

# ICT impacts in developing Asia: What we know and what we need to know

Rohan Samarajiva & LIRNEasia Systematic Review Teams



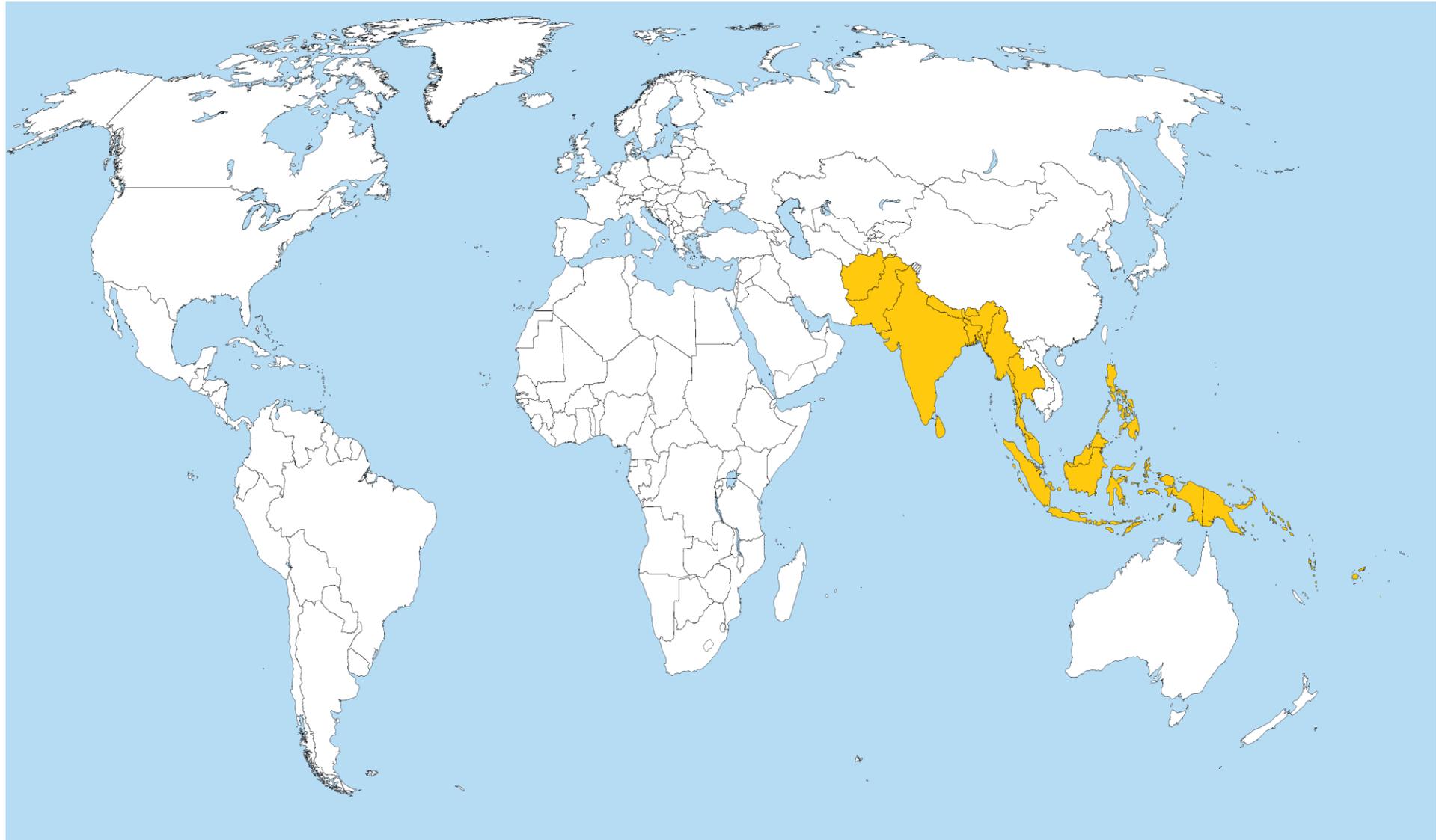
This work was carried out with the aid of a grant from the International Development Research Centre, Canada and the Department for International Development UK..



# About LIRNEasia

- Our mission:
  - *“Catalyzing policy change through research to improve people’s lives in the emerging Asia Pacific by facilitating their use of hard and soft infrastructures through the use of knowledge, information and technology.”*

# Countries that we engage with



# Policy perspective: Basis of big decisions re ICT investments

- Not evidence of causation, though some references are included in the justifications, e.g.,
  - 2002-04, e Sri Lanka, a USD 83 million comprehensive ICT development program
  - 2008-present, Digital Bangladesh initiative
- But once the big decision is taken, there is significant room for evidence to influence priorities and actions

# Academic perspective: Correlation beyond dispute. Causation?

- Larger debate triggered by Robert Solow's famous 1987 remark that the IT revolution can be seen everywhere except the productivity statistics seemed to apply.
- However in the late 1990s evidence began to appear of a significant, identifiable impact of ICT investment on US economic growth from Jorgenson and colleagues
- Across multiple countries and about telephones, specifically
  - Correlation evident since the work of Hardy (1980)
  - Cronin et al. advanced the analysis in the 1990s using lagged variables to establish causation
- Waverman and colleagues (mobiles) and Qiang (broadband) pushed the analysis further in 2000s

# But do these studies provide guidance on components, priorities & strategies?

- Choices amenable to use of evidence
  - Should priority be given to extension of telecom networks throughout the country or to high-speed broadband in commercial areas?
  - Will the benefits be greater if mobile financial services are promoted or if ICTs are incorporated into primary and secondary education?
- Why not start from “the bottom”?
- What do “micro” studies of ICT impacts in specific domains say?
- → Systematic Reviews of studies of impacts of ICT in specific domains

# A Systematic Review

- Uses ***explicit methods*** to ***identify, select,*** and ***critically appraise*** relevant research and ***summarize*** data from those studies that are included in the review
  - Biased towards quantitative to begin with, but now moving towards mixed methods and qualitative
- Originally from the field of medicine, now includes social sciences
- Uses only primary studies
- Protocols are registered
- Peer review is mandatory and has teeth

