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What is Information worth for an extra quintal of grain?: Randomised experimental evidence from farmers in India

by

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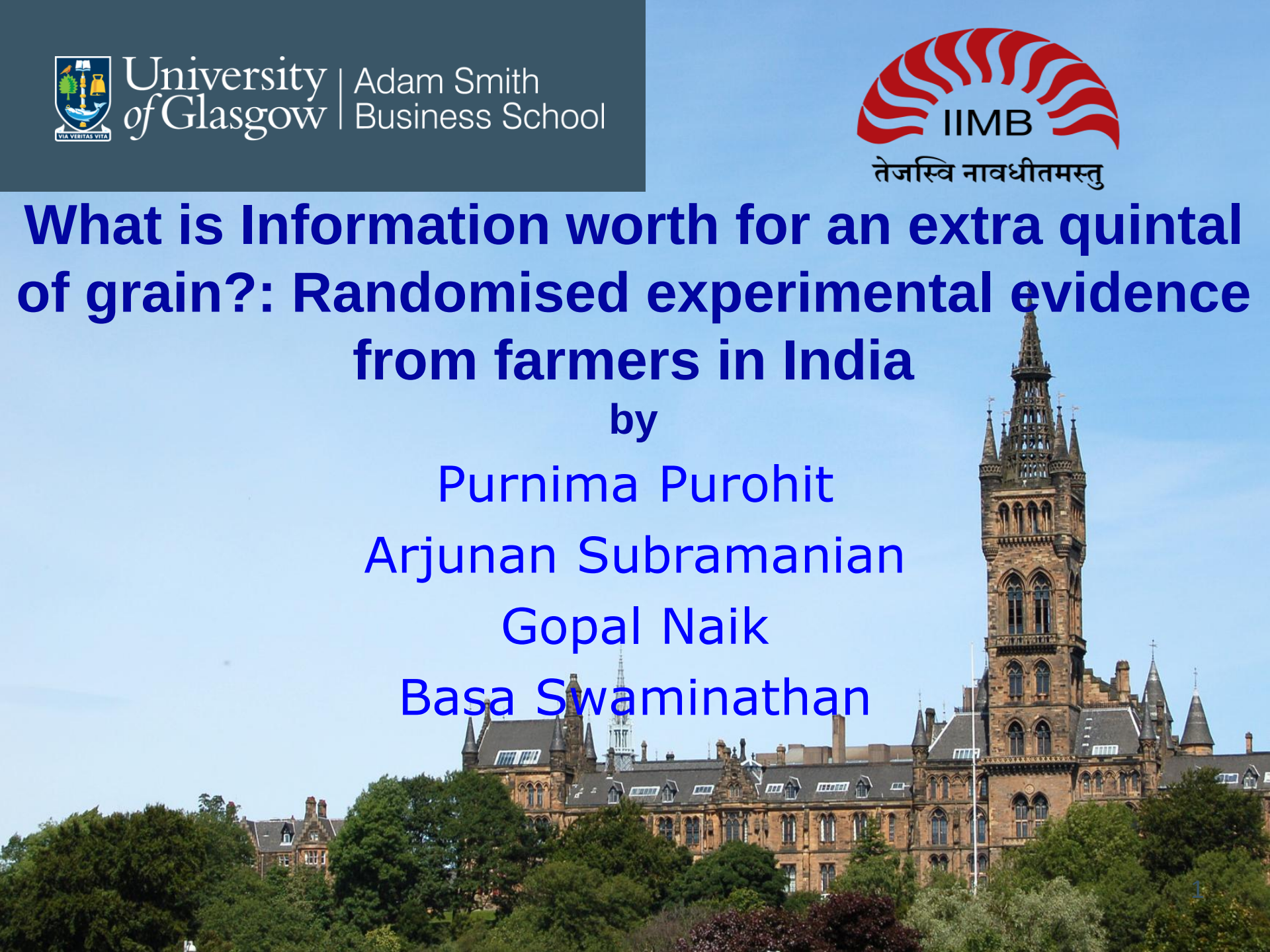

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Based on the project

"Information, Market Creation and Agricultural Growth"

Watch the video and find out more

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

UKaid from the British people

Research jointly supported by the ESRC and DFID

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Why this project - literature

Economics of information (Stiglitz, JPE, 1961; QJE, 2000; Jensen, QJE, 2007; Aker, several papers)

- Information is often costly and incomplete – violation of law of one price, resource allocation is not optimal
- Information is central to economic theory yet few empirical studies assess the effect of improvements in information

Behavioural economics (Duflo et. al., AER, 2008; AER, 2011;Hanna et. al. QJE, 2014)

- Fertilizer subsidy - increase yield vs distorts from optimal
- Puzzle: low investment rates despite high returns

Why this project – literature

- Behavioural biases limits investment – 69% farmers present biased
- Failure from learning to notice despite experience – framing of information

Learning failures (Fafchamps & Minten, WDR, 2012; Cole & Fernando, HBS WP, 2012)

- Examine outcome variables
- Selection bias

Research Questions

- Identify the impact of providing agricultural information on farm productivity among small holder agriculture?
- What impact does new information have on social network?
- What impact does access to information have on consumption smoothing strategies?
- To what extent is caste a barrier to information access?

