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Making Research Aid More Effective:
The Science of Scaling Up in Agroforestry

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Making Research Aid More Effective: The Science of Scaling Up in Agroforestry[1]

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Introduction

Development efforts in agriculture have had mixed success during the past sixty years (IAASTD, 2008). Multilateral and bilateral financial support has grown substantially (Lowder and Carisma, 2011) but not necessarily increased the proportion of successful programmes or projects (Ramalingam, 2013). Incomplete knowledge, capacity, materials, productivity thresholds, markets, supporting policies or clearly defined impact pathways are some of the reasons cited for lack of greater success. Some authors have also called for a shift away from relying on overly prescribed planning and *ex ante* analysis towards monitoring, learning and adaptation (e.g. Jones, 2011).

In recent years through high level processes there has been more of a focus on efficiency and effectiveness of Aid. This has been manifest largely through efforts to achieve greater impact from previous and currently successful innovations and interventions by scaling them up (Finn 2012). And yet a prevalent underlying reason for unrealised development impact is due to failed assumptions. More specifically, it is a failure to list, test and/or adapt the assumptions upon which the design and implementation of development programmes were based. Through simple, linear and mechanistic planning the interactions between political, social, economic, biophysical and ecological systems have been ignored. These systems are not only complex but also dynamic, diverse and unpredictable. It is enigmatic therefore that we attempt to use simple and single solutions to solve complicated and complex problems.

Interestingly, at least for a short period of time it is possible to make nearly any agricultural research output work at the farm, village or watershed level when large enough resources and adequate time are available. Farmers' income, crop production, household dietary intake, natural capital assets, market functioning or social inclusion may even double or triple as a result of some interventions. Surely a real benefit to those rural actors directly involved but the key question to ask is at what overall cost? An incremental reward to an individual beneficiary could be US$200 but if that reward cost $4000 per farmer to achieve it will only be more widely justifiable when the benefit:cost ratio is increased or, better still, reversed. Several NGOs in the early 1990s with donor prompting became focused on trying to show more impact per ODA dollar but often were missing a counterfactual (Hulme and Edwards, 1992). The lack of paired comparisons, counterfactuals and strong monitoring and evaluation (M&E) continues as has

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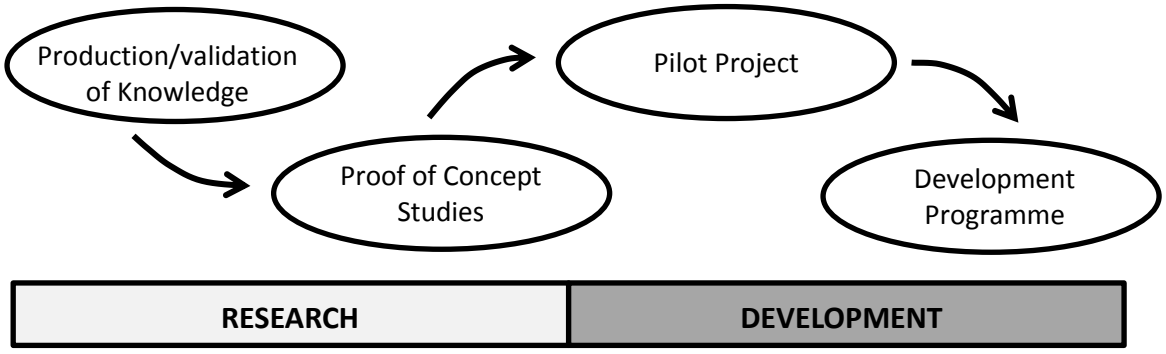
been seen with recent discourse on the Millennium Villages Project (Wanjala and Muradian, 2013). The cost-benefit figures quoted above are of course hypothetical averages and thus mask extremes including some who may end up being worse off. Obviously "*You may be worse off as a result of this intervention*" is not a very popular research or extension message, and yet it is implicit likelihood in every research option that scientists or extensionists provide.

