Agricultural Productivity in India- Review and Policy Implications

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Green Revolution in India

First phase of GR - late 1960s to mid 1980s

- Area expansion
- Increase in cropping intensity
- Higher use of HYV
- Intensive use of chemical inputs and machine labour
- Higher yield per unit of land
- High investment on irrigation, research & extension
- Achieved national food security

Second Phase of GR - beginning of mid-1980s

- Increase in production was input based
- Area expansion limited
- Decelerating yield growth
- Low growth in productivity

Sustainable Productivity

TFP trends indicate the sustainability

- Measures the extent of increase in total output which is not accounted by increase in total inputs.
- Influenced by change in technology, institutions, infrastructure, etc.

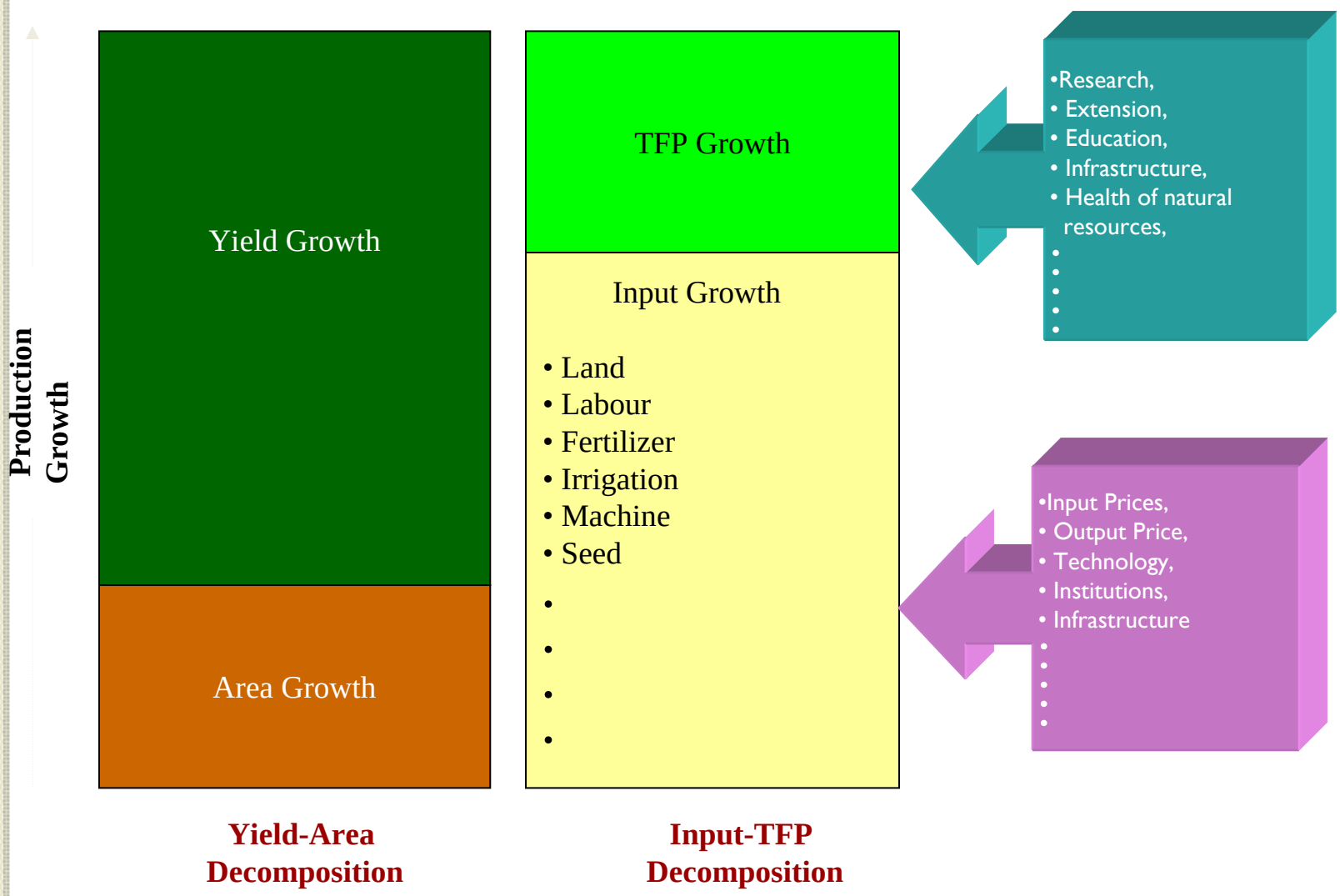
Crop-related technological changes often embodied in seed adoption can be divided into two components

- "quality" represents productivity improvement and cost reduction- determined by investment in R&D and is an exogenous variable in explaining TFP.
- "quantity" of technology is linked to- area on which the farmer adopts the technology- affected by extension, infrastructural development, as well as on-farm and off-farm characteristics.

