

Keywords: Capital intensity, *Cloud slaughterhouse*, Effluent, Eucalyptus, Growth rate, Investment, Hub & Spoke, Irrigation, Karnal Technology, Plant location, Primary processing, Scale economies, secondary processing, Specific water consumption, Wastewater,

Handbook On Design & Operation Of Poultry Slaughterhouse – Chapter 2 – Land & Location

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Preface

Ideally a handbook should not relate to current events or current situations – it should confine itself to time-independent general principles and practices. Preoccupation with current events and current situations should belong to the realm of newspapers and journals. But in writing this Chapter we decided to relate our observations and analyses of the present prevailing context because they are foundational, *time-independent* just as handbooks need to be, and will therefore shape the future of this nascent industry unless the flaws are removed.

In discussing location and suitability of land for poultry processing, we were also able to identify structural problems faced by this industry, solutions to which fall within the ambit of national agricultural, water management and wastewater disposal policies and laws. We have amplified these aspects here. Therefore this Chapter ought to find use not only for students of poultry processing, but also for planning authorities.

Chicken are one among a number of poultry species. Turkeys, ducks etc. - all belong to this broad category. Within poultry itself, there are two main streams – broilers: which are bred for meat and layers: which are bred for table eggs. Backyard poultry breeds which are promoted by our research institutions for the benefit of small and marginal farmers, fall between these two categories – they produce eggs and are also slaughtered for meat. But this segment is small and likely to remain so.

A poultry slaughterhouse may process broiler or even layer hens, which are typically culled at the end of their egg-laying lifespan, at around the 65th week of their lives. However the number of layers culled each year is insignificant in comparison with the number of broilers harvested for slaughter. Likewise the population of backyard poultry is very small and their farming is widely dispersed all over India. So this category does not and can not form an important part of the feedstock for poultry slaughterhouses.

Therefore when we mention poultry slaughter, we mainly mean slaughter of broilers. We have generally used chicken, broilers and poultry to mean meat birds in this Chapter. Within the industry this flexibility of nomenclature is understood from the context itself, but since we expect this Chapter to be read also by people outside of this industry, we felt the need to state these distinctions.



1 Essential Requirements For A Poultry Slaughterhouse

There are eight essential requirements. These are:

	A poultry slaughterhouse.....	Remarks
1	...needs lots of water	Must have easy and constant access to raw water. The smallest plant needs 25 litres of water per bird. A large plant processing 6000 birds per hour (BPH) and above, needs 13-15 litres per bird. Since a plant location must be chosen to facilitate growth, at its peak of growth and expansion, a 6000 BPH plant may use 1512 kilolitres of fresh raw water for two shifts per day. Except for some insignificant uses, water cannot be recycled . If you wish to learn why, refer to the article 'Water Recycling In Poultry Processing – State-Of-The-Art'. This article may be downloaded from the Aptec website.
2	.... must be close to live bird supply	Transportation always causes some death, especially in warm climates. To keep dead-on-arrival (DOA) figures low, proximity of farms to slaughterhouse is important.
3	.... needs convenient discharge of treated liquid effluent	Discharge requirement quantitatively equals raw water usage. Existing Indian laws forbid discharge of raw wastewater or even treated wastewater into natural waterways, municipal drains, irrigation canals and over land except over cultivated land provided the plant owner enters into a written agreement with the local authorities (e.g. village chief or <i>sarpanch</i>) for it. Else the plant owner must himself own all the land over which he can spread treated wastewater. This is called the zero discharge policy . At the same time prudence requires that he must also have access to a natural water-course for discharge into (at his own risk) during monsoon rains when crop irrigation is unwanted. In other words he must either violate the law or shut down his plant during monsoon rains!
4	..... needs labour	To avoid having to build lots of residential/hostel accommodation for staff, a poultry slaughterhouse must be located reasonably close to a village, hamlet or town.
5	..... cannot be built close to certain structures	Such as places of worship and archaeological sites. Nor too close to human habitations as residents may object to the odour nuisance from the operation.
6	.... must have good and reliable access to plenty of power	Small plants need 350-450 kVA of power. Larger plants may need 1500 kVA. Reliable supply may not be had from an 11 kV agricultural feeder. The best supply is at 32 kV, i.e. directly from a sub-station, possibly by a dedicated feeder. Proximity of sub-station is therefore important if the cost of the dedicated feeder is to be kept low.
7	..... must have reasonable proximity to market and town(s)	Processed meat is not much affected by distance to market. Proximity to towns is important for the convenience of plant workers' families.
8	..... must have sufficient area of land.	An absolute minimum of 3.5 acres of land is needed for a start-up capacity, with larger holdings of upwards of 6 acres for a normal plant (not counting area needed for item 3). Many companies in the south have opted for closer to 100 acres since land is cheaper there than it is in the north. This also explains why there are far fewer plants in the north.

2 Challenges To Growth In Poultry Processing

Modern broilers have been raised from strains of wild native jungle chicken which were painstakingly hybridised and selectively bred over the past century in the West, in Australia and in Israel. Over time, two global monopolies have emerged in this sector by acquisition and merger over the latter half of the last century. These monopolies for high performance broiler breeds are **Aviagen** and **Cobb**. These companies also have a near monopoly over layer breeds.

Backyard poultry breeds developed by our own research establishments are no match for breeds from these global monopolies. Although backyard breeds provide livelihood to poor and marginal farmers and should be encouraged for that reason, for healthy growth of the broiler meat sector we cannot avoid the use of day old chicks (DOC's) from these global monopolies. Poultry processing is an intensely scale sensitive industry which cannot be based on intermittent, geographically dispersed and small numbers that backyard poultry farming can supply.

