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Can we evaluate network brokerage initiatives using data that are byproducts of the network broking process?

by

Abigail Barr, University of Oxford*

Sophie Alvarez, CGIAR Challenge Program on Water and Food

Katherine Tehelen, International Center for Tropical Agriculture

Boru Douthwaite, CGIAR Challenge Program on Water and Food

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* **Corresponding author:** Abigail.barr@economics.ox.ac.uk, Centre for the Study of African Economies, Department of Economics, University of Oxford, Manor Road Building, Manor Road, Oxford, OX4 1XP, UNITED KINGDOM

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Abstract: Increasingly, development projects list social capital development and network brokerage among their objectives. How do we quantitatively evaluate such initiatives? Best practice, diff-in-diff methods may be impossible or too costly. Here, we try using data that are byproducts of the network broking process to evaluate the Challenge Program for Water and Food along this dimension. We find that, in accordance with its objectives, the program is associated with bridging linkages between organizations in the water and food sectors and between CGIAR members and their counterparts in government and that, in the case of the former, the association may be causal.

Keywords: Food production; water; Project evaluation; organizational networks; network brokerage; dyadic analysis.

JEL classifications: O32 - Management of Technological Innovation and R&D; O33 - Technological Change: Choices and Consequences; Diffusion Processes; Q16 – R&D; Agricultural Technology; Agricultural Extension Services; Q25 – Water.

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Introduction

Increasingly, since the late 1980s, social scientists and development practitioners have recognized the importance of social capital in the lives of people in developing countries.[1] Among social scientists, there is now widespread agreement about the significant role played by networks, trust, and pro-social norms as bases for exchange and collective action, especially in the absence of well functioning, formal institutions.[2] And among development practitioners, there has been a shift away from working with individuals and households, towards working with communities and groups, the idea being that the social capital embodied therein may be harnessed as a force for the good.[3]

More recently, the impact of development projects on social capital has come under scrutiny and interventions designed specifically or in part to foster social capital development have started to emerge.[4] Many of these interventions take the form of working to improve the capacity of recipient groups that either existed prior to or were formed during the early stages of the interventions. Some also involve network brokerage, i.e., the fostering and strengthening of linkages between individuals and between organizations, and in a few cases network brokerage appears among stated project goals.[5]

As this trend continues there will be a growing need to find ways of evaluating project impacts on networks, trust, and norms, especially where those impacts are stated

[1] Early works on social capital include Bordieu (1986), Coleman (1987, 1988), Putnam (1993), Portes (1998). Recent reviews of the literature are provided by Halpern (2004) and Burt (2005).
[2] For early reviews of the literature on development and social capital see Platteau (1994), Hyden (1997), Grootaert (1997), Woolcock (1998) and for more recent reviews see Durlauf and Fafcahmps (2004) and Woolcock and Narayan (2006).
[3] The group lending contract pioneered by the Grameen Bank in Bangladesh is probably the most well known example of an intervention designed to apply to groups rather than individuals (Morduch, 1999), but there are others including the World Bank's Social Investment and Community Development Funds.
[4] The participatory research movement may be seen as part of this endeavour, e.g, Humphries et al (2000) and Douthwaite et al (2006).
[5] For example FARA (Forum for Agricultural Research in Africa) engages in advocacy and coordination of agricultural research for development and explicitly supports networking through networking support functions (see http://www.fara-africa.org/networking-support-functions/).

objectives. To date, while several qualitative evaluations of the impact of World Bank projects on social capital exist, there have, to our knowledge, been no quantitative analyses.[6] In large part, this is because such evaluations require very specific and potentially expensive data and, in some cases, data that we have yet to work out how to collect or generate. However, in some instances the intervention-related activities themselves actually generate data. This is especially the case when development practitioners conduct workshops in which people undertake tasks that are designed to render various aspects of their social capital observable so that they can then be discussed. The question we address in this paper is whether it is possible to conduct first-cut quantitative evaluations using such data. We do this by endeavouring to undertake such an evaluation using the data generated by a series of workshops relating to a global initiative of the Consultative Group on International Agricultural Research (CGIAR).

In 2003 the CGIAR set up the Challenge Program on Water and Food (CPWF), a global initiative aimed at increasing the productivity of water used in agriculture. From the outset, network brokerage was a stated goal of the project. According to its web site, the "CPWF is an international, multi-institutional research initiative with a strong emphasis on north-south and south-south partnerships. The initiative brings together research scientists, development specialists, and river basin communities in Africa, Asia and Latin America to create and disseminate international public goods (IPGs) that improve the productivity of water in river basins in ways that are pro-poor, gender equitable and environmentally sustainable."[7] More specifically, the CPWF aimed to foster and strengthen bridging linkages between organizations in the food and water sectors, research organizations and those working on the ground to encourage the dissemination and application of new technologies, and members of the CGIAR network and their counterpart organizations in national governments.[8] By fostering and strengthening

[6] For examples of qualitative analyses of the impact of World Bank projects on social capital, see Van Domelen (2006) and Fox and Gershman (2006).
[7] For further information go to http://www.waterforfood.org/
[8] Bridging linkages have been defined as those that exist between agents who are dissimilar in at least one dimension. They are associated with information flows, emergent opportunities and innovation. Sobel (2002) develops a structural definition related to the concept of node centrality, but the two definitions are empirically related. In contrast, bonding linkages exist between similar agents, possibly belonging to the same community, and provide a sense of identity and common purpose (Gittell and Vidal: 1998).

linkages between organizations in the food and water sectors they aimed to improve coordination and, hence, the allocation of finite water supplies across competing uses. By fostering and strengthening linkages between research organizations and organizations engaged in outreach and knowledge dissemination they aimed to maximize the rate at which newly generated knowledge on the efficient use of water in agriculture flows to and is applied by the people who need it most. This objective also applied to the fostering of linkages between CGIAR members and their counterpart organizations in national governments. However, these linkages were of particular importance as they may also reduce the likelihood of political and bureaucratic hurdles standing in the way of the application of the new knowledge as it emerged.

With the aim of encouraging CPWF project leaders express and discuss their plans for maximizing the developmental impact of their research, each project leader was invited to participate in one of a series of workshops. During these workshops, the participants performed a number of tasks including collectively drawing and discussing their research and knowledge disseminating networks. In this paper we combine the data generated during these network-drawing tasks with official data on CPWF funding and data harvested from the internet on the attributes of the various organizations that feature in the networks. Then, using dyadic analysis techniques, we endeavour to address the following question: has the CPWF led to an increased likelihood of bridging network linkages between (1) organizations in the food and water sectors, (2) CGIAR member organizations and their counterparts in national governments, and (3) research and development organizations?

We find evidence that CPWF funding is positively associated with bridging network linkages between the food and water sectors and between CGIAR members and their counterparts in national governments. CPWF funding is also associated with bridging network linkages between research and development organizations. However, this third effect is driven by the second: CGIAR members represent 20 percent of the research organizations in our dataset and their counterparts in national governments represent over 50 percent of the development organizations in our dataset. Put another way, the greater bridging between CGIAR members and their governmental counterparts in the presence of CPWF funding does not generalize to other research and development organizations.

These associations are consistent with the hypothesis that CPWF funding has had an impact on the likelihood of organizations forging the desired bridging linkages. However, they are also consistent with the hypothesis that CPWF funded organizations that already had bridging linkages. In an effort to distinguish between these two explanations, we first sought data relating to when the linkages were formed. However, due to the passage of time (four years) and personnel-turnover, such data proved impossible to come by. So, instead, we exploited the fact that the eight network-drawing workshops took place at different points in time, ranging from just one month after the first CPWF funds were rolled out to 28 months after that, and the order in which the workshops were conducted was unrelated to any aspect of the apparent performance of the projects represented in each. Thus, we find weak evidence of a causal relationship running from CPWF funding to bridging linkages between the water and food sectors.

That we were able to generate these findings suggests that it is, in some cases at least, possible to evaluate network brokerage initiatives using data that is a by-product of the brokering process. However, the evaluation inevitably captures only part of CPWF's potential impact and this renders the findings conservative and leaves some important questions unanswered. Also, to generate the findings we had to accept a number of methodological compromises all of which are discussed below. On balance, we think that the endeavour was worthwhile but that the resulting substantive conclusions need always to be viewed with these caveats in mind.

The paper is organized as follows. In section 2, we present the empirical formulation that provides the basis for the analysis that follows and discuss the various analytical issues that arise when working with network data. In section 3, we describe our data. We start by presenting the data generated by the network-drawing workshops. Then we present data extracted from two other sources specifically to support the analysis. These relate to CPWF funding and to the attributes of the various organizations featuring in the networks. In section 4 we present the first of two sets of empirical results. These explore the associations between CPWF funding and the three types of bridging linkage described above. Then, in section 5 we incorporate the data on the timing of the workshops into the analysis in an effort to establish whether the identified associations strengthen as the CPWF progresses, implying a causal relationship. Finally, in section 6 we conclude with a

review of our findings, a discussion of their strengths and weaknesses, and a consideration of whether it would be possible to conduct a best practice, diff-in-diff evaluation of a network brokerage initiative such as this.

2. Empirical formulation

The empirical formulation that guides our analysis is derived from those of Fafchamps and Gubert (2007) and Arcand and Fafchamps (2008). A network linkage is a characteristic of not one but a pair of agents (organizations in this study). Thus, when testing hypotheses about whether linkages between certain types of agent are more likely to exist under certain conditions, we need to work with datasets in which each observation relates to one such pair or dyad. To this end, we define a variable l_{ij}, which takes the value 1 if a network linkage exists between i and j and zero otherwise. The network matrix L ≡ $[l_{ij}]$ is symmetrical since $l_{ij} = l_{ji}$ by construction and, as noted by Fafchamps and Gubert (2007), so the explanatory variables must also enter the model symmetrically. Thus, to identify the associations of interest here, a model of the following form is appropriate:

$$
\begin{aligned}
l_{ij} = {} & \alpha_0 + \beta_W \left|W_i - W_j\right| + \beta_{FW}\left(\left|W_i - W_j\right| * (F_i + F_j)\right) + \beta_R \left|R_i - R_j\right| + \beta_{FR}\left(\left|R_i - R_j\right| * (F_i + F_j)\right) \\
& + \beta_{CG}\left(\left|C_i - C_j\right| * \left|G_i - G_j\right|\right) + \beta_{FCG}\left(\left|C_i - C_j\right| * \left|G_i - G_j\right| * (F_i + F_j)\right) + \beta_{FF}\left(F_i + F_j\right) \\
& + \gamma_1 \left|C_i - C_j\right| + \gamma_2 \left|G_i - G_j\right| + \gamma_3 \left|F_i - F_j\right| + \gamma_4 \left(W_i + W_j\right) + \gamma_5 \left(R_i + R_j\right) \\
& + \gamma_6 \left(C_i + C_j\right) + \gamma_7 \left(G_i + G_j\right) + \gamma_8 \left|H_i - H_j\right| + \gamma_9 \left(H_i + H_j\right) + \gamma_{10} S_{ij} + B_{ij} + \xi_{ij} \qquad (1)
\end{aligned}
$$

where:

- $W_i \in \{0,1\}$, equals 1 if i's sectoral focus is water, zero if i's sectoral focus is food, and falls between zero and one if their focus is divided between the two;
- $F_i = 1$ if i is funded by CPWF and zero otherwise;
- $R_i = 1$ if i is a research organization and zero if i is a development organization;
- $C_i = 1$ if i is a CGIAR member and zero otherwise;

- $G_i = 1$ if *i* is a national government counterpart to CGIAR and zero otherwise;
- H_i is a control variable that proxies for *i*'s presence in the public eye;
- $S_{ij} = 1$ if *i* and *j* are located in the same country;
- B_{ij} is a vector of river basin fixed effects;
- ξ_{ij} is the error term; and
- $\alpha_0, \beta_W, \beta_{FW}, \beta_R, \beta_{FR}, \beta_{CG}, \beta_{FCG}, \gamma_1, \gamma_2, \gamma_3, \gamma_4, \gamma_5, \gamma_6, \gamma_7, \gamma_8, \gamma_9$, and γ_{10} are the coefficients to be estimated.