Objective

- Productivity trends of major crops and crop sector in India
- Decompose the sources of growth of TFP growth
- Policy measures for having sustainable productivity growth

Production Growth Models



Total Factor Productivity

The Accounting Approach: Approximates technological change by the computation of factor productivity indices, mainly the rate of change of TFP indices (Christensen, 1975) - **Divisia-Tornqvist index**

- Output Index

$$TOI_t / TOI_{t-1} = \prod_j (Q_{jt} / Q_{jt-1})^{(R_{jt}+R_{jt-1})^{1/2}}$$

- Input Index

$$TII_t / TII_{t-1} = \prod_i (x_{it} / x_{it-1})^{(S_{it}+S_{it-1})^{1/2}}$$

Total Output Index

TOI (t) = TOI (1).TOI(2)……TOI(t-1)

Total Input Index

TII (t) = TII (1).TII(2)……TII(t-1)

Total Factor Productivity Index

$TFP_t = (TOI_t / TII_t)$

TFP Decomposition Model

TFP = f (Research, Extension, Literacy, Infrastructure, Urbanisation, Dummy variables)

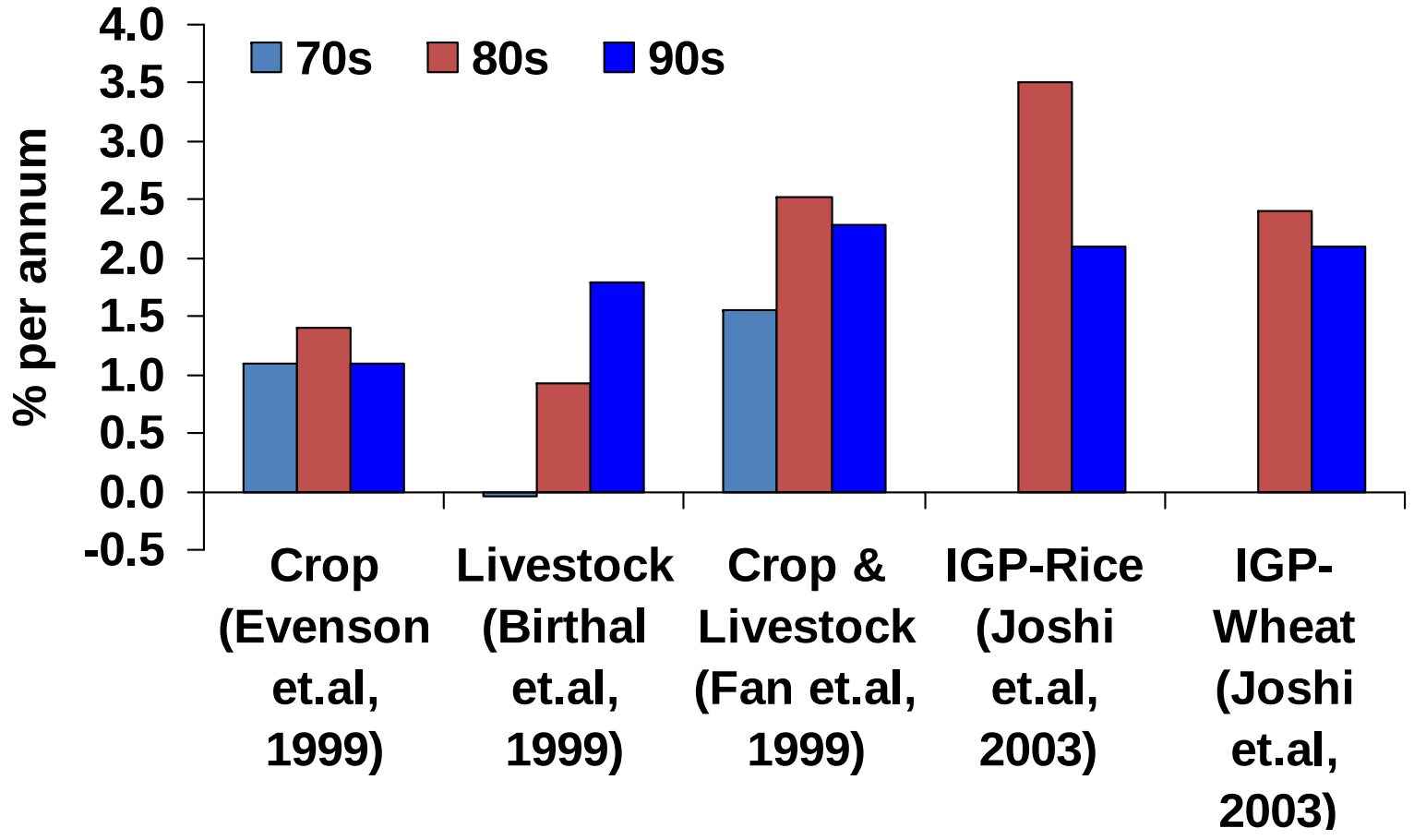
- Research: Research stock of the crop (Rupees per ha).
- Extension: Extension stock (Rupees per hectare of net crop area).
- Literacy: Percent of total rural population literate.
- Infrastructure: Percent of villages electrified.
- Urbanisation : Share of Urban population in total
- Dummy variables: KVK, Water Table, Region dummy's