Farming practices below optimal

- New pests and diseases
- Development of resistance by old pests
- New seed varieties with better traits
- Change in chemical composition of soil

Climate Change!

Huge potential exists for yield increase & reduction in cost of cultivation

- Better sprays
- Choice of appropriate variety of seeds
- Application of fertilizer at the right time and quantity

Procedures in conducting an RCT

- Selecting a reference population
- Random assignment of households to treatment, spillover and control
- Baseline assessment
- Intervention
- Re-assessment post intervention
- Comparison of treatment and control in the pre and post intervention

Measuring the impact of intervention

Intervention – providing real-time, comprehensive and contextual agricultural information to farmers in enhancing farm productivity

Measure – value for information, farm practices, crop yield & cost of cultivation

- Crop & season wise comparison of control and treatment group using baseline and post-intervention surveys

Research design

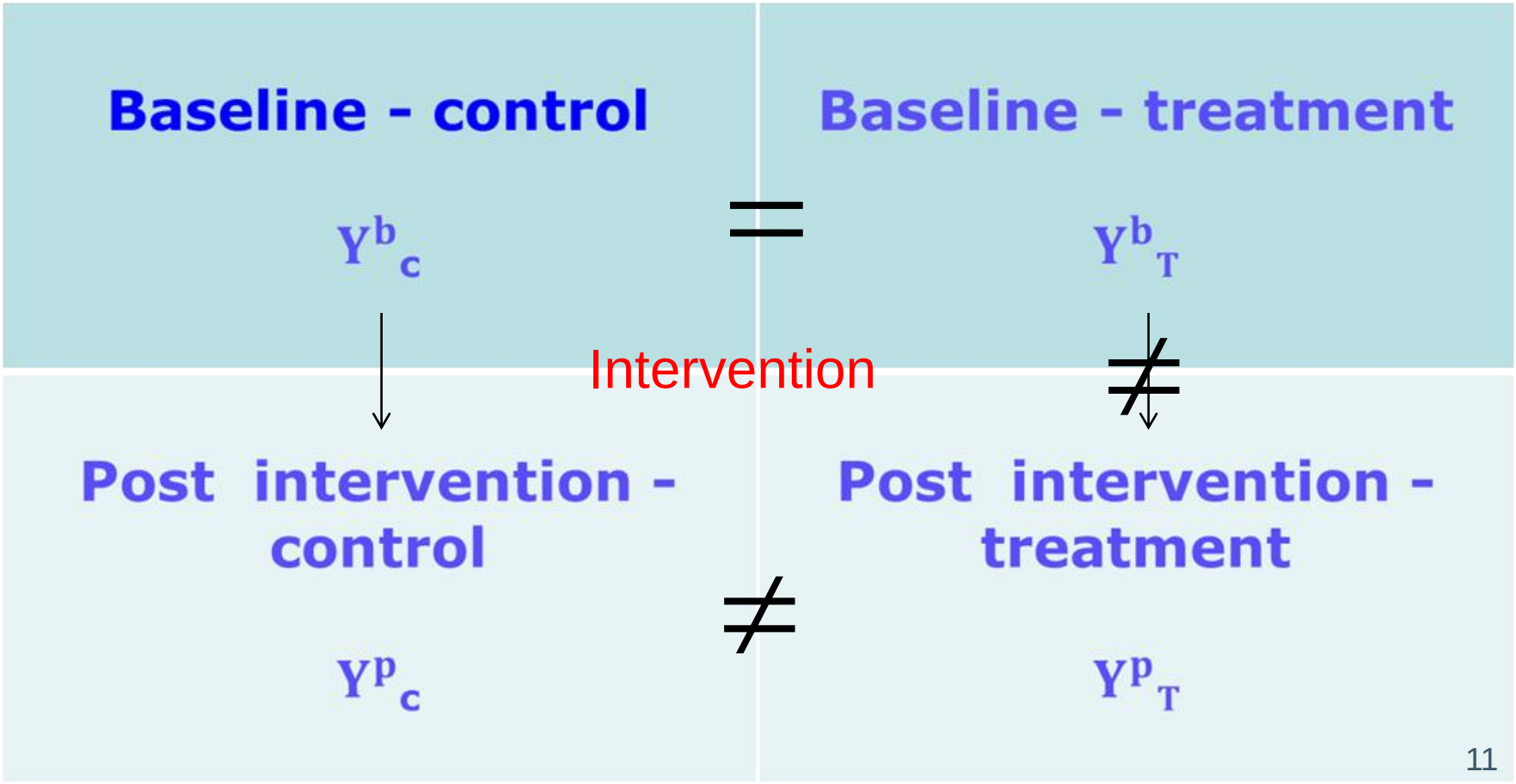
Information dissemination experiment

- Sample selection at household/village/gram panchayat?
- Strong spill over effects smaller the area
- Two stage randomization procedure – (1) GP (2) HH
- Random selection of spill over group within the village
- 50 treatment households + 10 spillover households
- 50 control households

Problems in design – contamination of control

- Continues and sequence of treatment
- Tailor-made to individual farmers
- No two treatment and control GP are next to each other
- Questionnaire asking control farmers for the source of agricultural information they received during the last season
- Spillover group to capture contamination

