

# **Political power in innovation systems: Smallholder sustainable intensification and rural mechanization**

**By**

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## **Introduction**

## **Rural Mechanisation**

The spread of Agricultural and Rural Equipment

Bangladesh

Nepal

Summary of the spread of smaller scale equipment and service markets

## **Observations on the history and debates on rural mechanisation**

General

Framing of debates

Cultures of Mechanical Engineering

Cultures of Commercial/ Bureaucratic /Projects

Sources of Innovation in rural engineering/mechanization

## **Ways forward**

Location, time and actor specific: Nepal

## **Innovations Systems Theory and Practice**

Personal reflections

## **Ways forward:**

The bigger political/cultural context

Institutions are always in the making

## **Conclusions**

Rural Employment and Rural Economic Development in a global economy

Is it a major development goal?













































Table 5: Number of machines used for agriculture purposes

Machine	1977	1984	1989	1996	2006	2008	2009	2010	2011
4 Wheel Tractors <sup>A</sup>	300	400	1,000	2,000	12,500	14,890	17,905	21,638	26,369
2 Wheel Tractors <sup>B</sup>	200	500	5,000	100,000	300,000	343,000	366,700	400,030	420,027
DTWC	4,461	15,519	22,448	24,506	28,289	31,302	32,174	32,912	-
STWD	3,045	67,103	223,588	325,360	1,182,525	1,304,973	1,374,548	1,425,136	-
LLPE	28,361	43,651	57,200	41,816	119,135	138,630	146,792	150,613	-
Threshers (Open drum) <sup>F</sup>	-	500	3,000	10,000	130,000				190,000
Threshers (Close drum) <sup>G</sup>	-	100	1,000	5,000	45,000				65,000
Maize sheller <sup>H</sup>				100	850				5,000
Combine Harvester <sup>I</sup>						±30			100
Winnower <sup>J</sup>						±500			±200
Sprayer <sup>K</sup>						1,250,000			1,250,000
Reaper <sup>L</sup>						±40			±50
Dryer <sup>M</sup>						±500			
PTOS <sup>N</sup>					451	481	620	870	1190
VMP <sup>O</sup>									45