Aid effectiveness is about providing aid in a way that maximises its impact on development and achieves value for money. The push for aid effectiveness has been reaffirmed in the past decade and comprehensively addressed by the Paris Aid Declaration (2005), the Accra Agenda for Action (2008) and Busan High Level Forum (2011). However, the discussion about research *per se* within the development aid agenda is wanting. With the emphasis on "value for money" in development this leaves research, which often has a lag phase, somewhat exposed and probably under-performing and under-appreciated. This was recently recognised by the recent UK Parliamentary review on agriculture (Foster, 2013).

The discourse about research in development is often polarized around two axes of thinking. The first axis asserts that we have inadequate or incomplete knowledge and we need to fill these gaps. The second axis says we have sufficient knowledge and all we need to do is better apply existing knowledge. In reality, it is a combination of the two axes but this duality does not inform well our typical research cycle or the way we link research and development. The conventional research to development pathway follows a linear logic of: (a) produce and validate knowledge; then (b) undertake a "proof of concept"; then (c) design and run a pilot project; and finally if the pilot was considered successful then (d) finance and implement a large programme (Figure 1).

Figure 1: Typical linear research development pathway incorporating four main stages.



This "produce-proof-pilot-programme" approach can usually have exponential increases of actors/beneficiaries along the pathway; for instance from 5 farmers to 100 farmers to 10,000

farmers to 5 million farmers. Research is largely confined to the produce and proof stages and development confined to the pilot and programmes. However, it is this outdated paradigm and research-development disconnect that needs fixing to achieve more substantial scaling up of knowledge and its positive impacts. The absence of learning, feedback loops and identification of next generation research issues is worrying. Several authors have advocated boundary spanning approaches and linking knowledge to action across diverse sets of partners (e.g. Cash et al., 2003; Kristjansson et al. 2009). Whilst offering great promise these approaches do not yet appear to have been widely taken up.

It is perplexing that during research we use highly systematic processes, highly trained scientific staff and highly rigorous validation procedures to generate and document knowledge but when it comes to development we use a single best bet technology, an individual guideline or a prescribed methodology. We test research hypotheses in basic research and proof of concept studies but we ignore the need to test development hypotheses of how and will an innovation or intervention work at scale.

The vocabulary for agriculture scaling up is somewhat vague and confused. The terms reach and benefit are often interchanged as are adopt and extend. In reality, except for a few rare technologies, practices or materials, most farmers test before they adopt and this seems to hold true for both “early adopters” and “late adopters”. Their assessments and modifications then dictate at what rate they and possibly their neighbours expand that innovation, or not, over scope (area, labour, capital) and time period. Too often projects have relied on spontaneous diffusion rather than a systematic approach to scaling up. The emergence of the new Global Forum for Rural Advisory Services in 2010 is a positive change that in time may solve many of the conceptual and definitional barriers to more effective and better documented scaling up.

The agricultural and natural resource management (NRM) sectors, in contrast to the health sector, largely remain fairly conservative and segregated in terms of research, extension and policy. Research outputs which work in often narrow conditions are then replicated at wider geographic scale through duplication, extension or outreach. Policy reform or support typically lags such occurrences. In this way not only are activities segregated but actors are also. Some useful participatory work with scientists and farmers does take place, although in much of the developing world still the uni-directional technology transfer model persists. Rarer still is the study of farmer adaptation of technologies and knowledge. Innovations in “boundary work” assist in better linkages but largely confine the discovery process to interactions amongst actors. Glaringly, scaling up strategies are often weakly developed or articulated contributing to inadequate extension, policy review and impact. Recent reviews of scaling up in agriculture have attempted to address this gap (e.g. IFAD, Linn et al., 2010; UN Global Compact, Power et

al. 2012; World Bank, Holcombe 2012). These reviews however overlooked the fact that research on scaling up per se was needed. At best we have scalability checklists and the Simplicity-Complexity Index (Cooley and Kohl, 2008).