Matrix of effects in yield (quintals/ acre)

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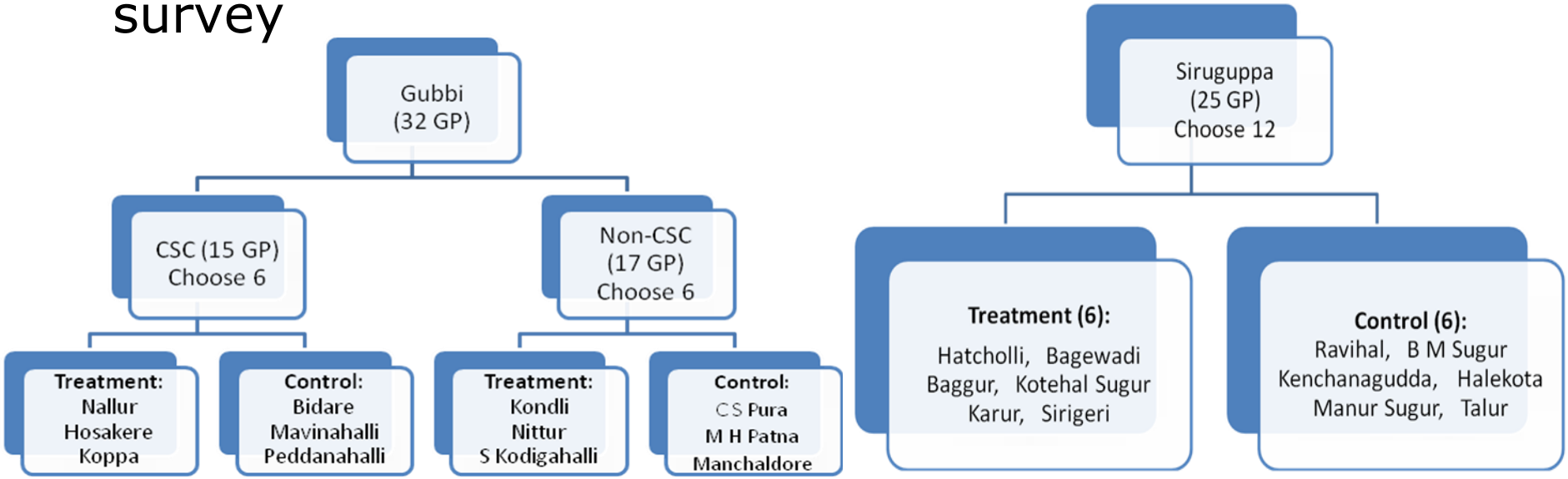
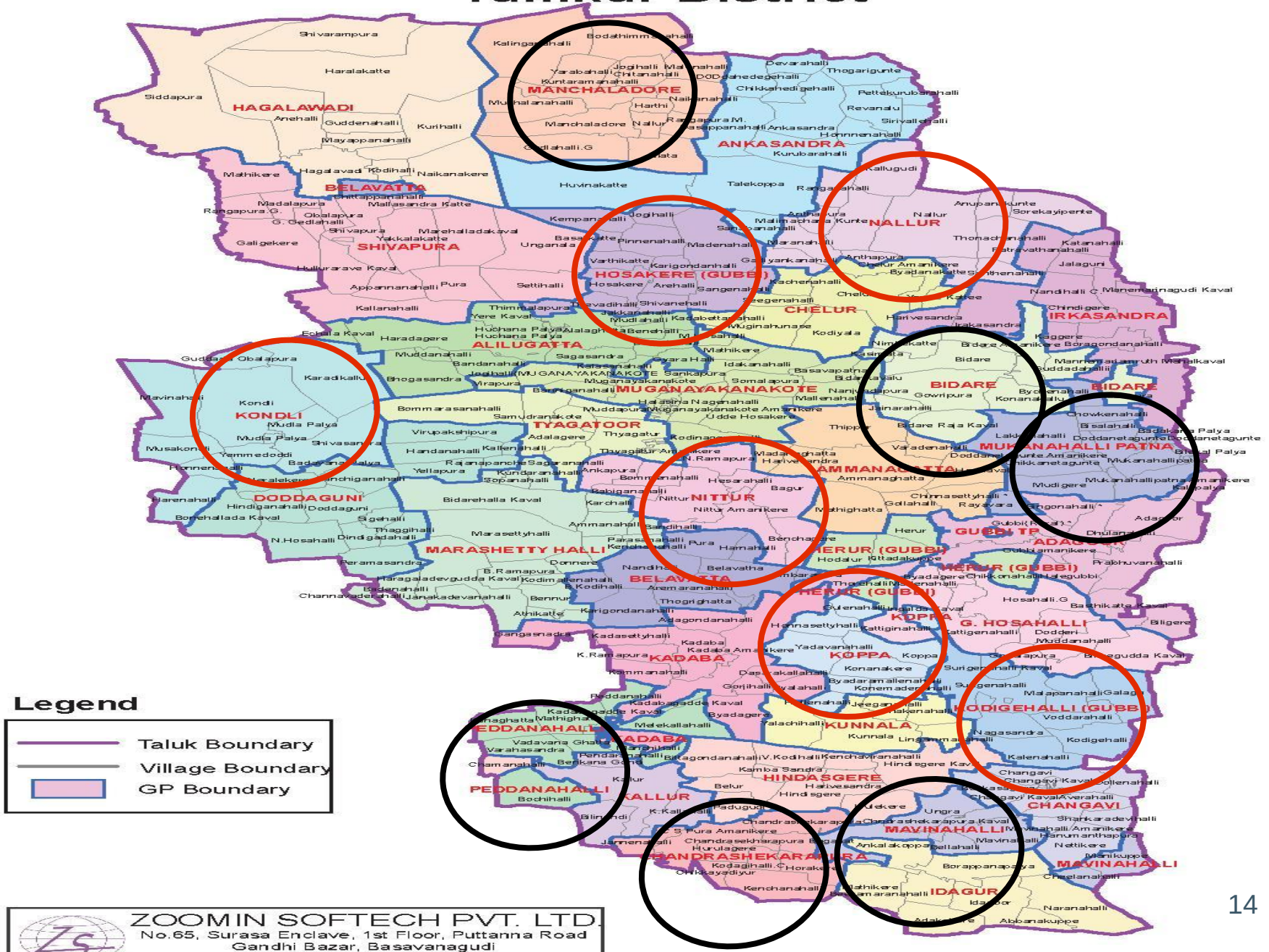
Gulbarga
Bijapur
Raichur
Bagalkot
Belgaum
Dharwad
Koppal
Gadag
Bellary
Haveri
Uttara Kannada
T - Tumkur
Davanagere
Shimoga
Chitradurga
Kolar
Udupi
Chikmagalur
Tumkur
Bangalore
Hassan
Dakshina Kannada
Mandya
Bangalore Rural
Kodagu
Mysore
Chamarajanagar

