"I myself went to see the Chairman!"

Change in gender role attitudes in a water and sanitation project in northern Bangladesh

A study by
July 2014

DASOH

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An analysis of DASCOH's Gender Analytical Framework data, 2011 - 2014

Development Association for Self-reliance, Communication and Health

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Cover photo: by Aldo Benini, Atgaon Union, Sulla Upazila, Sunamganj, 2011. The statement *"I myself went to see the Chairman!"*, which inspired the title of this report, has been attributed to two women independently interviewed for small case study purposes in the project in 2014. - Back cover photo by DASCOH, 2014.

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Preface by the CEO, DASCOH

In Bangladesh as in other poor societies, water and sanitation are tightly bound up with gender roles. According to the Multiple Indicator Cluster Surveys that UNICEF has conducted, 89 percent of all water carriers in Bangladesh are women, the second highest rate in the 44 countries surveyed. Children make up another six percent of the water carriers, while men account for 5 percent of the household water provision chores.

DASCOH's work in water and sanitation includes gender equity as one of its guiding principles, on an equal footing with social inclusiveness, environmental sustainability, and disaster risk reduction. This holds also for our Sustainable Solution for the Delivery of Safe Drinking Water (SDSD) Project in Sunamganj, one of the poorest districts in the northern region. Since its beginning in 2011, the SDSD has been practicing, across almost a thousand rural communities, an instrument that we call the "Participatory Gender Analytic Framework (GAF)". The GAF drives an annual community-based action research exercise that debates, and seeks practical steps to strengthen equity in, the gendered division of labor in the three spheres of household, village and NGOs/local government.

The GAF has been effective in starting and sustaining a public conversation on gender equity in the SDSD area. Trained volunteers lead the sessions and record the communities' attitudes towards the rights and duties of men and women. Thus the GAF at the same time is an important monitoring tool that, together with other project statistics, informs DASCOH of the parallel evolution of infrastructure work and aspects of social change. This perspective has emerged from the confluence of international development policy (e.g., "The Swiss Position on Gender Equality in the Post-2015 Agenda", October 2013), the shift from mere technical provision towards social engagement in the WatSan sector, as well as our own experience and desire to demonstrate impact.

This study probes changes in gender role attitudes in SDSD Sunamganj over four years. I am pleased to note that by and large attitudes have grown towards greater gender equity, in the sense of more widely shared male and female participation in a range of activities. The change may now be largely self-propelling, a synergistic effect from many sources, strengthened by, but no longer critically dependent on, the WatSan infrastructure growth. DASCOH feels extremely encouraged by this result and hopes to further adapt the GAF for the next stages of gender equity-conscious cooperation with these communities.

DASCOH gratefully acknowledges the financial support that the Swiss Agency for Development and Cooperation (SDC) is extending to the SDSD, including for this study.

Md. Akramul Haque
CEO, DASCOH

22 July 2014

Executive Summary

Introduction

DASCOH is a Bangladeshi NGO focusing on improved water supply, sanitation and local government effectiveness. For many years, the Swiss Agency for Development and Cooperation (SDC) has been supporting DASCOH's Sustainable Solution for the Delivery of Safe Drinking Water Project (SDSD). Since 2011, the project has been active in the northern district of Sunamganj, one of the poorest areas in the country. From its inception, the SDSD Sunamganj has sought to stir public conversations on the condition of women and girls, whose traditional roles include the provision of household water and the cleaning of latrines. The topic of gender equity suffuses the work with local government, committees in electoral wards as well as in the village communities in which the project has promoted the drilling of additional tubewells and the installation of hygienic latrines.

However, it is in the 988 villages and hamlets that the SDSD covers that a systematic, repeated and measurable approach to gender equity has been followed, using DASCOH's Gender Analytic Framework (GAF) tool. In four yearly exercises, SDSD volunteers conducted, in mixed-gender sessions, simple analyses of the division of labor between men and women. Standardized activity items from the spheres of household, village and Union Council (Parishad)/NGOs make the information comparable across years and communities. While the wording is descriptive (e.g., "Who cares for the sick - women, men or both?"), the response is best understood as attitudinal. Participants implied what men and women *should* do. The volunteers recorded what the communities perceived as persistent or changing parts of men's and women's social roles. While gender roles are learned and negotiated in daily activities everywhere, the communities in the SDSD appreciated the formal setting for a wider reflection and participated with enthusiasm. The response filled a complete, detailed attitude dataset.

This study addresses the question of whether a movement towards more gender-equitable attitudes can be discerned in the data that the GAF sessions produced 2011-2014. Also it seeks to identify the drivers of the observed change in gender role attitudes.

Findings

Indeed we find that the understanding of gender roles moved towards more equitable positions - meaning shared rights and duties - in all spheres - household, village and beyond-the-village. The change was particularly strong in the first year, between the 2011 and 2012 GAF exercises; it continued at a slower pace throughout the period.

For robust findings, we built a synthetic measure, the "gender attitude score" from all three spheres. Negative values denote more traditional attitudes with a sharper division of labor between the genders. Positive values appeared where meetings had called for more shared responsibilities. On this measure, the movement towards gender-equitable attitudes is positive and statistically significant, not only in the first year, but also from 2012 to 2014. However, the changes are *relative* to the values at the beginning of the period; they are not compared to any absolute standard taken from human rights or national law.

Table 1: Examples of non-traditional gender role attitudes, and change 2011-14

Prevalence of non-traditional attitudes				
Item short title / (Meaning of non-traditional)	Year			
	2011	2012	2013	2014
HOUSEHOLD				
Main earner in household ("Not only men")	5%	9%	16%	13%
Use of loans ("Both wife and husband decide")	11%	39%	45%	55%
VILLAGE				
Leadership ("Women too can be leaders")	3%	12%	14%	13%
Committee participation ("Women too can participate")	16%	45%	53%	64%
NGOs, UNION COUNCILS				
Participate in discussions at U. Council ("Women too can participate")	16%	24%	42%	48%
Fully informed on safe water and arsenic ("Women too can get the full information")	44%	59%	68%	76%

What drove the change in gender role attitudes? We estimated a statistical model that separates the effects from previous attitudes, socio-economic baseline conditions and DASCOH's work. As expected, previous attitudes linger in how communities see gender roles currently; yet, surprisingly, their effect changed from year to year. From 2011 to 2012, attitudinal differences among communities increased further. Later, however, communities with traditional attitudes would catch up while those already with more equitable views gained little on the score. The communities learned at different speeds.

Differences in socio-economic baseline conditions had surprisingly little effect on gender role attitudes. Higher proportions of households with members working overseas tended to go hand in hand with more gender-equitable attitudes, but the size of the effect was tiny compared to the program-year and preceding-attitude effects. Other baseline variables, including pre-existing water options and hygienic toilets, showed no demonstrable effect. Some of the baseline measures are of doubtful reliability; had the measurement errors been smaller, the effect might have been larger, as one would expect.

This takes us to the SDSD, whose effects on gender role attitudes we expect to be significant both from its mere duration (more time for the GAF process to make a

difference) and from the provision of physical infrastructure. Compared to 2012, the year-2014 effect is very strong. The infrastructure effect is positive, but statistically significant only for latrines, not for tubewells. It is small compared to the duration effect. This is an important finding; it suggests that the provision of infrastructure has a complementary, supportive function in gender equity work; it is not the principal driver. Most of the attitude change, to the extent that it came from the project, must have been due to the continuity of the GAF activities and to (unknown other) synergistic effects.

The pattern that we found in the attitude data is suggestive of a strong and positive result. In the four years, the SDSD, applying the GAF consistently, was able to initiate and sustain a public reflection on gender roles in the rural communities of Sunamganj. There has been a movement towards more equitable attitudes, with little dependence on the material infrastructure aspect of the project.

Limitations

We make two reservations. The relationship between attitudes and behavior everywhere is extremely fluid; this is true also of gender roles. We have very little information on the actual behavior change that, in theory, should have followed the attitude change. The GAF meetings were supposed to work out action plans. These have not been evidenced in this dataset; and we do not know how they took shape and were followed up.

Second, the volunteers who conducted the GAF sessions and the field workers who trained the volunteers wielded considerable influence over the recorded response. The similarity of responses within given electoral wards - each with a volunteer -, respectively within Unions - with one Field Facilitator per Union - is so strong that unknown local background factors can hardly be invoked. This lowers the quality of the data and calls for changes in the instrument. Plausibly, the volunteers were overwhelmed with the 29 questions to discuss in ninety minutes and wound up extrapolating the answers to many.

Recommendations

We recommend continuing the GAF process as a line of action research. The conversation needs to advance from the simplistic "Who does activity X - men, women or both?" to an emphasis on how specific components of gender roles should be changed.

As for the production of rigorous evidence of gender equity, the group meeting format and the village as sole analytic unit are not productive. The data collection will rather need to be re-focused on samples of households and on the Union Councils. Internationally, there is a research gap regarding the effects of WatSan programs on gender equity aspects above the local village. DASCOH, with its tradition of working with local government, could raise its profile with a thoughtful contribution.

Before any research at those levels is designed, however, DASCOH may want to tap into the treasure house of experience that the field workers and volunteers have accumulated. For this, qualitative research methods, and local analysis among Bangla speakers, look more promising. After all, these people observe actual behavior change in their daily

lives; also they should know what has become of the action plans - what works, what doesn't when a WatSan program addresses gender equity issues.

The technically interested reader will find the statistical approach detailed in the appendix.

Acronyms

DASCOH	Development Association for Self-reliance, Communication and Health
GAF	Gender-Analytic Framework
NGO	Non-governmental organization
SDC	Swiss Agency for Development and Cooperation
SDSD	Sustainable Solution for the Delivery of Safe Drinking Water
USD	US dollars
WASH	Water, sanitation and hygiene
WatSan	Water and sanitation

Acknowledgments

This study would not have been possible without the contribution of a large number of individuals, both in DASCOH's SDSD staff and in the participating communities:

- The data were originally recorded by the 225 Community Facilitators who led the GAF sessions in the villages and hamlets under the SDSD. They were further compiled by the 25 WatSan Field Facilitator of the project. Teresa Pereira entered all the data into a spreadsheet.

- Tabibur Rahman, Touhidul Islam and Khairul Islam, Upazila Managers in Sunamganj, provided case study material and some photographs. Ahashan Habib Mollick contributed photographs as well as fact checking in the field.

Introduction

DASCOH - earlier known as Development Association for Self-reliance, Communication and Health (DASCOH) - is a Bangladeshi NGO focusing on improved water supply, sanitation and local government effectiveness. The Sustainable Solution for the Delivery of Safe Drinking Water Project (henceforth SDSD) is one of its long-running projects. Supported by the Swiss Agency for Development and Cooperation (SDC), DASCOH embarked on it in 2004, at first in the western region of the country. In March 2011 DASCOH started SDSD activities in the northern district of Sunamganj, one of the poorest areas in the country. It has since been active in 25 Unions (communes) in four of the currently eleven Upazila (sub-districts) of the district.

The SDSD works in close cooperation with the local government tier known as Union Parishad. It emphasizes water and sanitation as entry points to improving Parishad services. The collaboration is guided by the principles of social inclusiveness, gender equity, institutional and environmental sustainability as well as disaster risk reduction. SDSD field workers liaise with multiple actors of the WatSan realm - councils, local committees at the electoral-ward and village levels, contractors and maintenance workers, other NGOs, as well as with the interested consumer households.

This study is specifically concerned with the relationship between SDSD and gender equity. Gender equity concerns arise at several organizational levels. In the households affected by the project, access to improved facilities by men, women and children may impact traditional gender role attitudes and, concomitantly, the actual gendered division of labor and thus women's and girl's workloads. In the village community, successful WatSan improvements strengthen inter-household cooperation, give greater scope for women's voice (such as in deliberations on siting new and maintaining existing facilities), and exert pressures for more equitable social control (such as by discouraging open defecation for all, by involving adults of both genders in facility maintenance). In ward committee and Union Parishad deliberations, women's participation, together with the open-budget and open-procurement policies advocated by DASCOH, make for greater transparency and stronger focus on underserved segments of the community. Finally, DASCOH, by employing more women and encouraging communities to support more female volunteers, contributes to changing gender relationships by its own example.

The data that we use here were collected in Sunamganj. This district is particular for its agro-ecological environment. Large tracts of Sunamganj form part of the Greater Sylhet Basin, a region of lengthy and deep seasonal flooding. In socio-economic terms, the district is often shown as part of a large contiguous north-to-northwest poverty belt. For example, the Bangladesh Rural Poverty Mapping Project (Kam and et.al. 2004) places all the subdistricts of Sunamganj, with the exception of Jaganathpur in the south-east, in the highest quartiles of poverty and extreme poverty. The poverty belt is characterized, among other effects, by low irrigation in the dry season, difficult road access to facilities, low educational attainment, and poor quality housing. Based on participatory village mappings, DASCOH classified 32 percent of the households in its working area as

Figure 1: The SDSD working area in Sunamganj District

Source: DASCOH and Benini (2011: 8)

extremely poor, 41 percent as poor, and 27 percent as middle class or rich (DASCOH 2014b: 4).

