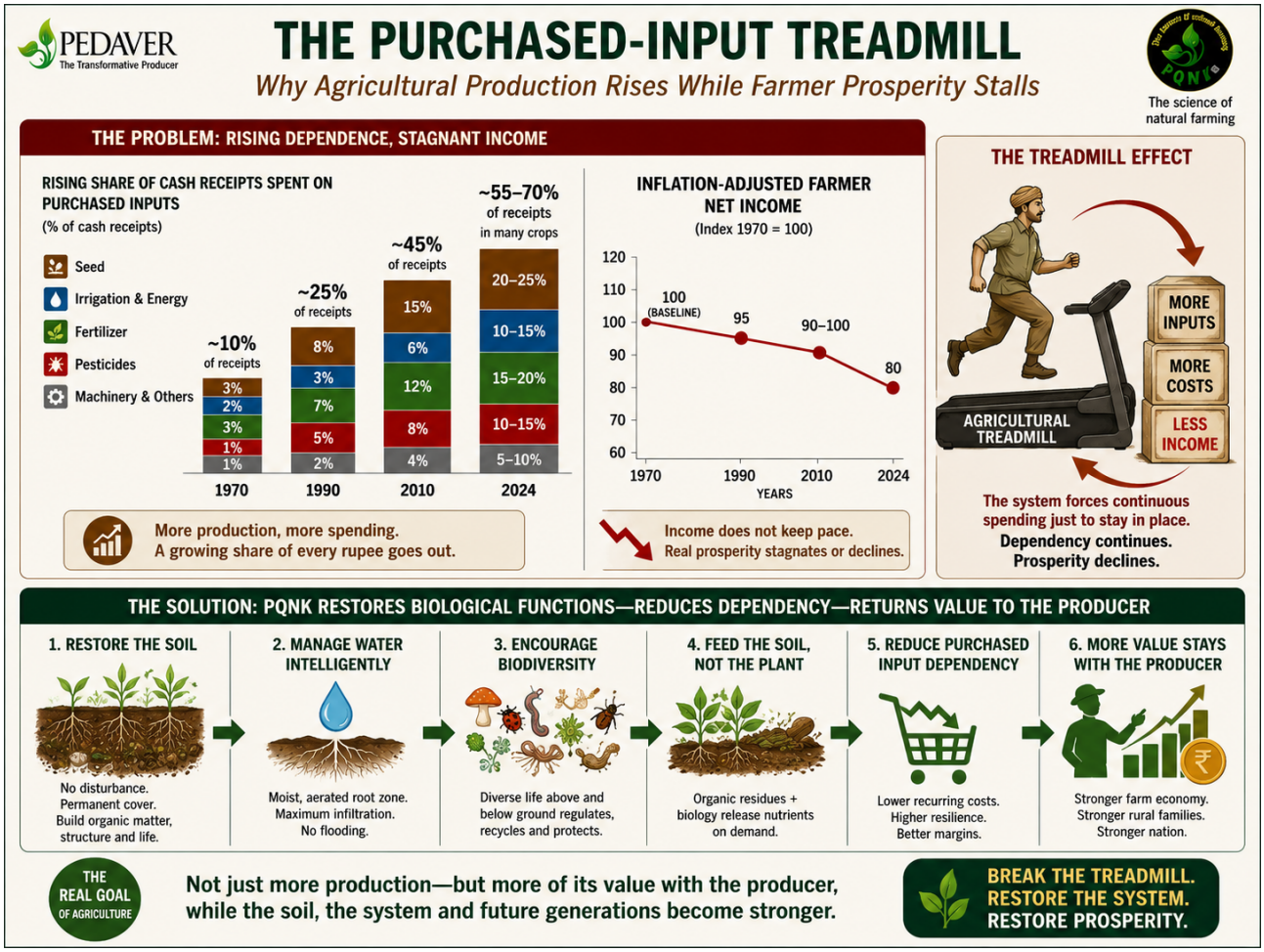

The Purchased-Input Treadmill

Why Rising Agricultural Production Does Not Necessarily Create Farmer Prosperity

Abstract

Modern agriculture is generally evaluated by yield: tonnes per hectare, maunds per acre, milk per animal or output per unit of land. Yet yield alone does not tell us whether agriculture is making the producer economically stronger. A farm may produce more while an increasing share of the value produced is transferred outward through recurring purchases of fertilizer, pesticides, proprietary seed, fuel, machinery operations, irrigation energy and other inputs.