VMP= Versatile Multi-crop Planter

PTOS= Power tiller operated seeder

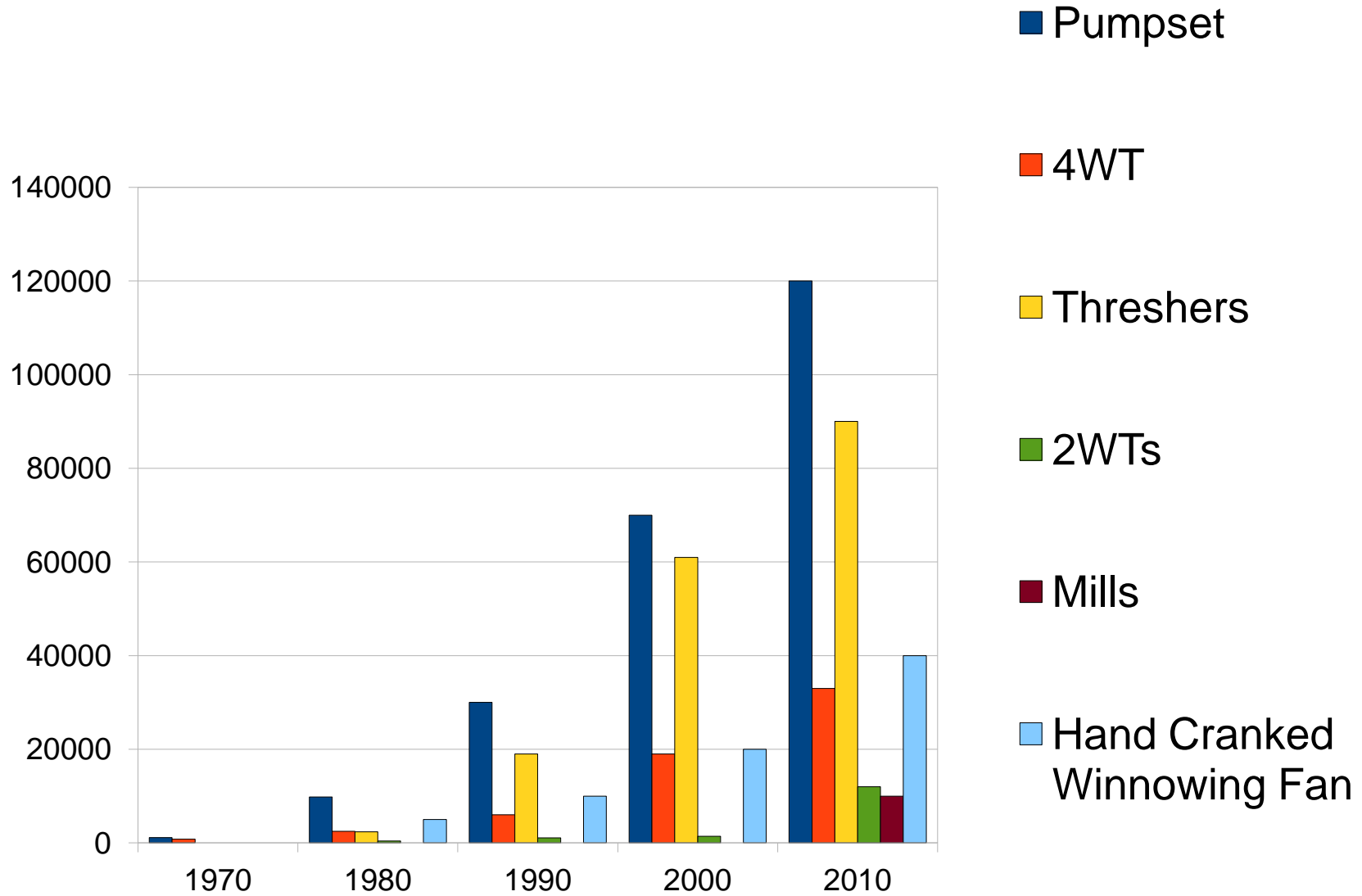
<sup>A, B</sup>= Data till 2006 has been taken from Roy and Singh (2008), other data came from estimations and triangulations made during this study. It should be noted that annual import for 2WT and 4WT is around 50,000 and 10,000 respectively. In case of 4WT, only 50% of the imported machines are exclusively sold for haulage purpose and the rest does both tillage and haulage. Estimating that 2006 data represents the actual number of 4WT operating exclusively for tillage at that time, we have estimated the 4WT data in the following years considering the annual drop out from agricultural uses and also the yearly import. In case of 2WT, even though 60,000 are imported, it is estimated that nearly 60% are not being used for agriculture each year, thus potentially around 20,000 units are being added to the agriculture tillage system

<sup>C, D, E</sup>= Data came from Minor Irrigation Survey of BADC

<sup>F, G, H</sup>= Data till 2006 has been taken from Roy and Singh (2008), other data came estimation.

<sup>I, J, K, L M</sup>= Data taken from Rashid (2009) and Wohab (2011)

Spread of Agricultural Machinery, Nepal





	Nepal			Bangladesh		
Energy Source	No. units	Total hp	% of total hp	No Units	Total hp	% of total hp
2WTs*	12,000	168,000	10%	400,000	5,600,000	46%
4Wts**	30,000	900,000	53%	15,000	460,000	4%
Irrigation shallow tube well pump Diesel ***	120,000	600,000	36%	1.2 M	6,000,000	49%
Irrigation pumpsets Electric****	10,000	20,000	1%	100,000	200,000	1%
Total Available Horsepower		1,688,000			12,260,000	