In India there are several constraints to the growth of a modern broiler agronomy which can find expression in the availability of quality processed poultry meat on supermarket shelves. Some of these constraints have already been mentioned in table 1, but are included here, nevertheless. They are:

- (a) A severe paucity of good locations for poultry processing plants - there being limited availability of water in sufficient quantities, particularly in the central and southern zones;



- (b) Limited availability of red zones (officially designated as suitable for, or simply set aside for ventures aimed at slaughter of animals for human consumption);
- (c) A shortage of locations that are sufficiently distant from populated areas and suffer no local resistance on account of the smell nuisance, particularly in the densely populated riverine zones in the north;
- (d) The zero discharge policy is impractical and forces investors to purchase large tracts of land. This is particularly inimical to growth of this industry in the riverine zones because land is extremely expensive and viable agriculture in these areas needs multiple cropping per year – not plantations that can be harvested only infrequently;
- (e) Insufficient trained manpower and managers educated in this field – veterinary college syllabi have not been designed for this branch of agronomy – the emphasis has been almost entirely on milch cattle farming;
- (f) Control of the market by a monopoly in supply of modern broiler breeds through an engineered price manipulation¹;
- (g) There is a competition between organised processing and wet-market² processing. Since a majority of processing plant owners are themselves integrators and produce DOCs in their own hatcheries and also own slaughter facilities, they divert their live birds to the wet-market when live bird prices rise, and so they become party to the monopolists' strategy of creating large, cyclic price swings.

Although price swings affect the overall availability of live birds, it is instructive to examine the growth of poultry processing in the country to understand whether beneath these swings there is a secular and credible growth trend. For this purpose we project capacity build-up data twice a year on our website.

We have calculated the growth rate on the base capacity figure for the year 2002, first for the period ending 2018 and then for the period ending 2026 (table 2). We also calculated the growth trend starting on the larger base capacity figure of 2018 and we believe this last trend is more likely to continue beyond 2026.

		Growth Rate per annum (CAGR)	References (Also see endnote³)
1	Capacity build-up over the period 2002 to end 2018, with growth calculated using base year data for 2002	12.29 %	Aptec Bi-annual Report of Feb 2018
2	Expected capacity build up over the period 2018 to mid 2026, with growth calculated using base year data for 2016	15.75 %	Aptec Bi-annual Report of Mar 2025
3	Overall growth rate for the quarter century 2002 to 2026	13.43 %	Endnote ³
4	Growth in supply of broiler expected from 2026	15.2%	Endnote ⁴
5	Share of the wet market in 2025	90%	
6	Per capita annum poultry meat consumption in India in 2025	6000 grams	

Market forces, technology and simple economics have driven this differential growth between broiler farming and broiler slaughtering in the past. Both supply of broilers and processing capacities are now growing at the same pace and therefore the share of the wet market is likely to remain pegged at around 90% unless addition of processing capacity picks up. But there are major constraints in growth of processing capacity.

Most of the existing constraints can be easily overcome by policy review. That will leave only two - namely (1) our existing disconnect from global trade and (2) non-adoption of GM maize and soybean which are the main, cost-effective ingredients of poultry feed. To overcome them we need to take advantage of the newly emerged US surplus of GM maize and soybean by setting up our own feed mills and solvent extraction plants in USA for export to India and Europe. Edible oil and pelleted poultry feed made from these facilities will ease our cooking oil shortage and given the high productivity of these crops in USA, this poultry feed will make our poultry exports competitive in global markets. At the same time GM crops will remain excluded from directly entering our human food chain – a condition that our activists insist on⁵. Finally, release of land from cultivation of maize, a crop for which our productivity is



much less than that of USA, will free large tracts for more remunerative crops like vegetables and fruits and for more poultry farms.

3 Plant Sites For Poultry Processing

In the beginning, design of poultry processing machines was wasteful of water. But starting from the mid 1970s this industry made impressive reduction in specific usage of water across all processing steps⁶. Now it has reached the limits in this aspect and there does not appear to be any room for further reduction. A seminal study carried out by *Carawan et al* is discussed in an article on the subject of water usage and the un-feasibility of recycling it within the plant⁷.

The specific water requirement for processing poultry has been given in row 1 of table 1. In the light of these water usage bench-marks, we can review the present size of this industry and develop growth targets to reach the status of a developed economy by mid century. We will then be able to pin-point paucity of water and other hurdles that stand in our path and are in need of solutions.

When a country establishes capacity to process at least 70-80% of the number of broilers its farms produce, it effectively shuts down the wet-market. To raise the existing 10% share outside the wet market to 75% by 2047, given the fact that the present average plant capacity is a poor 2770 BPH, we must build additional capacity equivalent to 300-350 plants of similar size in the next 25 years. **Unfortunately there simply are not enough suitable plant sites in India for so many poultry slaughterhouses.** For all thirty odd poultry processing plants (or some 50% of total processing capacity) that Aptec has designed and helped build in India, our most serious challenge has always been identifying a suitable plant site.

4 Hub & Spoke Model

We propose a two-pronged strategy to overcome this problem. The first strategy, based on an understanding of the process, requires us to split or divide it into two parts, each of which can function at a separate location. We call this the **Hub & Spoke Model of Poultry Processing**. The second strategy calls for a scrutiny of hurdles in the growth of this industry and a search for custom solutions. But first we will take up the Hub & Spoke Model and while discussing it, we will have the opportunity to itemise the remaining individual hurdles.

4.1 Split The Process & Plant Into Two

This model is based on a close examination of eight features or steps of the process, listed and discussed in table 3. Most of them allow splitting the process into Hub and Spoke, these being two halves of the process, separated into convenient sections that may function independently at different locations, while others are neutral to such a re-arrangement.

