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Investigating Costs and Benefits of Collaborative Research

The results of surveys of IFS collaborative research aspirants and grantees regarding IFS efforts to promote the benefits and reduce the costs of research collaboration assessed after one year

Haylor, Graham; Porter, Brian; Ghezae, Nighisty and Savage, William

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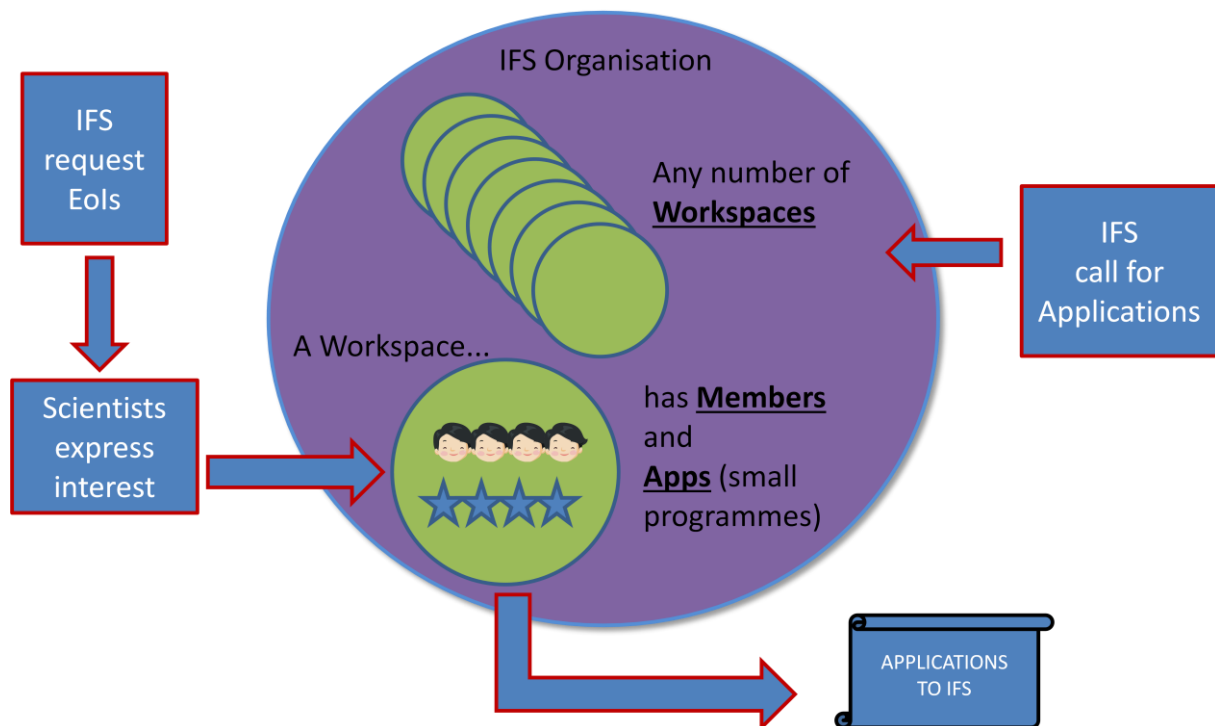
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1 Introduction

In 2012, after 40 years of support to individual researchers within the developing world, the International Foundation for Science (IFS) laid out a rationale and plans to support research collaboration. We characterized the challenges and requirements, built on our understanding of science research funding, visited and sought learning from experienced organisations, and reviewed the academic literature and articulated our new ideas. We investigated, designed, built and tested Information Communication Technology (ICT) tools, especially social networking media with relevant tools to enable searching, interaction and collaboration (built on the PODIO digital platform). We invited eligible scientists who expressed interest into the research collaboration social network and provided mentors to support the process. It was into this 'network' that we placed a call for collaborative research proposals. The process is summarized in Figure 1.

