabling investigators to proceed against manufacturers, financiers, transporters and controllers, rather than only frontline sellers.

By combining digital, chemical, packaging and financial forensics with money-trail analysis and asset action under the BNSS framework, enforcement can move beyond episodic product seizures to the systematic dismantling of entire criminal ecosystems. This integrated approach converts food adulteration from a regulatory infraction into a prosecutable organised crime, delivering real and lasting deterrence.

Technology, Capacity and Coordination

Technology and human capacity must be supported by strong coordination. **As with counterfeit medicines, a simple, centralised digital database for counterfeit and adulterated foods should be created** to record sample failures, seizures, FIRs, repeat offenders, and court outcomes, enabling hotspot mapping and case-linking across states. **Effective coordination between food safety departments, police, forensic laboratories, prosecutors, and regulators is essential**, with clear protocols for information sharing and joint investigations so that evidence flows seamlessly from inspection to prosecution. Regular cross-training and coordinated review meetings can prevent procedural gaps, ensuring that cases do not fail due to fragmented action or poor inter-agency communication.

The National Forensic Sciences University's Academic Course M.Sc. Forensic Food Analysis programme is academically rigorous and **strongly aligned with evidence-based strategies** for detecting and combating food adulteration. By integrating **forensic science principles with advanced analytical technologies and regulatory knowledge**, it builds essential capability for scientific investigation, legal enforcement, and public health protection. This synergy is critical for combating complex food adulteration issues in contemporary food systems.

Recent Case Studies: Organised, Recurrent and Seasonal

Recent years have brought several high-visibility cases that illustrate the organised nature of the problem. The Tirupati Laddu ghee adulteration case (2024–25), escalated to the Supreme Court with court-monitored investigation; the Punjab dairy adulteration crisis, revealing alarming failure rates in milk, paneer and khoya; large-scale adulterated ghee seizures in

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Gujarat (2025); festive-season crackdowns in Uttar Pradesh uncovering industrial dyes in snacks; viral fake juice incidents involving chemical mixing; and pre-Diwali paneer and khoya seizures across northern India. These episodes show that adulteration is not episodic but systemic, organised and seasonally amplified.

When Enforcement Works: The Rajasthan Example

State-level data demonstrate that outcomes can improve dramatically when enforcement shifts from routine regulation to focused prosecution. In Rajasthan (FY 2024–25), authorities reported 3,141 food-adulteration cases filed, with 489 convictions out of 499 decided cases in a single quarter—an extraordinary ~98% conviction rate. This success, however, reflects a targeted drive, not the national average, and underscores how prosecutorial strategy and coordination can transform outcomes.

Legal Framework: Strengths, Limits and Judicial Direction

India's response to food adulteration is anchored in the **Food Safety and Standards Act, 2006 (FSSA)**, which consolidated earlier food laws into a single science-based framework and established the **Food Safety and Standards Authority of India (FSSAI)** as the central regulator. The Act prohibits adulterated, unsafe, sub-standard, misbranded and falsely labelled food, prescribing graded penalties from fines to imprisonment depending on the severity of harm. FSSAI's regulatory architecture—covering additives, contaminants, packaging, labelling and laboratory procedures—directly targets the practices that underpin food counterfeiting, while tools such as licensing, surveillance, sampling, recalls, penalties and consumer-reporting platforms (including Food Safety Connect and the DART manual) form the backbone of enforcement.

Judicial interpretation has, however, reshaped how this framework operates in practice. The Supreme Court has consistently held that the FSSA is a special, self-contained statute that ordinarily displaces parallel prosecution under the IPC in routine food adulteration cases, leading High Courts to quash IPC charges in matters confined to sample failure and procedural non-compliance. While this approach strengthens due process and scientific rigour, it has also limited deterrence by confining many serious cases to regulatory penalties. Crucially, this restriction does not extend to independent criminal conduct: where adulterated or counterfeit food is introduced into the market through fake packaging, forged FSSAI licences, false expiry dates, fabricated batch numbers or deceptive branding, offences such as cheating (IPC 420), forgery (IPC 467–471) and criminal conspiracy (IPC 120B) are separately attracted, because they punish the fraudulent methods and deception, not merely the quality of the food.

At the same time, the Supreme Court has made it clear that liability under food law is strict and standard-based. Once a prescribed composition or quality standard is violated, the food is legally adulterated regardless of whether actual health injury is proven. Courts have repeatedly rejected "minor" or "borderline" defences, particularly in staple foods such as milk and paneer, emphasising that even small deviations undermine consumer protection and public health.