Function/Section/Facility	Location
Arrival, killing, evisceration, chilling, primary weighing & grading of carcasses, coop & truck washing (primary processing steps).	Hub
Wastewater treatment, rendering, raising steam, blast freezing, frozen stores & related refrigeration plant, large electrical sub-station (essential utilities for primary processing).	
Housing for essential operating, security and maintenance staff.	
Portioning, de-boning, packing and shipment (only to bulk consumers and to the immediate neighbourhood); in reefers, with thermal tracking. (secondary processing steps but only meant for bulk shipments from Hub).	
Fleet of large reefers with temperature tracking for shipment of fresh chilled skin-on carcasses packed in plenty of shell ice, once or twice a day to Spoke plants. Service facilities to be located in Hub.	Spoke
Computerized web-based delivery platforms for order booking & tracking using purpose-designed apps (service facilities at Spoke).	
Refrigerated work-space at +12°C, with work tables, cone de-boners, and/or Japanese cut-up lines, disc cutters, tray packing machines. Screw chillers for thawing frozen carcasses as required. Plate freezers, small single-chamber blast freezers, small frozen stores, chill stores for reception and dispatch and accompanying dedicated refrigeration units. Because of small size these can have skid-mounted dedicated CFC/HFC type refrigeration machines. (Machinery at Spoke)	
Fleet of 3 tonne and 1 tonne reefers; motor cycle fleet with riders for shipment of packaged portioned or de-boned fresh-chilled poultry to customers against orders. (Service facilities to be maintained at Spoke).	
Bones, gristle and trimming waste etc; frozen skin can be shipped back from Spoke facilities in delivery reefers to the Hub plant for rendering and for aggregation and sale to RTE customers respectively, on return trip of reefers.	



Poultry processing produces whole or portioned chicken, with each category being either blast-frozen for long term storage or fresh chilled for consumption within less than a week of processing. In the case of portioned chicken, the market has a long laundry-list of product and pack specifications. This proliferation of types is called Stock Holding Units or SKUs⁸ in marketing, and from this viewpoint there exist excellent reasons to split them by processing steps, as we have done in table 3.

Aptec developed this model during September 2020 and privately distributed a short note on it among poultry processing plant owners. Later, Asian Poultry Magazine published a report about the Hub & Spoke model in their January 2021 issue, following an October 2020 interview with this author. Here are the main features of the proposal.

4.1.1 Intensity Of Scale Economies

Poultry processing is highly scale sensitive⁹. Machinery manufacturers now offer line speeds of up to 15000 BPH. As you go up the line-speed ladder, the specific processing cost per chicken falls. And here we are, struggling at an industry average line speed of 2770 BPH as shown in the latest Industry Report on the APTEC website. Imagine the scale economies the processing industry is losing! If only we could improve scale economies in processing, poultry meat could become cheaper across the board.

4.1.2 Capital Intensity

Poultry processing is very capital intensive, requiring heavy investments. However, as table 4 shows, the bulk of the investment goes into primary processing. Added to this is the need to invest large funds in utilities and services like refrigeration, waste-water treatment, rendering and electrical sub-station in primary processing. The capital needs of secondary processing is overall lower not only in processing machinery but also in connected load like refrigeration because much smaller capacities of these utilities are required. Besides, the secondary processing end needs neither rendering nor wastewater treatment nor complicated machinery for the same.

Description of plant	Investment % in processing machinery in	
	Primary processing	Secondary processing
4000 BPH with moderate secondary processing (portioning & packing)	96.3	3.7
6000 BPH with high level of automation in secondary processing	89.1	10.9
8000 BPH with automatic portioning, packing & machinery for KFC 9pc cuts	75.3	24.7
9000 BPH with moderate level of automation in secondary processing	89.2	10.8
Average % investment, weighted on per bird basis	86	14
Source: Compiled from commercial offers made by Meyn and Marel between 2010 and 2018.		

4.1.3 Hunger For Resources

Poultry processing requires lots of water, generates need for a large effluent treatment facility for such quantities of water and uses plenty of power, mainly for refrigeration and rendering. But most of these resources are restricted to primary processing departments which include process steps from live bird hanging to whole carcass chilling with water and flake ice, a primary weight-wise grading of carcasses and freezing them either if frozen whole carcasses are in demand or the processor decides to take advantage of a sudden dip in live bird prices. To take advantage of price gluts the Hub location could have large blast freezing capacities and frozen stores, and thus take advantage of MOFPI¹⁰'s cold chain capital subsidy. With adequate freezing and storage capacities in the country, industry-wide price gluts would be progressively smoothened and poultry farming would become a low-risk farming activity instead of the gamble it now is.

4.1.4 Labour Requirements

A typical 6000 BPH plant needs from 300 to 400 workers if both primary and secondary processing stages are combined at one location. Of this, only up to 80 workers are required in primary processing, the rest being needed in secondary processing assuming that the plant contains only a low level of automation for secondary processing. Besides this large difference in labour deployment, workers in primary processing



must be very skilled while those in secondary processing generally need one or two weeks of training to pass muster. Because labour and staff number is small for primary processing in Hub facilities which must be located in up-country areas, plant promoters may provide on-site housing facilities for such workers. On the other hand, Spokes may be built close to towns on industrial estate plots or in existing industrial sheds taken on lease. There are always some unused plots or sheds in industrial estates near most Indian towns and cities. Labour requirement for Spokes may be sourced from among unemployed youth resident in the neighbourhood. This means that the plant management does not need to build housing facilities and may let the workers use existing mass urban transit networks for commuting.