This situation has adverse consequences for women and girls. In the WatSan area, Faisal and Kabir (2005: 182) found that women in Sunamganj - wives, daughters and daughters-in-law who do most of the water-related chores - reported higher physical, social and security hazards than elsewhere in Bangladesh[1]. In response to seasonal flooding, homesteads are clustered in villages and small hamlets on scarce highlands, with little space available for stable, safe and secluded latrines. This deprives women and girls of privacy whereas men and boys find outdoor places to defecate more readily.

An assessment by DASCOH in mid-2012 concluded that 77 percent of the households had access to safe water, 13 percent had access to safe latrines, and 26 percent observed basic hygienic practices. Sunamganj is not chronically water-scarce; deficiencies are in safety, hygiene, year-round access and convenience (ibd.: 18). Some tubewells produce arsenic-contaminated water, but the extent of the problem in the district is not fully known. DASCOH facilitated the testing of 4,589 wells in Derai Upazila in 2012; only in 122 was the arsenic level above the 50 ppb critical threshold.

DASCOH's Gender-Analytical Framework

The local communities debate water and sanitation matters in a variety of forums, ranging from informal conversations at the tubewell to meetings in community groups (many of them assisted by NGOs), to the yearly ward assemblies that establish people's priority project for inclusion in Union Parishad budgets, to meetings of the full Parishad. DASCOH supports these processes in a gender-conscious perspective. It has developed, and has trained its volunteer Community Facilitators in the use of, a dedicated instrument aimed at *"preparing and implementing gender-specific action plans"* that *"ensures women's active participation in all activities and through these brings [them into] lead positions"* (DASCOH 2014a: 4).

The so-called "Participatory Gender Analytical Framework" is two things in one. On the one hand, it stakes out the objectives and process of a reflection and planning exercise. A group of 15 - 20 men and women in each of the villages and hamlets meet in two sessions once a year to produce an action plan in *"WatSan and gender-related problems at both levels, household and community"*. (ibd.: 9). On the other hand, it is a diagnostic instrument with standardized questions that illuminate the gendered division of labor in the household, in the village community, and in relationships with local government and NGOs.

In this standardized form, the Gender Analytical Framework (henceforth GAF) information is amenable to statistical analysis. While the questions were formulated to capture the factual division of labor (e.g., "Who cooks and does the household work? - Women, men or both?"), they were asked against the backdrop of ascertaining

[1] In the preface to our study, a proportion of 89 percent women among persons fetching water in the Bangladesh sample of a UNICEF survey is quoted. That figure is a national average and is from Sorensen et al. (2011: 1524).

responsibilities and priorities for action. There is a normative component in the way the meetings were organized to further gender mainstreaming. It is therefore appropriate to view the response as attitudinal rather than descriptive. This study analyzes the distribution and change of *attitudes* towards the duties of men and women in 988 villages and hamlets, collected in four annual GAF exercises from 2011 to 2014. It also relates them to SDSD outputs and to ambient socio-economic conditions.

[Sidebar:] Impact on gender - What other research says

A small, yet growing body of research literature has looked into the outcomes for gender equity from water, sanitation and hygiene (WASH) programs. Recently, Carrard et al. (2013) have provided an overview of relevant findings. They start from the widely accepted premise that meaningful participation by women is key to the effectiveness and sustainability of such programs. A question with many more unknowns is how the programs in turn affect relationships between the genders, particularly the power and status of women and girls.

Unsurprisingly, most of what is known in this regard is from the immediate household sphere. As designed by the programs, new water and sanitation facilities tend to reduce women's workload in carrying water and caring for sick family members. Not in all situations, however, have they reduced the overall burden. The time gained may be now spent working on activities the proceeds from which the women do not control, such as farm work in husbands' fields. Nevertheless, women often point out that the most important benefit is improved family harmony, to the point of distinct reductions in intra-family violence. However, the authors correctly question whether the program simply removed a trigger - husbands find the water barrel empty less often than before -, or whether it helped change attitudes that kept violence acceptable. In other word, did the WatSan program contribute to a farther-reaching, strategic change in gender relations?

In the local public arena, the most consequential gains that WASH programs have delivered to gender equity are in improved educational opportunities for girls. But this must be supplemented by appropriate school sanitation. Absent or inadequate arrangements increase drop-out among menstruating girls. The authors refer to earlier work in Bangladesh where a program creating *"separate facilities for boys and girls resulted in an average annual increase in girls' school attendance of 11 per cent from 1992 to 1999"* (ibid.: 323). For women, WASH programs open opportunities to acquire leadership skills, which eventually may transfer to other arenas. The programs may also induce changes in community governance, not only through new structures (committees, user groups), but also in less patriarchal debate and decision styles. There have also been reports of women picking up technical skills such as in masonry that earlier had been reserved entirely to the male half of society.

As we move further out from the village or urban neighborhood public arena to larger political and administrative units, research findings about WASH outcomes in gender equity terms dry up. Carrard et al. found only two examples, of which only one seems relevant in terms of local community engagement - a legislative change in Peru that led to women and men being *"given equal representation on management oversight boards"* in small-town water suppliers (ibid.: 327). With its intensive involvement with Union

Councils, DASCOH may have a comparative advantage when it comes to meaningfully analyze gender equity consequences in this under-researched public sphere.

The authors list several more research gaps, some of which DASCOH's experience might help to narrow - such as regards WASH program impacts on the disabled, on older and pregnant women, and even on men and boys. They complain that much research has been *aspirational* in nature. It was concerned with what programs *wanted* to achieve, and less so with what they changed in terms of *actual* behavior, status and power between the genders. Our study shares this limitation. We are constrained, by the nature of the data, to X-raying attitudes towards gender roles, with only a small bit of insight into behaviors.

Project area and uptake

The SDSD in Sunamganj is active in 988 villages and hamlets (locally known as *hati*) in 25 Unions. In 2012, DASCOH calculated that 711,736 persons in 128,132 households were living in these settlements (DASCOH 2014b: op.cit., 4, using 2011 population census figures).

The project has reached all 988 communities through hygienic education sessions and, by the end of 2013, at least 765 of them through tubewell and latrine construction. This table summarizes the uptake dynamic.

Table 2: Key project outputs, 2011-13

WatSan intervention area	Year			2011-13
	2011	2012	2013	
Tubewells				
Installed	325	553	625	1,503
Male beneficiaries	17,047	24,556	25,544	67,147
Female beneficiaries	16,717	24,487	25,491	66,695
Household beneficiaries	6,739	9,388	9,250	25,377
Latrines				
Constructed	1,300	1,671	670	3,641
Male beneficiaries	4,405	5,936	2,278	12,619
Female beneficiaries	4,138	5,714	2,250	12,102
Household beneficiaries	1,375	1,889	690	3,954
Hygiene education sessions				
Sessions conducted	0	4,940	5,928	10,868
Male participants	0	53,832	49,522	103,354
Female participants	0	100,610	98,308	198,918
Villages / hamlets with activity				
Only tubewells and latrines (*)	338	521	492	765
Including hygiene education	338	988	988	988

Source: Calculated from DASCOH (2014c). (*) A community was included in the count if at least one tubewell or at least one latrine was installed with DASCOH's support.

As a result of these investments, of its work with stakeholders from households to Union Parishads, as well as of the work of other NGOs and agencies, DASCOH (2014b: op.cit., 18) has estimated that key outcome indicators (in proportions of households) changed between mid-2012 and the end of 2013 as follows:

Access to safe water:	From 77 to 93 percent
Access to safe latrines:	From 13 to 26 percent
Basic hygienic practices:	From 26 to 36 percent.

The uptake statistics are relevant for the attitudes expressed in the GAF exercises in two respects. The first round, in 2011, was not a baseline measurement, in the sense that it took place while practical action was underway already in a third of the working area. The following rounds, 2012-14, were embedded in the momentum of the quickly expanding SDSD activities. We will therefore test also how far the dynamic of gender attitudes follows that of key project activities.

Gender role attitudes

Data collection in the SDSD project

As noted, the gender role attitudes were discussed in mixed male-female meetings that DASCOH-trained volunteers led. Once a year, from 2011 to 2014, these Community

Facilitators would cover all villages inside their own electoral wards - twelve villages on average. Everywhere the volunteers would ask the participants the same 29 questions. Every question enquired about the subject of a particular activity. The participants had the choice to answer that the women, or the men, or both (typically) performed it.

The coverage is complete for all 988 working communities and all four years. It is complete for all 29 questions, with the exception of the one concerning access to medical care among persons affected by arsenic contamination. This question was hypothetical and was answered in less than two thirds of the meetings[2].

It is important to point out supervision and selection effects inherent in this process. The GAF is the object of skills training downwards in the SDSD fieldstaff structure and into the communities. The SDSD Training Officer trains regional WatSan Field Facilitators, who in turn provide training to the local facilitators jointly selected by DASCOH and their communities. These volunteers are not randomly selected from among the adult population; they are sought out for their known personality traits suitable for motivating fellow villagers and for working with SDSD field workers and other relevant outsiders. A local facilitator usually conducts GAF sessions in all the *hati* of the local electoral ward (2 - 8 *hati*) whereas the Field Facilitator is posted to a Union (every Union is divided into nine wards).

Turnover among them as well as among the Field Facilitators has been considerable. In addition, the gender balance in these meetings varied. DASCOH did keep figures on attendance, but they are not readily available. The composition of participants in the hygiene education sessions has been reported; it gives an indication of the extent of variability in mixed-gender meetings. On average, about one third of the participants were male. This proportion, however, ranged all the way from 7 to 82 percent. Even assuming that the GAF sessions were somewhat more steadily gender-balanced, the predominance of one or the other gender was liable to favor perceptions and preferences.

The understanding of the questions therefore fluctuated across meetings, with effects from location (Wards and Unions - the areas in which Community and Field Facilitators are active), year (when Facilitators or volunteers turned over), and meeting composition. As a result, the response - "This is typically done by men, that by women, and a third thing by both genders" - is a mixture of description (how things actually get done), aspirations (what members of a particular gender hope to achieve) and normative ideas (what the participants think is the right thing to do). In the way it was practiced, the GAF elicited attitudes, not behavioral statements.

This reading of the data is all the more plausible if the practical circumstances are taken into account. The 29 questions were to be discussed, and some consensus answer was to be recorded to each of them, during a session planned to take only ninety minutes. In this time, the participants were expected to establish also a ranking of what to them seemed to be the most important problems touched upon in the initial discussion. This makes it

[2] During the tubewell testing period in Derai (see above), DASCOH scouted for arsenicosis patients, but found none.

likely that many of the questions were not attended to distinctly, and that answers were eventually recorded by the local facilitator relying on his personal reading of what the participants might have intended. This explains also the absence of missing values such as "Don't know" or "Not applicable" (except in the response to arsenicosis care).

A possible interpretation of such a procedure is that it produced a sampling of attitudinal expressions towards a common object - gender -, but with rather loose connections to the specifics of the gender roles as detailed in the 29 questions. We will see that the detailed structure of the response agrees with this interpretation.

Measuring gender role attitudes

The answers were uniformly recorded as either "women", "men" or "both". However, the meanings of these categories in terms of gender role attitudes differ across the 29 questions. For example, household water provision traditionally is the responsibility of women; the options "men" or "both", when used with this question, thus mark a departure from traditional attitudes. Conversely, decisions on household expenditure are a male prerogative; in this question, "women" and "men" signify the non-traditional pole.

Tradition and change

Accordingly, we transformed ("re-coded") the response to all questions to the two options "traditional" vs. "change-oriented"[3], depending on the predominant categories in the first year, which we took to signify the traditional pole. In fact, in 2011, the distinctions between men's and women's responsibilities were sharp, with one interesting exception: In village-level decision making processes bearing on water and sanitation, there was no clearly prevailing gender. It appears that both men and women traditionally spoke and were heard in public debates on this particular subject.

The re-coding yielded 29 binary attitude items. The interested reader may find a tabulation of the response of the first year and the recoding instruction for each item in the appendix. The evolution of non-traditional attitudes, item by item, over the four measurement points can be seen in the table on the next page. The presentation follows the distinctions that DASCOH's GAF format made: Gender roles are carried out in three major domains - the household, the village and the part of the world beyond the village that is of special interest in this context. This includes NGO fieldworkers, electoral wards and Union Councils. However, we do not have proof that the meeting participants themselves associated the items exactly by this scheme. This is potentially important. If there are several independent dimensions of changing gender attitudes, they may cut across the three domains.

[3] The wording "change-oriented" as the antonym to "traditional" is unsatisfactory, but still preferable to "modern", which implies that any departure from tradition is a sign of modernity. Throughout this note the reader will find that our language in this regard is still searching; we use words like "non-traditional", "liberal", "gender-equitable", "progressive" where they seem justified.