Data Requirement

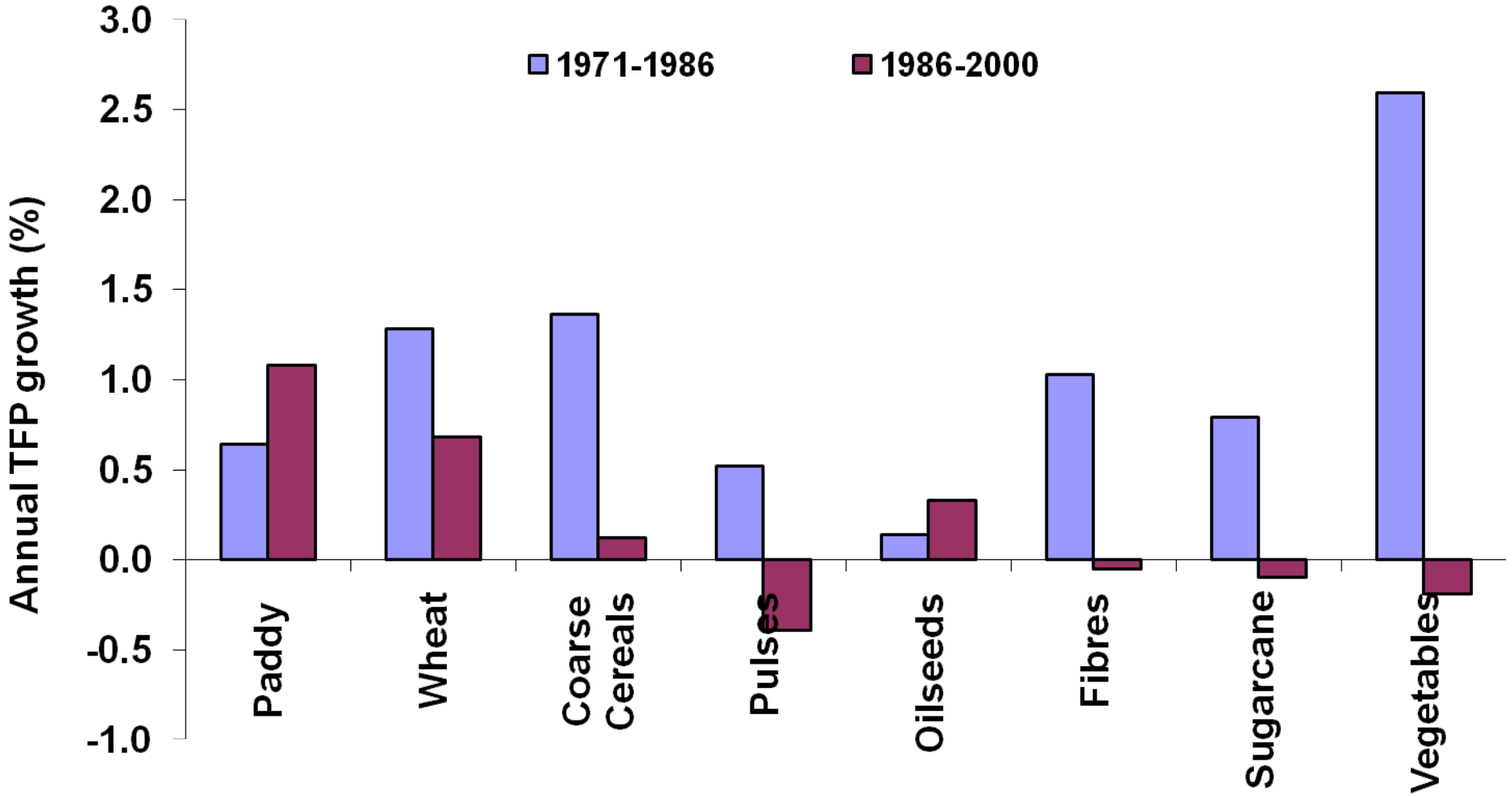
Total Input Index	*Output Index*
• Human labour • Bullock labour • Machine labour • Farm yard manure • NPK fertilisers • Irrigation • Plant protection • Land • Input Price	• Production • Farm Harvest Prices

The analysis uses the data till 2000, but now the information is available till 2007.