If the Hub & Spoke model was to be implemented, manpower problems could be solved by extending the Skill-India initiative to cover this sector. By way of social engineering, a team could periodically pick promising young candidates from the present wet market and give them on-the-job training in existing modern poultry slaughterhouses, to be later absorbed in Hubs or spokes as appropriate.

4.1.5 Work Schedule

The primary processing shift operation usually begins very early in the morning to match the arrival of live birds at the slaughterhouse. To facilitate this, transport of birds generally occurs at night to save them from heat stress and reduce DOA. So if the primary shift starts at around 0600 hrs and ends at say 1500 hrs, the secondary shift starts at 1100 hours and ends at 2000 hrs or goes beyond it, depending on day's workload. The secondary shift is staggered because of a technological factor called **maturation**. For maturation whole carcasses are rested for 4-5 hours at between -1 and +4°C to make poultry meat more tender and juicy. This results in a natural separation in the overall poultry processing activity corresponding to primary and secondary shifts. If maturation is allowed to happen in the reefer during transport of carcasses from Hub to Spoke, we can effectively increase the shelf life of fresh-chilled poultry by 4-5 hours. This would be achieved because we would have squeezed two serial value-addition activities into one time-slot.

4.1.6 Rendering

Slaughtering waste or offal is generated in primary processing and to protect the environment, reduce the spread of avian diseases and recover valuable protein from this waste, one requires to have an offal rendering facility for each slaughterhouse. Secondary processing, on the other hand, generates practically no waste, except some bones when it is required to convert portions into bone-less meat. These bones can be rendered along with slaughter waste if they are collected from Spokes periodically and delivered into the intake hopper of the rendering plant at the Hub.

Players	Skills/Barriers
Integrators, Industrialists ("Hub")	Can create barrier to competition by <ul style="list-style-type: none"> • having captive live bird supply • having access to capital • employing engineers, veterinarians and food technologists to run large, high technology, low processing cost plants
Merchandisers ("Spoke")	Can create barriers to competition by <ul style="list-style-type: none"> • consumer marketing skills • proximity to consumer • knowledge of local culinary traditions • piggybacking complementary items (eggs, red meat, fish, pork, beef, quail, rabbit, RTE, RTC, spices, condiments, seasonings) in their product-mix and so spread the operating cost

4.1.7 Land

For treatment of processing wastewater, primary processing needs a large land area. Given the condition that treated wastewater must necessarily be used only for irrigation of crops, primary processing must occur in the midst of up-country agricultural crop or plantation land. On the other hand, secondary processing needs less land as it does not generate any waste-water. Secondary processing can therefore conform to urban industrial estate standards and be located near towns, closer to consumption centres.

4.1.8 Inventory Management

Preoccupation of managers in primary and secondary processing are different. The primary processing manager handles veterinary, technical and machine maintenance issues while the secondary processing



manager grapples with logistical, scheduling and inventory management issues. No doubt, several overlaps exist, but the difference of focus is important.

Secondary processing can produce a large number of product types or SKUs. As mentioned earlier, these are distinguished, one from another, by the size of packing, whether frozen or chilled, whether mixed portions (curry-cuts) or only one type of portions in a pack, whether skin-on or skin-off, whether bone-in or bone-out, whether edible offal or prime chicken portions, whether bulk-packed for institutions or small packs for consumers, whether marinated or not and so on. So the larger his operation and the farther he is from the consumer, the harder does the inventory management job of the manager get and from time to time he may get burdened with unsold inventory, which he must liquidate, by offering discounts. It therefore makes sense to separate primary from secondary processing and to locate the latter closer to the consumer.

4.2 Emerging Market Conditions Suit The Hub & Spoke Model

In recent years a number of web-based order booking and delivery or D2C companies have come up. They book and track orders using purpose-designed apps and for this reason their customer base must be restricted to small geographic areas – within towns and cities. They must therefore carry an undifferentiated inventory of fresh-chilled whole carcasses which they can source from existing poultry slaughterhouses and process them into the desired SKUs against orders received by mobile phones or over the internet. By processing against firm orders they can avoid generating and carrying dead inventories.

As municipalities chased most of the wet-market vendors out of cities and towns over the recent past, their operations went underground and became invisible. Some of them took a cue from the home-delivery D2C outfits and climbed the band-wagon. In effect the municipal drive made the wet-market computer-savvy and some of their members set up web-based home-delivery platforms of their own. Like the current phenomenon of *cloud kitchens*, we now have *cloud-slaughterhouses* as wet-market butchers no longer need to display the actual gruesome process of killing birds. However, this development may fail in terms of product hygiene, biosecurity and sanitary disposal of processing waste. And because they have been born out of the wet market culture, these clandestine operators may continue to dump their processing waste onto landfills or into municipal drains by force of habit.

On the other hand, if the processing industry sets up a sufficient number of Spoke units it may benefit from the D2C trend and the industry. Together with new D2C entities the industry may succeed in improving processing conditions in these clandestine *cloud slaughterhouses*. The industry may also try promoting entrepreneurship among unemployed urban youth by including them in a franchise arrangement at Spoke establishments. In the same way fall in live bird price volatility with increase in processing activity may encourage integrators to involve unemployed rural youth in contract farming. For the processing industry to adopt this idea, large integrators should convert their existing plants into Hubs, operating 2 shifts, the better to utilise their assets. Simultaneously the industry should rapidly set up many Spoke facilities close to cities and towns.