If the coefficient β_W is negative and significant it may be taken as evidence that, in the absence of CPWF funding, organizations that are dissimilar with respect to sectoral focus (water-food) are less likely to share a network linkage. And if the coefficient β_{FW} is positive and significant it may be taken as evidence that this tendency is lower when CPWF funding is flowing to dyads that are dissimilar in this way. If the coefficient β_R is negative and significant it may be taken as evidence that, in the absence of CPWF funding, dyads in which one is a research organization and the other is a development organization are less likely to share network linkages than if either both or neither are in research.[9] And if the coefficient β_{FR} is positive and significant it may be taken as evidence that CPWF funding is associated with a reduction in this tendency. If the coefficient β_{CG} is positive (negative) and significant it may be taken as evidence that, in the absence of CPWF funding, CGIAR members and their governmental counterparts are more (less) likely to share network linkages than the average dyad containing one research and one development organization.[10] And if the coefficient β_{FCG} is negative (positive) and significant it may be taken as evidence that CPWF funding is associated

[9] In our dataset all of the organizations (nodes) are either research or development organizations, i.e., organizations involved in outreach and knowledge dissemination within the context of the CPWF.

[10] This interpretation acknowledges the fact that CGIAR members are research organizations and their governmental counterparts are development organizations: to the extent that they are just like any other research-development dyad the likelihood of them being linked is captured by β_R. β_{CG} captures the *additional* effect of being a CGIAR and a governmental counterpart.

with less (more) of a reduction in this tendency than in the case of other research-development dyads. The last coefficient of interest is β_{FF}. This will be positive and significant if CPWF funding is associated with a greater likelihood of any possible dyad sharing a linkage.

The coefficients γ_1 to γ_7 capture effects that, were they not controlled for, would bias the coefficients of interest.[11] γ_8, γ_9, and γ_{10} relate to control variables capturing three other factors that may affect the likelihood of linkages existing. These are the difference in and collective presence of the organizations in the public eye and whether they are located in the same country. The workshop fixed effects, B_{ij}, are included to absorb the effects of all workshop- and basin-level unobservables including regional variations in the physical, technological, and political environment and variations in the 'mood' that, for one reason or another, pervaded the workshops.

The models are estimated using a Logit. However, before any statistical inferences can be drawn, all the standard errors relating to the estimated coefficients described above need to be adjusted to account for non-independence between dyadic observations sharing a common element. Three methods of adjustment are available. The most comprehensive method can be applied if the data sample can be broken down into a sufficiently large number of distinct sub-samples – distinct in the sense that each node appears in only one sub-sample and there are no links between nodes in different sub-samples. Under these circumstances the standard errors can be adjusted by clustering on the sub-samples. This method adjusts for both interdependences between dyadic observations sharing a common element and interdependences between those that do not share a common element but appear in the same cluster and so may have been affected by a common unobserved factor. Our network data was generated in a series of interactive workshops within which

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[11] γ_1 and γ_2 correspond to elements in the interaction terms used to identify the association between CPWF funding and bridging linkages between CGIAR members and their governmental counterparts. Excluding these elements from the estimations could lead to omitted variable bias in the coefficients on the interaction terms of interest. γ_3 to γ_5 and the variables to which they correspond must be included in the estimations because, depending on a characteristic's distribution across the nodes in a network, a within-dyad difference in that characteristic may be correlated (across dyads) with the dyadic sum of that characteristic. So, by excluding the dyadic sum, one may cause a bias in the coefficient on the within-dyad difference and vice versa (Fafchamps and Gubert (2007)).

all observations could be interdependent. For this reason, clustering by workshop is a very attractive option. However, when clusters are few, as is the case here (there were only eight workshops), this method may lead to biased estimates of the standard errors.

Fafchamps and Gubert (2007) developed a method of adjustment that can be used in this situation, i.e., when there are too few distinct sub-samples in the dataset to support clustering. It corrects for non-independence between dyadic observations sharing a common element, but not for interdependences between dyadic observations that do not share a common element but belong to the same distinct sub-sample.

This method is a good second best to the clustering method. However, our data displays one feature that compromises our ability to apply either of the methods described above: a significant proportion of the nodes and, hence, the dyads in our dataset appear in the networks drawn in more than one workshop. Thus, to apply the clustering or Fafchamps and Gubert (2007) method to the pooled dataset generated by the eight workshops we have to assume that dyadic observations sharing a common element (or two) but originating from different workshops are independent.[12]

This is not ideal and leads to the consideration of one further method. We can take the data from the eight workshops and embed them in a single square network matrix of size n*(n-1) where n is the total number of organizations in the dataset. Put another way, we can construct a single network out of the eight workshop-specific networks. Then we can apply Fafchamps and Gubert's (2007) method of adjustment treating the whole dyadic sample as one.[13] However, in order to do this we have to make some assumptions about whether dyads made up of nodes that do not appear in the same workshop-specific network share a linkage and this is not straightforward. The obvious assumption is that they do not. However, this is clearly incorrect when applied to pairs of CGIAR members.

So, we have three methods available to us and each is compromised by one or more aspects of our data. Given these compromises and the absence of an ideal method of

[12] Formally, wherever the subscripts *ij*, *i*, and *j* appear in (1) above, they should be replaced with *ijb*, *ib*, and *jb*, where *b* is a workshop identifier, respectively.
[13] Here, a dyad that appears in more than one workshop will have more than one non-zero element in B_{ij}.

adjustment, wherever possible we apply each of the three methods in turn and base our conclusions on a review of the results of them all.

Table 1: Summary of Organization's (node's) characteristics

Variable description	Percentage or mean	Std. Dev.
Research	37.96%	
CGIAR Organization	6.17%	
Advanced Reseach Institute	6.79%	
Other research organization	25.00%	
Non-research	62.04%	
National Govt. Agricultural Research and Extension Organization (NARE)	34.88%	
Other government organization	11.11%	
Non-governmental organization (NGO)	12.04%	
Private Enterprise	2.78%	
End user group	1.23%	
Distribution across workshops and basins		
Andes only	6.79%	
Volta only	5.86%	
Mekong only	13.89%	
Karkheh only	2.78%	
IndoGangetic only	12.35%	
Yellow only	5.86%	
Limpopo only	9.57%	
Nile only	14.51%	
More than one workshop (basin)	35.19%	
CPWF funding		
Funded under CPWF	45.37%	
Budgeted funding (in 1,000s of USD)	95.941	341.940
Google hits linking node to water / Google hits linking node to water or food	0.509	0.164
Overall Google hit rate (1,000,000s)	0.438	2.920
Observations	324	

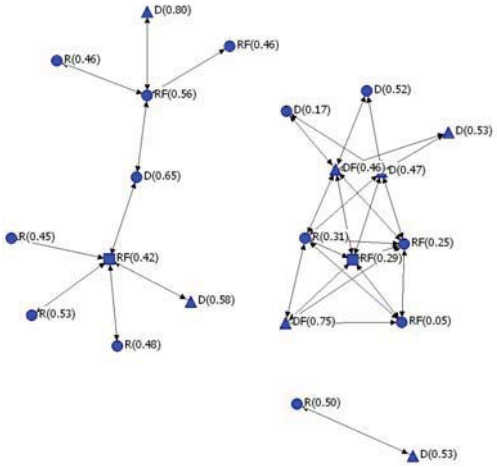
3. Data

The first round of the CPWF involved 32 projects distributed across nine geographical areas. Eight of these areas correspond to some of the world's largest river basins: the Volta; Mekong; Karkheh; Indo Gangetic; Yellow; Limpopo; Nile; and Sao Francisco river basins. The ninth area corresponds to the Andes mountain range or, more specifically, to some of the small water catchments that make up the Andean System of Basins.

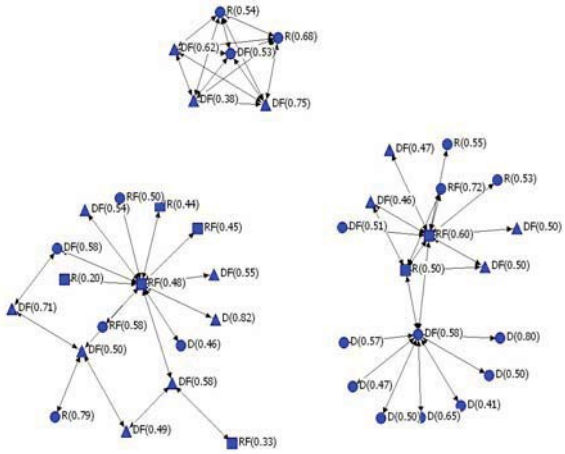
Soon after the rollout of CPWF funding commenced, a series of workshops was launched. Eight workshops were conducted, one in each of eight out of the nine geographical areas. The staff from each of the 32 first round projects were invited to attend the workshop in their area. Staff from 29 projects attended. No workshop was conducted in the Sao

Francisco river basin as there was only one first round project in that basin and for this reason the Sao Francisco river basin is excluded from the analysis.