Replicating The Anti-Counterfeit Drug Enforcement Model to Tackle Food Adulteration

The success of India's anti-counterfeit drug initiative by IPA has clearly demonstrated that crimes impacting public health can be effectively controlled when they are approached as organised economic offences rather than routine regulatory violations. By integrating police action, regulatory oversight, forensic science, financial investigation, digital intelligence, and focused prosecution into a single enforcement ecosystem, the counterfeit medicine model moved investigations beyond isolated seizures to the dismantling of entire criminal networks. The same architecture is directly replicable in food adulteration cases, where syndicates, supply chains, and profit structures closely resemble those seen in fake drug operations. Applying this proven, forensic-driven and intelligence-led model to food safety enforcement can convert routine sampling into strong criminal cases, improve conviction rates, and create meaningful deterrence against large-scale food adulteration.

Conclusion: From Regulation to Deterrence

India already possesses the legal framework, institutional capacity and technical expertise required to confront food adulteration and counterfeiting effectively. What remains is a strategic reorientation—from reactive regulation to proactive crime control, and from symbolic enforcement to credible deterrence. Treating food adulteration as an organised public health crime, supported by forensic rigor, financial scrutiny and coordinated prosecution, offers the most viable path to protecting consumers, dismantling criminal networks and restoring trust in India's food system.

For sustainable deterrence, regulators, enforcement agencies, and industry must move toward a layered approach: prevention through authentication and traceability, detection through surveillance and analytics, and enforcement through forensic investigation and prosecution. ASPA and its member organisations, with decades of expertise in physical, digital, and phygital authentication solutions, are uniquely positioned to support this transition and to collaborate with regulators and forensic institutions to build a resilient, future-ready food safety ecosystem

Institutionalising authentication and traceability across the food ecosystem will not only reduce the volume of adulterated products entering the market, but will also dramatically improve the quality, speed, and success of forensic-led investigations and prosecutions.

Supreme Court rulings collectively demonstrate that Indian food law is already stringent enough; the real deficit lies in investigative discipline, forensic integration and prosecutorial preparedness, not in legislative weakness. The consistent judicial insistence on procedural compliance shows that credible deterrence will emerge not from harsher laws, but from forensic led, legally precise investigations that respect statutory safeguards while targeting organised adulteration networks

accenture ASPA Authentication Solution Providers' Association Diverse technologies, common goal.

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Indian Traceability & Authentication Industry Study 2025

Report Key Findings

- **Research Basis:** This study, conducted by Accenture, is based on survey responses from ASPA member companies along with in-depth interviews with industry stakeholders, government authorities, and global bodies
- **Indian Market Size:** The Indian A&T industry stood at ₹9,705 crore in FY 2023-24, registering a CAGR of 7.4% between FY 2019-20 and FY 2023-24.
- **Forecast:** The market is projected to grow to ₹10,612 crore in FY 2024-25 and further reach ₹16,575 crore by FY 2028-29, representing a CAGR of 11.3%.
- **Global Context:** The global A&T market was valued at USD 147 billion in 2023 and is expected to grow to USD 382 billion by 2032, with Asia-Pacific showing the fastest CAGR of 14.2%.
- **End-User Segments:** Pharmaceuticals (17%), consumer products (14%), cosmetics (13%), and auto components (13%) are the largest adopters of authentication and traceability solutions in India.
- **Growth Drivers:** Rising counterfeiting, consumer awareness, regulatory requirements, and the expansion of e-commerce are key demand triggers.
- **Technology Adoption:** While traditional methods like holograms and QR codes remain dominant, emerging solutions such as AI, blockchain, IoT, and phygital (physical + digital) technologies are expected to drive the next phase of growth.

ASPA®

Authentication Solution Providers' Association

Diverse technologies, common goal.

ASPA is a Non-Profit organisation which came into existence in 1998, it has a rich heritage of 27 years and is recognised globally as a regulated and ethical organisation. It is working to build up the authentication eco-systems & environment in the country against the counterfeiting activity and illicit economy.

ASPA works on four key areas:

Awareness | Advocacy (Industry Partnership) | Research | Innovation

Currently, ASPA has 80+ member companies providing physical, digital and phygital authentication and traceability solutions. As an industry body of authentication solutions providers, it encourages its members to adopt best practices, standards, and advanced use of technology in providing cost-effective anti-counterfeiting solutions against counterfeiting.

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