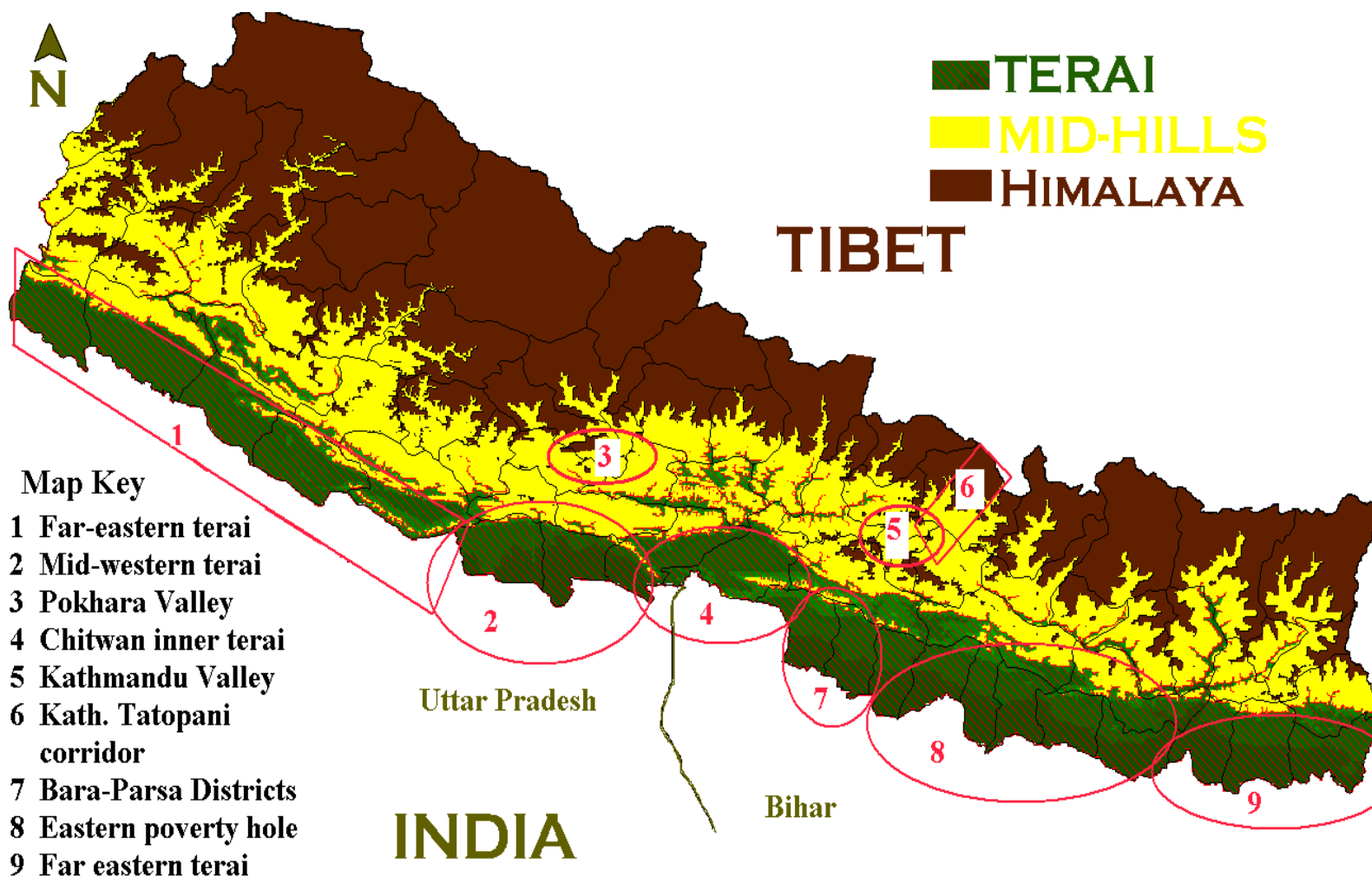
Estimates of the numbers of power sources (and their hp ratings) used primarily in agricultural and processing uses, including groundwater irrigation pumps. It does not for example include the many engines used in Bangladesh to power riverboats, rice mills, processing, etc, although these are a vital part of the Bangladesh agriculture and rural economy.