Scale in the agricultural domain is best reflected by four variables of population, land area, productivity and financial return, which in turn have high co-variance. Scaling up is defined as the geographic, market, social and political expansion of knowledge, technologies, products, behaviours or policies. Here project, institutional or programme outputs are promoted to reach a larger number of people or a greater area of land. To have impact at scale requires understanding of the complexities and interactions of these factors over space and time. This usually is inadequately captured as part of an M&E assessment focused on where the single approach worked or did not, and ignoring interdependencies amongst the factors. Furthermore the determinants of successful scaling up are seldom documented.

Using examples from tree-based research and extension, a more comprehensive and less differentiated approach is presented. Here a "proof of application" phase introduces investigation, experimentation and learning in the scaling up process. Sound scientific methods incorporating documented strategy, hypotheses to test, controls, replication and geo-spatial stratification accompany work on social acceptance, facilitating partnerships, input supply systems, communication, rural advisory services, policy review and policy-maker engagement. Sustainability in the context of knowledge-intensive rural development requires greater experiential learning than has been offered by previous linear and simplistic methods. Researching the development process whilst undertaking scaling up provides such an opportunity. Examples of farmer to farmer dissemination, volunteer farmer trainers, extension programme analysis, rural resource centre establishment and civil society campaigns are presented for fodder, fertiliser and fruit trees. As the developing world looks to scientists for more than generic Global Public Goods such as (i) actionable knowledge for greater impact; and (ii) robust evidence for better decision-making for policies and investments, the above approaches offer prospects for a new paradigm for research in agriculture and NRM.

Research Planning and Implementation

Arguably, the modern research management tool most used by researchers is the Gantt Chart developed by Henry Gantt in 1910. This was chronologically followed by "Flow Line Scheduling" and "Critical Path Methods" (Manhattan Project) in the 1930s and 1940s. Concepts from the 1960s of earned value, configuration management, precedence scheduling and resource allocation informed the now 40-year-old methodology of Logical Frameworks developed by USAID in 1969. And since then we have had more nuanced versions produced such as Project Resource Organisation Management Planning Technique (PROMPT/PRINCE2) by UK in 1975,

Goal Oriented Project Planning (ZOPP) by GTZ in 1998, Balanced Scorecard by Kaplan in 1990 and Results Based Management by CIDA in 1996.

All of the above mentioned tools and methodologies have been useful in making research planning more systematic but don't incorporate serendipity (unplanned results) or the pure inventiveness (spontaneous creativity) of scientific discovery. Their biggest flaw though lies in their singular description of what needs to happen without corresponding guidance on how it might happen. Moreover whilst they may resonate with some researchers and development practitioners they seem alien to CBOs and rural dwellers. After all, at the end of the day farmers are more interested in **Incomes** rather than **Outcomes** no matter how convincingly the latter is explained. In the 2000s, a more advanced approach was adopted by many in the health sector with the creation of "Knowledge to Action" or "Knowledge Translation Clearing House" methods. Apart from KTCH approaches the health sector overall is well supported by evidence based approaches such as Randomised Controlled Trials (RCTs) and the Cochrane Reviews. Whilst RCTs are considered a gold standard of evidence Roche and Eyben (cited in Green 2013) also point out that power and politics can change and influence behaviours and outcomes as much as evidence.

The old adage of "you can only manage what you can measure" has led to measurement being all important. Researchers seek standardization, they revere precision, and aspire for control. In relation to metrics, our guiding premise is that better measurement (methods and data) will create a learning environment from which better decisions about research and development can be made. However, as Carr (2011) points out the premise is broken where institutional pressures run against hearing bad news. Where donors and implementers shy away from acknowledging failure we miss out on often the most important learnings and greater likelihood of repeat mistakes. Such an atmosphere of failure-aversion can also increase the likelihood of scientific fraud. In the article by Wheatley and Kellner-Rogers (1999) they highlight some of the dangers in just relying on measurement as opposed to also using feedback. In addition, they produced a useful comparative table of some of the differences between feedback and measurement (see Table 1).