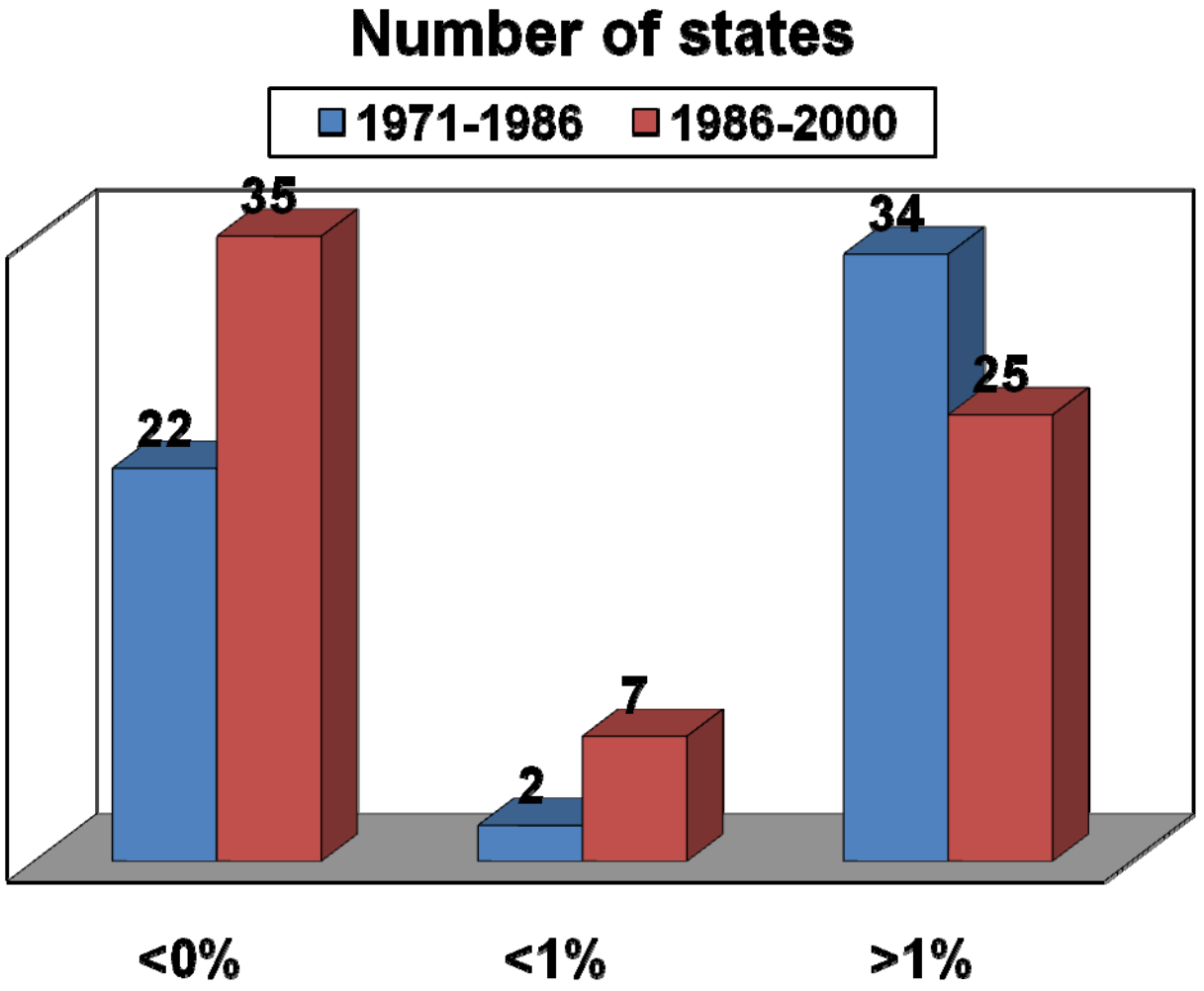
TFP growth- Empirical Studies



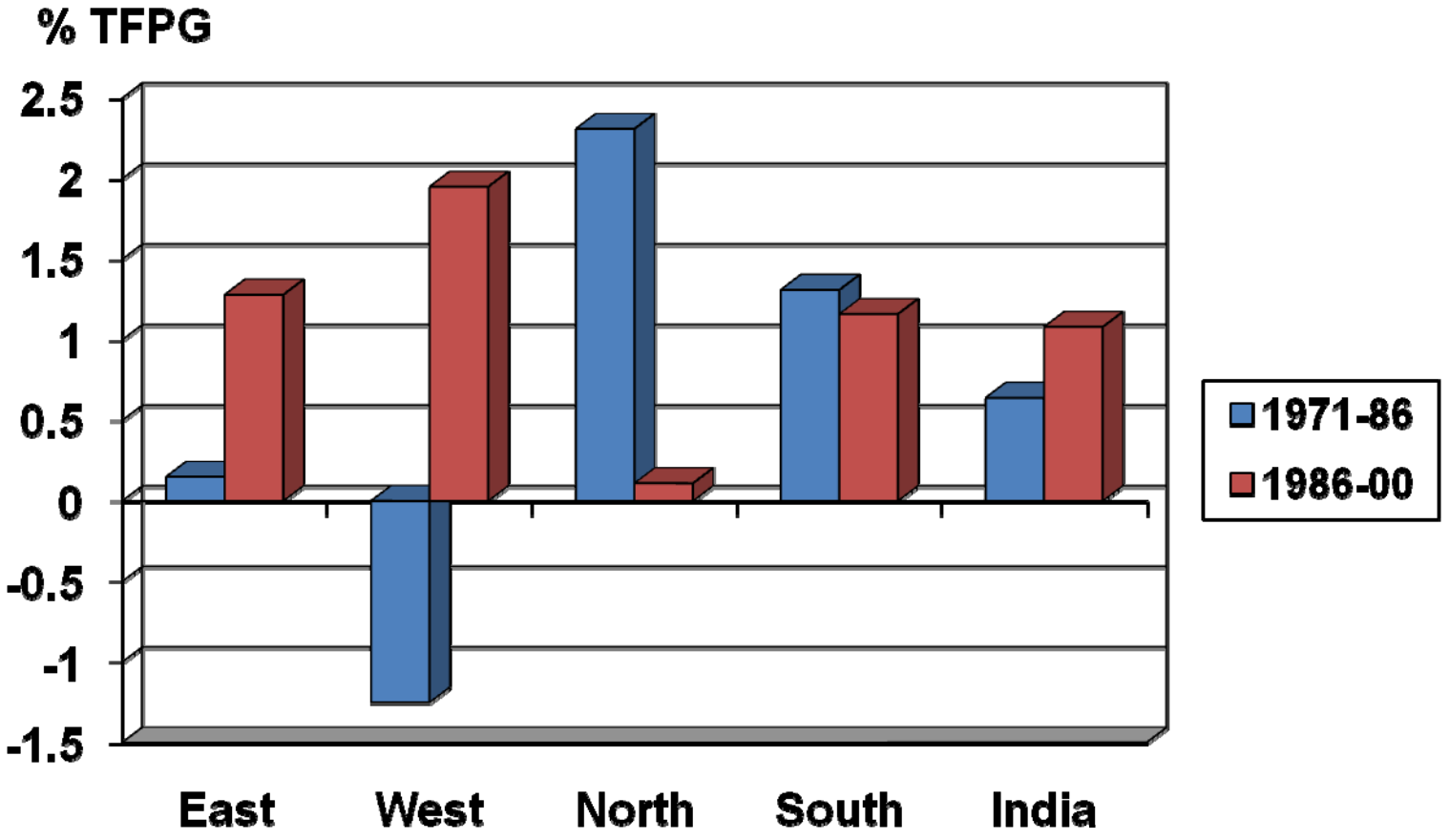