Table 3: Prevalence of non-traditional attitudes, 2011-14

Prevalence of non-traditional attitudes					
Item no.	Item short title	Year			
		2011	2012	2013	2014
Domain 1: HOUSEHOLD					
1	Water	0%	2%	3%	4%
2	Sick care	4%	20%	26%	31%
3	Family care	4%	16%	17%	21%
4	Household	1%	2%	3%	3%
5	Clean latrine	19%	50%	70%	74%
6	Garden, poultry	9%	24%	35%	36%
7	Farm and fish	10%	17%	22%	19%
8	Main earner	5%	9%	16%	13%
9	Select site	20%	40%	53%	58%
10	HH budget	10%	41%	51%	57%
11	Loan use	11%	39%	45%	55%
12	See doctor	15%	50%	53%	64%
Domain 2: VILLAGE					
13	Mobility	7%	24%	30%	27%
14	Social events	19%	30%	29%	33%
15	Leadership	3%	12%	14%	13%
16	Trainings	24%	45%	54%	64%
17	Committee particip.	16%	45%	53%	64%
18	Committee leadership	9%	21%	27%	33%
19	Collect money	9%	20%	28%	26%
20	Influence	8%	16%	33%	27%
21	WatSan agenda	12%	41%	40%	49%
22	WatSan siting	19%	43%	57%	60%
23	Manage fund	10%	27%	32%	29%
24	Owns wells	16%	24%	31%	30%
Domain 3: NGOs, UNION COUNCILS					
25	Meetings	23%	44%	57%	65%
26	UP liaison	13%	30%	41%	51%
27	UP discussion	16%	24%	42%	48%
28	Arsenic care	51%	65%	75%	83%
29	Arsenic info	44%	59%	68%	76%

At first glance, a literal interpretation appears straightforward. By 2014, attitudes had changed towards more shared responsibilities in all items. The change was uneven; particularly in the household domain and with regards to village-level leadership, strongly traditional gender expectations persisted. Yet, even casual visual inspection reveals that in every domain attitudes with regards to some items changed significantly.

For example, in 2011, trainings and participation in village committee deliberations (item no. 16 and 17) were still seen largely as male prerogatives. Three years later, nearly two thirds of the groups doing the GAF exercise felt that women as well as men could legitimately participate in these activities.

Extraneous influences

However, there are two objections to literal interpretation, item by item. First, the largest extent of the change towards less traditional gender role attitudes happened between 2011 and 2012. From then onwards, attitudes continued to move overall towards the non-traditional pole, but at a slower pace. This raises a potential issue as to how the questions were treated in 2011 and 2012.

Looking closely at the data, it is noticeable that the responses are similar to a considerable degree within the Unions. The clustering is particularly strong in 2011. For example, in response to the question "Who cultivates vegetables, does the home gardening and rears poultry?", eleven out of twelve meetings in Bhatipara Union settled on "men"; in Charnachar Union, everywhere this was considered women's work. The likely reason is that in the former the WatSan Field Facilitators who trained the local volunteers emphasized commercial vegetable production, usually undertaken by men. In the latter Union, home gardening was the primary element, traditionally a women-led activity. The volunteers in a given Union were assisted by the same Field Facilitator, whose personal interpretation of questions exercised a strong "supervisor effect" (Bassi and Fabbris 1997).

The effect extended to all questions. There may be real-world causes why the communities in some Union tended to have more traditional or more gender-equitable attitudes than those in other Unions. However, this would not justify why the within-Union clustering was so strong in 2011. A statistical indicator of this tendency reads 0.70 in 2011, 0.49 in 2012, 0.20 in 2013 and 0.29 in 2014, where 0 indicates total independence of the attitudes among groups within Unions, and 1 results from identical answers across all groups within each Union[4]. This implies that the influence of the DASCOH field workers on the exercise outcomes decreased from 2011 to 2013, to slightly increase again in 2014.

The value for 2011 is so extreme that we would be justified to dismiss the GAF exercise in this year as a mere warm-up exercise. There is nothing dishonorable in the view that 2011 essentially was the pre-test of a new instrument. It does, of course, affect the degree of attitude change that we recognize for the period of the SDSD project in Sunamganj. These changes were much smaller when we compare to 2012, rather than to 2011.

The second objection concerns items for which the groups in all four annual GAF exercises professed a very low level of changing gender role attitudes. Two items belong here - household water chores (item no. 1) and cooking/household work (item no. 4). Although these have shown increases in non-traditional responses, the frequencies are

[4] Technically, the indicator is the year-mean, over the 29 items, of their intra-group correlation coefficients, with the Union as the grouping variable.

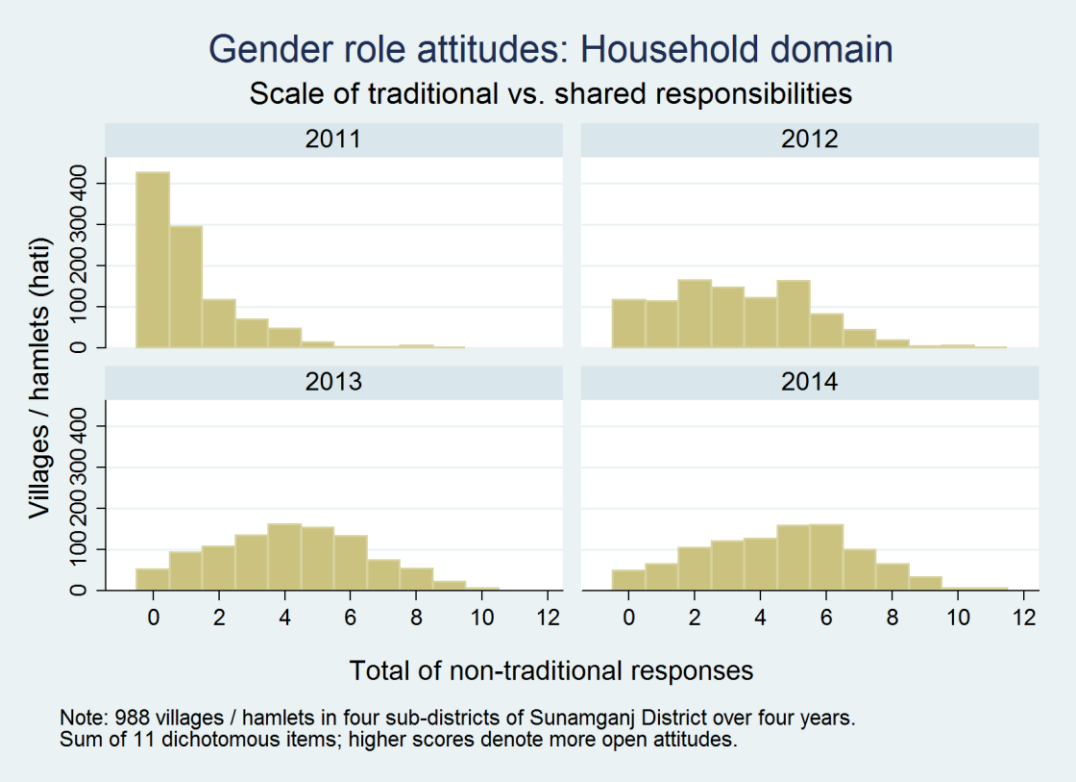
low throughout and not above measurement error even under generous assumptions. For the time being, water chores, cooking and indoor work are being seen as female responsibilities in the way of universally accepted norms. These items are best removed from measures of change.

Combined measures

The discussion of item-wise changes soon becomes tedious; and there is a need felt for measures that summarize them, if not for all 29 items, then at least within each of the three major domains. One might simply add the "1"s by which the non-traditional options were coded, over all the items of a domain and compare the totals by years. All items are considered equally important.

This combined chart, with four year-panels, exemplifies such an approach for the household domain with its eleven items. For each possible total of non-traditional responses - from 0 to 11 -, it shows the number of villages whose GAF exercise produced this result. The dramatic change from 2011 to 2012 and the smaller subsequent changes are conspicuous.

Figure 2: Distribution of gender role attitudes over 988 villages, by year



Intuitively, however, most observers will agree that certain attitudes are harder to change than others. For example, the expectation that a male household member should be the main earner (item no. 8), despite an increase in gender-balanced responses, has remained dominant. Compare that to the attitude towards decisions on the use of loans. By 2014,

the groups favoring both male and female input slightly outnumbered those believing in the men's prerogative. One may conclude, not surprisingly, that the norm of the male household head providing the bulk of income is harder to change than one related to the microfinance business, in which the majority of clients have long been women.

We thus seek a procedure that assigns higher weights to items that are harder to change. This procedure should also compute a score for each local community on a scale running from very traditional to very gender equity-minded.

The Rasch model

A technique known as the "Rasch model" meets those two requirements (Wikipedia 2013). The Rasch model is conceptually demanding, but it offers three advantages for the analysis of DASCOH's GAF data.

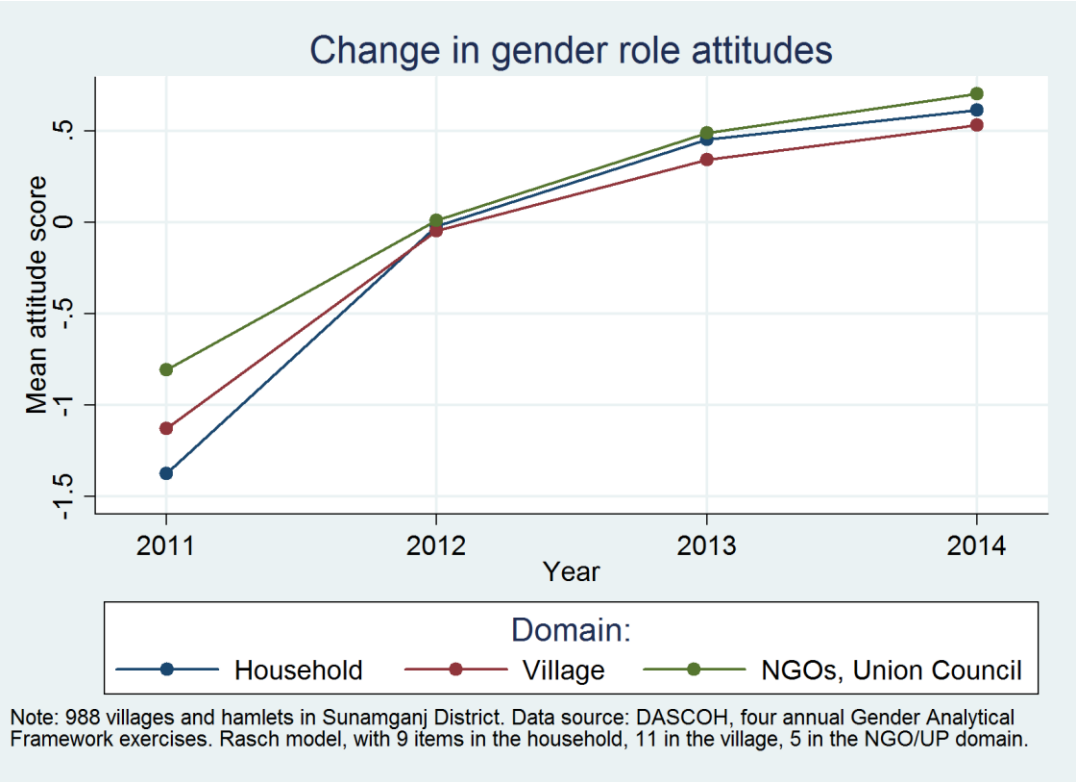
First, it affords insight into the quality of the data. This exploits the intuition that if the attitude towards item A is more traditional than that towards item B, it should remain *relatively* more traditional in any village and at any point of time. In other words, A and B move together, with A always tending to prompt the more traditional response than B does. This assumption is reasonable in a culturally and socio-ecologically homogenous area like rural Sunamganj. It is undermined if the GAF trainers and facilitators administer the questions in highly variable manner. Hence the degree to which the data deviate from stable relations between items opens a window on how well the GAF instrument performed.

Second, the GAF observes gender role attitudes in the household and village domains through 11 items each. For the NGO-Union Council domain it offers five items only, one of which - who receives medical care as an arsenicosis patient - was not applicable everywhere. The Rasch model estimates weights for all five items despite this restriction. Third, and most importantly, the scores are easy to summarize and to graphically visualize.

Have gender role attitudes changed?

The graph charts the average Rasch-scored gender role attitudes for the three domains for the four years of GAF exercises. The attitude scores are oriented from more traditional (negative values) to more gender-balanced (positive values). The estimates were run separately for each of the domains - household, village, NGOs and Union Council. From the household domain, two of the eleven items - water chores (no. 1) and cooking / household work (no. 4) were excluded because of their low positive frequencies.