To sum up, by splitting the process into two steps, we can contain pollution, manage water and power requirements at fewer locations (where we can solve these issues more efficiently because the solutions themselves exhibit scale economies). Besides, by restricting pollution generation and abatement to fewer locations, better control and compliance may become feasible. And the poultry processing industry may then leverage the emerging business model to create new avenues of employment and enterprise among youth.

Trend	Example
Ongoing consolidation by brand leaders	<ul style="list-style-type: none"> • Suguna purchases Alpha Agro, SHL Agro, evaluates Caris Pure. • Shanthi, Godrej and Suguna evaluated purchase of Amrit's defunct plant, then drop it. • CP uses Penn Foods and ProTAC. • Licious, Fresh to Home, Nandus, Zomato use ProTAC, Miki, Huda, Penn. • Indian Poultry Alliance consolidates several companies.
Business model options for integrators	<ul style="list-style-type: none"> • Promote their own brand or • Become commodity suppliers to the emerging breed of web-based food delivery platforms like Amazon, Fresh to Home, Licious, Swiggy, Zomato, etc.



5 Water Stress - Cause & Effect

Although India remains well endowed with freshwater, population and over-exploitation of riverine and groundwater for flood irrigation has created scarcity in several regions. The principal culprits are (a) the commercial cultivation of paddy in low rainfall areas such as Punjab and Haryana (b) the stubbornness of some regional governments against adopting sensible river water sharing formulas and (c) unsound agricultural policies implemented by short sighted politicians.

5.1 Unsound Agricultural Policies

We give here two examples of this last mentioned reason. Number one is the promotion of irrigated soybean cultivation in central India. This region had a traditional agronomy of coarse cereals which performed well with limited rainfall. This traditional choice of coarse cereal crops was well balanced with cattle farming because the biomass generated by these crops became cattle fodder. With the promotion of soybean, irrigation took centre-stage and since soybean does not generate biomass suitable for cattle, this traditional agronomy was dismantled.

The second example is large scale introduction of sugar cooperatives in rain-deprived regions of Maharashtra. Although this did generate a favourable environment for a local politician to rise spectacularly, it created an unwarranted need to flood-irrigate a region where coarse cereals had once ruled the roost.

Finally we must acknowledge that growth of the Indian economy is driving increased water usage across sectors. In step with this, wastewater generation is increasing significantly and in the absence of proper policies and measures for treatment and management, the existing freshwater reserves are being depleted, polluted and vast areas are now water-stressed.

Given this background, any growth of the poultry processing industry will remain constrained by the availability of water. Even when good plant locations are identified by prospective processors, they must remember that access to water for household needs and irrigation of crops will always assume a higher priority. There are few locations, specially in the plateau and in the south, where adequate uninterrupted supply of raw water exists for this industry after meeting these more important and socially sensitive needs. Therefore unless new red zones are identified and earmarked for this activity, future location and growth of new facilities will not only be restricted but may occur sub-optimally.

5.2 Skewed Growth

Figure 7 shows the distribution of poultry slaughterhouses in India. To get further details of slaughterhouses listed in it, refer to an October 2025 Industry Report, which is posted on the Aptec website. You will note how skewed the distribution of plants is, in comparison with the distribution of meat consumers over the country. Entire Uttar Pradesh, all seven states of the north-east, Orissa, entire central India, Rajasthan and Gujarat have no processing plants. Haryana has the highest concentration of vegetarians but also hosts several processing plants. Uttar Pradesh and Bihar have among the highest population densities in the country but propose to set up only one plant in Kishanganj. This implies that processed poultry is being frozen, hauled long distances and sold at a tremendous disadvantage in competition with local wet-markets. These factors actually further depress consumption in these areas.

6 Solutions

6.1 Balance The 'Wastewater For Irrigation' Contract

Earlier we mentioned the pollution abatement rule which requires poultry processors to enter into an agreement with nearby *panchayats* for use of treated wastewater for irrigation. Now the basic principle involved in any legal arrangement requires all participants to conform. But as stated in this rule, while the poultry processor is obliged to deliver irrigation water, no quid-pro-quo reciprocal obligation binds the farmer to depend primarily on this water for irrigating his crops. He remains free to choose canal water or tube-well water for his needs. Because of this freedom, he may use the agreement as a bargaining chip, forcing the processing plant to shut down operations whenever he chooses to do so. On the other hand, if the farmer was equally obliged under the agreement to restrict his irrigation source to the plant's treated



wastewater stream, there would be a level playing field. With the quid-pro-quo clause, the contract would also end up conserving canal water, preserving ground water and saving electricity.

A solution may also lie in (a) the pollution control board permitting discharge of treated wastewater into irrigation canals subject to continuous automatic monitoring and logging devices being attached at the discharge points at processing plants, or (b) legislating a form of **ownership of irrigation rights**. Under this latter scheme, a poultry processor may buy **irrigation rights** for a certain agricultural acreage near his plant on payment of a fraction of his land registration fee. Once the processor has secured such a right, the law will prohibit the farmers owning adjacent crop land to draw ground-water or canal water for irrigating their land with, as long as the processor is ready to supply them treated wastewater conforming to the discharge standards laid down by the pollution control board for such irrigation. This will protect the farmer, groundwater resources and an unfair cost burden on processors.

6.2 Bundle Wastewater Treatment & Crop Irrigation With Food Parks Projects

Of the ninety-one organised sector poultry slaughterhouses listed in Aptec's March 2025 Industry Report, only six were in food parks or industrial estates¹¹ and they constituted only 6.1% of the total mid-2026 projected capacity. Why do the remaining plants prefer greenfield for which they need to get changed land usage (CLU) under zoning law certificates through an outstandingly tedious process, build a lot of infrastructure and draw dedicated power lines instead of choosing industrial estate and food park land? And with a poor score of 6.1%, why have the industrial estate and food park schemes failed to attract slaughterhouse projects?