TFP trends in India



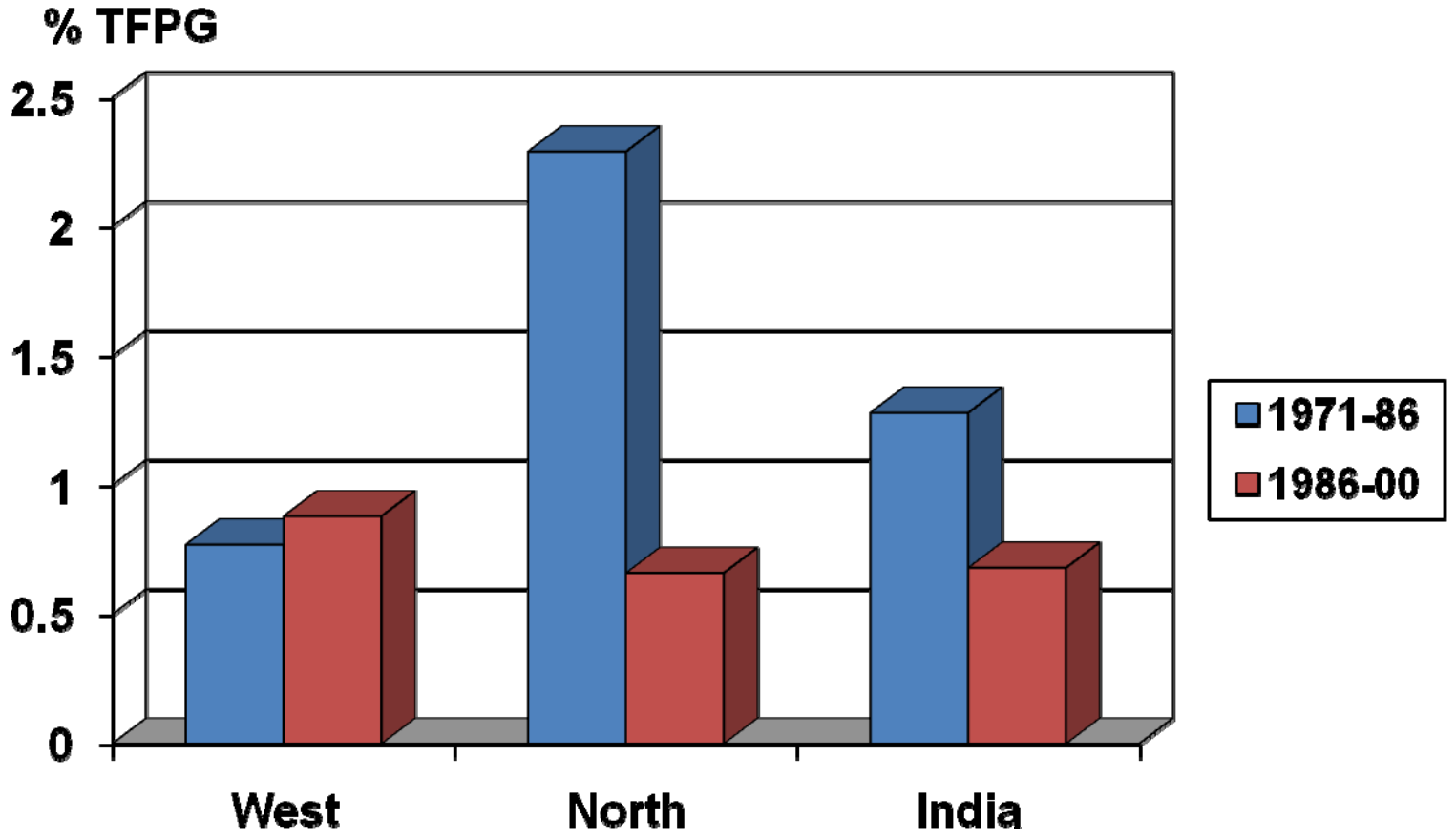
Structural Change in TFP Growth for Crops