Figure 3: Change in gender role attitudes, by year and domain



For all three domains, the evolution of the gender role attitudes is similar. The largest gains were achieved at the beginning - from 2011 to 2012. It is doubtful that this finding is valid - the 2011 GAF exercise was more of warm-up to familiarize with the new instrument rather than a reliable baseline assessment, as we have seen. A better indicator of attitude change can be found in the significance of the change from 2012 to 2014. Although we notice a clear slowing down with respect to 2011/12, is the momentum of change being sustained?

Have attitudes changed towards more gender-equitable?

Since all villages in the working area participated in the GAF exercises, statistical tests do not seem necessary. However, what really happened is that DASCOH worked with samples of volunteers and meeting participants drawn from the village populations. We are therefore bound to test for differences in attitudes from 2012 to 2014 in a sample of events drawn from the (hypothetical) universe of all possible volunteers and meetings.

Appropriate tests for this situation do indeed confirm that the change towards more gender-equitable attitudes over those two years was statistically significant. It was significant in every domain. Although the increases may seem minor in the above diagram, these results are not surprising. When we inspect the data closely, we find, for example, that the attitude scores for the household domain in 2014 were higher in 700 of the 988 communities than their levels two years earlier.

[Sidebar:] What the people had to say

The reader must feel that the approach to this study is exclusively quantitative and even boxed into the corner of an arcane measurement. While working from a complete, well-defined dataset is a clear advantage, the study is short on qualitative information. There is only a tiny bit of it. Staff members wrote up seven short cases of persons who affirmed that their lives were touched beneficially by GAF processes. In themselves, the case studies do not offer compelling evidence. Yet across the seven, recurrent themes are illustrated, providing support for the assumption of positive change. Moreover, they point to aspects of the attitude change that the statistical data do not capture.

Common points

- For men and women, GAF meetings acted as effective **eye openers**. In particular, men came to acknowledge that the women were overburdened, that something needed to be done to ease women's workload and, if this happened, women held greater potential and would unfold it for the benefit of family and community. Many examples of ensuing behavior change were volunteered. Although it is impossible to say how representative they are of actual behavior, they chiefly fall into three categories:

    - Some men started giving wives a hand in traditionally female chores: cleaning latrines, carrying water, preparing food. Men also grew more interested in household hygiene, and more of them would attend hygiene promotion sessions.
    - Men encouraged (or at least allowed) wives and daughters to attend meetings and to seek training outside the village. In this regard, it certainly did not harm that several NGOs in Sunamganj had taken to paying honoraria for volunteer work.
    - Parents seemed to be more willing to invest in girls' education (although there are hints that their poverty frustrated some of those plans). For most, this meant continued schooling, but particularly older girls seemed to find ways to round off their education through a surprising variety of NGO-led trainings.

- **Shame**, and the fear of public shaming, are strong regulating factors in new behaviors. Several men noted that they had to fight mockery and ridicule at first when they were seen helping with domestic chores. These challenges went away once the village saw several men adopting some non-traditional activity. Similarly, the success of collective action, manifest in a new tubewell, seemed to reinforce more helpful attitudes at large. Also related to the shaming complex, **physical safety** was a strong motivator for women. New tubewells were appreciated particularly because they shortened the distance for carrying water at night.

- The formalization of public problems in poor communities has grown in the wake of the participatory planning movement. The significance of the GAF process results from an external agency - DASCOH - creating a **formal setting for collective reflection**. Men and women knew this, and some came to the meetings deliberately to express their aspirations in this framework. They may have exceeded the original purview, such as the woman who felt that the GAF

questionnaire would teach her with which agencies to press for particular services. For others, the meetings turned out to be springboards to new roles beyond the village, such as in family conflict resolution and in water and sanitation committees. Village maps and discussions centered on the maps, which are standard in the DASCOH approach, seemed to energize both collective and personal improvements. Outstanding engagement in drawing maps and collecting survey data was a gateway, at least for some young people, into community facilitator and subsequently other NGO-related positions.

- DASCOH has worked to strengthen intermediary structures between villages and the Union Parishads, chiefly through committees and preference aggregating processes in the electoral wards. Surprisingly, then, direct personal contact with the UP chairperson was still highly prized. For several women attending the GAF meetings, traveling to the UP compound and requesting a meeting was a test of personal courage. The material benefits were of two kinds. Some women presented the case for WatSan improvements and subsequently acted as leaders in putting together applications for new tubewells and in collecting the twenty-percent cost contribution. Others went to demand benefits under established social welfare programs. What they obtained was usually modest, but the personal meetings with powerful public figures broke **psychological barriers** and strengthened social recognition at home.

Khadija - A personal face

Finally, in order to put a face on this synopsis, the case of a young woman volunteer for the project is illuminating. **Khadija, 19 years' old**, lives together with nine sisters and one brother in a household in Vimkhali Union in Jamalganj Upazela. The family has always been poor. Her father is eighty years' old and unable to do strenuous work. The brother suffers from a disability and is unable to contribute to the family's maintenance.

When DASCOH arrived in her village in 2011, Khadija went out of her way to help collect survey data and to draw the village map. DASCOH field staff recognized her initiative and made her the local community facilitator. Subsequently, she found work as a volunteer, as far as we know, with at least four other NGOs. The list of trainings that she received in those positions, or simply as an outgoing interested individual, is impressive: safe water and sanitation, gender, disaster risk reduction, adolescent empowerment, nutrition for pregnant mothers and children, poultry and livestock rearing, tailing, and credit management. Khadija topped up the honoraria that she drew from the NGOs with a Tk. 5,000 (USD 45) microloan to set up a small grocery store. The store gives her father useful work.

Recently Khadija enrolled in college. Her vision of the future has personal as well as community elements: she hopes to land a good job with an NGO. She looks forward to the day when her village will be declared "100 percent hygienic sanitation".

Perspective

These positive messages have to be tempered in a wider perspective. First, **synergistic effects** are obvious. Many organizations and programs are working on gender issues; they cross-fertilize, as we can see in volunteer careers, although the extent of actual mutual reinforcement is difficult to gauge. DASCOH's GAF process benefits from audiences that were exposed to other programs before; its outcomes will feed back helpfully into these and possibly yet others.

Second, gender attitude change is being facilitated by the supply of **volunteer opportunities**, many of which are open to, or even reserved for, women and girls. Plausibly, it is poverty rather than suddenly liberating attitudes that motivates them to opt for honorarium-paying work. This is precarious employment; the instability of volunteer positions in Bangladesh is notorious. A tiny minority of volunteers will ascend to better paid and stable jobs. Nevertheless, every volunteer sets an example of what can be done differently from the traditional ways of dealing with outside agencies. Some of these new ways affect the perceptions of gender and particularly of dormant potentials in women and girls.

Third, one must not discount the **power of new ideas**. Creativity in Sunamganj has few local outlets; families cope by sending sons to work in cities and abroad. Thus, when organizations like DASCOH present visions of achievable progress at home, cast in a format that village communities can actively assimilate, at least some of the people will be willing to experiment with new ideas. The GAF is attractive because it is embedded in a process that delivers badly needed water and sanitation facilities. Yes, to this extent the connection is opportunistic, but there is no reason why the collective reflection on gender should stop at tubewells and latrines.

A strong result despite weak data

The strengthening of gender-equitable attitudes during the project period is an important result. Whether this movement will be sustained in future cannot be determined with the data and models extant. However, this finding is more than simply descriptive; the change was demonstrated under the demanding Rasch model, with the help of statistical tests and despite excluding the low 2011 baseline. The changes are significant in all three domains. They would plausibly be even more dramatic if the data were stronger.

Do the gender role attitudes in the domains move together? For example, would communities with more equitable attitudes in the household domain tend to have similar attitudes in the NGO / Union Council domain? This is not the case. In both comparison years, 2012 and 2014, the attitude scores among the three domains were weakly correlated (with correlation coefficients ranging from 0.22 to 0.45). In addition, when we compare the scores in 2012 to those in 2014 separately for each domain, they are practically uncorrelated (with coefficients from 0.06 to 0.12).

Both statistics contradict commonsense. The first because gender roles are strong; the weak correlations among the domains imply a degree of autonomy across domains that does not exist in the reality of this conservative rural society. The second because villages with more equitable attitudes in 2014 had plausibly held somewhat more equitable ones

already in 2012. Attitudes are notoriously unstable, but not to the extent of complete randomness among almost a thousand communities.

Both results must be explained by the diverse circumstances in which the 90-minute GAF sessions unfolded. In the same village, from year to year, different people participated, and the questions that could be discussed in any meaningful detail may well have differed to some extent. Another way of describing such overburdened conversations is to say that each meeting drew a conceptual sample from the broad realm of gender roles that the participants were asked to discuss (with strong influence from the facilitators who set the initial stage for the discussion). Items that corresponded to the sampled concepts received some detailed attention and finally a determination of which gender was responsible for the associated activities. Others were recorded from extrapolation.

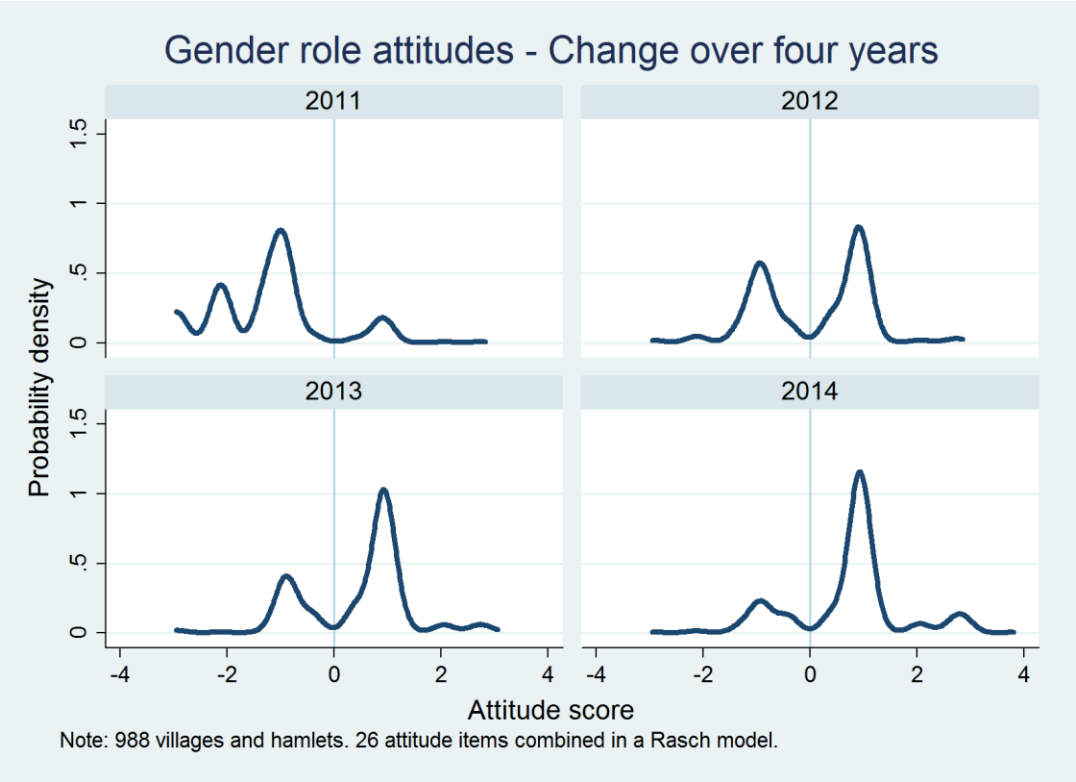
For this analysis, the consequence is that we must now look beyond the three domains and probe the attitude change holistically.

An overall view

We form a holistic view by combining all items in one attitude measure. From the 29 recorded ones, we drop three - "household water chores" (item no. 1) and "cooking / household work" (no.4) because the non-traditional options were used rarely throughout, as well as "care of arsenicosis patients" (no. 28) because of its hypothetical character. As before, we use a Rasch model because it simultaneously establishes weights for each item and the position of each village on the traditional vs. more equitable gender role scale.

The graph lets us see how these positions changed for the ensemble of 988 villages.

Figure 4: Overall attitude change, 2011-14



How do we read this chart? Each panel conveys information on the distribution of attitudes across the spectrum from very traditional to very equitable, which on the x-axis runs from -4 to +4. Waves indicate concentrations of communities around peak values. Thus, in the first panel, for the year 2011, there is a small group of communities with very traditional gender role attitudes. It peaks at the lowest observed values, around -3. Another group, also relatively small, professed slightly less traditional attitudes, manifest in a peak around -2.2. The majority of communities, by attitude, congregate in the biggest wave, between roughly -1.8 and 0. In this year, only a small minority came out with definitely more equitable gender role attitudes, a low wave peaking at +1. The following year panels show the movement of these waves towards the right hand sides.