Program evaluation – RCT

- Difference in yield between control and treatment farmers resulting from the treatment
- Base line farm survey; Midline season survey; End line survey



Villages and GPs in Gubbi Taluk
Tumkur District



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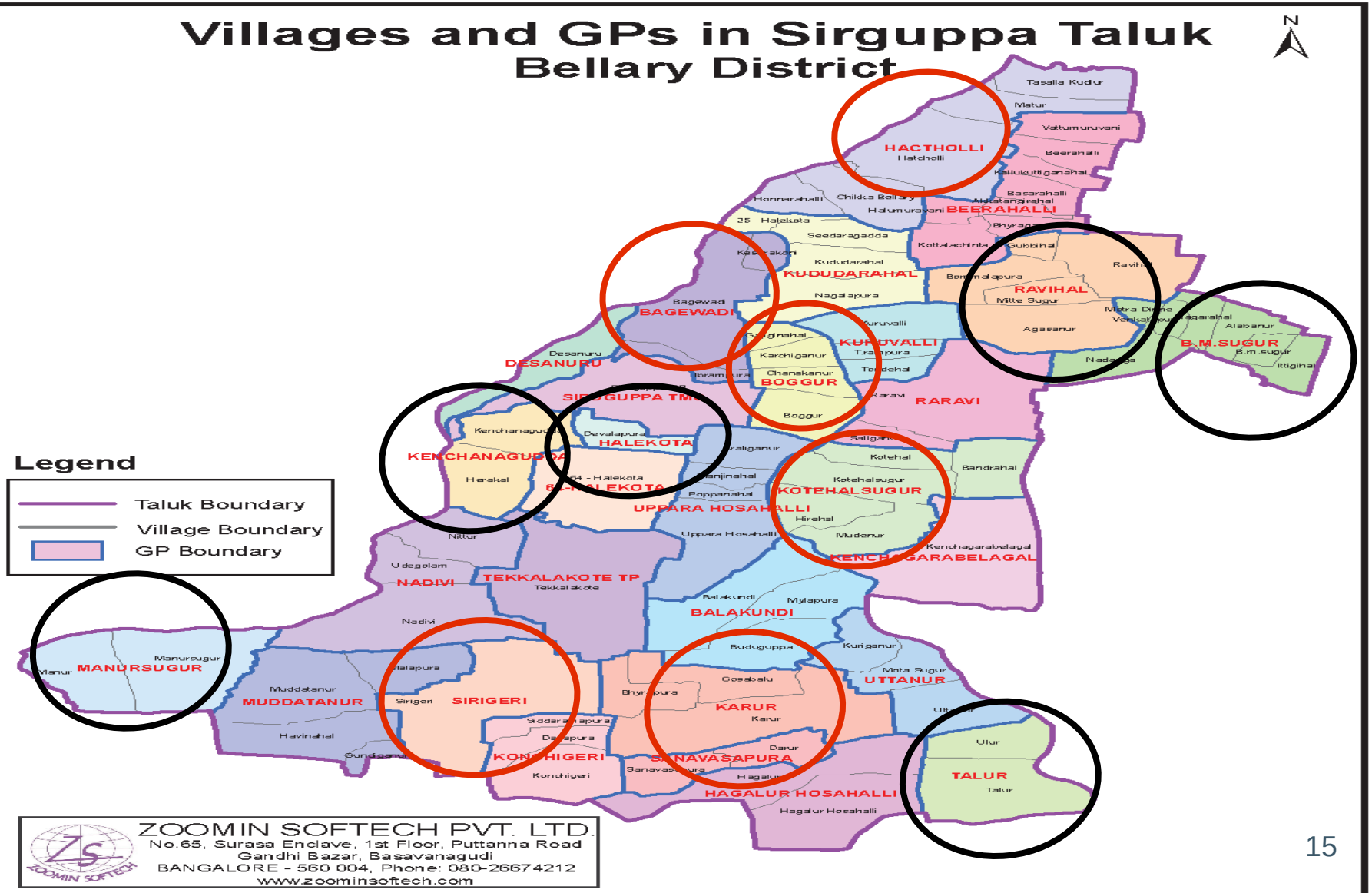
Villages and GPs in Sirguppa Taluk
Bellary District