\*Average of 14 hp per 2-wheel tractors (2WT)

\*\* Average of 30 hp per 4-wheel tractor

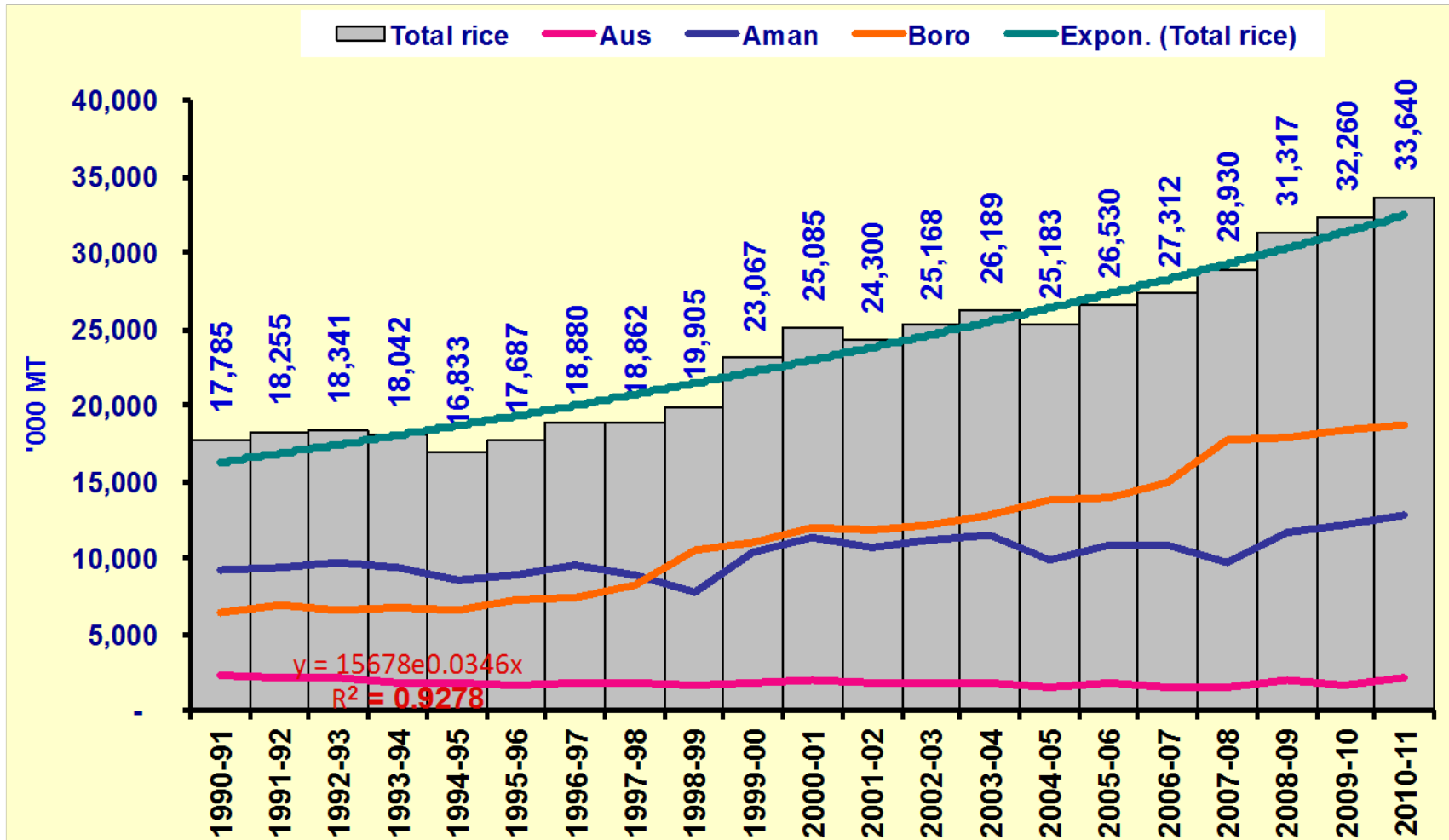
\*\*\*Diesel / petrol irrigation pumpsets are average 5 hp. 5 – 10 % of the pumpsets are petrol/kerosene.

\*\*\*\*Electric irrigation pumpsets are average 2 hp





# How Has Agriculture Done in Rice Production?



➤ Productions of other crops (except pulses & oilseeds), fish, poultry and livestock products also increased.