We already know that between 2011 and 2014 overall attitudes changed significantly towards the non-traditional pole, and most pronouncedly so from 2011 to 2012. The combined measure only confirms that. What its adds in the way of new insight is the polarized distribution of attitudes.

In 2011, most GAF meetings produced traditional views of gender roles. As noted, a significant minority held *very* traditional ones, and only a tiny group had moved towards a distinctly less traditional position. By 2012, the very traditional group had virtually disappeared. A clear polarity appeared in an almost symmetrical distribution. One year later, the two-peak pattern persisted, with more equitable attitudes becoming more

frequent. This trend continued into 2014, now enhanced with another distinct, albeit small group expressing even more progressive attitudes.

That suggests that gender role attitudes across the SDSD working area are not smoothly distributed - in the sense of a Bell curve or at least a one-peak-only distribution. This is intriguing. Are such polarized attitudes real? Are they a statistical artifact? What social forces might have produced them? Has the SDSD nudged some group of communities forward while others linger nearer to the traditional pole?

Caution is appropriate. Yes, even when we drop 2011 as the baseline because of data quality problems, the change from 2012 to 2014 is statistically significant. But as was true of the domain-specific attitudes, the broad-based gender attitudes did not move in lockstep. The correlation between the 2012 and 2014 scores is low (+0.11). The speed of progress is uneven; in more than a quarter of the villages, the score actually decreased.

It is now time to start looking for the factors that explain differences in these attitudes. A word of caution is due: The scale of gender role attitude captures *relative* positions among the communities involved in the GAF process. It is fair to say that the scores express traditional vs. less traditional, or, if you will, traditional vs. more gender-equitable attitudes, relative to those held by others. But they cannot be gauged to any absolute sociological, policy or ethical standard, nor do they measure how attitudes are translated into actual behavior.

Drivers of change

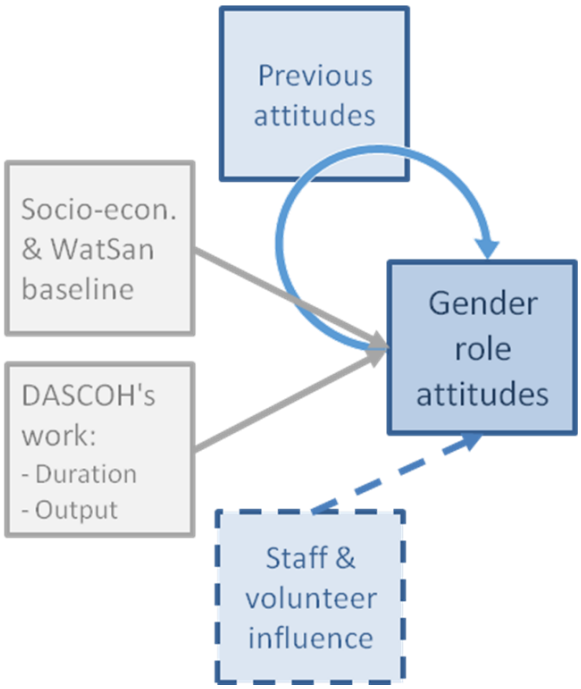
Social factors affecting gender role attitudes

A conceptual model

We conceive of gender attitudes as subject to various forces of change. These can be grouped into three sets of factors:

- **Previous attitudes:** First, despite a sometimes surprising degree of instability, attitudes in general are determined by the existence, firmness and direction of perceptions and sentiments that individuals and groups have held towards the same object at earlier points in time. This is plausible also of attitudes towards gender roles. In the schematic, this view is expressed by a circular arrow that passes through the "previous attitudes" box and reverts to the current "Gender role attitudes".

Figure 5: Conceptual elements of the gender attitude model



- Second, **socio-economic conditions** that vary across communities may promote differences in these attitudes. It is difficult to propose specific hypotheses. One might speculate that communities with greater outside contact and those with higher education levels will more readily depart from traditional gender role attitudes. Yet not all developmental progress may translate into more liberal attitudes. For example, communities that are better off economically may harbor a larger share of middle-class families anxious to preserve traditional *purdah* norms. Similarly, the water and sanitation conditions at baseline have unknown impacts on gender role attitudes. One could argue that communities with a higher prevalence of hygienic latrines must have gone through some social modernization process. If so, WatSan baselines and gender role attitudes must be correlated, although no direct causality may exist. Even if a firm theory of the effects of socio-economic factors existed, we might be wrong about their strength and direction. Whether these factors work to change or to reinforce traditional attitudes - this will be seen only in the data.

- Third, and of the greatest interest to DASCOH, the impact of its work on gender role attitudes matters. Here we obviously mean the impact of the **SDSD project** in Sunamganj District. We can reasonably expect that the mere **duration** of the project makes an impact. Every year, the project arranges a GAF exercise, from which, in theory at least, a gender-related action plan is to emerge. The project thus ensures a measure of continuity in the collective reflection on gender roles. However, merely continuing a project is not enough; its essential **outputs** will also contribute to attitude change. Plausibly this is so because every additional tubewell and latrine related to the project creates an event in the community on which the more liberal voices can capitalize.

The readers will have noticed the box at the bottom, framed with a dashed line, "Staff & volunteer influence". This is a reminder that the Community Facilitators each responsible for the GAF exercises within an electoral ward as well as the Field Facilitators each supervising work in a Union wield significant influence over the reported gender role

definitions[5]. It is therefore highly desirable to filter out their influence in any statistical estimates as much as possible.

Measuring social and project factors

Our statistical model follows this conceptual scheme. We express the gender roles attitudes in a given village and year by the combined score from 26 gender role items, as explained earlier. Previous attitudes are simply summarized by the value of that variable in the preceding year. For instance, the attitude score in 2013 stands for the previous attitudes influencing current attitudes in 2014.

Two important points need to be noted here: First, we analyze attitudes only during three years (2012 - 2014) because the 2011 GAF was the first in SDSD Sunamganj and thus has no previous-year attitude scores (We do make use of the 2011 measures - as the previous-year values in the year 2012!). Second, we allow effects of previous attitudes to vary in each year. This is necessary because we must not presume that attitudes are determined in constant fashion over the entire course of mobilizing communities for gender equity. It is conceivable that communities that were already more liberal at the start of the SDSD adopted progressive attitudes faster. Yet later, by 2014, communities that had been more reticent initially may be catching up.

The socio-economic and WatSan baseline conditions remain constant during the four years of reported GAF exercises. We use the following indicators:

- Fraction of households in the village that are middle-class or rich
- Fraction of households with members working overseas
- Fraction of 12 to 18 year-old with more than primary education
- Distance from nearest commercial center (km)
- Households in the village (log10)
- Arsenic-free water options per 100 households
- Fraction of households with hygienic toilets

As regards the effects of DASCOH's SDSD project on gender role attitudes, we take account of the duration simply by treating each year as its own variable. We measure key outputs as the *cumulative* numbers, up to the *previous* year, of tubewells sunk and, separately, of latrines installed under SDSD. The idea is that the GAF participants have had that many occasions to observe new facilities promoted by DASCOH before they meet in the annual exercise. Note that we do not use the number of hygiene promotion sessions because in any given year every village received the same.

Finally, electoral wards and Unions are introduced in the model as categorical variables. Although every village was observed three times (through the GAF results in 2012, 2013

[5] Examples of their strong influence were given earlier in this note. Purists will object that this is simply a measurement issue and should not figure in a substantive model of attitude change. This is not entirely correct. Since there is only one Community Facilitator per electoral ward, and one Field Facilitator per Union, volunteer and Union staff effects are mingled with the effects of unmeasured variables at those levels.

and 2014), the link across these observations is established by the previous-year attitudes, not through a categorical variable "village / *hati*". The four Upazilas are not included in the substantive part since we have no prior assumptions why gender role attitudes should differ among them.

Technical details are given in the appendix. The next section presents the findings that are of interest to the general reader.

Key findings

Prior attitudes

Prior attitudes towards gender roles have a strong effect on how traditional vs. how liberal attitudes in the year in point will be. Surprisingly, however, the directions of their influence were opposite between 2012 and the subsequent two years. In gross simplification, this chart makes the differences patent:

- Between 2011 and 2012, differences in attitudes grew more extreme. Communities with very traditional attitudes in 2011 tended to stay as they were; others with already more liberal ones tended to become even more so.

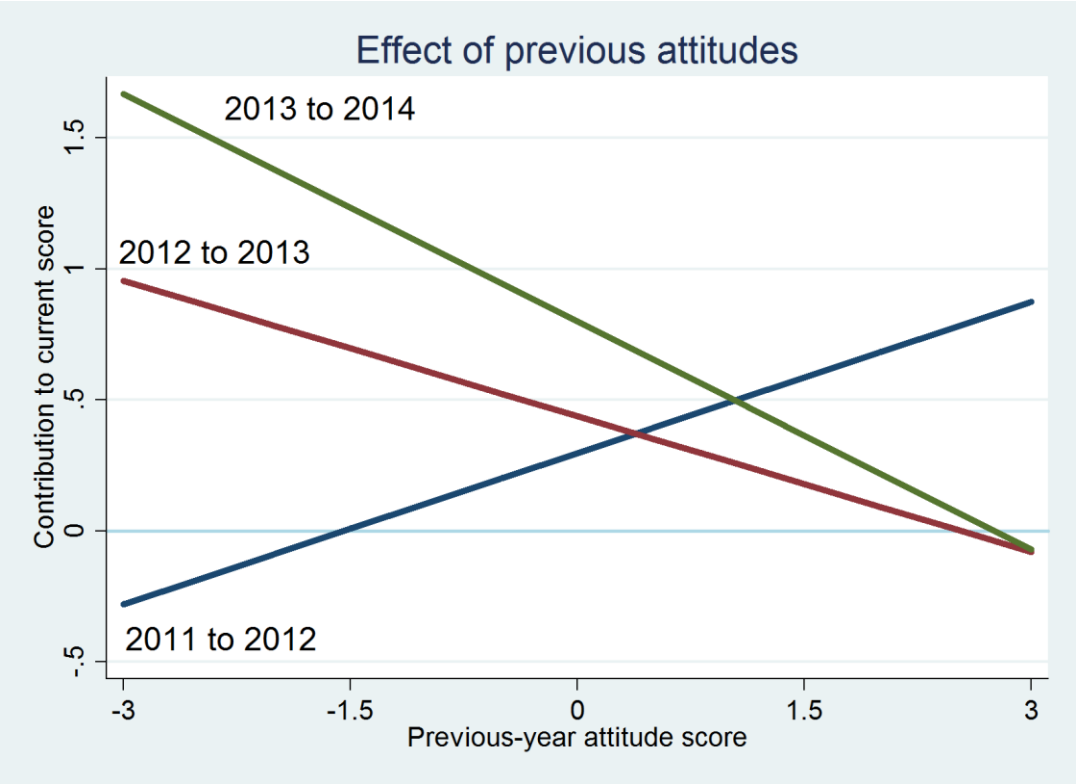
- The trend was reversed, weakly in 2013, and then strongly in 2014. Between 2012 and 2014, communities with very traditional attitudes tended to catch up considerably in the direction of more liberal attitudes. Those already more liberal did continue to make gains, but to a smaller extent. The gains basically vanished for the already most progressive ones.

This catching-up phenomenon is relevant from a GAF programming viewpoint. It suggests two things: First, communities with very traditional attitudes may initially resist opening towards a more gender-equitable worldview. Eventually, some learning processes take hold, leading to a belated release of change energies. "Change energies", of course, explains nothing - the statistical approach is simply unable to pinpoint the specifics of these learning processes. The physical program outputs - tubewells and latrines - did not directly motivate the catch-up (their effect is measured through other variables). The catching-up may be the result of the sheer repetition of GAF exercises. Communities with very traditional attitudes may have needed more time and more coaching in order to seriously start debating rights and duties between the genders.

Second, the dynamic at the other end of the scale - among the communities with the most gender-equitable attitudes - suggests that eventually attitudes consolidate. They stop growing ever more progressive. This is of concern in a sustainability perspective. Recall that the Rasch model-derived score is a relative measure. It does not measure attitudes with any absolute yardstick such as under human-rights or national gender policies. Our estimates only suggest that the relatively most progressive attitudes found in SDSD communities will freeze in the absence of further stimuli. If so, these communities may settle into slightly improved, but eventually stagnant arrangements between the genders.

In a society as poor as Sunamganj's, the opportunities to revamp the gendered division of labor may be narrowly circumscribed.

Figure 6: The effect of previous attitudes, year by year



Socio-economic and WatSan baseline

Of all the socio-economic baseline variables listed above, only overseas employment showed a significant (and positive) effect on more gender-equitable attitudes. Post-primary education comes close to it, but fails statistical significance[6]. However, the effect of overseas employment, while statistically significant, is small - only about five percent of the program duration effect from 2012 to 2014. Neither of the two baseline WatSan variables has a significant effect on gender role attitudes.