TFP growth of rice by regions



TFP growth of wheat by regions

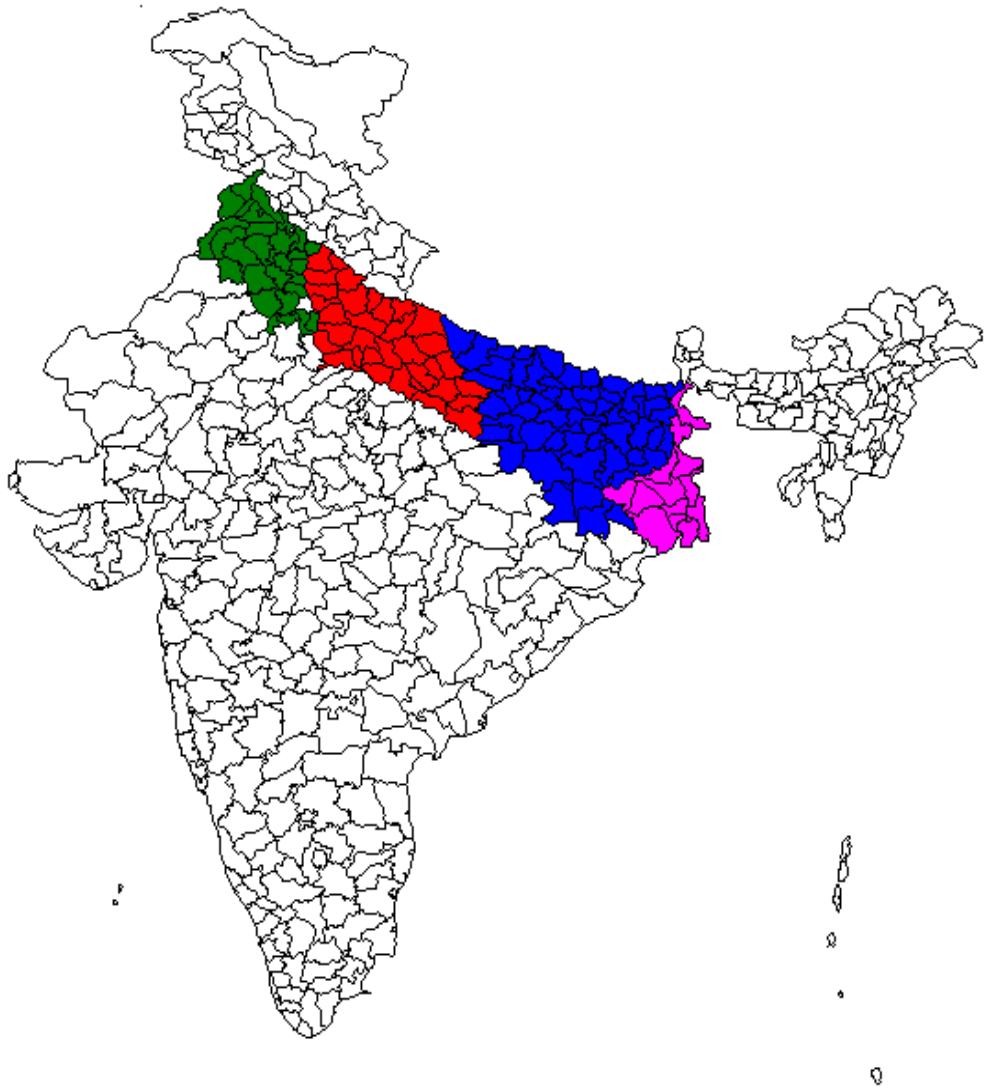


Productivity- TFP- INDIA

Crop	Annual growth rate (%) in TFP		
	1975-85	1986-95	1996-05
Rice	0.90	0.74	0.40
Wheat	1.60	2.51	1.61