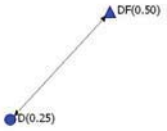
Figure 1a: The workshop-specific networks



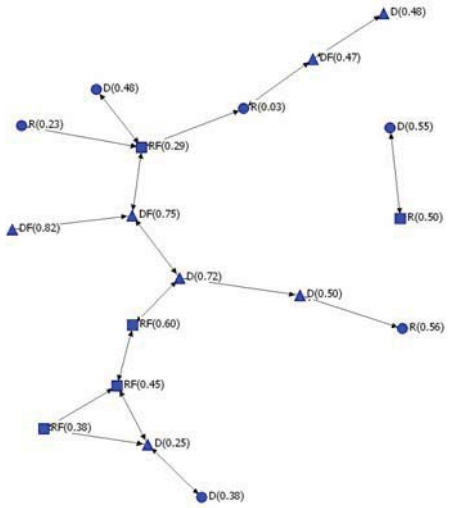
Andes catchments



Indo Gangetic river basin



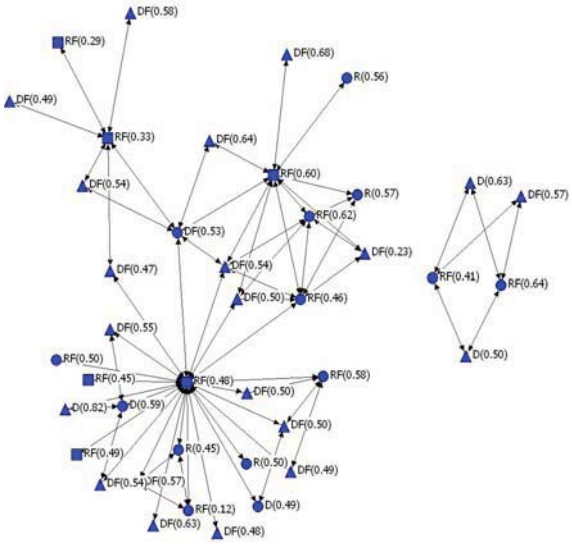
Karkheh river basin



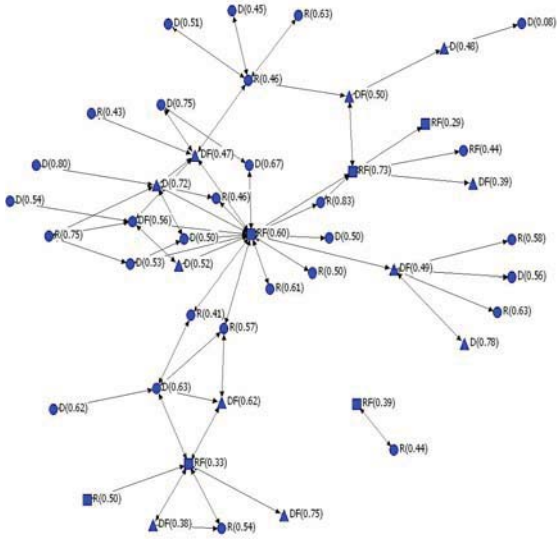
Limpopo river basin

Notes: CGIAR members indicated by ■; national agricultural research and extension organizations indicated by ▲; other node types indicated by ●; research organizations indicated by R; development organizations indicated by D; CPWF funded organizations indicated by F; the nodes' relative focus on water (as opposed to food) is shown in parentheses; nodes with no linkages are not shown.

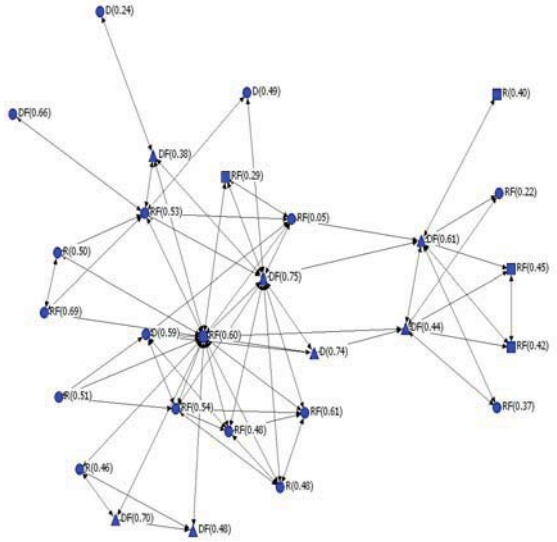
Figure 1b: The workshop-specific networks (continued)



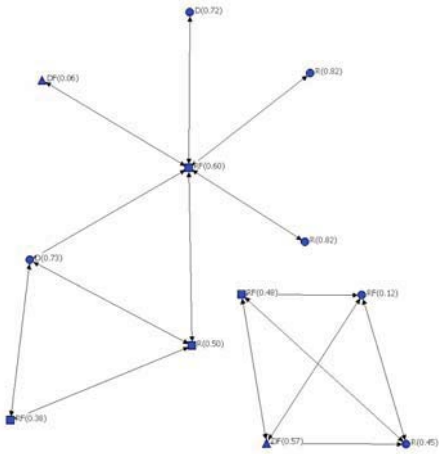
Mekong river basin



Nile river basin



Volta river basin



Yellow river basin

Notes: CGIAR members indicated by ■; national agricultural research and extension organizations indicated by ▲; other node types indicated by ●; research organizations indicated by R; development organizations indicated by D; CPWF funded organizations indicated by F; the nodes' relative focus on water (as opposed to food) is shown in parentheses; nodes with no linkages are not shown.

During each workshop the project staff members were invited, first, to draw their collective networks and, second, to discuss and indicate how these networks might be

enhanced to better serve the needs of their CPWF projects. In the analysis that follows, we use the network data generated during the first of these activities to construct three, closely related dependent variables, l_{ij}.

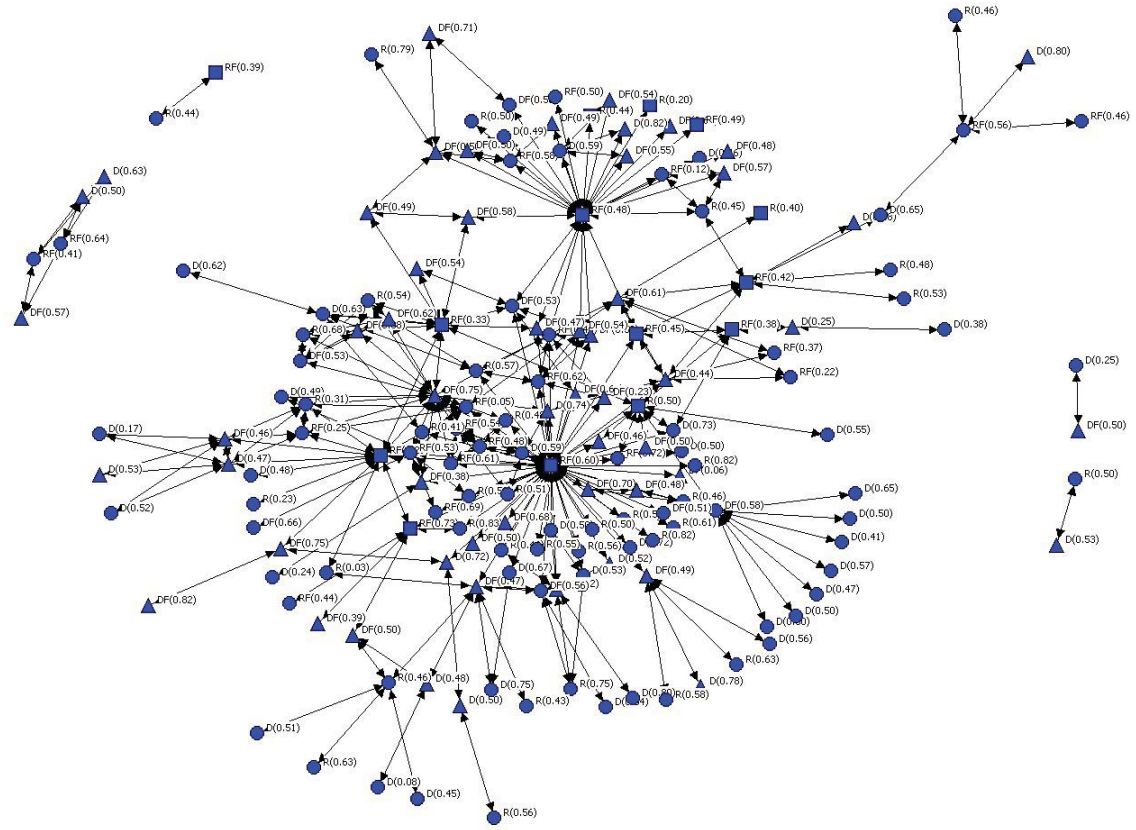
A total of 336 organizations, ranging from CGIAR members, through governmental and non-governmental organizations, to remote community-based, end-user-group organizations, were identified during the first task and every one of these was linked to at least one other by either a functional network linkage relating to a collaborative research or knowledge dissemination activity or a flow of funds or both.[14] Here, we restrict our analysis to 324 of these organizations, excluding six because they are donor organizations and a further six due to missing node-characteristic data. The characteristics of these 324 organizations are summarized in Table 1 and described below. Over 71 percent were identified during only one of the eight workshops (see table for distribution), whereas 21 percent were identified in two workshops, four percent in three workshops, two percent in four workshops, and one organization, the CPWF itself, in all eight workshops.[15]

Stylized representations of the networks associated with research and knowledge dissemination drawn in each of the workshops are presented in Figures 1a and 1b and the outcome of merging all eight basin networks into one is presented in Figure 2. Figure 2 shows the degree to which the networks corresponding to the different areas covered by the CPWF are interconnected. Note the square node in the centre of the diagram. This is the CPWF hub. Other CGIAR members and entities are also indicated by squares. The corresponding network data is summarized in dyadic form in Table 2. Table 2 contains two sets of two columns. The first set contains proportions, means and corresponding standard errors for the dyadic sample pooled across the eight workshops. In this sample there are 30700 unique *ijb* dyadic observations. The second set of columns contains proportions, means and corresponding standard errors for the dyadic sample made up of the 104652 dyads that can be generated from the full list of 324 organizations. The

[14] We do not use the data on funding flows identified during the workshops in the analysis as these funding flows may relate to projects other than CPWF. Instead, we use data on CPWF funding drawn from official CPWF documents, principally project contracts and sub-contracts.
[15] CGIAR members are overrepresented among those who were identified in more than one workshop.

construction of the dataset for this sample is based on the assumption that all dyads made up of organizations identified in different workshops do not share a linkage.[16]

Figure 2: The CPWF Network



Notes: CGIAR members indicated by ■; national agricultural research and extension organizations indicated by ▲; other node types indicated by ●; research organizations indicated by R; development organizations indicated by D; CPWF funded organizations indicated by F; the nodes' relative focus on water (as opposed to food) is shown in parentheses; nodes with no within-basin linkages are not shown; nodes that appeared in different basin workshops are assumed to share no linkage.

[16] This assumption is also applied to dyads containing two CGIAR, despite it being clearly incorrect, as it seems appropriate to treat all dyads for which we have no network data the same.