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Farmers identification

HDFC

- List of farmers received subsidy or benefits

Rayata Samparka Kendra

- List of farmers who purchased seeds – crop grown

Panchatantra

- List of households in villages – may or may not be farmers

Bhoomi

- List of land record holders – fathers or grand fathers name – land sold recently – did not grow focus crops – owner but living in the city or dead – splitting of households

Focus crops

Gubbi	Siriguppa
Paddy	Paddy
Red Gram	Bengal Gram
Ragi	Sunflower
	Cotton

Intervention – animation, voice, real time connectivity

- Crop production – soil testing, fertilizer, pesticide
- Livestock production – feed fodder, diseases control
- Regular updates of input and output price
- Agricultural credit
- Crop insurance
- Cattle insurance

Some Preliminary Results from *work-in-progress: Gubbi Experimental Survey*

Hypothesis: Farmer's valuing of real time information indicates real time learning!

- Exposure to intensive real time agricultural information over extended seasons improves the value for information among treatment farmers to reflect gains from the educational intervention.
- Farmers may learn and value significance of the agricultural information that need not necessarily always result in higher yields.
- Presence of uncertainty lead farmers to value information – comprehensive and available throughout crop-cycle!
- Also in WDR 2015, farmers need adequate cognitive space and time before they adjust to new information and apply them!

Existing Literature unsettled!

Evaluates effect of information service on knowledge gain through farm outcomes (Change in Farm Practices, Yields and Cost of Production)!

For e.g. *Feder, Murgai & Quizon,* WB 2003; *Duflo, Kremer & Robison*, Mimeo, MIT, 2008; AER, 2011; *Fafchamps and Minten*, WB 2012; *Cole and Fernando*, Harvard Business School, 2012; *Hanna, Mullainathan and Schwartzstein* , QJE, 2014

Mixed Evidence of efficacy: **Not Clear** whether this is due to variation in programmes offered, or methodological challenges associated with evaluation programmes!

Contribution: Using randomised field assignment, no study focuses on valuation of information for the case of agricultural information services.

Placing value directly reveals learning impact of information access to accrue economic benefits sooner or later in a long run.

Table1: Control and Treatment Households – Baseline Balance Check

	Control	Treatment	Control	Treatment
	2013	2013	2013	2013
Variable	Obs	Obs	Mean (Std. Dev)	Mean (Std. Dev)
Size of the Farmer's Family	300	300	5.15(2.39)	5.09(2.46)
Farmer's age in years	300	300	50.65(13.63)	50.55(12.73)
Farmer's education in years	300	300	6.69(4.71)	5.91(4.77)
Farmer's cropping experience in years	300	300	29.82(12.20)	31.67(12.59)
Farmland owned by the Farmer in Kharif (in acres)	300	300	4.06(3.94)	4.68(4.36)
Farmland cultivated by the farmer in Kharif (in acres)	300	300	4.00(3.32)	4.55(4.35)
Farmland irrigated by the farmer in Kharif (in acres)	300	300	1.78(2.81)	1.63(2.53)
Number of visit of the Extension Advisor	300	300	1.04(.44)	1.18(.55)
Possess own House	300	300	.416(.493)	.55(.498)
Possess Mobile phone	300	300	1.15 (.759)	1.116(.66)
Possess Motor bike	300	300	.52(.608)	.59(.645)
Whether experience income shock in kharif?	300	300	.89(.309)	.94(.237)

Authors' calculations

Table 2: Pre and Post-Intervention Valuing of Information *(Raw Values)*

	Treatment	Control	Difference
Pre-Intervention Valuing Information 2013 (% of farmers)	53.65 %	39.32%	14.33%
Post-Intervention Valuing Information 2014 (% of farmers)	80.67 %	56%	24.67%
Difference (Increase in Worth)	27.02%	16.68%	**10.34%**
Pre-Intervention Free Info 2013 (% of farmers)	46.33%	60.67	14.34%
Post-Intervention Free Information 2014 (% of farmers)	19.33%	44%	24.67%
Difference (Reduction in Zero Worth)	27%	16.67%	**10.33%**

Authors' calculations

Table 3 : Difference-in-Difference Aggregate Impact of Real time farm information on Valuing Information