Industrial estates and food-parks offer plots of land which are woefully unsuited for poultry processing because (1) the plots are too expensive, (2) too small, (3) have no provision for common wastewater treatment, (4) lack reasonable access to agricultural land on which to dispose the treated wastewater and (5) provide neither back up power nor common steam supply. In fact, in developing industrial estates, local and central governments alike behave like real estate developers rather than industry facilitators¹². As a result investors prefer greenfield sites, obtain CLUs and set up all facilities including dormitories for essential staff, all by themselves. Finally the zero discharge rule further disillusions potential industrialists and diminishes the lure of industrial estates and food parks.

6.3 Identify New Red Zones In Line With Riverine Planning

Particularly for peninsular and central India, the government is in the process of linking rivers, making piped water supply available from barrages and setting up several multipurpose hydrological projects. Study of a map of such projects should help the pollution control authorities to identify new spots where water will become available through these efforts for the establishment of Hub zones. If this is jointly done by all concerned government agencies, new red zones may be identified on poor soils close to the new waterways. Once such new red zones are declared, new poultry farms and Hub processing facilities could be set up in a planned manner and linked by roads to all nearby consumption centres with new Spoke facilities.

6.4 Scrap Environmental Laws Based On 'Correlation Is Causation' Fallacy

For a long time pollution control authorities have been selling the idea of setting up eucalyptus plantations on land owned by poultry slaughterhouses to manage their treated wastewater. Briefly, this theory recommends eucalyptus plantations because this tree is declared by our agricultural scientist to be most efficient in losing water through transpiration. The Karnal University is the most visible promoter of this idea – in fact it is called the **Karnal Technology**. We have studied this proposition over a long period and could not restrain ourselves from demolishing this so called 'technological solution'.

What are the principal and fundamental arguments against the imposition of this Karnal Technology?

- (1) If the pollution control authorities are unable to enforce proper wastewater treatment and discharge, can they hide the failure of their own executives by taking legislative action instead of punishing their executives?



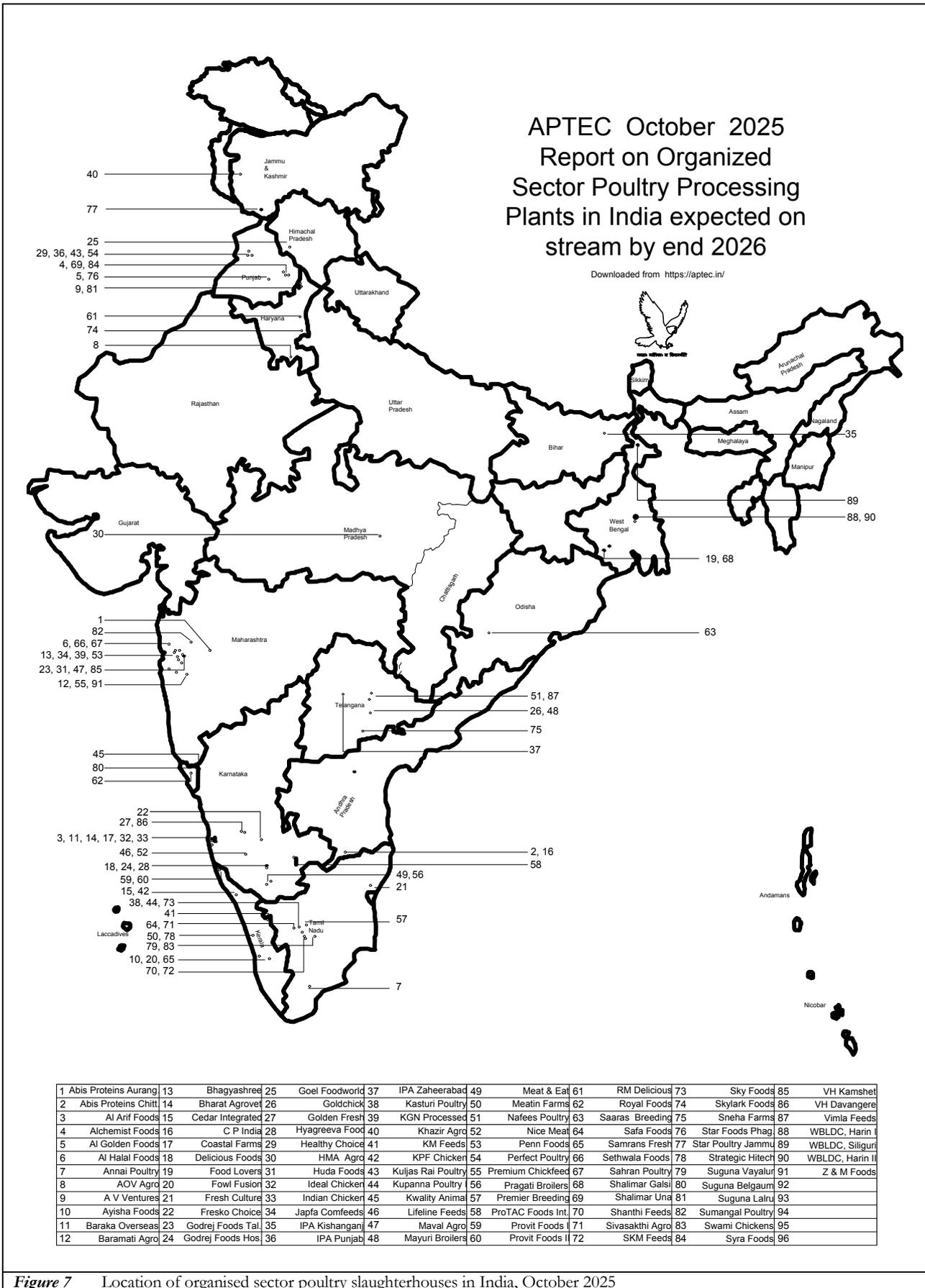


Figure 7 Location of organised sector poultry slaughterhouses in India, October 2025