# Why SRs?

- Based on collating best available results
  - to find the impact or effectiveness or what works – Quantitative
  - to find out why it has worked – Qualitative
- Can help identify causal mechanisms and enabling conditions
- Could be useful in influencing policy, broadly defined
  - Used extensively in formulation of treatment guidelines issued to healthcare providers
- Could be useful in communicating with the media
  - Recently education SRs have started gaining some traction
- Helpful in identifying best methodologies and gaps that require more research

# LIRNEasia's role

- Initially got into it in 2011
  - 3ie funding and training → Mobiles & rural impact, discussed today
- Received IDRC funding in 2014 for reviews and capacity building
  - 70+ researchers introduced to systematic reviews
  - 40 researchers taught systematic reviews in depth
  - 15 researchers engaged in systematic reviews
  - 3 SRs completed → Mobile financial services & education discussed
- Currently working in partnership with DFID and PwC India to build further capacity in South Asia

# Mobile phones → Economic impact

Christoph Stork, Nilusha Kapugama & Rohan  
Samarajiva



# About the review

- What did we study?
  - Mobile phone interventions for improving **economic and productive outcomes** in **rural areas** in low and middle-income countries (LMICs)
- Economic and productive outcomes = changes in:
  - Individual income/savings/wages/expenditure
  - Household income/savings/expenditure
  - Business profit/productivity
  - Wastage
  - Market price dispersion or volatility

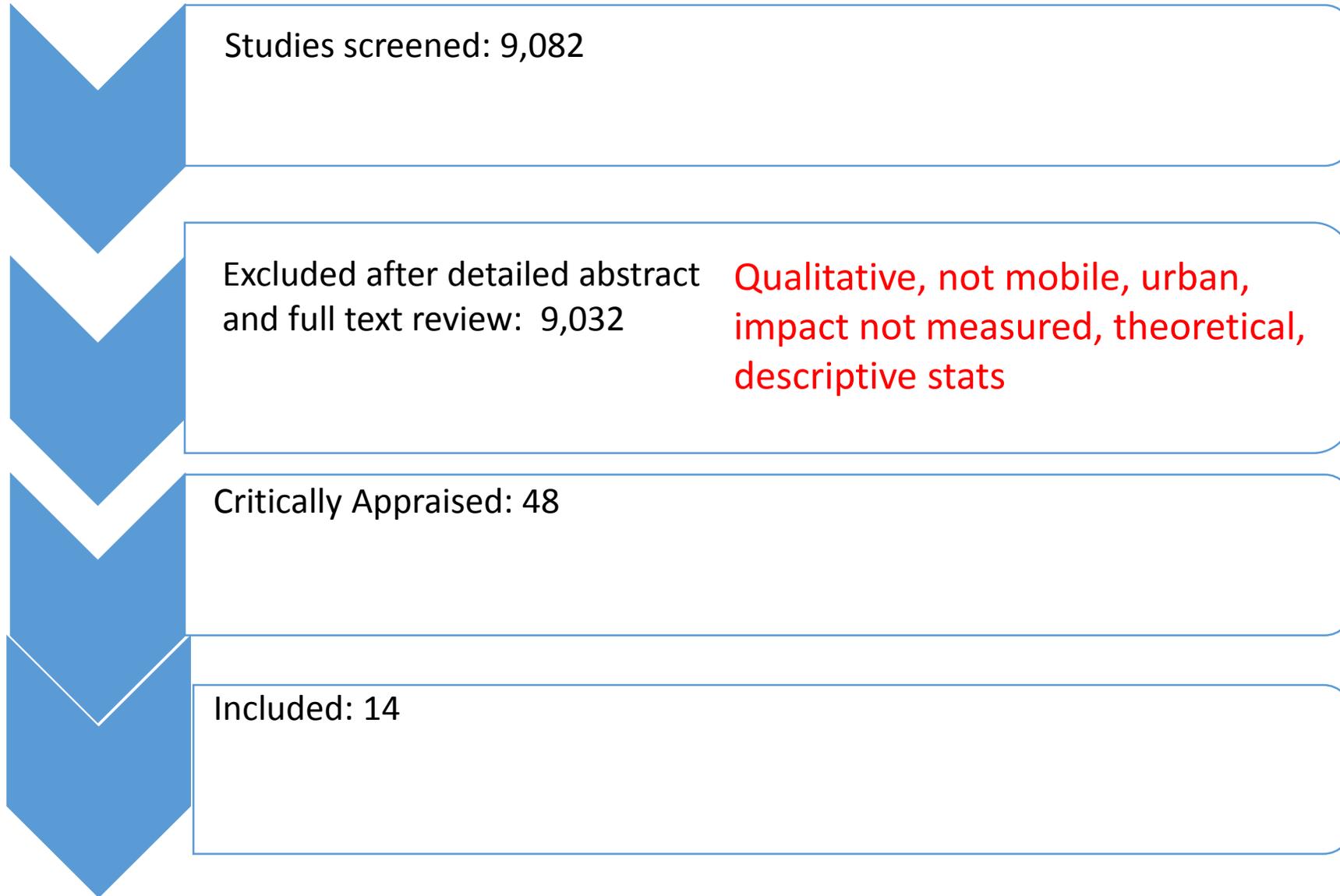
# What did we do?

The image shows the top navigation bars of two websites. On the left is The World Bank (IBRD · IDA) with the tagline 'Working for a World Free of Poverty'. It has a menu with 'Home', 'About', 'Data', 'Research', 'Learning', 'News', and 'Projects & Operations'. On the right is the American Economic Association with a menu including 'Annual Meeting', 'EconLit', 'Jobs', 'Resources', and 'Members'. A search box is visible on the right side of the American Economic Association header.

The image shows the SSRN (Social Science Research Network) website. The header includes the SSRN logo and the text 'SOCIAL SCIENCE RESEARCH NETWORK'. Below the header is a navigation bar with 'Home', 'Search', 'Browse', 'Submit', and 'Subs'. A 'MEMBER SIGN IN' section contains a 'First-time user? Free Registration' link, a 'USER ID' input field, a 'PASSWORD' input field, and a 'Sign In' button. Below this is a 'RESEARCH NETWORKS:' section listing various fields and their corresponding acronyms: Accounting (ARN), Anthropology & Archaeology (AARN), Cognitive Science (CSN), Corporate Governance (CGN), Economics (ERN), Entrepreneurship (ERP), Finance (FEN), and Health Economics (HEN). A central section titled 'Enter SSRN eLibrary' is co-hosted by Chicago Booth, ECgi (European Corporate Governance Institute), Korea University, and Stanford Law School. Below this are buttons for 'Top Papers', 'Top Authors', and 'Top Organizations', along with 'Search' and 'Browse' buttons. Further down are links for 'Research Paper Series', 'Partners in Publishing', 'Organization Home Pages', and 'Conferences'.