This paper examines what may be called the **Purchased-Input Treadmill**: a production architecture in which important functions once performed within the farm ecosystem are progressively replaced by externally purchased products and services. Once those external inputs become structurally necessary, the producer must purchase them again for the next crop merely to maintain production.

Rising output can therefore coexist with high production expenses, volatile margins and stagnant farmer prosperity.

The evidence does not justify one universal percentage showing input expenditure rising identically in every country or crop. It does, however, strongly establish that production expenses are a major determinant of farm profitability, that important purchased inputs can absorb large fractions of crop operating costs, and that input-price shocks can sharply compress farm margins. USDA data, for example, show U.S. farm production expenses remaining historically elevated after the major increases of 2022–23, while fertilizer alone has represented roughly one-third to nearly one-half of operating costs in U.S. corn production during some periods.

PQNK addresses this problem at a deeper level than input substitution. Its economic proposition is to restore biological and ecological functions within the production system so that recurring purchased dependency progressively declines. The objective is therefore not merely **more production**, but **more of the value of production remaining with the producer while the productive capacity of the farm itself improves**.

1. The Question Agriculture Rarely Asks

A farmer harvests a record crop.

Agricultural statistics record an increase in production. Extension departments may describe the season as successful. Seed, fertilizer and pesticide suppliers point to the yield as evidence that the technology worked.

But one question remains:

After everybody has been paid, how much of the value created by the farm remains with the farmer?

That question changes the meaning of agricultural productivity.

Suppose two farmers each produce crop worth Rs. 200,000 per acre.

The first spends Rs. 140,000 producing it and retains Rs. 60,000 before other obligations.

The second spends Rs. 60,000 and retains Rs. 140,000.

Measured by gross output, they are identical.

Measured by the economic strength of the producer, they are entirely different production systems.

This is the starting point for understanding the Purchased-Input Treadmill.

2. What Is the Purchased-Input Treadmill?

A treadmill allows a person to run faster without actually moving forward.

The agricultural equivalent occurs when a producer must continually increase expenditure simply to maintain the productive system on which previous output depended.

The recurring purchases may include seed, fertilizer, pesticides, herbicides, irrigation energy, diesel, machinery operations, crop-protection services, supplemental nutrients and increasingly sophisticated combinations of products.

Not every purchased input is inherently harmful, nor is every input unnecessary under every farming condition. The economic issue is **structural dependence**.

When production becomes dependent upon an external input, the farmer does not purchase that function once.

He purchases it again next season.

And again the season after that.

If its price rises, his production cost rises.

If credit becomes expensive, his financing cost rises.

If crop price falls, the input bill does not automatically fall with it.

The producer therefore carries a recurring liability before the crop has generated a rupee of income.

That is the treadmill.

3. The Evidence: Costs Matter as Much as Receipts

Formal agricultural economics already recognizes this relationship.

USDA defines net farm income broadly as farm income after production expenses, while net cash farm income subtracts cash expenses from cash income. In other words, the economic performance of farming cannot be understood from receipts alone.

The scale is substantial. U.S. farm-sector production expenses reached an inflation-adjusted $484.7 billion in 2023 and remained historically high thereafter; USDA noted that even after forecast declines, expenses remained above the 2004–23 average.

Individual purchased inputs can represent a major fraction of production costs. In U.S. corn, fertilizer represented about **33–44% of operating costs** between 2010 and 2019, and around 16–24% of total costs. Fertilizer prices later surged, with average fertilizer cost per acre increasing sharply in 2022.

The point is not that American corn represents all agriculture.

It demonstrates the mechanism:

A technically productive crop can carry a very large externally purchased cost burden.