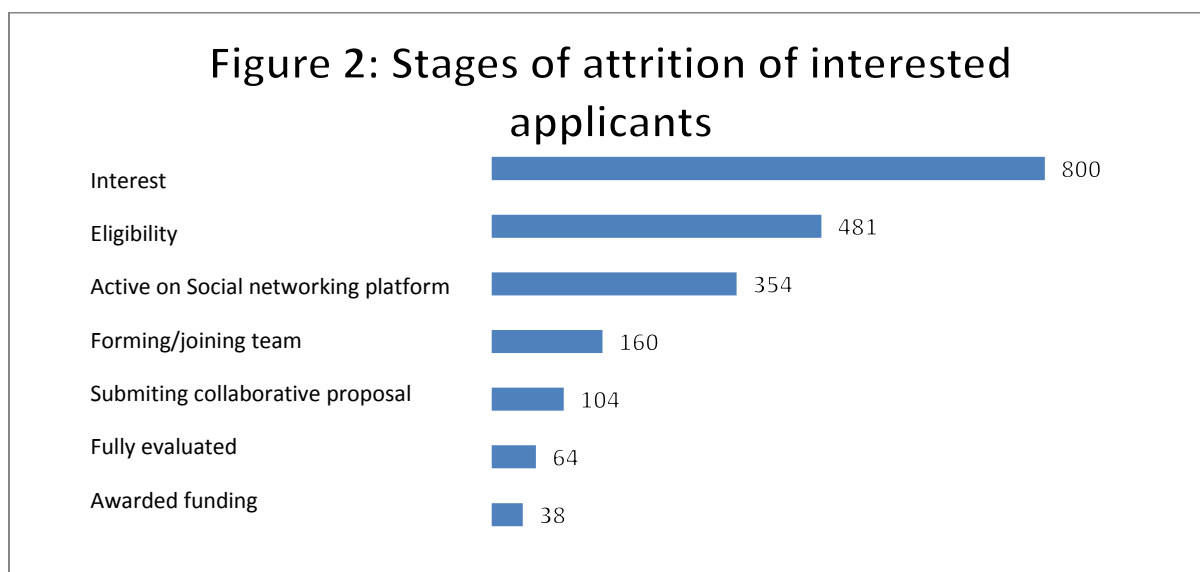
Figure 1: The IFS collaborative research application process



The first call for collaborative research proposals (2012-13) featured five pilot countries in West, East and Southern Africa: Ghana, Nigeria, South Africa, Tanzania and Uganda. It encouraged research that would aim to support the understanding and use of neglected and underutilised species.

Figure 2 highlights the attrition of applicants over the course of the research design and evaluation process. Over a 2-week period, following online and poster-based advertising targeted at eligible

scientists in the selected countries, 800 on-line expressions of interest were received. Of these, 481 interested parties fulfilled the eligibility criteria and were imported into the social networking site built by IFS to support researchers to find colleagues from a range of countries and disciplines. In total, 354 colleagues were active on the site. IFS provided a 14-week window between the call and the submission deadline for teams to coalesce and design their approach. Teams could comprise three to five colleagues drawn from West Africa and working with colleagues from East and/or Southern Africa. Following multiple interactions and exchanges in the Plenary Working Space, where invitees landed and had access to each other's searchable Scientific Profiles, 40 teams were built, each requesting and working within their own protected Team Workspaces in the social networking platform. At the submission deadline, 25 teams submitted proposals and all were reviewed by multiple Scientific Advisers using qualitative and quantitative criteria. Advisers paid attention in their reviews to each individual researcher's planned contributions and research budgets, the way the individuals would combine as a team, and the collaboration budgetary components, as well as the relevance of the topic, the strength of the approach, and the proposed outcomes and timeframes. Seventeen teams passed 'Pre-screening' (an assessment process regarding eligibility and a light scientific screening) and all the involved scientists were invited to a week-long capability-building workshop. A one-day Collaborative Research Science Advisory Committee was convened to review the adviser's comments and advise a funding decision for each proposal. At the conclusion of the process, ten teams were awarded funding, representing just less than 5% of those expressing interest (see Figure 2).



Before embarking on the process outlined above, IFS conceptualized the possible benefits of collaborative research, and also the likely costs. In a Working Paper entitled 'Breaking Fences' we characterized seven commonly considered benefits and five commonly reported costs (see Haylor, 2012). We then designed the documentation, the software, and the process to try to maximize the benefits and reduce the costs of research collaboration for those involved.