The image shows the Google Scholar search interface. It features the 'Google scholar' logo. Below the logo is a search input field with a blue search button. Underneath the search field are radio buttons for 'Articles' (selected) and 'Case law', with a checked box for 'include patents'. Below this is a purple link that says 'New! 2014 Scholar Metrics released' and a green link that says 'Stand on the shoulders of giants'.

# What did we do?



# What did we find?

## THE QUARTERLY JOURNAL OF ECONOMIC

Vol. CXXII August 2007

### Does ICT Benefit the Poor? Evidence from South Africa

Stefan Klöpper, Cornell University and J. W. C.

*American Economic Journal: Applied Economics* 2 (July 2010): 46–59  
<http://www.aeaweb.org/articles.php?doi=10.1257/app.2.3.46>

### Information from Markets Near and Far: Mobile Phones and Agricultural Markets in Nigeria

By JENNIFER C. AKER\*

THE DISCLOSURE  
MARI

When information  
arbitrage is  
allocated efficiently,  
performance is improved.  
Using micro data from  
fishermen, the  
dispersion of prices  
is reduced.  
Law of One Price

How does  
information  
affect  
market  
equilibrium  
(LOP) (i.e.

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POLICY RESEARCH WORKING PAPER 4996

IMPACT EVALUATION SERIES No. 33

## The Power of Information

### The Impact of Mobile Phones on Farmers' Welfare in the Philippines

Julien Labonne  
Robert S. Chase

### Is IT Enough? Evidence from a Natural Experiment in India's Agriculture Markets

Chris Parker, Kamalini Ramdas, Nicos Savva  
London Business School, Regent's Park, London NW1 4SA, United Kingdom,  
cparker.phd2007@london.edu, kramdas@london.edu, nsavva@london.edu

Access to information and communication technologies (ICTs) such as mobile phone networks is widely known to improve market efficiency. In this paper, we examine whether access to timely and accurate information provided through ICT applications has any additional impact. Using a detailed dataset from Reuters Market Light (RML), a text message service in India that provides daily price information to farmers, we find that this information reduces geographic price dispersion of crops in rural communities by as much as 5.2% (std. error 2.6%, p-value 4.5%), over and above access to mobile phone technology and other means of communication. To identify the effect of information on price dispersion we exploit a natural experiment where bulk text messages were banned unexpectedly across India for twelve days in 2010. We find that access to RML information has the highest impact in areas where RML has the largest number of subscribers. Also, the effect is largest for perishable crops. RML thus reduces the higher risk associated with high value perishable crops. We discuss implications for development organizations and for information providers.

*Key words:* price dispersion, information and communication technology, natural experiment, supply chains

developing countries.  
This paper provides  
evidence on the  
impact of mobile  
phone service  
on market pairs with

information from  
in Magaria, Niger

market agents have  
found that this  
information is  
not symmetric.  
Due to this  
asymmetric  
information  
(Austen Goolsbee  
2002) (Goolsbee  
2007). In this  
context, the  
implications  
for nascent  
markets.

#### 1. Introduction

The rapid and widespread growth of information and communication infrastructure such as mobile phone networks in Africa and Asia has created a number of opportunities for economic growth

# Mobile Phones

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graph TD; A[Mobile Phones] --> B[Impacts due to coverage expansion and access to a phone]; A --> C[Impacts due to mobile phone based services];
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Impacts due to coverage expansion and access to a phone

Impacts due to mobile phone based services

# About the studies

Author	Observations	Occupations	Duration	Location
Jensen (2007)	74,700	Fishers, traders	1997-2001	Kerala, India
Aker (2010)	53,820	Traders	1999-2006	Niger
Aker and Fafchamps (2011)	39,120	Traders, farmers	1999-2008	Niger
	2,503			
Labonne and Chase (2009)	2,092	Farmers	2003-2006	Philippines
Beuermann et al. (2012)	40,000	Cross-sectoral	2001-2007	Peru
Klonner and Nolen (2008)	57,486	<b>Cross-sectoral</b>	1996-2001	South Africa