- (2) Does deliberate and planned transpiration of treated wastewater not worsen water stress? Should treated water not be allowed to return to subterranean aquifers to raise the seriously falling water table instead of forcing plant owners to contribute to the formation of clouds?
- (3) Why must industrial estates, especially those promoted as food parks, not offer common treatment of wastewater for the entire facility? Would such an arrangement not reduce cost, increase efficiency, considerably improve monitoring and control? And, if the discharge standards were brought up to mark, could not food parks also include crop irrigation as their stated objective and thus make it another incentive to the local population, who routinely protest against acquisition of their land for building food parks on?
- (4) Why insist on eucalyptus plantation for accelerating transpiration? If transpiration is your objective, can you prove that eucalyptus is indeed the most efficient choice?

The first four questions are rhetorical – they already contain their own answers. But the last needs further explanation. To understand this we must trace the possible origins of the ‘**Eucalyptus Is The Culprit**’ hypothesis.

Depletion of groundwater in Punjab and present day Haryana (which was earlier a part of Punjab) was first noted shortly after independence. When populations were exchanged, DPs entering eastern Punjab encountered much worse agricultural conditions than they had been familiar with in western Punjab. The land that they had fled from had one of the world’s most developed irrigation canal networks, built over decades past by the British.

Wealthy immigrants soon set about improving their new land in east Punjab. They consolidated holdings to create large crop fields and planted eucalyptus as windbreak on walkway *bunds* or footpaths around these fields. The Punjab government paid special attention to *choes* which brought in large quantities of sand and boulders from the Shivalik hills. These hills had been denuded by the British of their forest cover to meet their war requirements. The farmers also drilled a large number of tube-wells for use with diesel pumps and went about flood-irrigating their land. In short order, in fact, a massive local industry manufacturing small diesel engines mushroomed all over India, making India the world leader in the manufacture of small diesel engines!

Eucalyptus has over 800 varieties and only some grow fast, tall, with few branches (hence no nesting sites for birds) and thin canopies. These qualities make some varieties of eucalyptus the ideal windbreak. Such varieties were chosen by the prosperous immigrant farmers for planting all over the *bunds* separating individual fields. It was then that the Indian authorities noticed that Punjab had suddenly developed a rapidly falling water table. When scientists from local agricultural universities got to work, they promptly wrote up the ‘eucalyptus culprit snake-oil theory’ based on knee-jerk science!

Ask yourself – how could they have identified eucalyptus as the smoking gun? Did they carry out comparative transpiration or root structure studies on various tree species and conclude that eucalyptus was indeed the culprit? Or did they just scan the horizon for anything unfamiliar and made up their minds? It had to be the latter! Land that had had practically no agriculture, nor need for tubewells, now had a falling groundwater level – what else could be the culprit? Not the nascent agriculture, nor the new tubewells, but surely **the most visible new feature – eucalyptus trees!**

Did it not occur to them that flood irrigation of fields would by itself have produced evaporative loss several orders of magnitude higher than the significantly small number of windbreak trees could? Did they not compare the exposed surface area offered by the collective number of eucalyptus leaves with the surface area of the flooded fields? And did they not compare eucalyptus leaves which evolution optimised by coating it with cuticles for water conservation in the face of aridity with the proclivity for evaporation presented by flooded soils?

To survive in the often dry and nutrient poor soils of their native habitats in Australia, eucalyptus trees can grow roots that reach depths of up to 20 meters in order to access water and nutrients. But when they grow in more fertile and humid soils, eucalyptus roots have no need to descend very far in search of nutrients and water. As these trees grow in such environments, their root system spreads laterally, close to the surface of the soil, sometimes for a horizontal distance of up to 30 metres from the trunk. Experts say that



90 percent of a cultivated eucalyptus' root system is found in the top 300 mm from the surface. Root structures in such cases do not go very deep: so much so, that when grown in wet or waterlogged soils, these tree gets uprooted and come crashing down in the mildest thunderstorms. It helps to remember that raising water from great depths costs the tree in terms of energy, which it naturally conserves when there is plenty of surface water supplied by obliging farmers.

Evolution has promoted special adaptation features for plants to make them fit to grow in low precipitation or arid regions. These features are clubbed under the name **xerophytic adaptations** and include thin needle-like leaves, cuticles on leaves and scaly bark on trunk, reduced number of stomata on the underside of leaves, existence of an oily sap and the ability of roots to go very deep in search of water. All xerophytic adaptations help conserve water and seek to snatch it from dry soils. Eucalyptus has all these adaptations and yet our so called scientists insist that eucalyptus is profligate about losing water through transpiration!

So can we conclude that eucalyptus windbreaks in Punjab farms were guilty of drawing water all the way from the water table and so contributing to its fall? The farm land was well irrigated and the trees were, with the help of their lateral root system, thriving off the flood-irrigation water that pumping brought to the surface. Clearly intensive pumping of irrigation water was the primary reason for the falling water table: the culprit was not eucalyptus!

To conclude, this “theory” (actually a hypothesis, and a faulty one, to boot!), is based on the commonest logical fallacy known to mankind, namely, **correlation is causation!**

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Endnotes

¹ Price volatility in live broilers results in alternate periods of over-supply & crash in price and shortages & peaking of prices, once or twice a year. When a monopoly engineers supply of breeding stock to create large price oscillations, it tends to wipe out any emerging competition in the market for breeding stock. This is how a monopoly is perpetuated.