To identify how the IFS Collaborative Research Approach was performing in these endeavours and against these 12 costs and benefits, IFS surveyed all those who were invited into the PODIO workspace (481 'Aspirants') and the first cohort of collaborative research team members (38 'Grantees') towards the end of the first year of their research collaborations.

2 Method

In March 2013 after the collaborative research proposal writing process, but before the outcome was announced, a 33-question survey (see Appendix 1) was designed and sent to the first cohort of 481 Aspirants, that is, those who requested to be invited into the IFS social networking software and had therefore received the call for collaborative proposals.

The objective was to understand more about what happened and to learn about aspirants' experiences of the networking and engagement process and the utility of the tools we had put in place to support this. As was reported in the introduction, we were able to determine from Podio that 354 of the 481 aspirants (around three-quarters) were active on the site. More specifically, the people who were invited into Podio (the survey population) can be divided into four logical groups:

- Those who built teams and submitted applications (22%)
- Those who built teams and did not submit applications (11%)
- Those who did not build teams, but were active in Podio (40%)
- Those who expressed interest, were invited into Podio, but were then not active (25%)

To address the different groups of people with only relevant questions, we used the skip logic in Survey Monkey (see Appendix 1), so as to address each person with only those questions that were relevant to them, depending on which logical group they belong to.

At the end of 2014, after almost one year of collaboration by the teams that received funding, a 21-question survey was designed and sent to all 38 grantees involved in the IFS Collaborative Research Approach pilot (see Appendix 2). The objective was to learn more from everyone's experience about the collaborative research process. Most questions were in the form of a statement, and colleagues were asked to indicate how much they agreed or disagreed with the statement from their own experience with IFS collaborative research to date. There was also an option to add an explanation related to their answers. The questionnaire was anonymous to avoid bias in answers from grantees. The questions were designed to understand people's perceptions of the costs and benefits of research collaboration based on the expected costs and benefits described by IFS at the outset.

3 Results and Discussion

3.1 The Aspirants' survey

The aspirants' survey (2013) was conducted to understand more about what happened, and to learn about aspirants' experiences of the networking and engagement process and the utility of the tools we had put in place to support this. A breakdown of the cohort of aspirants that was surveyed and their response rates are shown in Table 1.

Table 1: IFS 2013 Pilot Collaborative Research participants' survey

	Total	Ghana	Nigeria	S. Africa	Tanzania	Uganda
Received invitation to survey	481	85	233	21	68	74
Responses	123	24	49	3	24	23
%	26%	28%	21%	14%	35%	31%

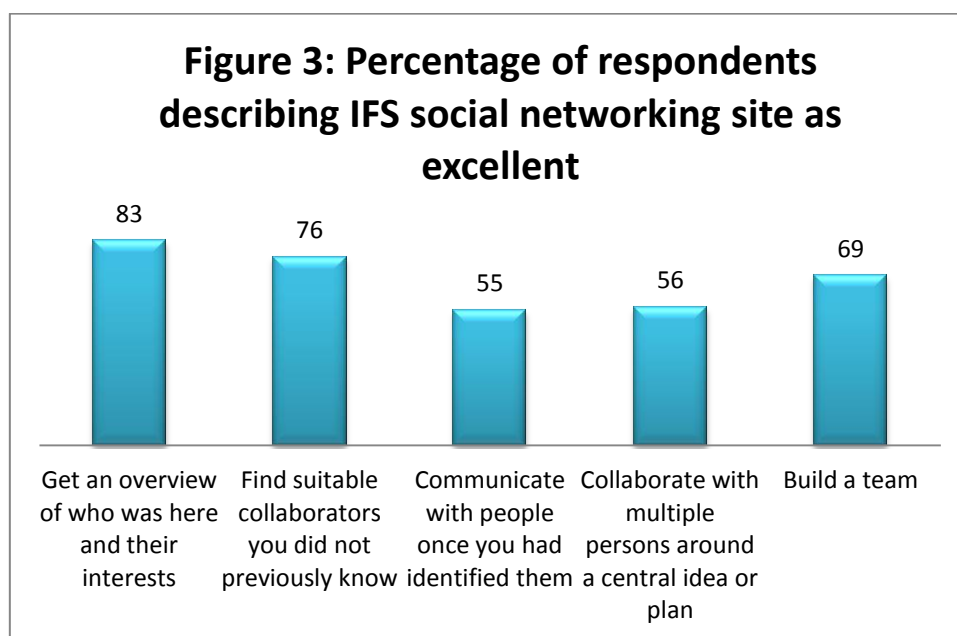
Whilst the national response rates varied from 14-35%, the overall response rate was 26%. According to Penwarden (2014) this compares to an average response rate for email surveys of 24.8%.