# Findings

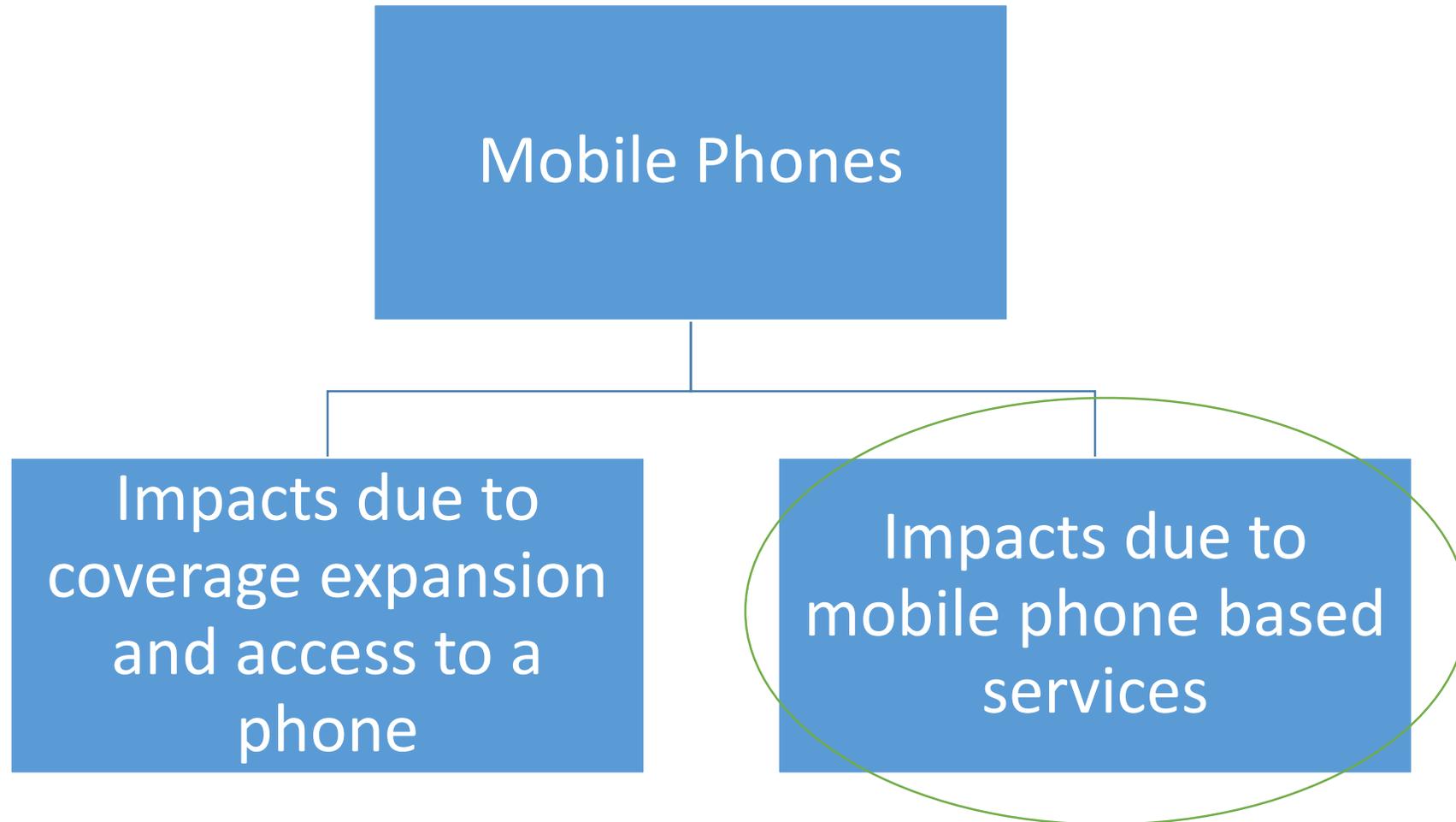
Author	Findings
Jensen (2007)	INR 5 reduction in Max-Min spread of prices between market
	fishermen's profits increased on average by 8% consumer price reduced by 4%
	5-8% waste reduced to almost 0
Aker (2010)	10%-16% reduction in grain price dispersion. The effect is stronger for market pairs with higher transport costs
Aker and Fafchamps (2011)	50% reduction in the Max-Min price spread of farm-gate prices within a region
	reduces producer price dispersion for cowpeas by 6%. No higher producer prices but lower intra-annual price risk for farmers.
Labonne and Chase (2009)	increase in growth rate of per capita consumption: 15% (excluding communication)

# Findings

Author	Findings
Klonner and Nolen (2008)	Employment increases by 15 % when a locality receives complete network coverage (increased employment by women).
Beuermann et al. (2012)	Wage income increases by 15% after 2 years coverage, 34% after 6 years of coverage. Value of household assets increases by 23% 2 years after coverage, and increases to 54% after 6 years of coverage.

# Mobile network expansion has impact

- Causal mechanism
  - Improves coordination between buyers and sellers in hitherto separate agricultural markets, in effect merging them into a bigger market
    - Reduces price dispersion (Law of One Price) and aligns supply and demand (Say's Law)
  - Has similar effect on labor markets
    - Indirect effects too
    - In South Africa mobile coverage increased likelihood of someone being employed by 33.7%
  - Economic improvements were reflected in rising disposable income, household assets and thus expenditure (easier to measure)
    - Expenditure increased by 44.6%, six years after coverage arrived in Peru
    - Resulted in increased growth of consumption (about 15%) among farmers in Philippines, excluding communication-related consumption
- But enabling conditions (which vary even within countries) must exist, e.g.,
  - Even if price/demand information available from new location through mobile communication, it must be possible for the supplier/trader to take commodity to that place: physical transport
  - The institutional conditions must permit the action. If the fisher/trader is not empowered to sell in new location by owner of boat/grain, information by itself will not improve outcomes



# About the studies

Author	Service Offered	Sample/obs	Duration	Location
Fafchamps and Minten (2011)	Price, weather and crop advisory information via SMS	1,000	12 months	Maharashtra, India
Parker et al. (2012)	Price information via SMS	14,349	12 months (12 days)	India
Camacho and Conover (2011)	Price and weather information via SMS	1,107	26 weeks	Colombia

# Findings

Author	Findings	
Fafchamps & Minten (2011)	price dispersion	Not generalizable
	price received by farmers	Not generalizable
	crop loss	Not generalizable
	likelihood of changing crop varieties and cultivation practices	Not generalizable
Parker et al. (2012)	Price dispersion for crops for each state	5.2% higher spatial price dispersion during a bulk SMS ban
Camacho & Conover (2011)	sale price	Not generalizable
	farmers' revenues	Not generalizable
	household expenditures	Not generalizable
	crop loss	Not generalizable

# Reasons for impact (or inability to find impact)

- Too short a time to find effects
- Problems with targeting
  - Did the intended beneficiaries get the relevant information at the relevant time?
- Language issues
- Literacy issues – especially with SMS
- Push versus pull service
- Experience in using the service

# Causal mechanism & enabling conditions

- Causal mechanism same as with network extension (difference being proactive supply of information)
  - Hitherto separate markets consolidated through ICTs
- Information services reduced price dispersion but the desired impacts were not seen
- Same qualifications re enabling conditions