Table 1: Differences between feedback and measurement (Wheatley, Kellner-Rogers, 1999)

Feedback	**Measurement**
Context dependent	One size fits all
Self-determined; the system choose what to notice	Imposed. Criteria are established externally.
Information accepted from anywhere	Information in fixed categories only
System creates own meaning	Meaning is pre-determined
Newness, surprise are essential	Prediction, routine are valued

Focus on adaptability and growth	Focus on stability and control
Meaning evolves	Meaning remains static
System co-adapts	System adapts to the measures

Proof of Application: The Science of Scaling Up

Nearly all suitable alternate prepositions and conjunctions have been juxtaposed with research and development (R&D), including R for D (R4D), R on D, R in D and R of D. In the health sector the concepts are well developed and tested (e.g. ExpandNet) whereas in agriculture we are largely left with the concepts without much experiential learning about the science of scaling up. Indeed a Google Scholar search of "Science of Scaling Up" in Agriculture revealed fewer than five refereed articles that even mentioned the term and none that set out principles and definitions. The valid caution expressed by Goldacre (2007) in "Bad Science" about scaling up becoming a pseudo-science in medicine is equally applicable in agriculture.

The World Agroforestry Centre (ICRAF) for some years has been working on the science of scaling up in agroforestry, which we often term "Proof of Application". Here rather than taking the approach outlined above in Figure 1 we test several mini-pilots simultaneously with a control. The mini-pilots can concern different technologies, tree species, dissemination approaches or social institutions. Here ten principles common in most research endeavours are applied to development, which include:

1. Problem-based (high utility, not curiousity)
2. Testing a development hypothesis, construct or paradigm
3. Systematic/experimental approach
4. Repeated observations
5. Independent reasoning, deductive thinking
6. Documented and shared
7. Undergoes critical peer review (credibility)
8. Validated, revalidated (robustness)
9. Expect unplanned discoveries (serendipity)
10. Progressive, builds on knowledge base, zero fraud

ICRAF defines proof of application to be ***"deliberate efforts to increase the impact of agroforestry interventions and innovations tested in multiple pilot or experimental dissemination projects so as to benefit more people and to foster policy and continued development on a more lasting basis."*** This definition differs from the broader term of "scaling up" used by others which generally refers to broadening the impact of existing or new practices.

Typically research projects will have large budgets per individual contact farmer or beneficiary ($1000s) and typically do not break even in terms of return on investment. Whereas development projects aim for high returns on investments and can be as high as 100-500%. Of course these typically ignore environmental externalities can often reverse the values to negative ones (Trucost, 2013).