Table 2: Summary of the organizational dyads' characteristics

Variable description	Workshop datasets pooled		Single network dataset constr-ucted from workshop datasets	
	Percentage or mean	Std. Dev.	Percentage or mean	Std. Dev.
Linkage variables				
Dyad shares at least one functional tie	2.03%		0.89%	
Dyad shares a research-related tie	1.56%		0.76%	
Dyad shares an outreach-related tie	0.67%		0.20%	
knowledge dissemination	0.38%		0.11%	
advocacy-related	0.34%		0.10%	
Number of organizations CPWF funded (0, 1, or 2)	1.105	0.712	0.907	0.703
Dissimilarities				
One research, one not	47.78%		47.25%	
One a CGIAR org., one a NARE org.	8.41%		4.32%	
One a CGIAR org., one not	21.07%		11.62%	
One a NARE, one not	44.90%		45.57%	
One CPWF funded, one not	48.25%		49.72%	
Difference in sectoral focus	0.159	0.139	0.177	0.151
Difference in web presence (1,000,000s of hits)	0.012	0.051	0.008	0.040
Corresponding dyadic sums				
Aggregated focus on water sector	1.016	0.212	1.018	0.232
Number in research (0, 1 or 2)	0.830	0.702	0.759	0.685
Number of CGIAR organizations (0, 1 or 2)	0.237	0.455	0.123	0.340
Number of NAREs (0, 1 or 2)	0.703	0.680	0.698	0.673
Combined web presence (1,000,000s of hits)	0.013	0.052	0.009	0.041
Organizations in same country	10.40%		3.63%	
Months between first roll-out of CPWF funding and network data collection				
Months (range: 1 to 29)	12.966	10.959	-	-
Distribution of dyads across workshops and river basins				
Andes	6.45%		1.89%	
Volta	9.32%		2.73%	
Mekong	22.17%		6.50%	
Karkheh	0.78%		0.23%	
IndoGangetic	21.64%		6.35%	
Yellow	4.34%		1.27%	
Limpopo	13.13%		3.85%	
Nile	22.17%		6.50%	
Dyadic observations	30700		104652	

Notes: The first two columns present the percentages, means and standard deviations relating to the dataset pooled across the eight workshops. It contains 30700 unique ijb observations each associated with one workshop/basin. The last two columns present the percentages, means and standard deviations relating to the single network dataset constructed using the eight workshop datasets. It contains 104652 unique ij observations. During the construction it was assumed that organizations indentified in different workshops share no linkage. In this dataset dyads made up of organizations identified in different basins are not associated with any specific workshop/basin and dyads made up of organizations that were both identified in more than once are associated with more than one workshop/basin.

In the first task undertaken during the workshops, 624 functional linkages were identified. So, of the pooled sample of 30700 dyads, two percent share a research- or knowledge-dissemination-related linkage and of the constructed sample of 104652 dyads 0.9 percent share such a linkage. Focusing on the pooled sample, 1.6 percent of the dyads share a research-related linkage, 0.4 percent a linkage associated with a knowledge dissemination

activity, and 0.3 percent a linkage associated with an advocacy activity.[17] These proportions fall to 0.8, 0.2, 0.1, and 0.1 percent respectively when we move to the constructed sample. All of the proportions are small. However, this is not uncommon in network data and, given the size of the dyadic samples, does not preclude analysis.

We use data on CPWF funding to distinguish between those nodes and dyads that CPWF has impacted upon directly and those that have received either no impact or an indirect impact via the network. This data was harvested from official CPWF documents containing contracting and sub-contracting information. Table 1 shows that 45 percent of the organizations identified during the network-drawing workshops received funding from the CPWF. Budgeted amounts ranged from zero to 3.9 million USD, and the average budgeted amount was USD 96,000. Correspondingly, Table 2 shows that just under half of the dyads in both samples contain one funded organization, approximately one quarter contains two, and the remaining quarter contains no funded organizations.

The official documentation also yielded some information on the characteristics of the organizations in the network. However, this was incomplete. So, the internet and the Google™ search engine were employed to harvest the rest of the required data. Establishing the type of each organization and the country in which it was located was fairly straightforward. Of the 324 organizations in the dataset 38 percent are research organizations. These include members of the CGIAR network (six percent), advanced research institutes (seven percent), other research organizations such as universities and independent think tanks (25 percent). The remaining 62 percent were classified as non-research or development organizations. These include the CGIAR members' counterparts in governments, i.e., national agricultural research and extension organizations (NAREs) (35 percent),[18] other governmental organizations (eleven percent), non-governmental organizations (twelve percent), private enterprises (three percent), and end-user groups

[17] All linkages are assumed to be undirected. In research collaborations this is strictly true. However, knowledge dissemination linkages could be either undirected, e.g. *i* and *j* work together to disseminate knowledge, or directed, e.g., *i* disseminates knowledge to *j* or *i* receives knowledge from *j* or *i* lobbies *j* to facilitate the dissemination of knowledge.

[18] As their name suggests, these governmental organizations may engage not only in outreach and knowledge dissemination but also in research, which calls into question their classification as development organizations. We will return to this issue again below.

(one percent). Table 2 shows that 48 percent of the dyads in the pooled sample and 47 percent of the dyads in the constructed sample contain one research organization and that the average dyad contains 0.83 and 0.76 research organizations in each sample respectively. Dyads containing one CGIAR member and one NARE are rarer, making up eight and four percent of the two samples respectively. The organizations were distributed across 50 countries.[19] Ten and four percent of the pooled and constructed dyadic samples respectively contain organizations located in the same county.

Devising an objective measure for the sectoral focus of each organization was more challenging, in part, because many organizations in the food sector include water management in their remit and organizations in the water sector work with food producers, especially in predominantly agricultural economies. Here, we used the Google™ search engine to generate an objective proxy for the relative importance of food and water in each organization's portfolio by (1) conducting a series of searches using each organization's name and the word 'water' to generate a count variable, w_i, equal to the number of resulting hits, (2) conducting a second series of searches using each organization's name and the word 'food' to generate a count variable, f_i, equal to the number of resulting hits and (3) calculating the ratio $W_i = w_i/(w_i + f_i)$ to use as an indicator of the organization's focus on water relative to food. Table 1 indicates that the mean relative sectoral focus on water for our sample of 324 organizations is 0.51 indicating an even split between water and food across the sample, although individual organization's vary from 0.003, i.e., almost entirely focused on food, to one, i.e., entirely focused on water.[20] Table 2 shows that, across dyads, the mean difference in relative sectoral focus is 0.16 or 0.18 in the pooled and constructed sample respectively.

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[19] Australia, Bangladesh, Belgium, Benin, Bhutan, Brazil, Burkina Faso, Cambodia, Canada , Chile, China, Colombia, Denmark, Egypt, Eritrea, Ethiopia, France, Germany, Ghana, Honduras, India, Iran, Israel, Japan, Kenya, Laos, Malaysia, Mali, Mexico, Mozambique, Nepal, Netherlands, Nicaragua, Nigeria, Norway, Peru, Philippines, South Africa , Sri Lanka, Sudan, Sweden, Switzerland, Syria, Thailand, UAE, UK, USA, Uganda, Vietnam, Zimbabwe.

[20] The existence of the CPWF is likely to bias this measure towards 0.5 as the program title contains both the word 'food' and the word 'water'. Any web site containing the name of a specific organization and the program title will add one to the numerator and two to the denominator of F_i for that organization. This bias will diminish with the number of Google hits that an organization receives. It is also likely to be greater for funded organizations as funding will increase the likelihood of CPWF and an organization being mentioned

Finally, we conducted a series of simple Google™ searches based on the name of each organization and took the resulting hit rates, H_i, as an indicator of the extent to which each was in the public eye and, hence, how readily they might be found by other organizations seeking project partners. These hit rates are also likely to be correlated with the size of the organizations, their degrees of formality and technological capabilities, and negatively with their remoteness. Across the sample of 324 organizations, the hit rates varied from one to 41.6 million.[21] The mean difference in hit rate across dyads was 12,000 or 8,000 depending on whether one focuses on the pooled or constructed sample and the corresponding dyadic sums are 13,000 and 9,000 respectively.

4. Results: Associations between CPWF funding and bridging linkages

In this section we present a series of Logit estimations designed to establish whether CPWF funding is associated with an increased likelihood of bridging linkages existing between different types of organizations. The series is presented in Tables 3 to 5. Each table corresponds to a different dependent variable, i.e., a different definition of l_{ij}. In Table 3 l_{ij} equals one if i and j share a functional linkage and zero otherwise. In Table 4 l_{ij} equals one if i and j share a research linkage and zero otherwise. And in Table 5 l_{ij} equals one if i and j share a knowledge-dissemination-related linkage and zero otherwise. Linkages relating to advocacy activities aimed at the facilitation knowledge dissemination are included in this third definition. All three tables are organized in a similar manner. So, having worked through Table 3 in some detail, we will summarize the additional findings that may be drawn from Tables 4 and 5 more quickly.

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on the same web page. This could bias estimates of the coefficient β_{FW}, but the bias will be towards zero, rendering our estimates conservative.

[21] The organizations receiving only one hit were named on the web sites of larger, more formal organizations' working with them to disseminate new knowledge to end users.

Table 3: Dyadic logit analyses of the incidence of functional links

Dyad shares a functional link	Logit model 1				Logit model 2			Logit model 3				Logit model 4		
	Coeff.	Standard errors clustered	Standard errors dyadic	Marginal effects	Coeff.	Dyadic s.e.	Marginal effects	Coeff.	Standard errors clustered	Standard errors dyadic	Marginal effects	Coeff.	Dyadic s.e.	Marginal effects
Diff. in sectoral focus	-4.055	1.330 ***	1.096 ***	-0.046	-4.266	1.220 ***	-0.006	-4.073	1.318 ***	1.096 ***	-0.047	-4.312	1.207 ***	-0.007
Diff. in sectoral focus x Number CPWF funded	2.532	1.035 **	0.963 ***	0.029	2.306	1.119 **	0.003	2.551	1.028 **	0.969 ***	0.029	2.356	1.114 **	0.004
One research, one not #	-0.235	0.198	0.312	-0.003	-0.302	0.346	$-4.5e^{-4}$	0.012	0.082	0.138	$1.4e^{-4}$	0.093	0.165	$1.4e^{-4}$
One research, one not x Number CPWF funded	0.211	0.151	0.225	0.002	0.351	0.246	0.001							
One a CGIAR org., one a NARE org.#	-0.996	0.734	0.628	-0.008	-1.100	0.734	-0.001	-1.152	0.779	0.591 *	-0.009	-1.341	0.663 **	-0.001
One CGIAR, one NARE x Number CPWF funded	0.551	0.281 **	0.355	0.006	0.544	0.406	0.001	0.677	0.315 **	0.313 **	0.008	0.745	0.346 **	0.001
Number of orgs. CPWF funded	0.133	0.334	0.235	0.002	$-3.8e^{-4}$	0.269	$-5.6e^{-7}$	0.219	0.358	0.219	0.003	0.144	0.242	$2.2e^{-4}$
One CPWF funded, one not #	0.219	0.151	0.184	0.003	0.277	0.199	$4.2e^{-4}$	0.224	0.153	0.184	0.003	0.279	0.199	$4.2e^{-4}$
One a CGIAR org., one not #	0.308	0.165 **	0.275	0.004	0.730	0.528	0.001	0.319	0.171 *	0.275	0.004	0.757	0.533	0.002
One a NARE org., one not #	0.314	0.346	0.176	0.004	0.230	0.177	$3.5e^{-4}$	0.348	0.360	0.178 *	0.004	0.290	0.178	$4.4e^{-4}$
Aggregated focus on water sector	1.474	0.757 **	0.631 **	0.017	1.256	0.915	0.002	1.479	0.757 *	0.631 **	0.017	1.261	0.915	0.002
Number in research	0.302	0.117 ***	0.240	0.003	0.284	0.234	$4.3e^{-4}$	0.300	0.120 **	0.243	0.003	0.280	0.238	$4.2e^{-4}$
Number of CGIAR organizations	0.940	0.211 ***	0.225 ***	0.011	0.475	0.217 **	0.001	0.927	0.208 ***	0.223 ***	0.011	0.445	0.215 **	0.001
Number of NARE organizations	0.077	0.161	0.305	0.001	0.053	0.319	$7.9e^{-5}$	0.056	0.169	0.304	0.001	0.013	0.318	$2.0e^{-5}$
Difference in web presence	-12.122	3.539 ***	4.134 ***	-0.139	-12.515	5.404 **	-0.019	-12.103	3.491 ***	4.077 ***	-0.139	-12.498	5.242 **	-0.019
Combined web presence	4.771	3.541	3.273	0.055	6.144	4.901	0.009	4.782	3.509	3.234	0.055	6.180	4.784	0.009
Organizations in same country#	1.503	0.175 ***	0.222 ***	0.033	2.132	0.261 ***	0.010	1.495	0.170 ***	0.219 ***	0.033	2.118	0.257 ***	0.010
Basin f.e.s included	yes				yes			yes				yes		
Pseudo R-squared	0.114				0.290			0.114				0.289		
Observations	30700				104652			30700				104652		
Sig. of sum of coeffs on 'One research, one not' and 'One a CGIAR org., one a NARE org.'	14%		4%		2%			14%		5%		15%		
Sig. of sum of coeffs on 'One research, one not x No. CPWF funded' and 'One CGIAR, one NARE x No. CPWF funded'	4%		2%		1%			-		-		-		