Dynamic Agricultural Tablet-based Extension Service (DATES Treatment)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Ln(Value Info)	Ln(Value Info)	Ln(Value Info)	Ln(Value Info)	Ln(Value Info)	Ln(Value Info)	Ln(Value Info)
Target DATES	0.243	0.096	0.150	0.139	0.119	0.253	0.277
	[0.178]	[0.570]	[0.571]	[0.576]	[0.578]	[0.578]	[0.583]
Information Impact	**1.564*** **	**0.534** **	**0.534** **	**0.534** **	**0.534** **	**0.534** **	**0.534** **
(Target DATES*Year '14)	[0.189]	[0.261]	[0.261]	[0.261]	[0.262]	[0.262]	[0.262]
Constant	2.403***	1.464**	1.424**	1.217*	1.123	0.875	0.919
	[0.104]	[0.603]	[0.607]	[0.725]	[0.752]	[0.791]	[1.395]
GP Fixed Effects	**Yes**	Yes	Yes	Yes	Yes	Yes	**Yes**
Time fixed Effects	**No**	Yes	Yes	Yes	Yes	Yes	**Yes**
Individual & village controls	**No**	Yes	Yes	Yes	Yes	Yes	**Yes**
R^2	0.088	0.217	0.219	0.219	0.219	0.222	0.223
F	69.092	37.906	31.441	26.815	24.343	21.565	19.328
N	1200	1200	1200	1200	1200	1200	1200

Standard errors in brackets * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Controls include: *Source of Crop Information (*Public, Private or other farmer), *Number of visits by Extension Advisor (one, two or three visits a month), Source of Income Shock (crop damage, illhealth), mobile phone factor, motorbike factor, owning house factor, Ln(years of cropping experience), Ln(years in age), Ln(years in education)*

Authors' calculations

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Heterogeneous Effect of Treatment

Table 4: Impact based on **Farmer's Age**		
	Ln(Value Info) age<=46	Ln(Value Info) age>47
Target DATES	-1.140 [0.950]	1.066 [0.657]
Info. Impact (Target DATES*Year '14)	**0.734*** [0.402]	0.382 [0.345]
R^2	0.239	0.239
F	6.382	14.217
N	512	679
Table 5: Impact based on **Farmer's Cropping Experience**		
	Ln(Value Info) exp_c<=35	Ln(Value Info) exp_c>35
Target DATES	-0.481 [0.818]	0.988 [0.893]
Info. Impact (Target DATES*Year '14)	**0.577*** [0.331]	0.464[0.430]
R^2	0.244	0.213
F	9.720	4.636
N	746	454
Table 6: Impact based on **Farmer's Land Size**		
	Ln(Value Info) la_ow_k<=4	Ln(Value Info) la_ow_k>=4
Target DATES	-0.128[0.615]	1.034[1.759]
Info. Impact (Target DATES*Year '14)	**0.828***** [0.318]	0.406[0.422]
R^2	0.218	0.226
F	14.498	8.185
N	808	494

Standard errors in brackets
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Controls include: *Source of Crop Information (*Public, Private or other farmer), *Number of visits by Extension Advisor (one, two or three visits a month), Source of Income Shock (crop damage, illhealth), mobile phone factor, motorbike factor, owning house factor)*
GP Fixed Effects
Time Fixed Effects

Authors' calculations

Contd…Heterogeneous Effect

Table 7: Impact based on **Farmer's Caste**		
	Ln(Value Info) Caste=General	Ln(Value Info) caste=SCST
Target DATES	0.531[0.653]	2.114**[0.842]
Inf. Impact (Target DATES*Year '14)	0.120[0.338]	**2.121*** [0.732]**
R^2	0.211	0.443
F	11.742	51.199
N	748	140

Standard errors in brackets
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Controls include: *Source of Crop Information (*Public, Private or other farmer), *Number of visits by Extension Advisor (one, two or three visits a month), Source of Income Shock (crop damage, illhealth), mobile phone factor, motorbike factor, owning house factor)*
GP Fixed Effects
Time Fixed Effects

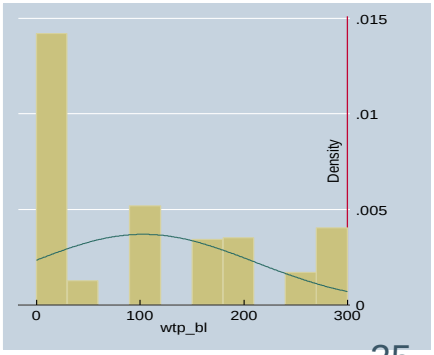
Robustness Check: TOBIT Model (Censoring in the Data)

Table 8: Robustness Check: Aggregate Impact of Real time farm information using Tobit Model	
	Ln(Value Info)
Target DATES (d)	-0.6588 [0.5522]
Information Impact (d)	**3.3915*** [1.1295]**
N	1200
pseudo R^2	0.098

Marginal effects; Standard errors in brackets; (d) for discrete change of dummy variable from 0 to 1
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Authors' calculations

Figure1: Distribution of Value of Information



Note: Data both left and right censored

Conclusion

- Noteworthy result since they capture relatively short-term effects of farm information on farmer's perceptive behaviour in valuing information, that otherwise are hard to measure.

- This study helps to form understanding that information that is comprehensive, real-time and contextual as opposed to the more generic or piecemeal information provided in some recent experimental studies is more powerful to influence farmers to build trust and shun skepticism towards both knowledge , the source of knowledge and its adoption.