The same accounting principle applies whether the farmer is in Iowa, Punjab, Sindh, India, Africa or elsewhere, although the actual percentages differ greatly by crop, country, irrigation system, mechanization, land tenure and year.

4. A Necessary Correction to the Infographic

The accompanying infographic illustrates input dependence as rising from roughly 10% of cash receipts in 1970 to 55–70% or more today.

That is a useful **conceptual representation**, but it should not be mistaken for a single measured global historical series.

Agriculture is too heterogeneous for such a universal numerical progression.

Cotton is not wheat. Potato is not rain-fed millet. Pakistan is not the United States. A highly mechanized irrigated farm has a different cost structure from a smallholder relying mainly on family labour.

Even within one crop, input shares change with fertilizer prices, diesel prices, commodity prices, yield, weather and interest rates.

The scientifically defensible statement is therefore:

Across input-dependent production systems, purchased production costs can absorb a large and sometimes increasing proportion of crop value, and sharp increases in input prices can substantially compress farmer margins.

The treadmill is real.

The precise percentage must be measured for the particular production system being discussed.

That correction actually strengthens the argument because PQNK does not need exaggerated numbers to establish its economic case.

5. Industrial Agriculture Changed More Than Inputs

The deeper transformation was not simply that farmers began buying fertilizer and pesticides.

Agriculture progressively transferred **functions** from the ecosystem to external products.

Natural nutrient cycling became fertilizer procurement.

Biological pest regulation became pesticide programs.

Ecological weed regulation increasingly became herbicide dependence.

Soil architecture became repeated tillage and mechanical reconstruction.

Seed regeneration increasingly became recurring commercial seed purchase in many crops.

Natural soil-moisture buffering was replaced in many systems by increasingly intensive irrigation management.

As more functions moved outside the farm ecosystem, more of the production process became monetized.

The farmer began purchasing not merely products but **substitutes for ecological functions**.

This distinction is central to the PQNK economic argument.

6. Why High Yield Can Hide Economic Weakness

A crop can yield extremely well and still leave the farmer economically vulnerable.

The reason is simple:

Yield measures biological output. It does not measure retained economic value.

The production manager ultimately needs to know:

Gross value of production
− recurring purchased inputs
− machinery and energy
− finance
− labour and other production costs
= economic value retained

A technology that raises output by 10% but increases recurring cost by 20% may be agronomically impressive and economically harmful.

Conversely, a system producing the same yield with dramatically lower recurring expenditure creates a major economic gain even though a conventional yield comparison might describe it as "no improvement."

Therefore agricultural progress needs another metric:

How much net value does the production system retain for the producer per unit of land, water and time?

7. The Ratchet Effect

Purchased-input dependence also contains a ratchet.

Once a farming system has been reorganized around external inputs, abruptly removing them does not necessarily restore natural production.

A biologically impaired soil does not recover merely because fertilizer is stopped.

A compacted field does not become structurally healthy because tillage is abandoned tomorrow.

A simplified biological system does not instantly regenerate pest regulation because spraying stops.

This is why farmers can become trapped.

The existing system requires external support, while withdrawing the support before restoring biological function can reduce production.

The farmer therefore concludes:

“I cannot farm without these inputs.”

Under the existing degraded production architecture, he may temporarily be correct.

But that does not demonstrate that crops biologically require the commercial input system.

It demonstrates that the farm's **internal functional capacity has been weakened and has not yet been restored**.

This is precisely why PQNK has a transition architecture rather than simply instructing farmers to stop inputs.

8. Subsidizing the Treadmill Does Not Remove It

Governments frequently respond to rising production costs by subsidizing fertilizer, seed, electricity, credit or machinery.

Such measures can provide genuine short-term relief to farmers.

But economically there is an important distinction between:

making an input cheaper

and

making the production system less dependent upon that input.

The first changes who pays part of the bill.

The second changes why the bill exists.

Punjab itself has used input-subsidy programs to reduce farmers' costs and encourage changes in seed, fertilizer use and crop choice. Such programs can improve farm economics in particular circumstances, but they remain interventions within an input-purchasing architecture.