Notes: Logits 1 and 3 are based on a dataset generated by pooling (or stacking) the datasets relating to each of the eight workshops, coefficients, two corresponding standard errors, one adjusted for non-independence within basins by clustering and one adjusted for non-independence across dyads with a common element, and marginal effects are reported; Logits 2 and 4 are based on the sample of all possible dyads given the full sample of 324 organizations described in Table 1; all dyads made up of two CGIAR organizations are assumed to share a research and, hence, a functional link; other dyads are assumed to share a functional link if they are indicated to do so in at least one workshop; all other dyads are assumed to share no link, coefficients, corresponding standard errors adjusted for non-independence across dyads with a common element, and marginal effects are reported; all standard errors are corrected for heteroscedasticity; *** indicates that the z-stat corresponding to that particular standard error is sig. at 1%; ** indicates that the z-stat corresponding to that particular standard error is sig. at 5%; * indicates that the z-stat corresponding to that particular standard error is sig. at 10%; # indicates a dichotomous variable for which the reported marginal effect relates to a 0 to 1 change.

Table 3 presents four estimated Logit models. Models 1 and 2 correspond directly to (1) above, taking '*i* and *j* share a functional linkage' as the dependent variable. Logit model 1 is based on the pooled sample of 30700 unique *ijb* dyadic observations. For this model we present the estimated coefficients, two sets of standard errors, one adjusted using the clustering method and one adjusted using Fafchamps and Gubert's (2007) method while acknowledging the eight workshop sub-samples, corresponding indicators of the statistical significance of each of the estimated coefficients (the asterisks), and the marginal effects implied by the estimated coefficients. Logit model 2 is based on the constructed sample of 104,652 unique *ij* dyadic observations. For this model we present the estimated coefficients, one set of standard errors adjusted using Fafchamps and Gubert's (2007) method treating the dataset as a whole, corresponding indicators of the statistical significance of each of the estimated coefficients (the asterisks), and the marginal effects implied by the estimated coefficients. Below each model are the results of a number of linear restriction tests designed to shed further light on the relationship between CPWF funding and the likelihood of CGIAR members and their counterparts in government sharing functional linkages.

The coefficient on the 'Difference in sectoral focus', β_W, is negative and highly significant (one percent level) in model 1, irrespective of which adjustment method is applied to the standard errors, and also in model 2. And the coefficient on the 'Difference in sectoral focus x Number CPWF funded', β_{FW}, is positive and significant (five percent level or stronger) in model 1, irrespective of which adjustment method is applied to the standard errors, and also in model 2. These results indicate that, in the absence of CPWF funding, the less similar two organizations are with respect to sectoral focus (water-food) the less likely they are to share a functional linkage and that this tendency is less pronounced when CPWF funding is flowing to dyads that are dissimilar in this way.

The coefficient on 'One research, one not', β_R, is negative but insignificant and the coefficient on 'One research, one not x Number CPWF funded', β_{FR}, is positive but insignificant, irrespective of the model and the method of adjustment applied to the standard errors. Similarly, the coefficient on 'One a CGIAR organization, one a NARE organization', β_{CG}, is negative but insignificant and the coefficient on 'One a CGIAR,

one a NARE x Number CPWF funded', β_{FCG}, is positive but significant only in Logit model 1 when the standard errors are adjusted by clustering. Their individual insignificance notwithstanding, the sum of β_R and β_{CG} is negative and significantly different from zero in two out of the three specifications (five percent level) and the sum of β_{FR} and β_{FCG} is positive and significantly different from zero (five percent level or stronger) according to all three specifications. Also, if 'One a CGIAR, one a NARE' and 'One a CGIAR, one a NARE x Number CPWF funded' are excluded from the model, β_R becomes significant (ten percent level) when the standard errors are adjusted by clustering and β_{FR} becomes significant (at least five percent level) in all three specifications (results tabulated in Appendix Table 1). Taken together these results indicate that CPWF funding is associated with an increased likelihood of CGIAR members and their counterparts sharing a functional linkage and that this may be redressing the tendency for such dyads to be less likely than others made up of more similar organizations to share a linkage.[22] As a result of these effects, CPWF funding is associated with an increased likelihood of research and development organizations sharing a functional linkage. However, there is no evidence that the effects generalize to research-development dyads that are not made up of CGIAR members and their counterparts.

Also, there is no evidence that, after controlling for the impact of CPWF funding on the three types of bridging linkage of interest, there is a general effect of the funding on dyads of all configurations.[23]

To explore the effects relating to CGIAR members and their counterparts more closely, we estimated Logit models 3 and 4. These models exclude the interaction term 'One research, one not x Number CPWF funded' from the set of explanatory variables.[24] This exclusion renders the positive coefficient β_{FCG} significant (five percent level), irrespective of the model and the adjustment method applied to the standard errors, and thereby adds

[22] Here, we cannot reject the hypothesis that CPWF funding is associated with a full offsetting of the effect.
[23] If the three interaction terms involving 'Number CPWF funded' are excluded from the analysis, 'Number CPWF funded' itself bears a significant positive coefficient.
[24] 'One research, one not' is retained because of the significance of the coefficient on 'Number of research organizations' in Logit models 1 and 2; one cannot include the latter without also including the former.

to the weight of evidence indicating that CPWF funding is associated with an increased likelihood of CGIAR members and their counterparts sharing a functional linkage.

Before moving on from Table 3, there are three effects relating to control variables that are robust across all four Logit models and all methods of adjustment applied to standard errors: 'Number of CGIAR organizations' bears a positive and significant (at least five percent level) coefficient indicating that, within the CPWF context, CGIAR members are maintaining more linkages than other organizations; 'Difference in web presence' bears a negative and significant (five percent level or stronger) coefficient indicating that, within the CPWF context, larger, more visible, more formal organizations tend not to share linkages with smaller, less visible, less formal organizations; and 'Organizations in the same country' bears a positive and significant (one percent level) coefficient indicating that being in the same country increases the likelihood of two organizations sharing a linkage. While these three effects do not relate directly to the question we posed, they make intuitive sense and, thereby, serve to increase our confidence in the analysis.

Table 4 presents four estimated Logit models that are identical to the models presented in Table 3 in every way except that, here, the dependent variable indicates whether '*i* and *j* share a research-related linkage'. Thus, we see that, in the absence of CPWF funding, the less similar two organizations are with respect to sectoral focus (water-food) the less likely they are to share a research linkage (at least five percent level of significance) and that this tendency is less pronounced when CPWF funding is flowing to dyads that are dissimilar in this way (five percent level of significance). However, there is no evidence that CPWF funding is associated with an increased likelihood of research linkages existing between either CGIAR members and their counterparts in national government or research and development organizations in general. Further, there is no evidence that, in the absence of CPWF funding, either CGIAR members and their counterparts in national government or research and development organizations in general tend not to share linkages. However, there is evidence that CPWF funding increases the likelihood of dyads of any configuration sharing a linkage (ten percent level of significance or stronger).

Table 4: Dyadic logit analyses of the incidence of research-related links

Dyad shares a research link	Logit model 1				Logit model 2			Logit model 3				Logit model 4		
	Coeff.	Standard errors		Marginal effects	Coeff.	Dyadic s.e.	Marginal effects	Coeff.	Standard errors		Marginal effects	Coeff.	Dyadic s.e.	Marginal effects
		clustered	dyadic						clustered	dyadic				
Diff. in sectoral focus	-4.804	1.984 **	1.503 ***	-0.035	-5.353	1.572 ***	-0.005	-4.804	1.982 **	1.502 ***	-0.035	-5.353	1.564 ***	-0.005
Diff. in sectoral focus x Number CPWF funded	3.009	1.370 **	1.223 **	0.022	2.928	1.383 **	0.003	3.009	1.370 **	1.224 **	0.022	2.933	1.383 **	0.003
One research, one not #	0.064	0.343	0.424	$4.7e^{-4}$	-0.062	0.528	$-5.8e^{-5}$	0.065	0.131	0.173	$4.7e^{-4}$	0.120	0.221	$1.1e^{-4}$
One research, one not x Number CPWF funded	$3.7e^{-4}$	0.200	0.310	$2.7e^{-6}$	0.146	0.345	$1.4e^{-4}$							
One a CGIAR org., one a NARE org.#	-0.825	0.893	0.810	-0.004	-0.765	1.054	-0.001	-0.826	0.878	0.739	-0.004	-0.874	0.971	-0.001
One CGIAR, one NARE x Number CPWF funded	0.542	0.378	0.424	0.004	0.476	0.485	$4.5e^{-4}$	0.542	0.375	0.364	0.004	0.560	0.418	0.001
Number of orgs. CPWF funded	0.596	0.329 *	0.279 **	0.004	0.479	0.268 *	$4.5e^{-4}$	0.596	0.355 *	0.276 **	0.004	0.541	0.276 **	0.001
One CPWF funded, one not #	0.482	0.204 **	0.237 **	0.004	0.542	0.258 **	0.001	0.482	0.206 **	0.239 **	0.004	0.542	0.258 **	0.001
One a CGIAR org., one not #	0.209	0.115 *	0.302	0.002	0.543	0.597	0.001	0.209	0.113 *	0.302	0.002	0.551	0.602	0.001
One a NARE org., one not #	0.253	0.320	0.190	0.002	0.135	0.203	$1.3e^{-4}$	0.253	0.321	0.175	0.002	0.158	0.186	$1.5e^{-4}$
Aggregated focus on water sector	1.430	0.707 **	0.637 **	0.010	1.213	0.868	0.001	1.430	0.708 **	0.637 **	0.010	1.213	0.869	0.001
Number in research	0.828	0.431 *	0.410 **	0.006	0.805	0.410 **	0.001	0.828	0.431 *	0.409 **	0.006	0.807	0.411 **	0.001
Number of CGIAR organizations	0.753	0.222 ***	0.235 ***	0.005	0.313	0.212	0.000	0.753	0.228 ***	0.236 ***	0.005	0.302	0.215	$2.9e^{-4}$
Number of NARE organizations	0.333	0.378	0.468	0.002	0.292	0.474	$2.7e^{-4}$	0.333	0.379	0.472	0.002	0.280	0.478	$2.6e^{-4}$
Difference in web presence	-15.338	6.298 **	5.767 ***	-0.112	-15.570	8.181 *	-0.015	-15.338	6.286 **	5.753 ***	-0.112	-15.533	8.104 *	-0.015
Combined web presence	5.698	3.465 *	2.932 *	0.042	6.866	4.690	0.006	5.698	3.463 *	2.930 *	0.042	6.850	4.630	0.006
Organizations in same country#	1.030	0.186 ***	0.251 ***	0.012	1.657	0.281 ***	0.004	1.030	0.189 ***	0.250 ***	0.012	1.652	0.282 ***	0.004
Basin f.e.s included	yes				yes			yes				yes		
Pseudo R-squared	0.126				0.295			0.126				0.295		
Observations	30460				104652			30460				104652		
Sig. of sum of coeffs on 'One research, one not' and 'One a CGIAR org., one a NARE org.'	38%		29%		39%			38%		30%		44%		
Sig. of sum of coeffs on 'One research, one not x No. CPWF funded' and 'One CGIAR, one NARE x No. CPWF funded'	17%		15%		15%			-		-		-		