- Evidence suggests that poor and marginal farmers value agricultural information more than the wealthier farmers, reflecting the growing disparity in accessing agricultural information in developing countries.

- Interestingly, value of information access is increasing in the lesser level of farmer experience or education, but experience/ education levels do not affect the size of information intervention effects.

- **Next Research Study: Impact of Information on Yield and Cost of Production**

Thank You

Supporting slides

Sample size

- RCT sufficient power to detect difference between treatment and control groups
- Calculation of sample size – adequate level of significance and power is essential

$$n = 2s^2 \left[\frac{z_C + z_P}{\Delta} \right]^2$$

- *s* denotes pulled standard deviation of both comparison groups
- *z* is standard normal variate
- Z_C and Z_P are the values for desired significance level and statistical power, respectively

Sample size

- Δ is the minimum expected difference between means in two groups
- To achieve 80% power and 95% significance level for our analysis - critical Z_C is 1.96 and critical Z_P is 0.845
- True value of Δ is unknown - fix the effect size to test the difference statistically

Frontline demonstration results for sample size

Season: 2010-11 Kharif					
Crop	Variety	Condition	No. of FLD	Check yield (q/ha)	Increase
Redgram	BRG-1	rf	32	9.6	14.2%
Paddy	BR-2655	ir	18	52.1	17.7%
Paddy	Tanu	ir	16	52.2	17.7%
Ragi	MR-6	rf	10	16.5	19.3%
Ragi	GPU-48	rf	5	14.7	11.8%
Ragi	ML-365	rf	5	16.6	15.9%
Ragi	KMR-301	rf	5	16.6	12.9%
Season: 2011-12 Kharif					
Crop	Variety	Condition	No. of FLD	Check yield (q/ha)	Increase
Redgram	BRG-1	rf	26	10	15%
Paddy	BR-2655	rf	18	50.5	15.3%
Paddy	Tanu	rf	19	58.4	15.8%
Ragi	ML-365	rf	18	19.5	10.2%
Ragi	KMR-301	rf	13	19.5	10.2%

Sample size

- FLD trials demonstrate the productive potential of newly released technologies
- FLD point out to the yield gap between farmer's current practices and an intervention
- The minimum increase in yield observed is 10.2%
- So, an effect size of 10% increase in yield seems a reasonable choice

Treatment (pest identification) to red gram farmers

Treatment (pest identification) to paddy farmers

Comparison of crop yields (quintal/acre) in Gubbi

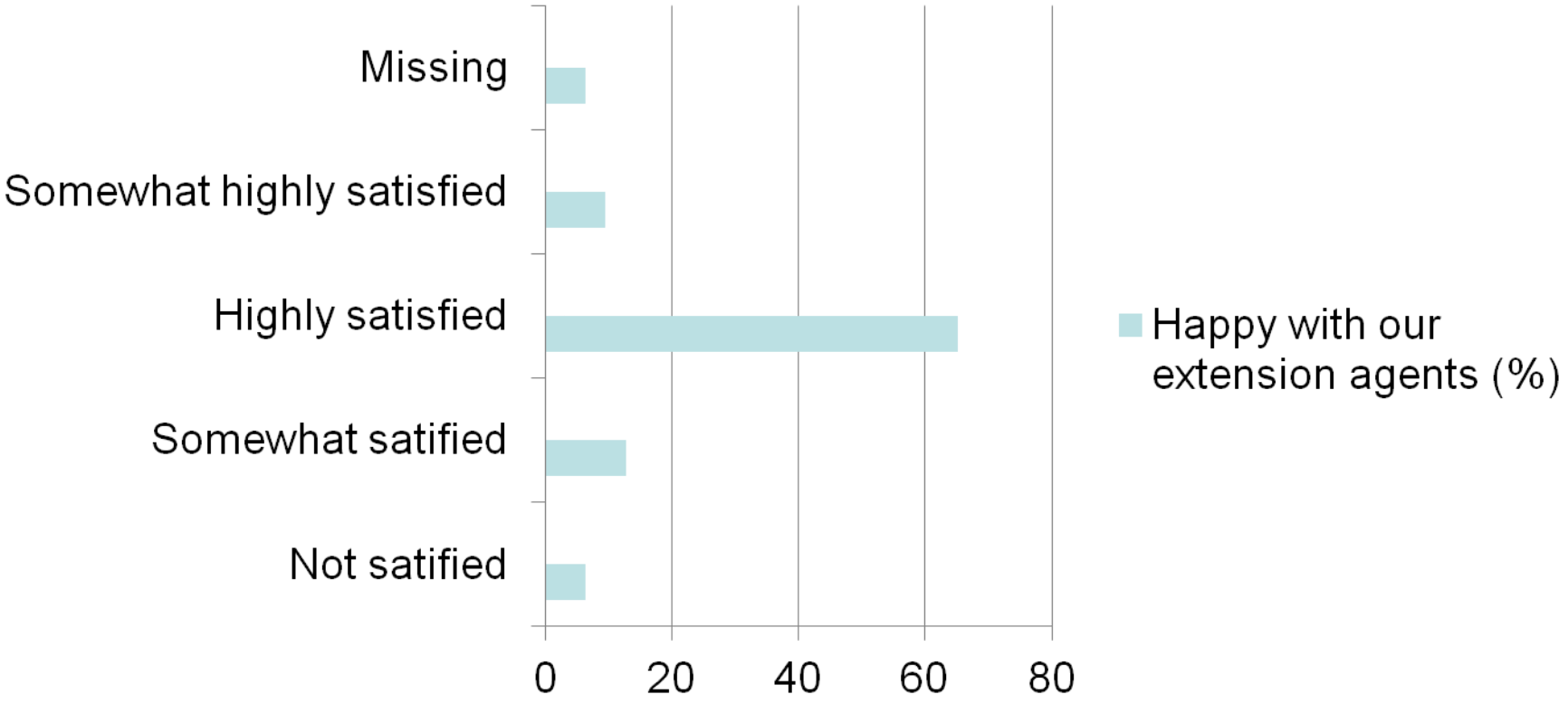
	Baseline survey		Post-intervention survey	
	Control	Treatment	Control	Treatment
Paddy	14.35 (11)	11.80 (10)	13.00 (3)	23.70 (12)
Ragi	2.81 (271) =	2.29 (323)	6.67 (277) =	6.10 (315)
Redgram	0.64 (5)	1.18 (10)	1.14 (9)	5.76 (16)
Horsegram	45.71 (1)	2.00 (1)		