This should not be the last word on the socio-economic conditioning of such attitudes. The data situation in this regard is unfavorable. These variables are makeshift measures from a baseline survey that was never intended to support this kind of modeling. Both validity and reliability issues abound in this data segment. If the measurement errors were smaller, we would plausibly find stronger effects. At this point, the effect of overseas employment tells us little. In more general terms, it suggests that outside contacts of a kind that is relevant to the communities' survival and prosperity are likely to facilitate change in attitudes.

[6] In other model specifications - not shown in this report -, this educational variable did have a significant and positive effect.

The work of DASCOH

The statistical model answers the question of the effect of program duration indirectly. It estimates the effects of the year 2013, respectively 2014 compared to 2012. Remember that the 2011 attitude scores are used only as the previous-year values in 2012. Thus we have a three-year comparison period, with 2012 being the base year. What makes these year effects attractive is that they are net of all other effects - the effects of, say, previous attitudes, baseline conditions and physical program outputs have been stripped out. The year effects reflect, if you like, the pure impact of the GAF work and of the subsequent communities' learning processes.

The year 2013 effect is positive, but not statistically significant. The 2014 effect is positive, strong and significant. It is larger than the effect of previous attitudes. In other words, the "warm-up" exercise in 2011 and the better organized one in 2012 set in motion a strong dynamic. It was such that by 2014 the typical community in the SDSD Sunamganj area had moved towards more equitable gender attitudes to the extent of almost half of the variability in the 2012 scores[7]. While this measure can be refined, it appears robust enough to conclude that there has been substantial positive attitude change initiated by the SDSD.

Compared to the program duration effect, the effects of providing physical infrastructure - with regards to gender role attitudes, of course! - are tiny. Moreover, they are difficult to interpret. The effect of the cumulative number of tubewells sunk in the *hati* at first glance is about 5 percent of the year-2014 effect, but it is not even statistically significant. However, the extra information provided by the number of latrines constructed is significant, in fact strongly so. Why is the contribution of new latrines more significant? Perhaps tubewells, which were few and expensive, were more readily gamed by traditional patronage politics between communities and Union Councils. Hygienic latrines, more numerous and cheaper per piece, invited more direct involvement of households, in particular of the women. Thematically, latrines may have a better fit with hygiene and GAF conversations than tubewells do. But these are speculations. Since the figures are mostly correct, the small effects cannot be blamed on measurement error.

A more pleasing, although unverifiable interpretation goes something like this: The creation of WatSan infrastructure has supported the change in gender role attitudes. However, this effect was merely complementary. The major thrust was provided by the the GAF process itself.

Influence of staff and volunteers

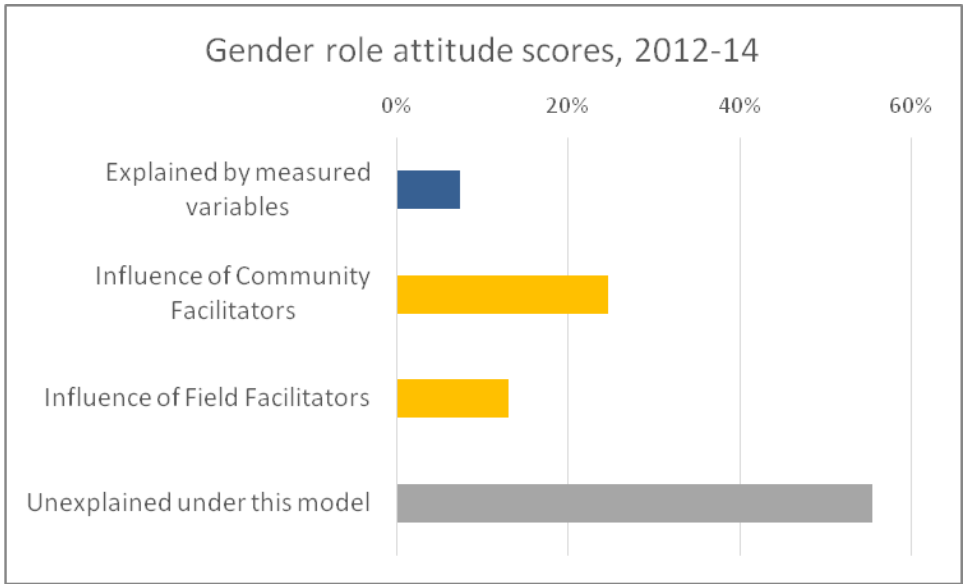
This rosy interpretation is compromised by the excessive influence that volunteers and field staff wielded over the GAF results. As earlier described, in the GAF format Community Facilitators would lead group discussions on 29 gender-related questions, and then sense, interpret or extrapolate and finally record the apparent group consensus in

[7] Computed as Year-2014 effect / standard deviation of the attitude scores in 925 effective-sample communities in 2012 = 0.502 / 1.030 = 48.7 percent. This back-of-the-envelope sum does not take account of the interaction with the previous-year attitudes scores.

response to each question. The recorded response showed a pattern of strongly correlated items across communities within a facilitator's range. Similarly, the frontline employees, the Field Coordinators, left their mark on the response pattern across Unions, presumably by the way each of them trained and supervised the Community Facilitators under his/her direct supervision.

With our estimates on hand, we can now quantitatively gauge their influence on the GAF response. Our model explains 45 percent of the variability in attitude scores measured during 2012-14. This is a respectable result. Of the *explained* variance, 29 percent can be attributed to the Unions - some of this to unknown local clusters of particularly traditional or particularly liberal attitudes, the rest to the influence of the Field Facilitators. At the electoral ward level, the proportion is more extreme. Of the explained variance, 55 percent is due to the wards - again some to unknown local circumstances, and a lot to the way the Community Facilitators managed the GAF process. Only 16 percent are traceable to the measured variables such as previous attitudes, DASCOH's work and the socio-economic baseline. That is a mere 0.16 * 45 = 7 percent of the total variance.

Figure 7: Variance explained by measures vs. volunteer and staff influence



There are two views for doing justice to those conducting the GAF activities. The first emphasizes that every volunteer and fieldworker struggled with a **unique local situation**. Every one naturally leaned on common experiences in his or her area. Therefore the response pattern within a ward or Union does reflect average attitudes in the area even if the individual data points are unreliable.

The second blames a **common factor** - the instrument, which was the same for all. The volunteers were overwhelmed having to administer 29 questions. The format itself - questionnaire, group discussion, short sessions - generated a high level of measurement error. The volunteers, heroically, steered the group conversations and recorded as much as possible in the way of answers to the specific questions.

The practical difference is minimal. The first view says that we can primarily see, in the response reported by the volunteers, wards and Unions with more traditional or more equitable gender role attitudes, and only a small bit of general trends over the years. The second assumes that the local differences are primarily statistical noise, and the general trends are still valid. In both views, the general findings have to be taken with caution. Yet several of them, as we discussed, are relevant and robust.

Conclusion and outlook

Gaps and achievements

The SDSD in Sunamganj has been conducting gender analysis with almost a thousand communities for four years. During this period, it has kept the format strictly the same. These efforts have created a platform on which the communities have started, and appear to be continuing with enthusiasm, a public conversation about gender roles.

DASCOH's water and sanitation activities have certainly acted as door-openers, but the conversations took a dynamic of their own, and the recorded changes towards more gender-equitable attitudes do not seem to depend much on the delivery of physical infrastructure. Rather, it was productive that the project created a formal setting for collective reflection, apart from the operations surrounding specific infrastructure and hygiene promotion.

The format caused community volunteers to record a complete set of responses to as many as 29 gender-related items. The size and completeness of this dataset testifies to DASCOH's monitoring abilities. These data are amenable to statistical analysis; the distribution of gender role attitudes can thus be mapped to considerable depth.

There emerges a clear attitude change from 2011 and 2014. Even if we downgrade the 2011 exercise to a mere pretest, the movement towards more gender-equitable attitudes between 2012 and 2014 is still significant. The speed of change was uneven; yet communities rated very traditional in 2011 tended to catch up afterwards.

This is a strong result. There are reservations to make, though. We know very little about change in actual behavior. The GAF process creates little written information on behavior. There may be action plans created in these sessions, and records may be kept at least on how some of the communities put them into practice, but none of this percolates upwards to the point where DASCOH can document actual new behavior.

Second, the attitude data themselves are weak. Because the sample is large, and the data collection was disciplined and complete, the statistical models do produce significant effects. These are barely audible through dense noise. The influence that the volunteers and frontline workers had on the recorded response is excessively strong. The instrument, in its current form, is suitable neither for the action research with the village participants not for the production of rigorous evidence of the gender-related outcomes that the SDSD pursues. At the same time, DASCOH has done little to tap into the treasure house of

qualitative experience that its hundreds of volunteers and dozens of fieldstaff must have gathered criss-crossing 988 villages during four years.

Recommendations

However a good foundation has been laid; DASCOH should find it easy to build on it. These recommendations distinguish between the action research and the outcome evidence uses of the GAF:

On the action research side, the SDSD should continue what has worked so well: a formal setting devoted to gender analysis, its periodic activation in every participating village, and the use of a standard instrument as well as of local volunteers trained to apply it. What should be changed it the modality of the instrument and, if the GAF meetings continue to make action plans, the follow-up and document-ation of these.

The number of questions needs to be reduced to far fewer (5 to 10) - so few that, on each of them, the facilitator can conduct the meeting through a small sequence of points:

1. "Nowadays, who typically performs activity X?"
2. "Should this be changed at all?"
3. "If yes, how should it be changed?"

The emphasis on the "how", rather than the "who", will stimulate greater creativity; the response will not only express dissatisfaction with existing gender roles, but will signal to DASCOH whether communities:

- Persist in the traditional gender role aspect
- Wish to change, but vaguely so, with only a general appeal to women's rights and men's duties
- Wish to change, and have specific ideas of how to do so
- Have specific change ideas that relate to the SDSD project potentials.

From a data management viewpoint, of course, DASCOH, with its strong tradition of highly standardized surveys, will be challenged to work out a system to assimilate the

qualitative diversity of the "How should it be changed?" part. But, this too should be feasible through trial and error.

For **rigorous evidence of outcomes** in gender equity, a number of steps will be necessary. The GAF instrument will not itself directly supply such evidence:

A qualitative research phase should precede any new initiatives to develop quantitative measures of gender equity parameters. This is necessary because before we count or measure we need to have the right distinctions. This phase can be designed and executed entirely with the existing SDSD resources and in Bangla. It is a matter of asking the right questions and presenting the right incentives so as to harness the knowledge and wisdom of the volunteers and field staff.

For example, under the working title *"A story of men and women in an SDSD project village - what can DASCOH learn from the people?"*, all volunteers and field staff can be invited to write stories or small essays. Essays need not be academic - each participants could simple strive to find an example each and narrate it in simple language under headings like these: *"A. An example of how we failed - why?"; "B. An example of how we faced difficulties and overcame them - why?", "C. An example of how our plan worked as initially designed- why?"*

Here the challenge will be for the DASCOH senior and M&E workers to iteratively develop a category system into which to log the key insights from the stories. If suitable, this can be done in a contest, with the best submissions honored and used in seminars where others can comment and further contribute. Other arrangements, perhaps closer to the "Most Significant Change" technique (Davies and Dart 2005), may serve the purpose as well. In this approach, the best submissions are selected in the field, by the next higher supervisor who comments on his preferred choice while he forwards the whole bundle of contributions upwards. At every higher level, seniors narrow down the selection of best submission with their own further comments. While the technique has been tested in Bangladesh, it requires a mature project organization and senior staff commitment. Regardless, this qualitative phase should be conducted entirely in spoken and written Bangla, to provoke a wave of participation and creativity clear of language barriers.

Once DASCOH has distilled the gender analytic substance from the qualitative research activity, it can determine the need and way forward for the production of any kind of rigorous evidence that seems worth the effort at that stage of the SDSD. If it confirms the need, the most productive course to pursue would not be to go to all villages. It is more likely that outcome and impact relevant information would be available at the household and Union Parishad levels. The first would call for household sample surveys. The second for full enumerations of whatever information items are of interest in the 25 councils that are SDSD's partners in Sunamganj. These components may need the involvement of outside experts, such as in gender studies and local government reform. We repeat the observation made by Carrard et al. (see page 12) that there is a research gap regarding the gender-equity outcomes of WASH programs at administrative levels

higher than then local village. This opens a niche for DASCOH to thoughtfully present its work with Union Councils such as in the SDSD in Sunamganj.

In essence, it is recommended that DASCOH consider the further developments of the action research and of the outcome demonstration tools for the GAF separately.

Outlook

With the application of the GAF in the SDSD, DASCOH has further demonstrated that its mode of operation is fully mainstreamed into the modern WatSan philosophy. The pivot of this is the integration of technical provision and social engagement. The GAF process responds to a priority, given the conditions of women and girls in the assisted communities. By all appearances, in Sunamganj it has successfully engaged men and women in public conversations on gender equity. It has, if not produced by itself, facilitated and documented a shift towards more equitable attitudes.