Notes: Logits 1 and 3 are based on a dataset generated by pooling (or stacking) the datasets relating to each of the eight workshops, coefficients, two corresponding standard errors, one adjusted for non-independence within basins by clustering and one adjusted for non-independence across dyads with a common element, and marginal effects are reported; Logits 2 and 4 are based on the sample of all possible dyads given the full sample of 324 organizations described in Table 1; all dyads made up of two CGIAR organizations are assumed to share a research and, hence, a functional link; other dyads are assumed to share a functional link if they are indicated to do so in at least one workshop; all other dyads are assumed to share no link, coefficients, corresponding standard errors adjusted for non-independence across dyads with a common element, and marginal effects are reported; all standard errors are corrected for heteroscedasticity; *** indicates that the z-stat corresponding to that particular standard error is sig. at 1%; ** indicates that the z-stat corresponding to that particular standard error is sig. at 5%; * indicates that the z-stat corresponding to that particular standard error is sig. at 10%; # indicates a dichotomous variable for which the reported marginal effect relates to a 0 to 1 change.

Table 5: Dyadic logit analyses of the incidence of knowledge-dissemination-related links

Dyad shares a knowledg dissemination link	Logit model 1				Logit model 2			Logit model 3				Logit model 4		
	Coeff.	Standard errors clustered	Standard errors dyadic	Marginal effects	Coeff.	Dyadic s.e.	Marginal effects	Coeff.	Standard errors clustered	Standard errors dyadic	Marginal effects	Coeff.	Dyadic s.e.	Marginal effects
Diff. in sectoral focus	-3.713	0.916 ***	1.298 ***	-0.012	-3.589	1.349 ***	-0.002	-3.749	0.898 ***	1.292 ***	-0.012	-3.667	1.330 ***	-0.002
Diff. in sectoral focus x Number CPWF funded	2.165	1.194 *	1.026 **	0.007	2.067	1.014 **	0.001	2.207	1.157 *	1.016 **	0.007	2.147	0.974 **	0.001
One research, one not #	-0.079	0.390	0.445	$-2.4e^{-4}$	-0.086	0.466	$-4.3e^{-5}$	0.097	0.210	0.298	$3.0e^{-4}$	0.202	0.303	$1.0e^{-4}$
One research, one not x Number CPWF funded	0.177	0.322	0.316	0.001	0.292	0.317	$1.5e^{-4}$							
One a CGIAR org., one a NARE org.#	-2.013	0.971 **	0.890 **	-0.003	-2.094	0.938 **	$-4.8e^{-4}$	-2.128	1.093 *	0.929 **	-0.003	-2.286	1.021 **	$-5.0e^{-4}$
One CGIAR, one NARE x Number CPWF funded	0.820	0.360 **	0.593	0.003	0.743	0.591	$3.7e^{-4}$	0.927	0.341 ***	0.576	0.003	0.921	0.625	$4.6e^{-4}$
Number of orgs. CPWF funded	-0.264	0.377	0.361	-0.001	-0.374	0.358	$-1.9e^{-4}$	-0.197	0.370	0.336	-0.001	-0.265	0.340	$-1.3e^{-4}$
One CPWF funded, one not #	0.120	0.186	0.290	$3.8e^{-4}$	0.133	0.313	$6.7e^{-5}$	0.124	0.187	0.291	$3.9e^{-4}$	0.140	0.315	$7.0e^{-5}$
One a CGIAR org., one not #	0.757	0.524	0.416 *	0.003	1.416	0.322 ***	0.001	0.770	0.543	0.420 *	0.003	1.446	0.349 ***	0.001
One a NARE org., one not #	0.323	0.404	0.291	0.001	0.302	0.283	$1.5e^{-4}$	0.350	0.441	0.297	0.001	0.346	0.291	$1.8e^{-4}$
Aggregated focus on water sector	2.087	0.811 ***	0.796 ***	0.006	1.948	0.984 **	0.001	2.099	0.798 ***	0.788 ***	0.007	1.958	0.980 **	0.001
Number in research	-0.482	0.288 *	0.317	-0.001	-0.457	0.341	$-2.3e^{-4}$	-0.497	0.310	0.324	-0.002	-0.484	0.352	$-2.4e^{-4}$
Number of CGIAR organizations	1.112	0.368 ***	0.451 **	0.003	0.579	0.650	$3.3e^{-4}$	1.108	0.364 ***	0.452 **	0.003	0.567	0.658	$2.8e^{-4}$
Number of NARE organizations	-0.105	0.451	0.391	$-3.3e^{-4}$	-0.089	0.400	$-4.4e^{-5}$	-0.131	0.459	0.387	$-4.1e^{-4}$	-0.130	0.395	$-6.5e^{-5}$
Difference in web presence	15.354	18.910	25.996	0.048	10.686	20.089	0.005	16.004	20.383	27.457	0.050	11.190	21.315	0.006
Combined web presence	-14.548	16.554	25.728	-0.045	-8.543	20.101	-0.004	-15.150	18.017	27.169	-0.047	-8.934	21.328	-0.004
Organizations in same country#	2.293	0.221 ***	0.278 ***	0.021	2.848	0.361 ***	0.007	2.290	0.215 ***	0.275 ***	0.021	2.841	0.355 ***	0.007
Basin f.e.s included	yes				yes			yes				yes		
Pseudo R-squared	0.144				0.266			0.144				0.266		
Observations	30460				104652			30460				104652		
Sig. of sum of coeffs on 'One research, one not' and 'One a CGIAR org., one a NARE org.'	6%		4%		5%			5%		4%		5%		
Sig. of sum of coeffs on 'One research, one not x No. CPWF funded' and 'One CGIAR, one NARE x No. CPWF funded'	1%		10%		12%			-		-		-		

Notes: Logits 1 and 2 are based on a dataset generated by pooling (or stacking) the datasets relating to each of the eight workshops, coefficients, two corresponding standard errors, one adjusted for non-independence within basins by clustering and one adjusted for non-independence across dyads with a common element, and marginal effects are reported; Logits 3 and 4 are based on the sample of all possible dyads given the full sample of 324 organizations described in Table 1; all dyads made up of two CGIAR organizations are assumed to share a research and, hence, a functional link; other dyads are assumed to share a functional link if they are indicated to do so in at least one workshop; all other dyads are assumed to share no link, coefficients, corresponding standard errors adjusted for non-independence across dyads with a common element, and marginal effects are reported; all standard errors are corrected for heteroscedasticity; *** indicates that the z-stat corresponding to that particular standard error is sig. at 1%; ** indicates that the z-stat corresponding to that particular standard error is sig. at 5%; * indicates that the z-stat corresponding to that particular standard error is sig. at 10%; # indicates a dichotomous variable for which the reported marginal effect relates to a 0 to 1 change.

Table 5 presents four estimated Logit models that are identical to the models presented in Tables 3 and 4 in every way except that, here, the dependent variable indicates whether '*i* and *j* share a knowledge-dissemination-related linkage'. Thus, we see that, in the absence of CPWF funding, the less similar two organizations are with respect to sectoral focus (water-food) the less likely they are to share a knowledge-dissemination-related linkage (one percent level of significance) and that this tendency is less pronounced when CPWF funding is flowing to dyads that are dissimilar in this way (ten percent level of significance or stronger). Here, we also see some evidence that CPWF funding is associated with an increased likelihood of CGIAR members and their counterparts sharing knowledge-dissemination-related linkages (one percent level of significance in models 1 and 3 but only when the standard errors are adjusted by clustering) and that this is redressing the tendency for such dyads to be less likely than others made up of more similar organizations to share a linkage (ten percent level or stronger).[25] However, these effects are not strong enough to lead to an association between CPWF funding and an increased likelihood of research and development organizations in general sharing a functional linkage (results tabulated in Appendix Table 2).

5. Results: Evidence of causality

Above, we found strong evidence that CPWF funding is associated with an increased likelihood of linkages between organizations with differing sectoral foci and weaker evidence that it is associated with an increased likelihood of linkages between CGIAR members and their counterparts, especially linkages relating to knowledge dissemination activities. However, we do not know whether this is because of a causal relationship running from CPWF funding to bridging linkage formation or because CPWF funding was more likely to flow to organizations already maintaining bridging linkages. In an effort to distinguish between these two explanations in this section we explore the effect

[25] That, CPWF funding appears to be associated with knowledge-dissemination related linkages but not research-related linkages existing between CGIAR members and NAREs, suggests that, within the context of the current study, it was appropriate to categorize the latter as non-research organizations.

of the progression (over time) of the CPWF on these two types of bridging linkage. To do this, we extend (1) to include four extra terms:

$$l_{ij} = \alpha_0 + \tau_{FW}\left(M_{ij} * \left|W_i - W_j\right| * (F_i + F_j)\right) + \tau_{FCG}\left(M_{ij} * \left|C_i - C_j\right| * \left|G_i - G_j\right| * (F_i + F_j)\right)$$
$$+ \tau_{FF}\left(M_{ij} * \left(F_i + F_j\right)\right) + \beta_W\left|W_i - W_j\right| + \beta_{FW}\left(\left|W_i - W_j\right| * (F_i + F_j)\right) + \beta_R\left|R_i - R_j\right|$$
$$+ \beta_{CG}\left(\left|C_i - C_j\right| * \left|G_i - G_j\right|\right) + \beta_{FCG}\left(\left|C_i - C_j\right| * \left|G_i - G_j\right| * (F_i + F_j)\right) + \beta_{FF}\left(F_i + F_j\right)$$
$$+ \gamma_1\left|F_i - F_j\right| + \gamma_2\left|C_i - C_j\right| + \gamma_3\left|G_i - G_j\right| + \gamma_4\left(W_i + W_j\right) + \gamma_5\left(R_i + R_j\right)$$
$$+ \gamma_6\left(C_i + C_j\right) + \gamma_7\left(G_i + G_j\right) + \gamma_8\left|H_i - H_j\right| + \gamma_9\left(H_i + H_j\right) + \gamma_{10}S_{ij} + B_{ij} + \xi_{ij}$$

where:

- M_{ij} is the number of months that had elapsed since the commencement of CPWF funding roll-out at the time when the data relating to dyad ij was generated in a workshop; and
- τ_{FW}, τ_{FCG}, and τ_{FF} are the additional coefficients to be estimated.