Note: Numbers in parenthesis are number of observations

Treatment (land preparation) to paddy farmers

Treatment on credit and insurance

Farmer survey (total farmers 63)



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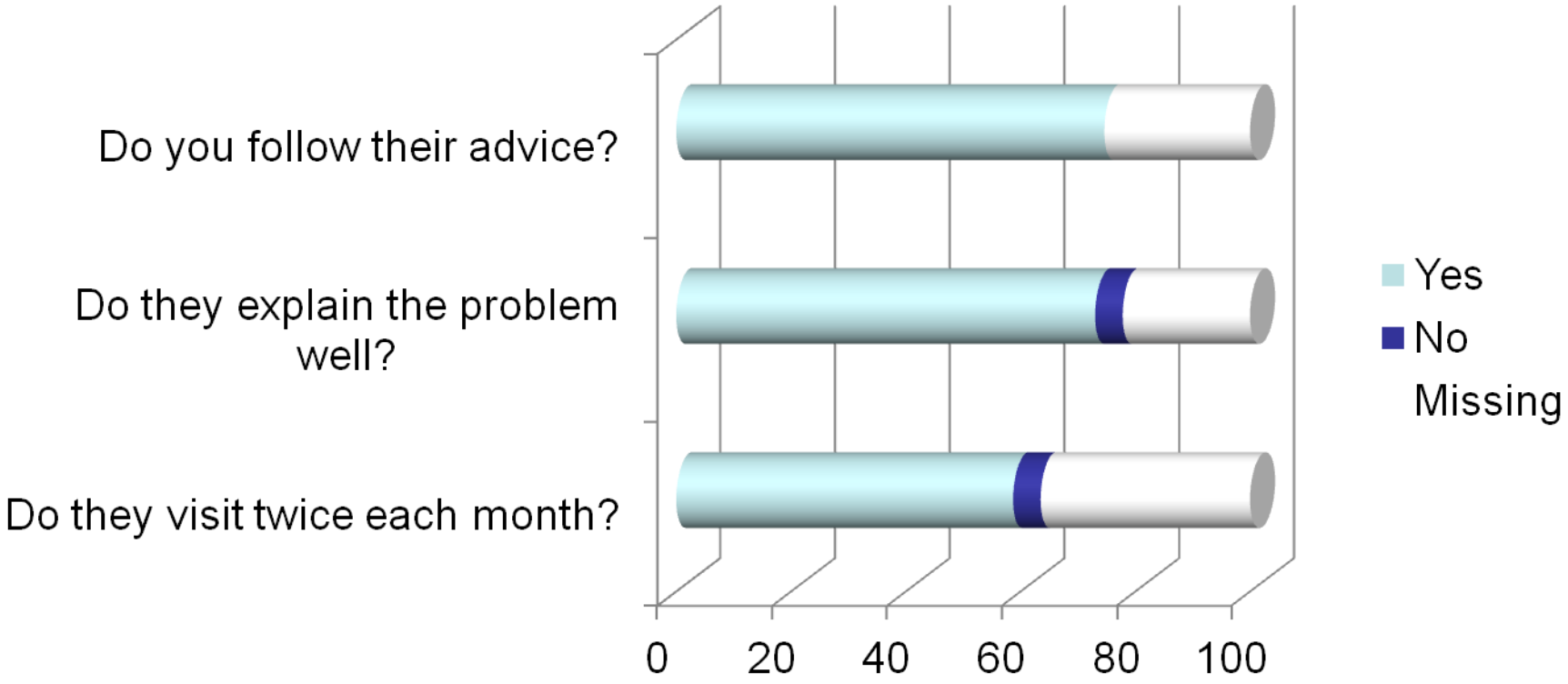

Our vision

“Give a man a fish; you have fed him for today. Teach a man to fish; and you have fed him for a lifetime”

Anne Isabella Thackeray Ritchie (1837–1919) in her novel, *Mrs. Dymond* (1885)