PQNK asks the more fundamental question:

Can the productive function itself be returned to the farm ecosystem?

9. PQNK Is Not Cheap-Input Agriculture

This point requires emphasis.

PQNK should not be understood as:

chemical fertilizer → cheaper organic fertilizer
pesticide → botanical pesticide
commercial stimulant → microbial bottle
expensive input → cheaper input.

That would leave the treadmill intact.

Only the supplier would change.

PQNK's larger objective is:

externally purchased function → internally regenerated ecosystem function

The difference is profound.

Instead of continually purchasing fertility, restore nutrient cycling and biological access to the geological mineral reserve.

Instead of continually purchasing soil reconstruction through tillage, establish permanent soil architecture.

Instead of repeatedly destroying and recreating beds, create them once and protect them.

Instead of inundating soil according to an irrigation calendar, manage the moisture condition of the root zone.

Instead of treating insects as an isolated chemical-control problem, restore biodiversity and biological regulation.

The economics emerge from the biology.

10. The Farm Becomes Productive Capital

Under a purchased-input system, much expenditure disappears with the crop cycle.

The fertilizer was used.

The pesticide was sprayed.

The diesel was burned.

The tillage operation is finished.

Next season much of it must be purchased again.

Under a biologically rebuilding system, management expenditure should increasingly create **productive capacity that remains**.

Better aggregation remains.

Root channels remain.

Permanent beds remain.

Biological populations reproduce.

Residues become future food for the soil system.

Organic matter contributes to continuing water and nutrient regulation.

Mycorrhizal networks recolonize.

The productive asset is therefore increasingly **the functioning farm ecosystem itself**.

This is a fundamentally different economic model.

11. The Transition Is an Investment, Not Instant Zero Cost

PQNK should not promise that all costs disappear on the first day.

Transition itself has costs.

Farm layout may need correction.

Hardpan may require one-time breaking.

Permanent raised beds must be established.

Machinery may need adaptation.

Residues and mulch must be managed.

Biology needs time to recover.

There may even be carefully limited nutritional or crop-protection interventions while the biological system is recovering.

But these expenses should be judged differently from a permanently recurring input program.

A useful economic distinction is:

Restorative investment builds future farm capacity.

Dependency expenditure must recur merely to keep the current system operating.

The direction of PQNK should therefore be:

high initial restoration where necessary → declining recurring dependency → increasing internal biological function.

12. Pakistan and the Purchased-Input Problem

The issue is particularly relevant to Pakistan because farm economics is exposed simultaneously to fertilizer prices, diesel and electricity costs, irrigation constraints, machinery costs, credit, seed prices and volatile crop markets.

Pakistan's agriculture also consists overwhelmingly of relatively small farms; the World Bank has noted that approximately 91% of Punjab farmers operate holdings below 12.5 acres.

A small farmer has little capacity to absorb repeated shocks.

If the input bill rises by Rs. 20,000 per acre, a large enterprise may have financing options.

For a smallholder, the same increase can consume household savings, force borrowing or determine whether the next crop is planted at all.

Therefore reducing structural production dependency is not merely an environmental issue.

It is a **farmer-survival issue**.

13. The Correct Measure of Agricultural Progress

The Green Revolution taught agriculture to celebrate:

yield per acre.

PQNK requires a broader accounting system.

A production system should be judged by at least:

yield and quality,
cost of production,
net producer income,
water consumed,
energy consumed,
recurring purchased-input dependency,
soil biological capacity,
soil physical condition,
nutritional value of produce,
and the productive condition of the farm left for the next crop.

The last measure is especially important.

If a farmer harvested 60 maunds but left the soil poorer, more compacted, more chemically dependent and more expensive to farm next year, part of that apparent income was obtained by **liquidating biological capital**.

If another production system harvests competitively while leaving the soil more functional and the next crop less dependent on external purchase, it has created capital.

Agricultural economics rarely puts those two farms on the same balance sheet.

It should.

14. From Gross Production to Farmer Prosperity

This leads us to perhaps the most important economic distinction in PQNK:

Food production and farmer prosperity are not the same measurement.