During 1990's the TFP gains have started stagnating in crop sector

Indo-Gangetic Plain of India



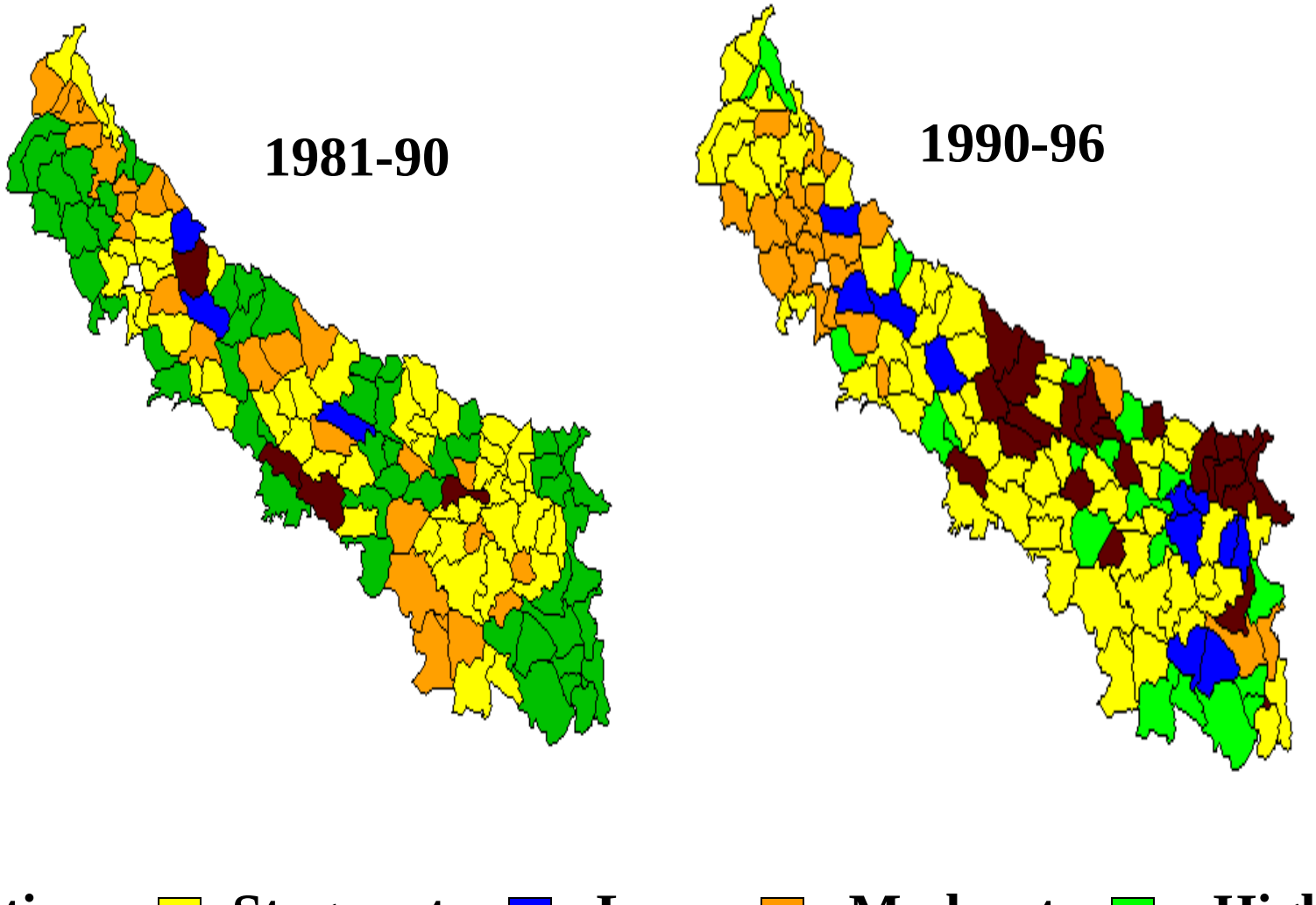
Trans Gangetic

Upper Gangetic

Middle Gangetic

Lower Gangetic

TFP growth of crop sector in IGP



TFP growth of crop sector in Indo Gangetic Plains

(Per cent *per annum*)

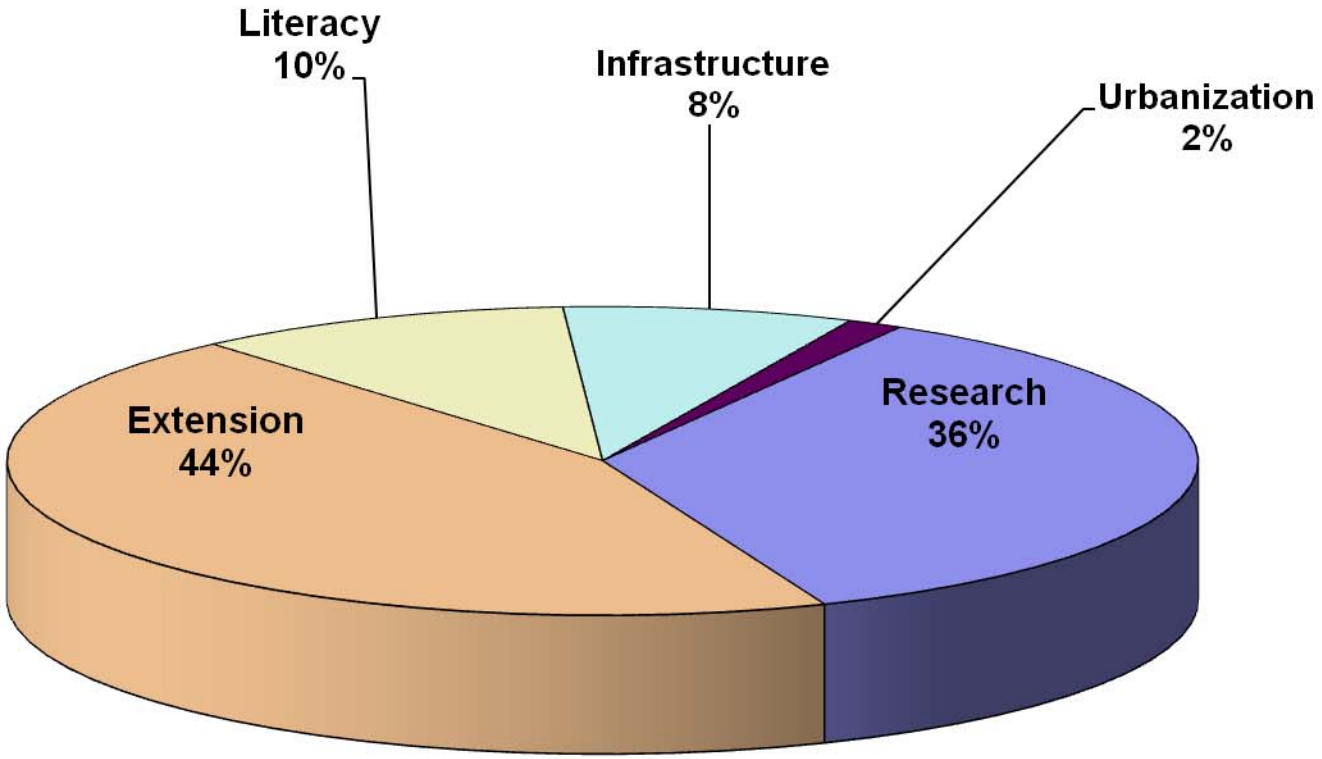
State	1981-1990	1990-1996
Punjab	1.2	1.2
Haryana	3.2	0.1 ns
Uttar Pradesh	1.4	-0.5
Bihar	1.5	0.2 ns
West Bengal	5.1	1.3
IGP	2.0	-0.02ns