Note that M_{ij} on its own is not included as an explanatory variable. This is because it is perfectly collinear with the vector of workshop fixed effects, B_{ij}. Note also that the term $\beta_{FR}\left(\left|R_i - R_j\right| * (F_i + F_j)\right)$ does not appear in the formulation and neither does its interaction with M_{ij}. This is because the former was insignificant in every one of the estimations in which it was included in section 4 and because as the number of interaction terms increases so too does the degree of multicolinearity and, hence, the power of our statistical tests.

If τ_{FW} is positive and significant, it can circumspectly be taken as evidence that as the CPWF programme progressed the positive impact of CPWF funding on the existence of bridging linkages between organizations in the food and water sectors strengthened. If τ_{FCG} is positive and significant, it can circumspectly be taken as evidence that as the CPWF programme progressed the positive impact of CPWF funding on the existence of

bridging linkages between CGIAR members and their counterparts in government strengthened. Finally, if τ_{FF} is positive and significant, it can circumspectly be taken as evidence that as the CPWF programme progressed the positive impact of CPWF funding on networking in general strengthened.

To estimate this formulation we make use of data on the timing of each of the workshops and, hence, the point in time when each dyad, linked or otherwise, was observed. Unfortunately, this variable is not defined for dyads made up of organizations observed in different workshops and each of the possible assumptions – treating the dyad as observed when the first organization in the dyad was observed or when the second was observed – could bias the analysis, towards finding a time effect in the case of the first assumption and against finding a time effect in the case of the second. For this reason, we can conduct this analysis only for the sample of 30700 unique *ijb*, dyadic observations.

Table 6 contains the resulting estimated coefficients, corresponding standard errors adjusted either by clustering or using Fafchamps and Gubert's (2007) method, and marginal effects implied by the estimated coefficients. Three Logit models are presented each pertaining to one of the three dependent variables described and used in section 4.

Only in Logit model 2, when we focus on research-related linkages and adjust the standard errors by clustering, do we see evidence of the effect of CPWF funding on bridging linkages across sectors strengthening over time. And, even here, the coefficient on 'Difference in sectoral focus x Number CPWF funded' remains significant and large indicating that, while the effect may have grown as CPWF progressed, much of it was there from the outset. There is no evidence of the effect of CPWF funding on bridging linkages between CGIAR members and their counterparts strengthening over time. And the coefficient τ_{FF}, while being highly significant (one percent level), is negative.

Table 6: Introducing time into the dyadic logit analyses of the incidence of functional links

	Logit model 1 Dyad shares a functional link				Logit model 2 Dyad shares a research link				Logit model 3 Dyad shares an outreach link			
	Coeff.	Standard errors clustered	dyadic	Marginal effects	Coeff.	Standard errors clustered	dyadic	Marginal effects	Coeff.	Standard errors clustered	dyadic	Marginal effects
Diff. in sectoral focus x No. CPWF funded x Months	0.045	0.034	0.049	$4.9e^{-4}$	0.055	0.033 *	0.053	$3.9e^{-4}$	0.054	0.054	0.045	$1.6e^{-4}$
One CGIAR, one NARE x No. CPWF funded x Months	0.002	0.009	0.010	$1.6e^{-5}$	$-2.8e^{-4}$	0.013	0.011	$-2.0e^{-6}$	0.004	0.017	0.020	$1.1e^{-5}$
No. CPWF funded x Months	-0.062	0.012 ***	0.019 ***	-0.001	-0.059	0.012 ***	0.020 ***	$-4.2e^{-4}$	-0.056	0.021 ***	0.028 **	$-1.7e^{-4}$
Diff. in sectoral focus	-4.468	0.930 ***	1.032 ***	-0.049	-5.319	1.489 ***	1.329 ***	-0.038	-4.008	0.903 ***	1.437 ***	-0.012
Diff. in sectoral focus x Number CPWF funded	2.382	0.981 **	1.100 **	0.026	2.830	1.285 **	1.360 **	0.020	1.866	1.236	1.034 *	0.006
One research, one not #	0.017	0.087	0.140	$1.8e^{-4}$	0.067	0.136	0.174	$4.8e^{-4}$	0.102	0.203	0.297	$3.0e^{-4}$
One research, one not x Number CPWF funded												
One a CGIAR org., one a NARE org.#	-1.236	0.797	0.608 **	-0.009	-0.878	0.882	0.758	-0.004	-2.215	1.145 *	0.982 **	-0.003
One CGIAR, one NARE x Number CPWF funded	0.731	0.320 **	0.321 **	0.008	0.602	0.383	0.368	0.004	0.936	0.343 ***	0.591	0.003
Number of orgs. CPWF funded	0.981	0.302 ***	0.320 ***	0.011	1.286	0.239 ***	0.319 ***	0.009	0.470	0.411	0.492	0.001
One CPWF funded, one not #	0.491	0.123 ***	0.184 ***	0.005	0.710	0.193 ***	0.226 ***	0.005	0.384	0.215 *	0.311	0.001
One a CGIAR org., one not #	0.302	0.180 *	0.279	0.004	0.181	0.109 *	0.302	0.001	0.799	0.562	0.431 *	0.003
One a NARE org., one not #	0.328	0.380	0.184 *	0.004	0.231	0.329	0.179	0.002	0.335	0.462	0.301	0.001
Aggregated focus on water sector	1.459	0.772 *	0.628 **	0.016	1.394	0.713 **	0.643 **	0.010	2.071	0.823 **	0.790 ***	0.006
Number in research	0.337	0.153 **	0.246	0.004	0.864	0.464 *	0.415 **	0.006	-0.478	0.298	0.323	-0.001
Number of CGIAR organizations	0.978	0.232 ***	0.225 ***	0.011	0.784	0.240 ***	0.239 ***	0.006	1.151	0.382 ***	0.457 **	0.003
Number of NARE organizations	0.114	0.186	0.309	0.001	0.380	0.409	0.477	0.003	-0.072	0.443	0.384	$-2.1e^{-4}$
Difference in web presence	-11.564	3.374 ***	3.968 ***	-0.126	-14.863	6.260 **	5.763 ***	-0.106	2.267	0.218 ***	27.198	0.047
Combined web presence	4.517	3.342	3.146	0.049	5.396	3.399	2.900 *	0.038	15.786	22.760	26.811	-0.043
Organizations in same country#	1.483	0.165 ***	0.220 ***	0.031	1.024	0.186	0.253 ***	0.011	-14.523	20.599 ***	0.274 ***	0.020
Basin f.e.s included	yes				yes				yes			
Pseudo R-squared	0.124				0.134				0.152			
Observations	30700				30460##				30700			

Notes: Coefficients, two corresponding standard errors, one adjusted for non-independence within basins by clustering and one adjusted for non-independence across dyads with a common element, and marginal effects are reported; all standard errors are corrected for heteroscedasticity; marginal effects evaluated at the mean for continuous variables; # for dichotomous variables reported effect relates to a 0 to 1 change; *** corresponding z-stat sig. at 1%; ** 5%; * 10%; ## all dyads in Karkheh basin dropped due to absence of research links.

6. Discussion

Our analysis provides evidence that CPWF funding is associated with an increased likelihood of CGIAR members and their counterparts in government and organizations in the food and water sectors sharing bridging linkages. It also provides what might best be described as *a hint of evidence* that, in the case of research-related linkages there is a causal relationship running from CPWF funding to the formation of bridging linkages between the food and water sectors.

The evidence relating to the association between CPWF funding and bridging linkages appears quite strong, especially in the case of bridging between the food and water sectors. However, we need to bear in mind that none of the standard errors upon which our statistical tests are based are ideally adjusted to account for the likely interdependencies between observations.

Further, this evidence is not derived from an experimental study in which CPWF funded dyads represent a randomly selected sub-sample of all the dyads in the dataset. Indeed, the analysis is based on a sample of dyads that is not random in any way. The full sample of dyads, rather than being randomly selected in accordance with a research design, was selected by the CPWF project leaders and staff who attended the workshops. It encompasses all those organizations that are connected to one or more of their organizations via a functional linkage or a funding flow and excludes the many organizations to which they are not connected. And the funded sub-sample of dyads, rather than being randomly selected, emerged as a result of the managers of the CPWF selecting organizations based on the relative strengths of their project proposals.

The process by which the sample as a whole came into being could be biasing our results but the likely direction of this bias is unclear. We would expect dyads that share a linkage to be overrepresented in the sample and those that do not share a linkage to be underrepresented, but have no reason to expect that these tendencies would differ between more and less similar dyads. And, even if they did, it is not clear that this would bias the coefficients of interest either towards or away from significance.

With regard to the funded sub-sample, the issue of selection has already been discussed and explored using data on the timing of the workshops. However, this endeavour was not very successful: most of the estimated Logits leave us unable to reject the null hypothesis that the associations between CPWF funding and bridging linkages were there from the outset. So, should we conclude that the associations are due to selection? We are disinclined to do so for a number of reasons. First, our analysis cannot distinguish selection effects from any effects that the CPWF had on networking prior to the roll out of the funding. As any researcher will know, new network linkages are often forged as part of a response to a call for proposals. The name and description of CPWF as well as the wording of the call for proposals could have caused many potential project leaders to forge new linkages salient to the CPWF in an effort to enhance their chances of securing funding and many of these linkages could have been bridging linkages. Second, our analysis cannot capture the possible effects of the workshops themselves on networking activity: the data that we use in the analysis above relates to the first task undertaken in the workshops, whereas it was during the second task that project staff were encouraged to think about how they might develop their networks in order to improve the performance of their projects. And, for this reason, our estimates of the causal effect of CPWF on networking activity are likely to be conservative. Third, given that we use CPWF funding to distinguish between those organizations and dyads upon which the CPWF has impacted directly from those upon which it has not, there may be other effects that we are not capturing. In the light of these reasons, we find the 'hint of evidence' supporting a causal relationship running from CPWF funding to bridging linkages between the food and water sectors very compelling.

The unexpected negative and significant coefficient on 'Number CPWF funded x Months' in the models presented in Table 6, while giving cause for concern in one regard, adds further to the weight of this 'hint of evidence'. The negative coefficient indicates that, directly after the commencement of the CPWF funding roll outs, the CPWF projects' staffs were more likely to indicate that CPWF funded organizations shared linkages than they were some time later. This suggests that a type of Hawthorne effect may have been triggered during the earlier network-drawing workshops, i.e., that the project staff may have embellished the networks that they drew to bring them into line with what they

thought that the workshop leaders would like to see and that this effect was stronger directly after the first roll out of CPWF funding but diminished over time.[26] This does give some cause for concern as it calls into question the verisimilitude of the network data. However, there is no reason why we should expect this effect to impact less on the drawing of a linkage between two funded but dissimilar organizations than on the drawing of two funded and similar organizations. Indeed, given the emphasis placed on bridging in the CPWF documents, if anything, we would expect the opposite. So, this too renders our hint of evidence conservative and, hence, all the more compelling.