The curious observer would now like to see what behavior changes are following. At this point of the GAF process, one expects DASCOH to summarize the action plans that the meeting participants made, and what has become of them. And this analysis might as well be done with methods and resources that stay closer to home. It can be instructive, as done for this study, to collect a large set of standardized data and then hand them to a remote consultant to detect patterns with the help of arcane analysis methods. Truer to the spirit of empowerment and ownership, however, DASCOH may want to strengthen its perceptual apparatus with qualitative methods practiced among Bangla speakers. Gender equity observations should be easy to transport in this medium.

Appendix

Tables and figures in the appendix are not captioned.

Recoding the original GAF response

The GAF questionnaire consisted of 29 closed questions, with three identical response options throughout. The option most frequently used in the first year (2011) was considered the traditional one (question #21 has two traditional options). The categorical variables were re-coded dichotomously, coded as 1 if any non-traditional option was chosen, else 0. This table reports how the non-traditional options were determined.

Item no.	Original question - English version of the GAF Manual	Item short title	Response frequencies in 2011				Non-traditional options in the binary re-coding
			Women	Men	Both	Total	
	A. Household level/ context						
	Household work						
1	Who collects and keeps water	Water	984	3	1	988	"Men" or "Both"
2	Who takes care if anybody sick	Sickcare	953	5	30	988	"Men" or "Both"
3	Who looks after the children and aging	Familycare	946	7	35	988	"Men" or "Both"
4	Who cooks and do the household work	Household	981	4	3	988	"Men" or "Both"
5	Who cleans the latrine	Clean latrine	803	107	78	988	"Men" or "Both"
	Income generating work						
6	Who cultivate vegetables/ home gardening and poultry rearing	Garden, poultry	902	48	38	988	"Men" or "Both"
7	Who involved in agriculture, fisheries and livestock rearing	Farm and fish	49	891	48	988	"Women" or "Both"
8	Who is the main earner of the family	Main earner	3	936	49	988	"Women" or "Both"
	Decision making						
9	Who decides the site for tube-well or latrine	Select site	7	794	187	988	"Women" or "Both"
10	Who decides the family expenditure	HH budget	5	889	94	988	"Women" or "Both"
11	Who decide the investment plan from the loan	Loan use	6	883	99	988	"Women" or "Both"

12	Who decides to go to doctor if anybody feel sick	See doctor	6	836	146	988	"Women" or "Both"
13	Who control mobility of the family members	Mobility	3	918	67	988	"Women" or "Both"
	B. Village/Social context						
	Participation in different activities in the village						
14	Who participate to take decision in different social work and festival	Social events	5	797	186	988	"Women" or "Both"
15	Who lead in important position of the society	Leadership	3	956	29	988	"Women" or "Both"
16	Who participates in training and workshops	Trainings	4	753	231	988	"Women" or "Both"
17	Who participates in different committee meeting	Committ.part.	4	832	152	988	"Women" or "Both"
18	Who lead the various responsibilities of the committee	Committ.lead	1	904	83	988	"Women" or "Both"
19	Who collect cost-sharing money of water points and latrine	Collect money	1	900	87	988	"Women" or "Both"
	Decision making in different activities at the village level						
20	Who influence to make decision in various meetings	Influence	11	905	72	988	"Women" or "Both"
21	Who talks about the need of water and latrine	WatSan agenda	519	353	116	988	"Both"
22	Who decides the site of the water options/ latrine	WatSan siting	11	804	173	988	"Women" or "Both"
	Control of resources at the village level						"Women" or "Both"
23	Who keeps and manage the cost-sharing of community	Manage fund	1	891	96	988	"Women" or "Both"
24	Who is the owner of the tube-well/ dug-well	Owns wells	3	834	151	988	"Women" or "Both"
	C. LGI and Service Provider Agencies level/context						
	Opportunities for services from government/ NGOS						
25	Who attend in meeting, govt. office, bank etc	Meetings	2	761	225	988	"Women" or "Both"
26	Who communicate or liaison with UP	UP liaison	1	863	124	988	"Women" or "Both"
27	Who participate in the UP arranged meetings discussion	UP discussion	5	832	151	988	"Women" or "Both"

	among the people						
28	Among the arsenic infected patients who get the facilities from health center (if applicable)	Arsenic care	5	306	317	628	"Women" or "Both"
29	Who gets the scope to information regarding safe water, arsenic and other issues	Arsenic info	29	551	408	988	"Women" or "Both"
	Traditional attitude pole						
	The only item with significant gender sharing already in 2011.						

Rasch model of gender attitude change

After recoding the GAF response into dichotomous variables, with zero for the traditional pole, and 1 for the non-traditional (generally more gender-equitable) pole [as detailed above], separate Rasch scales were calculated for the three domains - household, village and NGOs / Union Councils. In addition, a cross-domain scale was calculated that used 26 out of the 29 items.

The Rasch model (Wikipedia 2013) was chosen for the reasons given on page 20.

The language that we employ in the main section to describe procedure and results is in part didactical and technically not always correct. What we call "attitude scores" there are, in proper Rasch language, the latent traits. The "item weights" are the difficulty parameters. The latent traits result from a complex iterative process and are not simply the sum of the items weighted with the difficulty parameters. The "reliability index" is the Personal Separation Index (PSI), which is a measure of certainty that subjects with high estimated latent traits are actually in the high range of the trait (Linacre Undated).

Readers wishing to learn more about the internal mechanics of the Rasch model may find a nice Excel-based demonstration at http://raschsig.org/EDS_Rasch_Demo.xls.

Since the subjects (= villages) were measured repeatedly (four times between 2011 and 2014), special care was taken to eliminate the within-subject dependency in the estimation of the difficulty parameters. We followed the recommendation by Mallinson (2011) to estimate the model at first with a sub-sample in which every subject appears only once.

These steps were taken:

1. The four annual GAF datasets were stacked into the so-called long-shape format.
2. The 29 variables were re-coded into binary items.
3. A random sub-sample was drawn such that each village appears once, and each of the four years appears with the same frequency.

4. Separately for each domain, a Rasch model was estimated on the sub-sample, and the difficulty parameters saved (Mallinson calls them "anchors").
5. The models were rerun, on the full dataset, using the respective anchor values, to produce the latent traits for all villages and years.
6. For the three domain latent-trait variables, the two-year lagged variables were created, so that 2012 and 2014 values could be compared in the same records.
7. For the paired latent trait values in each domain, the equality of their medians in 2012 and 2014 was tested using the sign test variant of equality tests on matched data.
8. Finally, a model combining 26 items from all three domains was estimated, again at first on the anchoring sub-sample, and then on the full dataset (steps 4 and 5).

The Rasch models were implemented in Stata, using Hardouin's (2007) *raschtest* procedure. This table, in addition to the Rasch-based PSI, gives also Cronbach's alpha from classic test theory (Wikipedia 2014a):

Model	Items used	Cronbach's alpha	Rasch: PSI
Household domain	11	0.73	0.61
Village domain	11	0.71	0.56
NGO / UP domain	5	0.64	0.41
Cross-domain	26	0.84	0.77

In the classic perspective, all four item sets are scalable with acceptable internal consistency. The more demanding Rasch PSI rated the NGO / Union Council scale (with only five items and a considerable number of missing values in one of them) as poor. Only the 26-item cross-domain scale achieves good reliability.

Regression model for the 26-item gender attitude score

A mixed model of fixed effects of measured covariates of interest as well as of random effects of electoral wards and Unions - administrative entities covered each by one SDSD Community Facilitator, respectively Field Facilitator - was formulated. Given the three-year panel set-up, the choice of the residual error structure was critical. Experiments with an autoregressive structure (AR-1) were not satisfactory, presumably because of the inclusion of the lagged dependent variable on the right-hand side. We opted for an independent residuals type, with distinct variance for each year. The various models were estimated with Stata's *xtmixed* command (See, e.g., Marchenko 2006); we report only the one model finally retained.

Effective sample

DASCOH collected data on village size, household poverty rankings and WatSan facilities in 2011, 2012 and 2013. The 2011 data are not considered sufficiently reliable to serve as a baseline. Agreement between the next two annual measurements generally is good. We excluded from the regression models a small number of communities for which stark deviations were noted between the 2012 and 2013 values. Specifically we excluded

- 18 communities with 400 or fewer households in 2012 for which the absolute difference in household numbers was 100 or more
- 34 communities for which the absolute difference in the fraction of middle-class and rich households was 0.2 or more
- 10 communities for which the fraction of households using hygienic toilets was lower in 2013 by 0.1 or more (communities with significant improvements were not excluded)

We considered differences of those kinds and extents implausible. Since we had no way of telling whether an error had actually occurred or not, and whether it was made in 2012 or 2013 or in both years, we excluded the cases from the effective sample. This now includes 928 villages and hamlets, a loss of 60 communities or roughly 6 percent.

The exclusions are not unproblematic. The 60 excluded communities professed more traditional gender attitudes than the 928 included ones did. However, this difference was statistically significant only for the year 2012, not afterwards.

The resulting grouping variables are:

```
variable name   type   format      label      variable label
-------------------------------------------------------------------------------------
pol_upazilaenc  long   %9.0g       upazilaenc Upazila [sub-district][encoded]
pol_unionenc    byte   %17.0g      unionenc   Union [encoded]
pol_UnionWard   float  %9.0g       UnionWard  [unique Electoral Ward identifier]
sl               int    %10.0g                  "Slate number" [unique village identifier;
                                                panel variable]
```

with these many distinct values:

```
                 |        Observations
                 |      total   distinct
-----------------+----------------------
 pol_upazilaenc |       2784          4
   pol_unionenc |       2784         25
  pol_UnionWard |       2784        223
             sl |       2784        928
```

Descriptive statistics

Dependent variable

The latent trait of the combined 26-item Rasch model is the measure of interest, expressing the overall gender role attitude that the annual GAF meetings expressed in the 928 effective-sample communities. Because of the warm-up character of the 2011 exercise, only the 2012 - 2014 values are included.

Descriptive statistics

```
              storage  display     value
variable name   type   format      label      variable label
-------------------------------------------------------------------------------------
all26traitAll   double %10.0g                 Latent trait of the 26-item Rasch model
sample3years    byte   %8.0g                  Records 2012-14, outliers in 3 vars excluded
```

```
. summ all26traitAll if sample3years , detail

                        all26traitAll
-------------------------------------------------------------
      Percentiles      Smallest
 1%    -2.120358      -2.950306
 5%    -.9998324      -2.950306
10%    -.9460672      -2.950306       Obs                2784
25%    -.4104391      -2.950306       Sum of Wgt.        2784

50%     .9225367                      Mean           .4178391
                        Largest       Std. Dev.      1.034091
75%      .939596       3.060145
90%     .9960078       3.060145       Variance       1.069344
95%     2.053886       3.060145       Skewness      -.2698222
99%     2.848125       3.801114       Kurtosis       3.221088
-------------------------------------------------------------
```

Although skewness and kurtosis are not too far from the values of a normal distribution, the variable failed the Shapiro-Francia test for normality. This is so because of polarity of attitudes as seen in the two-mode distribution (see density graphs in the main part).

It would therefore seem convenient to transform the latent trait to its normal scores. However, this is contrary to the spirit of the Rasch model with its finely graded ratio-level latent trait. The normal scores would inflate differences in the center of the distribution and specifically the effect of the year 2013 relative to that of 2014.

We tested the different outcomes - for the untransformed latent trait vs. its normal-scored values - in a multi-level random effects model with communities (each of them observed in 2012 - 2014), electoral wards (areas of Community Facilitators), and Unions (areas of WatSan Field Facilitors), without fixed-effects covariates. The differences in the variances were minor. We therefore felt that the further modeling could proceed using the untransformed latent trait.

Fixed-effects covariates

Ambient socio-economic factors, incl. pseudo-baseline WatSan variables

These variables were collected in 2012; in our dataset, their values remain identical during 2012-14. The baseline is "pseudo" because it was established after the first GAF exercise; see above.

```
variable name   type   format      label      variable label
-------------------------------------------------------------------------------------
pol_fracmiddle  float  %9.0g                  Fraction HH middle-class or rich
pol_frac_hh_o~s float  %9.0g                  Fraction households with members working
                                                overseas
pol_fracpop12~S float  %9.0g                  Fraction 12 to 18 year-old with more than
                                                primary education
pol_DistNearC~r double %10.0g                  Distance from nearest commercial center (km)
magnitHH        float  %9.0g                  Households in the hati (log10)
pol_arsfree10~H float  %9.0g                  Arsenic-free water options per 100 HH
pol_frachygie~c float  %9.0g                  Fraction HH w. hygienic toilets
```

Descriptive statistics for the effective sample

Variable	Obs	Mean	Std. Dev.	Min	Max
pol_fracmi~e	2784	.2461356	.1452302	0	.9672131
pol_frac_h~s	2784	.044563	.0758037	0	.6796116
pol_fracpo~S	2775	.3611767	.2200502	0	.9607843
pol_DistNe~r	2784	3.763685	3.500765	0	25
magnitHH	2784	2.025424	.254303	.7781513	2.757396
pol_arsfre~H	2784	11.15627	10.19582	0	91.25
pol_frachy~c	2784	.0500614	.0771189	0	.7540984

Note the small number of missing values in the education variable, the fraction 12 to 18 year-old with more than primary education. It reduces the effective sample in the regression model by another 9 observations.