# The Impact of mobile financial services in low- and lower middle-income countries

Erwin Alampay and Goodiel Charles Moshi

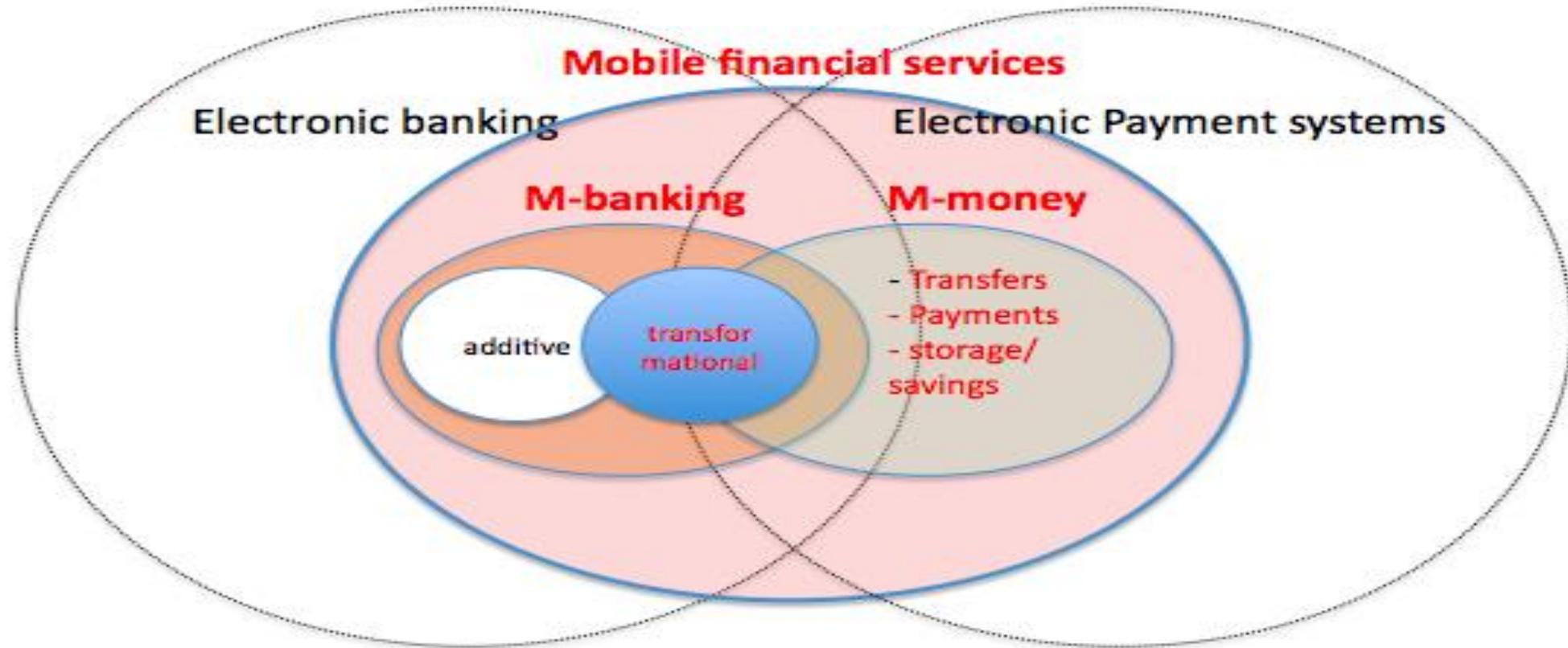
With assistance from Ishita Ghosh, Mina Peralta & Juliana Harshanti



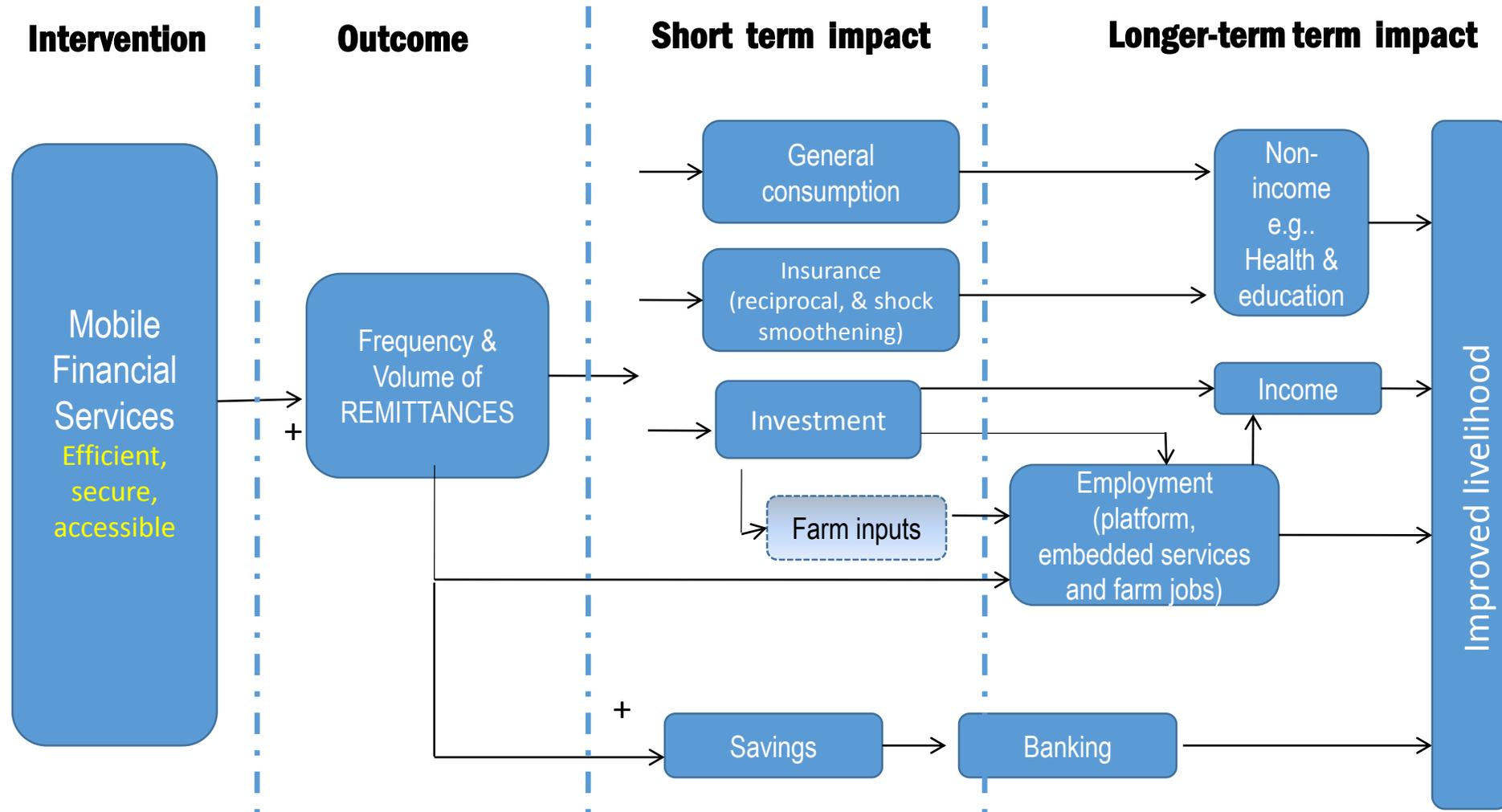
This work was carried out with the aid of a grant from the International Development Research Centre, Canada and the Department for International Development UK..