² The wet-market is defined as an unorganized slaughter location, typically at or near mandis in India and well concealed in villages close to or within cities and towns. Villages located within towns and cities are governed by traditional land use laws and municipal land use laws do not apply there. Because of this it is convenient for the wet-market operators, displaced by municipal orders from cities and towns, to hide their operations within such villages.

³ **Calculation of operating capacity and growth rate of poultry processing plants in India at 2018 end, based on Aptec Bi-annual Reports dated February 2018 and March 2025**

1	Operating capacity in Q3, 2002 (The 2002 capacity comprised Arambagh-Bolpur, West Bengal 2000; Godrej-Hoskote, Karnataka 1000; Goldchick-Hyderabad 2000; Riverdale-Somatne, Pune 1000; Toubro (Alchemist) Kurali 2000; Suguna-Vayalur 2000; Venkys-Kamshet, Pune 3000 =13000 BPH)		13000
2	Projected capacity by end 2018 (vide Aptec Feb 2018 Bi-annual Industry Report)		95600
3	Less capacities that failed to materialize/delayed	Srinivasa Prakasam unit 2000 Coastal Farms, Mangalore 2000 Goel Foods 2000 Nanda Group, Bangalore 2000 RFK Green, Pulwama 2500 VKS expansion delayed 2000 Subtotal 12500	-12500
4	Total operating capacity in 2018		83100
5	Calculated growth rate over the 14 year period (2018-2002) = 12.29% [(13000x1.1229) ¹⁴ =83109~83100]		
6	Projected capacity by Q2, 2026 (vide current Bi-annual Industry Report)		267800
7	Calculated growth rate over the 8 year period (2018-2026) = 15.75 % [(83100x1.1575) ⁸ =266297~267800]		
8	Calculated growth rate over the 24 year period (2002-2026) = 13.43 % [(13000x1.1343) ²⁴ = 267782~267800]		

⁴ Refer October 2025 Industry Report which is posted on the Aptec website. The growth rate over 2020 and 2024 March was 4.8%, indicating recovery during the Covid years and is expected to clock 15.2% over 2024-2026.

⁵ We are already importing BT cotton, extracting edible oil from cotton seed and utilizing the seed cake for animal feed manufacture. So the proposition does not in any way further expose our human food chain to GM crops.

⁶ In a seminal work *Water and Waste Management in Poultry Processing* (Carawan et al)¹ the major uses of water in a typical 70,000 broilers per day benchmark plant in the mid 1970s was shown to be 12.28 gallons or 46.83 litres per bird. This was reduced, by careful planning and rethinking described in the above publication, to 7.81 gallons or 29.56 litres per bird. It is now at between 25 and 13 litres per bird depending on plant capacity: the higher figure belonging to the smallest plant capacity of 1000 BPH and the lower figure belonging to roughly 10,000 BPH. Beyond this capacity figure the specific water consumption does not change.

⁷ APTEC Report - Water Recycling in Poultry Processing - State-of-the-Art

⁸ A stock-keeping unit (SKU) is a scannable bar code, most often seen printed on product labels in a retail store. The label allows vendors to automatically track the movement of inventory. The SKU is composed of an alphanumeric combination of eight-or-so characters.

⁹ Scale economies express how much more it costs to process one chicken is when it is performed in a plant running at 1000 BPH as compared to doing it in, say, a 6000 BPH plant. To obtain actual figures, download AptecApp from the Aptec website. This App allows you to choose from 5 different plant sizes, configure the product mix to your liking and it immediately generates the entire financial feasibility calculations. It also shows you how much a typical kilogram of marketable product costs to produce with your just-configured product mix and capacity settings. Maintaining the same product mix, switch to a different capacity choice and study the financials. You can read how much it costs to process at that capacity. This will illustrate the sensitivity of processing cost to scale of operation. Even within a single plant capacity setting you can choose a 20% over capacity or 20% under capacity operation and see the impact of specific processing cost.

¹⁰ MOFPI is the Indian Ministry of Food Processing Industries

¹¹ These are tabulated here

	Project	Status	Capacity	Remark
1	AV Ventures at Panchkula,	In operation from beginning 2023	1500	Plant began operation in January 2023
2	Goel's Foodworld, Simla	Under installation	4000	Have just been moved out of city limits and made to comply with local zoning laws
3	Godrej Tyson, Taloja	Intermittent operation	3000	Have to transport slaughterhouse waste to Bangalore for rendering it there. Wish to exit this location.
4	Lifeline Feeds, Chikmagalur	In operation, plans expansion in 2025	3000	Formed by consolidating four industrial estate plots, with three public roads separating the operation
5	Skylark Foods, Sonapat	In operation since 2004	1000	They have growth plans but cannot do so because they have not enough land. The plant exists on a mere 1800 SqM of land



6	Star Foods, Ludhiana	Expected to come on stream by mid 2025	4000	Plans made by Aptec by consolidation of 8 plots of land and partial wastewater treatment before pumping to common facility
6.1 % of the total mid-2026 projected capacity			16500	

¹² Lifeline plant occupies 4 plots of land separated by roads having overhead and underground pipelines connecting them. Star is planned on 8 adjacent plots of land. Godrej Talaja has serious problems with neighbours and for some time was transporting tanker-loads of processing waste to Hoskote for treatment. Skylark cannot use its rendering plant because of neighbours' complaints and cannot expand for lack of space. This clearly illustrates the unpopularity of government food parks for poultry processing.