To contain the extreme influence of outliers, the variables with the prefix "pol_" were winsorized at the high end, replacing the highest 5 percent of the values with the 95-percentile values (Wikipedia 2014b), resulting in

Variable	Obs	Mean	Std. Dev.	Min	Max
wins_fracm~e	2784	.2415349	.1333807	0	.5058824
wins_frac_~s	2784	.0385879	.0512466	0	.1847826
wins_fracp~S	2775	.3576779	.2127506	0	.7538462
wins_DistN~r	2784	3.612823	3.019805	0	11
magnitHH	2784	2.025424	.254303	.7781513	2.757396
wins_arsfr~H	2784	10.50274	7.784028	0	31.79191
wins_frach~c	2784	.0440494	.0532008	0	.1851852

Furthermore, to safeguard against excessive variance inflation in the regression model, the (winsorized) variables (plus the number of households, log10) were orthogonalized, i.e. converted to uncorrelated variables. It proceeded in this sequence:

variable name	type	format	label	variable label
o_middle	double	%10.0g		Fraction HH middle-class or rich (winsor. and orthog.)
o_overseas	double	%10.0g		Fraction households with members working overseas (winsor. and orthog.)
o_minHS12to18	double	%10.0g		Fraction 12 to 18 year-old with more than primary education (winsor. and orthog.)
o_DistNear	double	%10.0g		Distance from nearest commercial center (km) (winsor. and orthog.)
o_magnitHH	double	%10.0g		Households in the hati (log10) (winsor. and orthog.)
o_arsfree	double	%10.0g		Arsenic-free water options per 100 HH (winsor. and orthog.)
o_hygienic	double	%10.0g		Fraction HH w. hygienic toilets (winsor. and orthog.)

The orthogonalization implies an order of importance among the variables. For example, the "Fraction households with members working overseas" enters the regression model only in that part of its information which has not yet been present in the fraction of middle-class and rich families. Etc. Therefore the WatSan "baseline" variables, at this point, are nothing but the residuals after regressing them on all preceding variables in this o_-prefixed list.

Program output - cumulative sunk tubewells and installed latrines

The cumulative numbers of tubewells sunk and of latrines installed in the *hati* for each year were computed. These variables were lagged by one year, in order to obtain the cumulative values up to the previous year:

```
variable name   type   format      label      variable label
-------------------------------------------------------------------------------
Lsumserv_NoTW   float  %9.0g                   Tubewells installed, cumulative up to
                                                 previous year
Lsumserv_NoL    float  %9.0g                   Latrines constructed, cumulative, up
                                                 to previous year

. summ  Lsumserv_NoTW Lsumserv_NoL if sample3years

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
Lsumserv_N~W |      2784    .9342672    1.392058          0         14
Lsumserv_NoL |      2784    2.702945    4.337924          0         38
```

The number of hygiene promotion sessions was not used because in a given year all *hati* received the same number.

The two cumulative output variables were orthogonalized in the effective sample, for the same reason as noted for the socio-economic factors:

```
variable name   type   format      label      variable label
-------------------------------------------------------------------------------
Losumserv_NoTW   double %10.0g                     Tubewells installed, cumulative up to
                                                 previous year (orthogonalized)
Losumserv_NoL    double %10.0g                     Latrines constructed, cumulative, up to
                                                 previous year (orthogonalized)

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
Losumserv_~W |      2784   -3.56e-17     1.00018  -.6712614   9.387595
Losumserv_~L |      2784   -7.17e-18     1.00018  -4.565749   9.271072
```

Previous attitudes; program year

Previous attitudes were measured as the Rasch model latent trait in the preceding year and technically as the one-year lagged trait. The program year was entered categorically (i.year), with 2012 as the base.

```
variable name   type   format      label      variable label
-------------------------------------------------------------------------------
L1all26traitAll float  %9.0g                   Latent trait, one year lagged
year            int    %9.0g                   Year
```

The Pearson correlation coefficient between latent trait and its one-year lag in the effective sample is 0.29.

Stata regression command

The *xtmixed* procedure was used:

```
xtmixed all26traitAll i.year##c.L1all26traitAll Losumserv_NoTW Losumserv_NoL  o_* ///
if sample3years, vce(cluster  pol_upazilaenc)  || pol_unionenc:, covariance(identity) ///
|| pol_UnionWard:, covariance(identity) residuals(independent, by(year)) variance
```

Regression results

```
Mixed-effects regression                        Number of obs      =      2775

------------------------------------------------------------
                |   No. of       Observations per Group
 Group Variable |   Groups    Minimum    Average    Maximum
----------------+-------------------------------------------
   pol_unionenc |       25         45      111.0        183
   pol_UnionW~d |      223          3       12.4         33
------------------------------------------------------------

                                                Wald chi2(3)       =         .
Log pseudolikelihood = -3533.1617               Prob > chi2        =         .

                                   (Std. Err. adjusted for 4 clusters in pol_upazilaenc)
------------------------------------------------------------------------------------------
                        |               Robust
         all26traitAll |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------------+------------------------------------------------------------------
Year (base = 2012)
                 2013  |   .1405757   .1529942     0.92   0.358    -.1592875    .4404389
                 2014  |   .5020532   .2430246     2.07   0.039     .0257338    .9783726
                       |
Previous attitudes
       L1all26traitAll |   .1925783   .0479555     4.02   0.000     .0985873    .2865693
                       |
year#c.L1all26traitAll |
                 2013  |  -.3652248   .1475401    -2.48   0.013     -.654398   -.0760516
                 2014  |  -.4822351   .0736285    -6.55   0.000    -.6265442   -.3379259
                       |
Program outputs
        Losumserv_NoTW |   .0249773   .0196236     1.27   0.203    -.0134842    .0634388
         Losumserv_NoL |   .0179989   .0046739     3.85   0.000     .0088381    .0271596

Socio-economic baseline
              o_middle |  -.0000505   .0072378    -0.01   0.994    -.0142363    .0141354
            o_overseas |   .0277434   .0074025     3.75   0.000     .0132347    .0422521
         o_minHS12to18 |   .0158078   .0128589     1.23   0.219    -.0093952    .0410108
            o_DistNear |   .0040638   .0104276     0.39   0.697     -.016374    .0245015
            o_magnitHH |  -.0029268   .0173585    -0.17   0.866    -.0369488    .0310952
WatSan baseline
             o_arsfree |   .0109313   .0124019     0.88   0.378    -.0133759    .0352385
            o_hygienic |    .001831   .0047033     0.39   0.697    -.0073874    .0110494

                 _cons |   .2967154   .0764749     3.88   0.000     .1468273    .4466034
------------------------------------------------------------------------------------------

------------------------------------------------------------------------------
                            |               Robust
  Random-effects Parameters |   Estimate   Std. Err.     [95% Conf. Interval]
----------------------------+-------------------------------------------------
Union level: Field Facilitators
pol_unionenc: Identity      |
                 var(_cons) |   .2036104   .0219457      .1648371     .251504
----------------------------+-------------------------------------------------
Ward level: Community Facilitators
pol_UnionW~d: Identity      |
                 var(_cons) |   .3021165   .0283837      .2513068    .3631989
----------------------------+-------------------------------------------------
Residuals
Residual: Independent,      |
    by year                 |
                2012: var(e) |   .7528313    .186926      .4627502    1.224754
                2013: var(e) |   .5358727   .0771673      .4040974    .7106197
                2014: var(e) |   .6288235   .1442825      .4010717    .9859061
------------------------------------------------------------------------------
```

Variance component allocation

For convenience, the dependent variable was regressed on the random- and fixed effects predictions, with a Shapley and Owen decomposition of R-squared. The Stata procedure *rego* (Huettner and Sunder 2012) was used:

```
--------------------------------------------------------------------------------
Gr        Regressor |       Coef.      Std.Err.   P>|t|  Std.Coef. Shapley %R2
--------------------+-----------------------------------------------------------
 1     Union effect |    1.022367 ***  .0413704   0.000     0.3536     28.9057
 2      Ward effect |     1.14001 ***  .0317447   0.000     0.5249     54.7727
 3          Lpfp(*) |     1.04877 ***  .0437153   0.000     0.3512     16.3216
 -        Intercept |   -.0211291      .0223739   0.345
--------------------+-----------------------------------------------------------
(*)Linear prediction, fixed portion

       Observations |        2775
         Overall R2 |     0.44702
           Root MSE |    .7701177
      F-stat. Model |    746.6888 ***            0.000
     Log Likelihood |    -3210.69
--------------------------------------------------------------------------------
```

The bar chart on page 34 is based on this calculation.

Marginal effect of attitudes in the preceding year

These marginal effects were computed and graphed with the Stata procedure *marginscontplot* by Royston (2013).

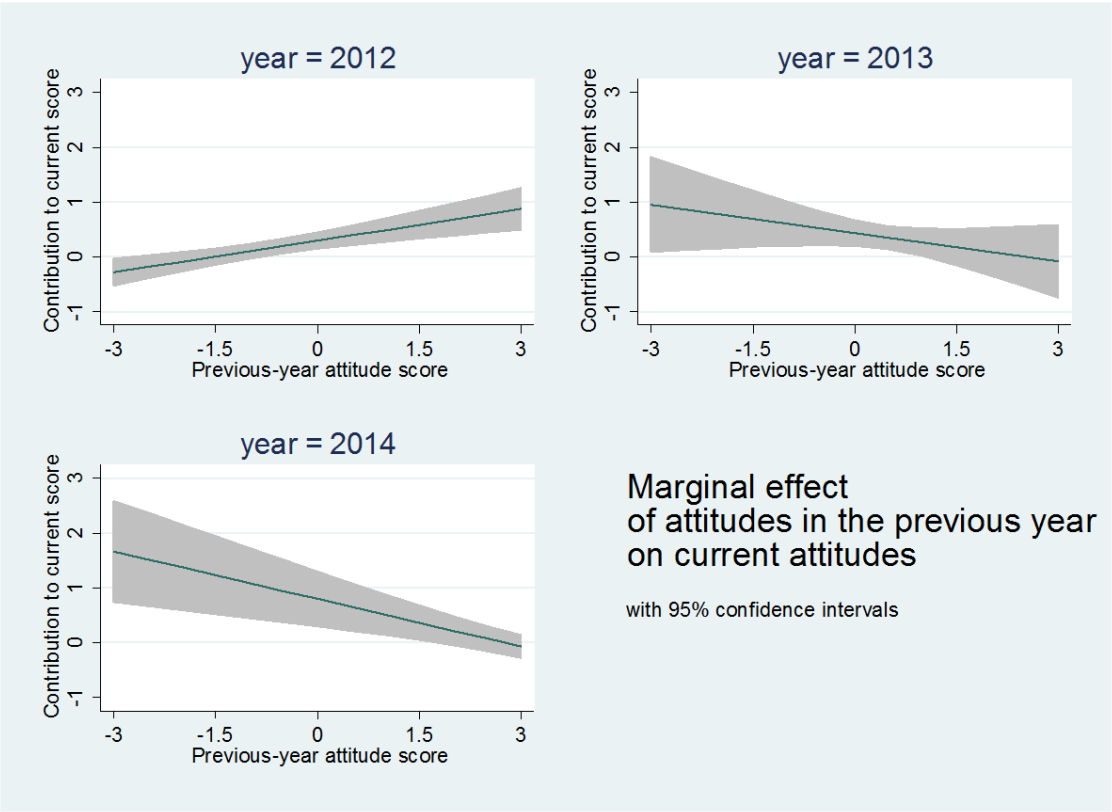


Figure 6 on page 32 is a simplified version of this graph, minus the confidence intervals.

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About the authors

Aldo Benini has a dual career in rural development, with a focus on Bangladesh and another on organizations of the poor, and in humanitarian action. In the latter capacity, he has worked for the International Committee of the Red Cross, for the Global Landmine Survey as well as for the Assessment Capacity Project. He has a Ph.D. in sociology from the University of Bielefeld, Germany, based on field research in community development in West Africa.

Between 1983 and 1986, Benini was the program coordinator of a large rural development NGO in northwest Bangladesh. He has since assisted NGOs in Bangladesh in various advisory capacities, including DASCOH's work with community-based organizations in Rajshahi and its baseline survey in Sunamganj District.

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