# Locating m-Financial Services



# Theory of Change



## SCREENING PROCESS

### EXCLUSIONS:

1. Publication before 2000
2. High-income and middle income
3. Not using mobile phones
4. Not about mobile money
5. Not on impact
6. Theoretical only
7. Qualitative only
8. Only feasibility/potential

Title screening

2759 titles screened

Abstract screening

205 abstracts screened

### Full text inclusions

1. Mobile Money
2. Low to low-middle income country
3. Quantitative
4. Study Design
5. Low Risk of Bias

Full text screening

109 articles + 22 from Grey Lit – 28 overlaps = 102 papers

Data Extraction

Data Extraction

12 final papers

# Findings

# Impact on remittances: Frequency

- In Kenya:
  - Increased likelihood of receiving and sending remittances by 37.4% and 34.3% (Jack & Suri, 2013)
  - MPESA adoption and frequency of sending/receiving transfers positively correlated; sending transfers statistically significant. Mbiti & Weil (2011:16)
- In Uganda:
  - 56% difference between users and non-users in frequency of remittances received (Munyegera et al. 2014).
- In Niger:
  - Frequency and amount of remittances by people with mobile phones with Zap were higher than those without the service (but not significant) Aker, et al. (2012)

SMOOTHENS FINANCIAL FLOWS  
MORE RECIPROCITY IN SHORT TERM

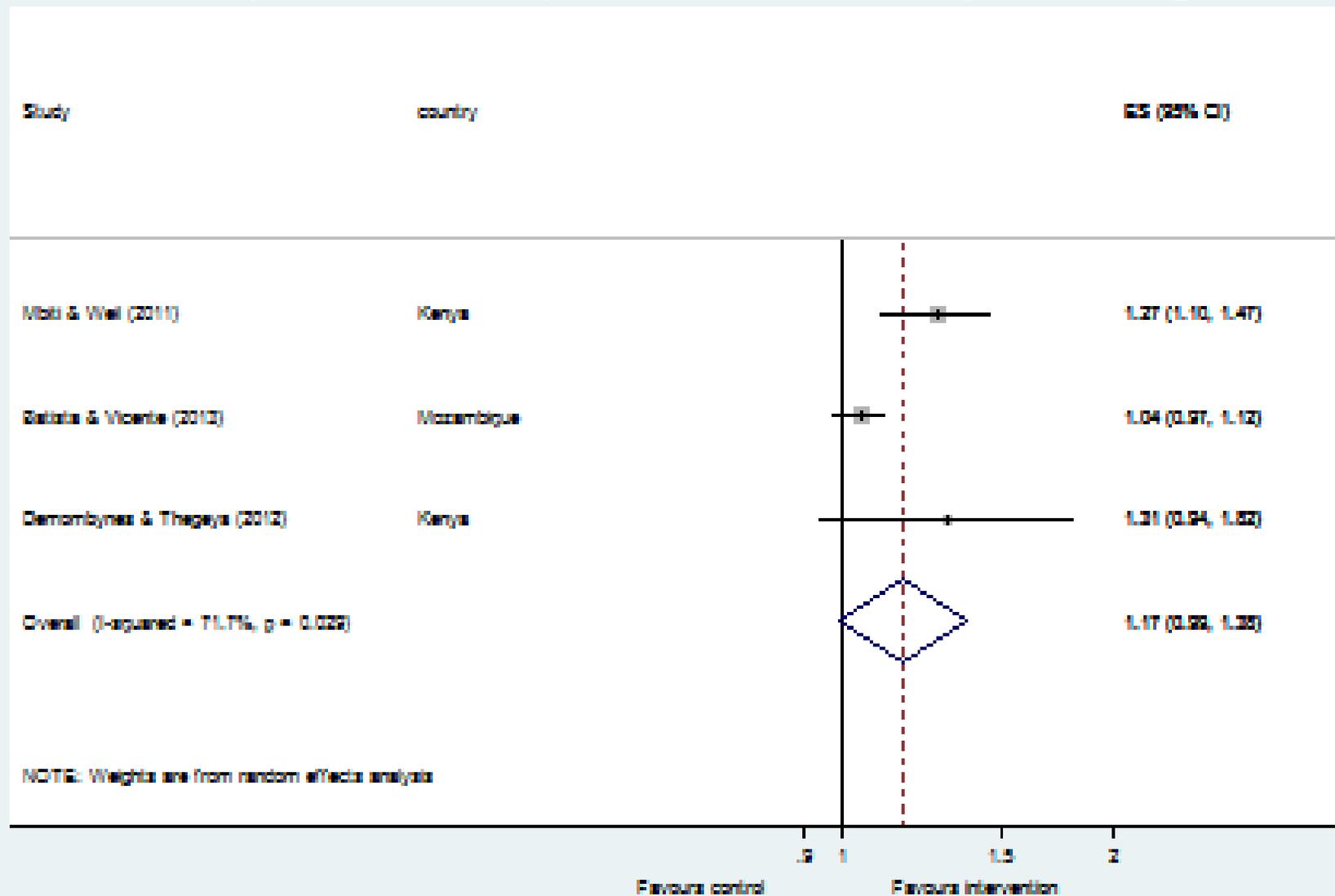
# Impact on remittances: Volume

- In Kenya:
  - 33.1 and 32.6 KES higher amounts of remittance sent and received by households with MPESA in ( $p < 0.01$  for both) (Jack & Suri, 2013).
  - Rural user households received KES 12,697 more than non user HH's (equivalent to 66%,  $p < 0.05$ ) (Kikulwe, et al. 2014)
- In Uganda:
  - 43% higher total value of remittance received ( $p < 0.01$ ) (Munyegera & Matsumoto, 2014)
- In Rwanda:
  - Airtime transfers increased during shocks (Blumenstock, et al. 2011)