Figure 3: Cost and benefit per farmer/beneficiary paradigms

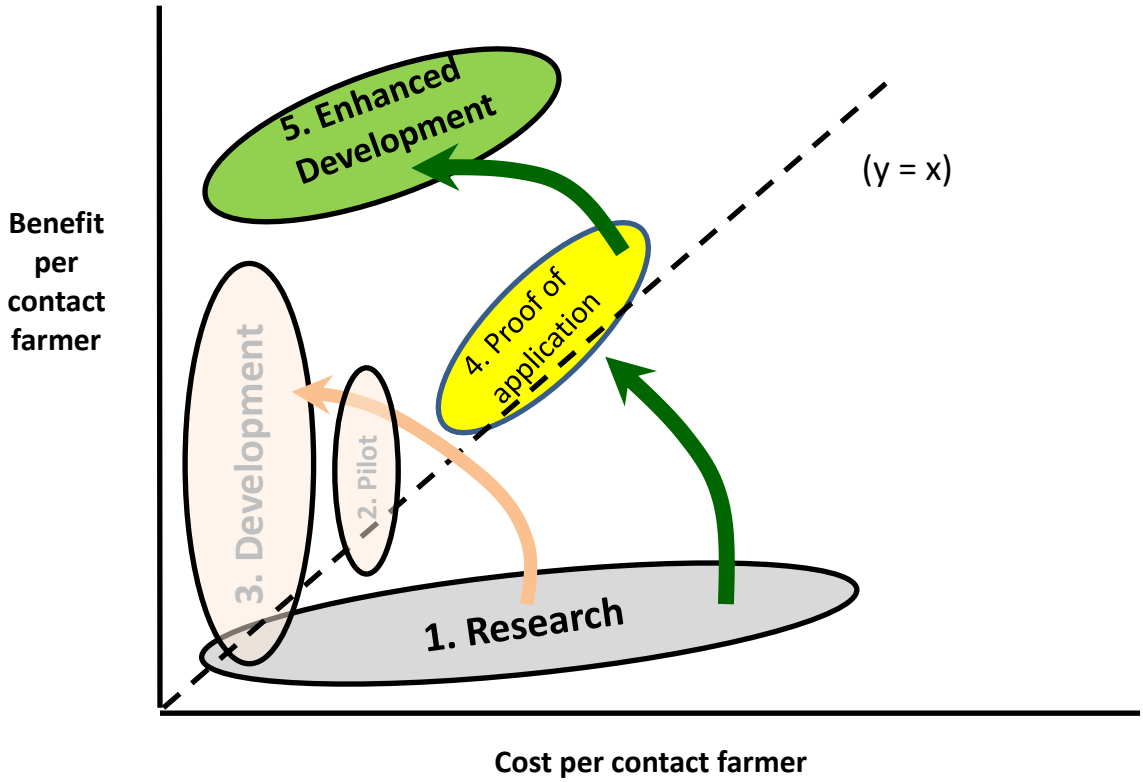


Figure 3 portrays two paradigms of cost and benefit per contact farmer. The classic approach is sequence of (1) Research to (2) Pilot to (3) Development whereas the "proof of application" approach is (1) Research to (4) Proof of application to (3) Enhanced Development. The rationale is that through more systematic testing of multiple pilots that the learning, adaptations and monitoring will led to even enhanced development, especially in the eyes of the beneficiaries.

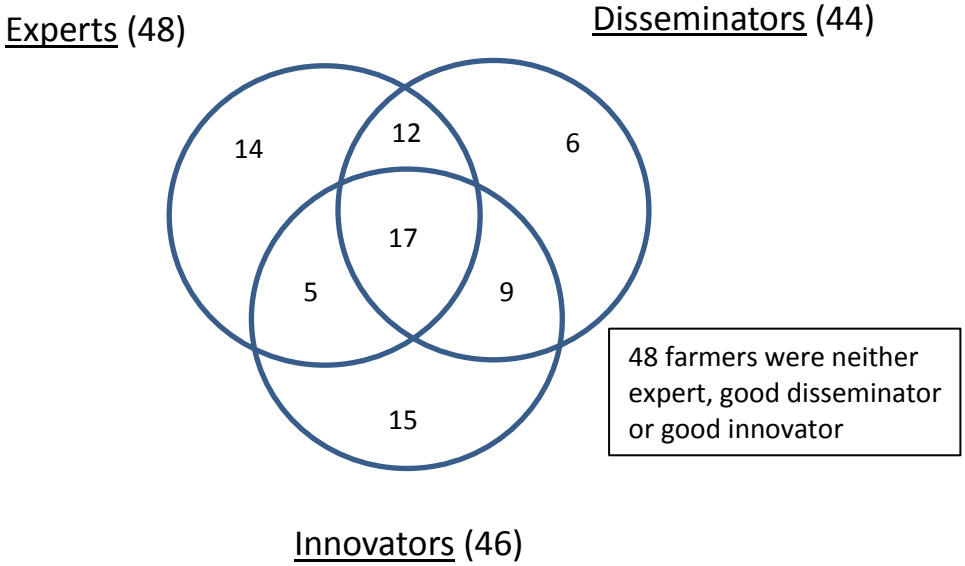
The table below highlights the current bilateral donor projects where ICRAF is testing the proof of application with 10,000's to 100,000's of contact beneficiaries/farmers. Significant attention is placed on monitoring and evaluation, and datasets are made openly available according to ICRAF's Data Management Policy at http://thedata.harvard.edu/dvn/dv/icraf.