A country can report record wheat production while wheat farmers lose money.

It can produce more cotton while growers leave cotton cultivation.

It can achieve impressive yields while requiring subsidies merely to keep the production system economically tolerable.

That is why national agricultural success should not be measured only by tonnes produced.

We must also ask:

Who captured the value created by those tonnes?

Seed company?

Fertilizer manufacturer?

Chemical supplier?

Fuel supplier?

Machinery owner?

Bank?

Trader?

Or producer?

A functioning food economy requires all legitimate participants to receive value.

But the biological producer cannot remain the residual claimant who accepts whatever value remains after everybody else has been paid.

15. The PQNK Economic Proposition

PQNK therefore makes an economic proposition alongside its biological one:

Restore internally generated productive functions so that a progressively larger share of agricultural value remains with the producer rather than being continuously exported from the farm through avoidable recurring dependency.

This is not opposition to commerce.

Farmers will always purchase machinery, services, knowledge, equipment and materials where these create genuine economic value.

The distinction is between **productive exchange** and **structural dependency**.

The test is simple:

Does this expenditure make the farm more capable of functioning independently next season, or does it guarantee that the farmer must purchase essentially the same function again?

That question should be asked of every agricultural input.

16. Breaking the Treadmill

The Purchased-Input Treadmill cannot finally be broken by cheaper fertilizer, a new pesticide molecule or another subsidy.

Those may change the speed of the treadmill.

They do not necessarily remove it.

The treadmill begins to disappear when the **production architecture changes**.

When soil remains undisturbed.

When it remains covered.

When water and air are managed together rather than repeatedly flooding and drying the root zone.

When biodiversity returns.

When living roots maintain relationships with soil biology.

When residues remain resources rather than waste.

When permanent production architecture replaces seasonal reconstruction.

When biology progressively resumes functions for which farmers had become accustomed to paying outsiders.

That is where ecology becomes economics.

Conclusion: The Farmer Must Keep More of the Value He Creates

The agricultural challenge is often framed as:

How do we produce more?

That question is incomplete.

The more important question is:

How do we produce abundantly while allowing the producer, the soil and the production system itself to become stronger rather than more dependent after every crop?

Purchased inputs are not automatically wrong.

Nor does eliminating an input automatically make a production system correct.

The real issue is the architecture of dependency.

A system requiring increasingly costly external intervention to sustain itself places the farmer on a treadmill.

A system that progressively restores internal biological function creates productive independence.

PQNK therefore changes the economic objective from:

maximum production through purchased inputs

to:

maximum biological performance with minimum recurring external dependency, while retaining greater value with the producer.

That is the economic meaning of moving from industrial agriculture to a natural ecosystem production system.

And that is ultimately how the treadmill is broken:

Restore the soil. Restore the system. Restore the farmer.

Evidence note for the accompanying infographic

I recommend we revise one part of the infographic before attaching it to this paper. The **10%, 25%, 45%, 55–70%**historical bars and the accompanying farmer-income index should be labelled

“illustrative pattern” unless we can trace each number to a defined dataset. They should not say **“measured, quantified”** as presently written.

The evidence behind the general argument is strong. USDA directly defines farm profitability through receipts minus production expenses, documents historically elevated recent production expenses, and provides crop-specific evidence of major purchased-input cost shares.

I would rather publish a slightly more conservative infographic attached to a **scientifically unassailable paper** than preserve impressive numbers that an economist could legitimately challenge.

Applying PQNK without understanding nature’s operating system will not deliver abundance, stability, or nutrient density.

*PQNK (pronounced “picnic”)—the regenerative & sustainable **Pristine Organic Farming System** —is grounded in **Natural Ecosystem Science**. This science employs perennial biodiversity, protects soil with organic mulch, and avoids practices such as water inundation, tillage disturbance, and leaving soil bare.*

*It is the **process** that matters most. PQNK is a pristine production system designed not merely for yield, but for optimal, balanced output—where quality, sustainability, and ecological harmony emerge from a self-regulated, zero-external-input methodology.*

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