Distribution of Districts According to TFP Growth in IGP

(Number of districts)

TFP Growth	1981-90	1990-96
Negative	4	23
Stagnant	33	40
Low	4	6
Moderate	18	11
High	35	14

Sources of TFP Growth in IGP 1981-96



Sources of TFP growth- Empirical Studies

Study	Sources of TFPG
Evenson, Pray and Rosegrant (1999)	Extension, Public Research, Private Research, Markets, HYV, Literacy
Fan, Hazell and Thorat (1999)	R&D, Road, Irrigation, Education, Electricity

Sources of TFP growth in India

Sources	Share of TFP explained (%)		
	Rice	Wheat	Maize
Research	20.0	54.5	57.9
Extension	7.3	1.0	0.4
Literacy	12.9	0.0	0.0
Electrification	47.3	6.8	21.8
Irrigation	12.5	1.9	19.9
Tube well	0.0	35.7	0.0

For the period 1971-01

Overall in India

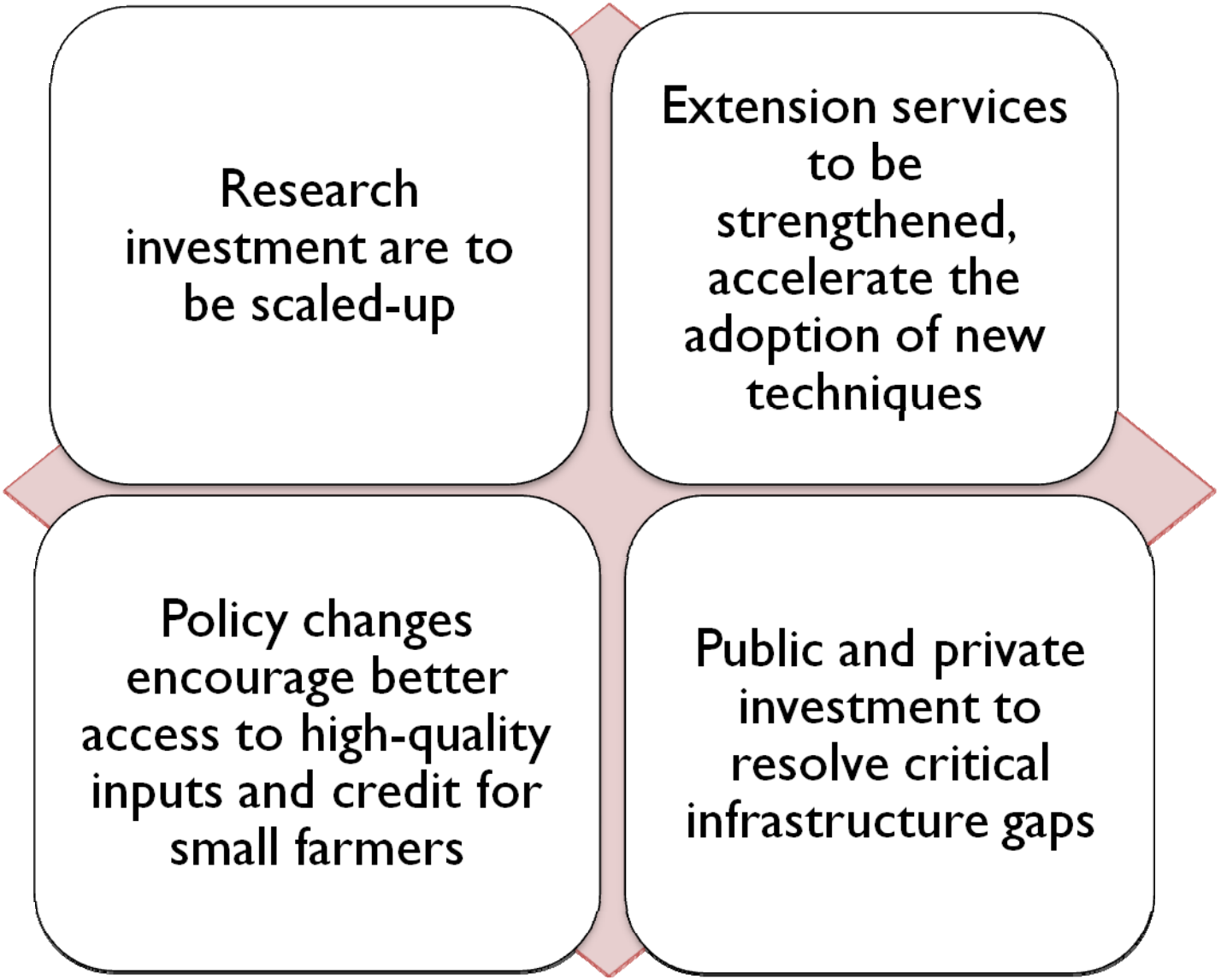
Positive and accelerating total factor productivity (TFP) growths of 70s and 80s turned stagnant or decelerated since early 90s

Farmers face threat of economic viability and sustainability in crop production

Productivity is hampered by

- declined investment in R&E
- Poor technology adoption
- Inefficiency in value/supply chain

Policy Solutions



Thank you!!