Table 2: Proof of Application Projects underway at ICRAF

Donor Project	Countries	Grant Total (USD)	Number of beneficiaries	Cost per beneficiary
DGIS – Food and Water Security	Burkina, Ethiopia, Kenya, Mali, Niger	$52,000,000	500,000	$104
Cocoa – Vision for Change	Cote d'Ivoire	$50,000,000	300,000	$167
Finland – Biocarbon and Rural Development	East Africa, Guinea, Mali, Sierra Leone	$13,000,000	100,000	$130
CIDA – Sulawesi integrated agroforestry	Indonesia	$9,300,000	100,000	$93
Irish Aid – Agroforestry FS	Malawi	$5,200,000	200,000	$26
ACIAR – Evergreen Agriculture in East Africa	Burundi, Ethiopia, Rwanda, Uganda	$5,200,000	80,000	$65

Many project managers and extensionists choose model or expert farmers for dissemination on the assumption that they will be better than non-expert or poorer farmers. In a study of 126 adopters of dairy tree fodder technology in East Africa funded by GATES some interesting findings emerged. Here when comparing experts, good disseminators and good innovators there was no effect of age, gender, education or size of land holding (Franzel, pers. comm.). Thus recruiting expert farmers may not lead to optimal dissemination. In addition it was found that poorer farmers with off-farm employment made better disseminators. Although the fodder tree technology is quite robust and tested for over 20 years in East Africa 46 of the 126 farmers experimented with 30 different innovations (e.g. spacing, propagation, management).

Figure 2: Relationship between being an expert/model farmer, good disseminator or good innovator for dairy fodder tree technology (n=126 farmers)



Gender Dimension of Scaling Up

Kiptot and Franzel (2012) outline well the gender dimension of women's participation in agroforestry and scaling up in Africa although many of the findings are valid across the developing world. They explored women's engagement in agroforestry (fodder, soil fertility, fruit, woodlots) compared to men and identified several challenges they face. The review highlighted how agroforestry has the potential to preferentially favour women; however, their participation is low in enterprises that are considered men's domain, such as timber and high in enterprises that have little or no commercial value, such as collection of indigenous fruits. This has significance in scaling up in terms of choice of enterprise and how to engage both men and women in proof of application, and to keep gender disaggregated data.

So as to better promote gender equity in agroforestry and to ensure that women benefit fully, Kiptot and Franzel (2012) recommend various policy, technological and institutional interventions. These include (1) facilitating women to form and strengthen associations, (2) assisting women to improve productivity and marketing of products considered to be in womens' domain and (3) improving women's access to information by training more women extension staff, holding separate meetings for women farmers, and ensuring that women are fully represented in all activities.

Guidelines for Proof of Application

The following list of 12 guidelines for proof of application studies are generic and not exhaustive. They have proved useful in various bilateral projects and CRP studies and will expand as we develop the paradigm and concepts further.

1. Adopt a "do no harm" approach avoiding placing farmers and other actors at risk. There will likely be relative winners and losers and this needs tracking and will need managing and messaging.
2. Undertake forecasting estimates for testing, expansion and adoption rates - and routinely assess assumptions and estimates. Farmers often test before they adopt and designing expansion and diffusion aspects of scaling up are important.
3. Scaling up may change, challenge or stress social hierarchies. Empowering one group may disempower or alienate another and this needs to be monitored, understood and corrected where needed.
4. Nothing should be a free handout to farmers. In as much as they may be provided with some inputs at no financial cost they need to realize they need to co-invest their land, labour and capital.
5. Assess and anticipate how much local contextuatilisation there will be as no knowledge, technology, method, policy or material will work everywhere.

6. Attempt multiple pilot approaches and avoid a single one which will provide fewer learning opportunities. This will require boundary spanning approaches and new ways of learning and reflection.
7. Language and definitions are important are need articulating and reinforcing as there are differences between reach and adopt, also some pilots may not be demonstrations in classic extension mode and be clear with farmers and others they are testing options.
8. Include a control treatment or counter factual.
9. Complex solutions and interventions do require increasingly more sophisticated information and support which needs to be planned and provided.
10. Allocate significant resources to Monitoring and Evaluation (M&E), especially to gender differentiated responses and results.
11. Scaling up solutions for a given problem(s) will likely lead to needs in the next set of problems.
12. Assess whether diffusion will be spontaneous or requires systematic support.

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