# Changing Structure of Farms

Farm holdings	1983/84	1996	2008
No. of marginal farms (LT 0.5 acre) million	2.42	3.35	4.10
No. of small farms (0.5 - 2.5 acres) million	4.65	6.07	8.43
No. of medium farms (2.5- 7.5 acres) million	2.48	2.08	2.11
No. of large farms (GT 7.5 acres) million	0.50	0.30	0.23
Av. Farmsize (acres)	2.00	1.50	1.26
No. of absolute landless holdings (million)	1.20	1.81	3.68

▪ Net cultivated area is decreasing very fast

▪ Small & marginal farms are dominating, while Medium & large farms are declining

▪ *Implications:*

- Timely delivery of inputs, credit & extension services increasingly challenging task – involving pvt sector & NGOs

▪ Farm to Market linkages for dispersed small production become crucially important- infrastructure & reform of marketing services initiated



## Summary

1960      1970      1980      1990      2000      2010      2020      2030

### Rural mechanization in some regions

-----rapid spread of smaller scale equipment-----

----- associated institutions-----

---Now?---

**Key Features:** Long history, great diversity by regions, national resources, policies, institutions, and trade regimes.

Technology was “good enough”

Multiple markets for diverse service (transport, water pumping, tillage)

Rural entrepreneurs: Those who own and or operate smaller scale equipment. In the case of 2wts, are using it as a mobile, multi purpose power unit.

Very different patterns in different countries and regions

Energy policy a central component

Agrarian/rural structure always important

## Time line: Global Mechanisation debates and events

1960	1970	1980	1990	2000	2010	2020	2030
---Community development (eg Comilla experiment)							
-----Macro choice of technique debates							
-----Green Revolution Debates							
---Small is beautiful, ITDG/Practical Action/AT							
-----Small & Medium Rural industries R&D & Policy							
-----Neoliberal Global & National Policies (Selective)							
Closing down Ag & Rural Mech R&D							
Closing down of mechanization policy debates							
“Land grabs”, “large, commercial ag.”							
-----Crisis							
(energy, financial mkts							
food, inequality, engineering)							
NOW							
-----Reopening of rural mech debates?							
Response to:							
Rural equity/poverty concerns							
Energy, water scarcity							
Food security/safety							
Rural economic development goals							
Need for worthwhile rural jobs.							



# **Observations on the history and debates**

## **General:**

**Closing of rural mechanisation/equipment debates  
and R&D Capabilities**

**Science & Technology Public Policy Bias towards  
Plant sciences and away from Rural Engineering,  
agronomy, animal husbandry, plot/farm level water  
management, etc**

## **Framing of debates**

Larger scale is better than smaller scale:  
consolidation of holdings and plots is necessary

Characterization of “stand alone family farms”

Separation of the agricultural sector from other  
sectors

Representation of the Green Revolution

Energy and water: always there/subsidized: Now  
rising prices



# Cultures of Mechanical Engineering

Data collection and the presentation of engineering information.

Prevalence of generalized theories of mechanizations

Proof of Concept

Leaving claims unchallenged

Reworking the old into the new

**Cultures of Commercial/ Bureaucratic /Projects**

**Sources of Innovation in rural engineering and  
mechanisation**

**It is different from other areas...but is it, and when?**



# **Innovations Systems Theory and Practice**

## **Personal reflections**

### **Personal origins of ISA**

1960s: Leontief Macro inter sectorial Macro economic frameworks. (Inclusion of externalities, and financial, economic, social prices for assessments of scenarios)

Modelling agrarian change, and effects of “Green Revolution” and other agrarian policies (distributive land reform)

Actor analysis (Norman Long)

SPRU: Freeman, Clark and Hall

# Use of Innovation Ideas and Methods 1970s -1990

2000:

Nepal: Nepal Agricultural Research and  
Extension Project:

Work situation

Articles with others:

Small scale mechanisation

Innovation Systems in crops,  
extension, etc with colleagues in the local  
institutions



## **Ways forward:**

- \* The locate in a larger political/cultural context
- \* Institutions are always in the making
- \* Exploring room for maneuver

## **Conclusions:**

### **Overall Political Context:**

Is there a return to a goal of Rural Employment and rural development in the global context?

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