# Impact on savings

- In Kenya:
  - Positive association between MPESA adoption, bank use and savings and employment (Mbiti and Weil, 2011:16)
  - Reduces informal savings (-38.3%,  $p < 0.05$ ), practice of hiding money for saving (-77.2%,  $p < 0.01$ ); Also translates into a positive increase in formal saving (+27.3%,  $p < 0.01$ )
  - Amount of monthly savings increases (OLS: +11.8%,  $p < 0.05$ ), IV: +31%, NS) (Demombynes and Thegaya, 2012)
- In Mozambique:
  - General saving (+4.3%, NS); mKesh saving (+24.9%,  $p < 0.01$ )
- In Afghanistan:
  - Users more likely to save on MPaisa, but total savings did not significantly differ from non-users (Blumenstock, et al. 2015)

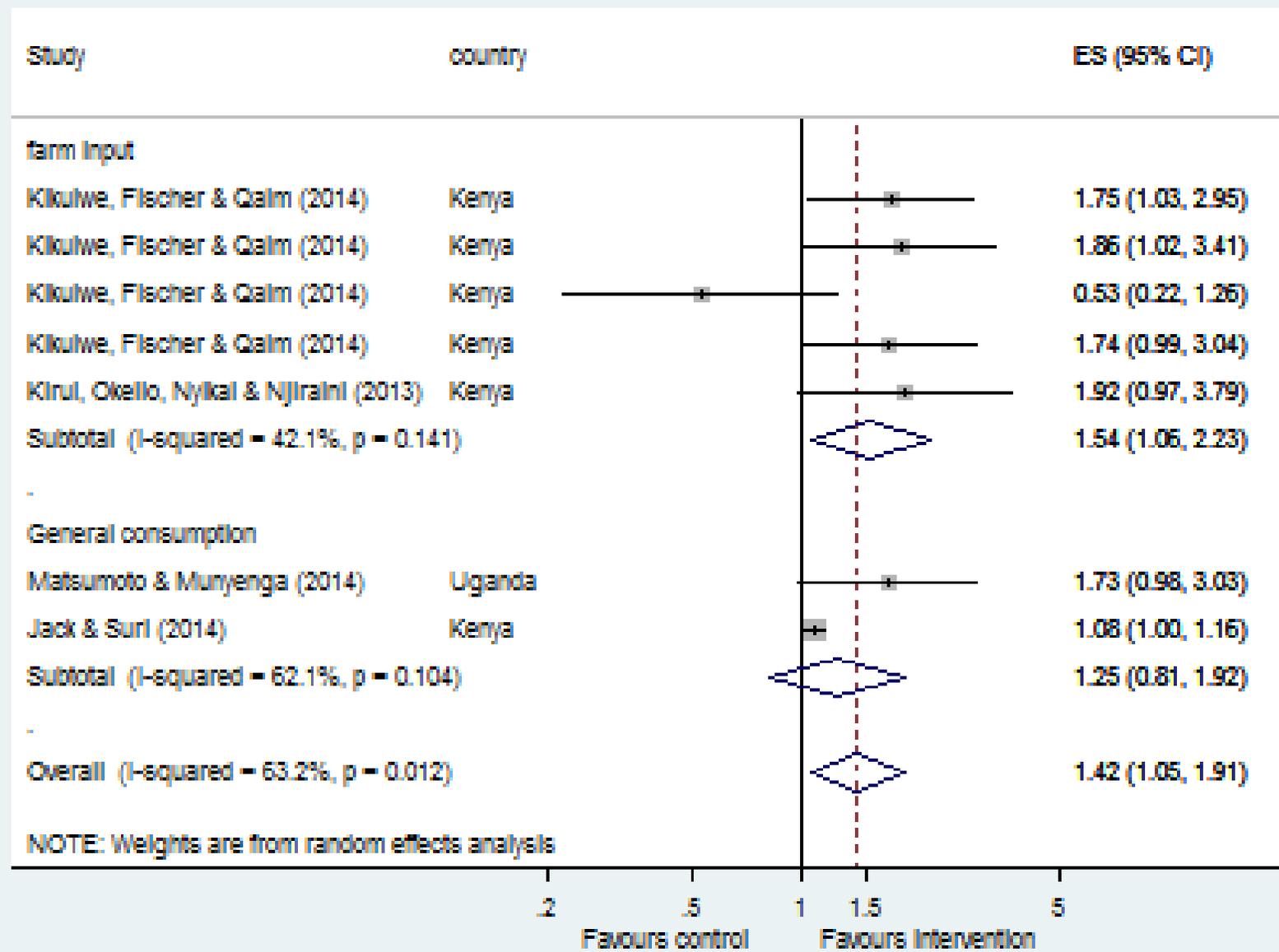
## Response ratio impact of mobile money on saving



# Impact on consumption

- Kenya:
  - Per capita consumption increases, ↑ USD 29 to USD 47 (13% increase in per capita consumption for users) Munyegera & Matsumoto (2014)
  - + \$42 difference in consumption of agricultural inputs Kirui, et al. (2012)
- Niger:
  - ↑ in the types of food and non-food items consumed (+20.1%,  $p < 0.01$ ) Aker, et al. (2011)
  - More diverse diet; higher non staple grains, more fats
- Afghanistan:
  - Blumenstock, et al.(2015) – larger and more frequent airtime purchases

# Response ratio impact of mobile money on consumption



Incomplete; 2015 studies to be added

# Impact on livelihoods

- Niger:
  - Diversity in basket of crops produced (**+8.1%**, **p<0.1**) (Aker, 2010)
- Kenya:
  - Commercialization 37% higher ( $p < 5\%$ )
  - Input use higher by USD 42 ( $p < 10\%$ ) leading to a HH income increase of USD 224 for m-money HH users, **income rose** by USD 224 ( $p < 1\%$ ) (Kirui, et al. 2012)

# Strategies for training or supporting teachers to integrate ICT in the classroom: A systematic review

Sujata Gamage and Tushar Tanwar,  
with assistance from Chivoïn Peïou, Achala Abeykoon and Amrita Khurakal



This work was carried out with the aid of a grant from the International Development Research Centre, Canada and the Department for International Development UK..