Without a doubt, had our findings been based on an experimental study within which a random sample of organizations and, hence, organizational dyads had been drawn, the network of linkages between them measured, then, a random sub-sample provided with CPWF funding, and finally, some time later the network of linkages between them measured a second time, they could have been taken a great deal more seriously, and rightly so as such a study would have supported a best practice, diff-in-diff analysis. However, while the diff-in-diff approach works well in many contexts, it is not obvious that it would work for the CPWF or, indeed, for any network brokerage initiative. Before drawing the full sample one would need to define and list the population of relevant organizations and it is very unclear whether and how this could be done. Putting this difficulty aside, there are several methods that could be used to measure the existing network both before and after the intervention. But then we come to the intervention itself. Given the potential importance of the CPWF and the amount of money that was committed to the first round of projects (around 31 million USD according to our data) it would have appeared very imprudent to have randomly assigned the funding and, hence, would have been unacceptable to donors.

A pilot could have been run in one basin perhaps, but this would have delayed a programme, the benefits of which are evermore eagerly awaited. And to what end? There is no reason why we should expect an organization that has had money randomly thrown at it to respond in the same way as an organization that has taken the time to prepare a

[26] The term 'Hawthorne effect' was coined in 1955 by Henry Landsberger when reanalyzing data from experiments at the Hawthorne Works, near Chicago, conducted between 1924 and 1932.

proposal. An analysis based on intention to treat comes to mind, but then we would need more than one basin for the pilot.

So, maybe we should simply not bother. Maybe we should focus our attention on evaluating only those projects and programmes that can be evaluated using so called 'best practice'. But this would leave at least some aspects of potentially very important projects and programmes unevaluated. In the current case, it would deny the leaders of the CPWF insights which, however flawed, could be of value during the planning stages of future phases of the programme.

Appendix: Additional dyadic models

Appendix Table 1: Dyadic logit analyses of the incidence of functional links assuming CGIAR-NARE dyads are like other research-non-research dyads

	Logit model 1			Logit model 2	
Dyad shares a functional link	Coeff.	Standard errors		Coeff.	Dyadic
		clustered	dyadic		s.e.
Diff. in sectoral focus	-4.130	1.319 ***	1.090 ***	-4.339	1.218 ***
Diff. in sectoral focus x Number CPWF funded	2.565	1.022 **	0.952 ***	2.337	1.111 **
One research, one not	-0.386	0.229 *	0.291	-0.425	0.305
One research, one not x Number CPWF funded	0.327	0.154 **	0.195 *	0.432	0.220 **
One a CGIAR org., one a NARE org					
One CGIAR, one NARE x Number CPWF funded					
Number of orgs. CPWF funded	0.130	0.316	0.220	0.016	0.266
One CPWF funded, one not	0.183	0.144	0.180	0.253	0.193
One a CGIAR org., one not	0.275	0.052 ***	0.248	0.655	0.472
One a NARE org., one not	0.283	0.285	0.154 *	0.177	0.154
Aggregated focus on water sector	1.484	0.751 **	0.629 **	1.267	0.917
Number in research	0.301	0.114 ***	0.237	0.284	0.231
Number of CGIAR organizations	0.919	0.186 ***	0.212 ***	0.439	0.201 **
Number of NARE organizations	0.049	0.159	0.267	0.008	0.288
Difference in web presence	-12.037	3.610 ***	4.045 ***	-12.398	5.320 **
Combined web presence	4.669	3.444	3.197	5.944	4.839
Organizations in same country	1.515	0.175 ***	0.221 ***	2.139	0.261 ***
Basin f.e.s included		yes		yes	
Pseudo R-squared		0.113		0.289	
Observations		30700		104652	

Notes: Logit 1 is based on a dataset generated by pooling the datasets relating to each of the eight workshops, coefficients and two corresponding standard errors, one adjusted for non-independence within basins by clustering and one adjusted for non-independence across dyads with a common element, are reported; Logit 2 is based on the sample of all possible dyads given the full sample of 324 organizations described in Table 1; all dyads made up of two CGIAR organizations are assumed to share a research and, hence, a functional link; other dyads are assumed to share a functional link if they are indicated to do so in at least one workshop; all other dyads are assumed to share no link, coefficients, corresponding standard errors adjusted for non-independence across dyads with a common element, and marginal effects are reported; all standard errors are corrected for heteroscedasticity; *** indicates that the z-stat corresponding to that particular standard error is sig. at 1%; ** indicates that the corresponding z-stat is sig. at 5%; * indicates that the corresponding z-stat is sig. at 10%.

Appendix Table 2: Dyadic logit analyses of the incidence of knowledge-dissemination-related links assuming CGIAR-NARE dyads are like other research-non-research dyads

Dyad shares a knowledge-dissemination link	Logit model 1			Logit model 2	
	Coeff.	Standard errors		Coeff.	Dyadic
		clustered	dyadic		s.e.
Diff. in sectoral focus	-3.753	1.010 ***	1.328 ***	-3.664	1.364 ***
Diff. in sectoral focus x Number CPWF funded	2.173	1.224 *	1.040 **	2.087	1.031 **
One research, one not	-0.213	0.399	0.457	-0.207	0.464
One research, one not x Number CPWF funded	0.225	0.247	0.273	0.295	0.294
One a CGIAR org., one a NARE org					
One CGIAR, one NARE x Number CPWF funded					
Number of orgs. CPWF funded	-0.204	0.355	0.352	-0.290	0.351
One CPWF funded, one not	0.124	0.125	0.273	0.156	0.293
One a CGIAR org., one not	0.544	0.385	0.375	1.133	0.259 ***
One a NARE org., one not	0.167	0.245	0.260	0.114	0.245
Aggregated focus on water sector	2.099	0.807 ***	0.795 ***	1.976	0.987 **
Number in research	-0.466	0.283 *	0.308	-0.426	0.326
Number of CGIAR organizations	0.987	0.232 ***	0.390 **	0.442	0.588
Number of NARE organizations	-0.222	0.432	0.373	-0.226	0.379
Difference in web presence	15.547	19.851	25.503	11.148	19.262
Combined web presence	-14.801	17.435	25.174	-9.131	19.210
Organizations in same country	2.301	0.220 ***	0.275 ***	2.855	0.361 ***
Basin f.e.s included		yes		yes	
Pseudo R-squared		0.141		0.263	
Observations		30700		104652	

Notes: Logit 1 is based on a dataset generated by pooling the datasets relating to each of the eight workshops, coefficients and two corresponding standard errors, one adjusted for non-independence within basins by clustering and one adjusted for non-independence across dyads with a common element, are reported; Logit 2 is based on the sample of all possible dyads given the full sample of 324 organizations described in Table 1; all dyads made up of two CGIAR organizations are assumed to share a research and, hence, a functional link; other dyads are assumed to share a functional link if they are indicated to do so in at least one workshop; all other dyads are assumed to share no link, coefficients, corresponding standard errors adjusted for non-independence across dyads with a common element, and marginal effects are reported; all standard errors are corrected for heteroscedasticity; *** indicates that the z-stat corresponding to that particular standard error is sig. at 1%; ** indicates that the corresponding z-stat is sig. at 5%; * indicates that the corresponding z-stat is sig. at 10%.

Bibliography

Arcand, J-L. and M. Fafchamps (2008) "Matching in Community-Based Organizations" (mimeograph).

Bourdieu, P. (1986) [1983] "The forms of Social Capital" in J. Richardson (ed.) *Handbook of theory and research for the sociology of education*. Westport, CT: Greenwood Press.

Burt, R. (2005) *Brokerage and Closure: An introduction to Social Capital*, New york: Oxford University Press.

Coleman, J. (1987) “Norms as Social Capital” in G. Radnitzky and P. Bernholz *(eds) Economic Imperialism: The economic method applied outside the field of economics*. New York: Paragon House.

Coleman, J. (1988) “Social Capital in the Creation of Human Capital” *American Journal of Sociology,* 94:S95-S120.

Douthwaite, B., A. Carvajal, S. Alvarez, E. Claros and L.A. Hernández, (2006). Building farmers’ capacities for networking (Part I): Strengthening rural groups in Colombia through network analysis. KM4D Journal 2(2): 4-18. www.km4dev.org/journal

Durlauf, S. and M. Fafchamps (2004) “Social Capital” NBER Working Paper No. 10485. Cambridge MA: National Bureau of Economic Research.

Fafchamps, M. and F. Gubert (2007) “The Formation of Risk Sharing Networks” *Journal of Development Economics*, 83(2):326-50.

Fox, J. and J. Gershman (2006) “Enabling social capital? Lessons from World Bank rural development projects in Mexico and the Philippines” in A. Bebbington, M. Woolcock, S. Guggenheim, and E. Olson (eds) *The Search for Empowerment: Social capital as idea and practice at the World Bank*. Bloomfield CT: Kumarian Press.

Gittell, R. and A. Vidal (1998) *Community organizing: Building social capital as a development strategy*. Newbury Park, CA: Sage.

Grootaert, C. (1997) “Social Capital: The Missing Link?” In *Expanding the measure of wealth*, ESD Monograph Series No 20. Washington DC: World Bank.

Halpern, D. (2004) *Social Capital*, Cambridge: Polity Press.

Hyden, G. (1997) “Civil Society, social capital, and development: Dissection of a complex discourse. *Studies in Comparative International Development*, 32(1), 3-30.

Henry A. Landsberger, H. A. (1958) *Hawthorne revisited: Management and the worker, its critics, and developments in human relations in industry*, Ithaca, NY: Cornell University.

Humphries, S., Gonzales, J., Jimenez J., and Sierra F. (2000). Searching for Sustainable Land Use Practices in Honduras: Lessons Learned from a Programme of Participatory Research with Hillside Farmers. AgREN Network Paper No 104.

Morduch, J. (1999) "The Microfinance Promise", *Journal of Economic Literature*, 37, 1564-1614.

Platteau, J-P. (1994) "Behind the market stage where real societies exist (parts I and II)" *Journal of Development Studies*, 30, 533-577, 753-817.

Portes, A. (1998) "Social capital: Its origins and applications in contemporary sociology" *Annual Review of Sociology,* 24, 1-24.

Putnam, R. (1993) *Making democracy work: Civic traditions in modern Italy*. Princeton, NJ: Princeton University Press.

Sobel, J. (2002) "Can we trust social capital?" *Journal of Economic Literature*, 40(1), 139-54.

Van Domelen, J. (2006) "Social capital in the operations and impacts of social investment funds" in A. Bebbington, M. Woolcock, S. Guggenheim, and E. Olson (eds) *The Search for Empowerment: Social capital as idea and practice at the World Bank*. Bloomfield CT: Kumarian Press.

Woolcock, M. (1998) "Social capital and economic development: Toward a theoretical synthesis and policy framework" *Theory and Society*, 27(2), 151-208.

Woolcock, M. And D. Narayan (2006) "Social Capital: Implications for Development Theory" in A. Bebbington, M. Woolcock, S. Guggenheim, and E. Olson (eds) *The Search for Empowerment: Social capital as idea and practice at the World Bank*. Bloomfield CT: Kumarian Press.