# Big picture

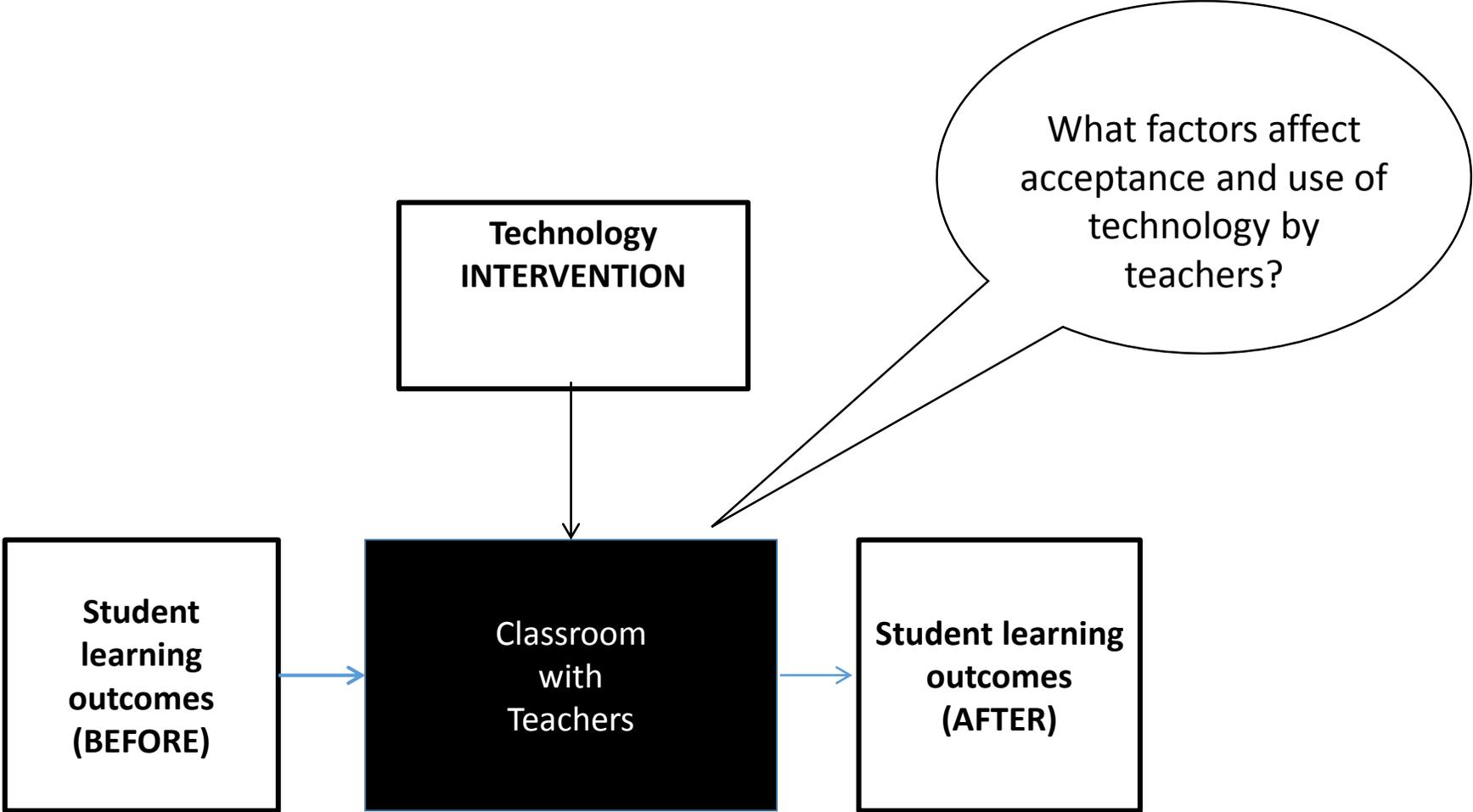
- Impacts of ICT in education are modest

“Educational technology is making a modest difference in learning of mathematics. It is a help, but not a breakthrough. However, the evidence to date does not support complacency. New and better tools are needed to harness the power of technology to enhance mathematics achievement for all children.”

- Non-acceptance of technology by teachers may be a factor

“Reviewers and researchers often treat the limited time devoted to technology as an implementation problem, but perhaps it speaks to a fundamental problem that separate CAI programs are not well accepted or seen as central to instruction by teachers, so teachers may not make sure that students get the full amount of time on technology recommended by vendors..”

Cheung, Alan C.K. and Slavin, Robert E. (2013). The effectiveness of educational technology applications for enhancing mathematics achievement in K-12 classrooms: A meta-analysis. *Educational Research Review* 9 (2013) 88–113.



# Unified theory of technology acceptance and use (UTTAU), Venkatesh (2003)

Acceptance and use of a specific technology by a teacher in the teaching and learning process is determined by:

- Behavioral (Perceived usefulness and ease of use)
- Normative (Social influence)
- Functional (Facilitating conditions)

# Research question

- What are the relative effects of perceived usefulness and perceived ease of use?

Usefulness is found to be more important than ease of use in other work settings.

# Screening process

- 11,419+ hits using keywords
- 5,274 concerning technology use in the classroom
- 1,998 empirical studies on technology use in K-12 classroom
- 65 Quasi-experimental
- 7 studies with technology intervention specified and usefulness and usability measured
  - Observation studies using multivariate regressions to tease out effects of other factors

# Usefulness is twice as important as ease of use when a specific technology is used for a specific application

Study-Year-country- Sample size	Technology used	RoB	ES2/ES1	
			Mean (SE)	CI Range
Kim-2009-Korea	Digital text book pilot	Med	2.70 (0.70)	1.3-4.1
Lay-2013-Taiwan	GIS for geography curriculum	Low	2.65 (0.07)	2.5-2.8
Pynoo-2012-Belgium	Klasscement portal for teachers	Med	2.09 (0.06)	2.0-2.2
Van Acker-2013- Netherland	Digital learning materials (DLM)	Low	2.79 (0.05)	2.7-2.9
Teo-2001-Singapore	ICT use by Algebra teachers	Low	2.05 (0.20)	1.6-2.4
DeSmet-2012-Belgium	LMS for information use	Low	0.89 (0.08)	0.7-1.0
DeSmet-2012-Belgium	LMS for Communication use	Low	1.29 (0.09)	1.1-1.5
Pynoo-2011-Belgium	Digital learning environment	Low	0.50 (0.21)	0.1-0.9

# Implications

## Policy

- Worry less about teacher ICT efficacy, but, more on getting them started with useful applications

## Research

- Only 7 out of 1998 empirical studies could be compared for policy relevant conclusions. New research directions are needed.

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