Why people expressed interest

Over three-quarters of those expressing interest in our process were driven by their interest in collaborative research, although 60% had never experienced research collaboration. Less than one-third were already involved in the research theme of neglected and underutilized species. Less than 10% were previous IFS grantees.

The use of social networking

Whilst everyone was new to the IFS social networking platform and no one had previously used Podio, more than 95% of respondents were users of a range of social media, most notably Facebook (almost 90%) and LinkedIn (over 70%). Over 92% of respondents found the IFS social networking site very usable, that is, easy to use (31%) or easy to learn (61%). The first action for most was to find and update their profile, many adding a photo. Then people quickly migrated into searching the profiles of others. The instructions sent out in advance to aspirants were found to be useful at this stage. Our moderators with universal site access observed the rapid emergence of natural leaders (within this context) who gathered others around their ideas, a number of these emerging later as successful team coordinators. Over 87% of respondents accessed the IFS social networking site via a personal laptop computer with 15% using a smart phone. Internet access available to respondents was most commonly described as satisfactory (43%); no one described their access as very bad. A large majority of respondents rated the IFS social networking site as excellent for its various purposes (see Figure 3).



The most used features were people's profiles (used by 97%) and the activity stream (a tool where people can post and respond to comments, used by 91%). The pre-prepared information and instructions for the IFS social networking site were used by a surprising 88% of respondents. The Apps (various digital applications, e.g., for searching candidates, co-editing documents, storing information, which we built or placed in the workspaces) were used by 84% of respondents.

Activity and team building

Almost 90% of respondents described themselves as active (compared to 74% of actual aspirants), and 65% of respondents were engaged in team building (compared to 45% of actual aspirants). Of those who built a team, over 98% wished to continue using the IFS social networking site during their research. Of those who did not build a team, they attributed their lack of success to failed team dynamics, other commitments, conflicts and communications difficulties, and losing team members and not being able to replace them, and not reaching agreements within the timeframe.

Of those who, having expressed interest, did not engage, over half reported that they were committed to other activities at the time of the call and could not engage, whilst 30% blamed poor internet connections. Two colleagues reported that they failed to understand how to use the system.

Table 2: Comparing experience and resources of aspirants against performance

Q. No.	Answer	No.	Performance					
			were active in Podio (Q.7)		were in a team (Q.15)		submitted a proposal (Q.26)	
			No.	%	No.	%	No.	%
1	Already doing NUS research	40	37	93%	25	63%	21	53%
	former IFS Grantees	12	8	67%	7	58%	6	50%
	had attended IFS workshop	9	8	89%	7	78%	5	56%
	not doing NUS research, but would like to	35	32	91%	20	57%	18	51%
	was interested in CR	94	86	91%	51	54%	44	47%
	was looking for funding	46	41	89%	24	52%	20	43%
3	Ghana	24	23	96%	15	63%	14	58%
	Nigeria	49	40	82%	25	51%	20	41%
	South Africa	3	3	100%	2	67%	-	-
	Tanzania	24	21	88%	11	46%	9	38%
	Uganda	23	22	96%	13	57%	12	52%
4	Yes [Experience of collaborative research]	49	39	80%	26	53%	23	47%
	No	74	70	95%	38	51%	32	43%
5	Yes [Experience of social networking]	117	105	90%	63	54%	54	46%
	No	6	4	67%	1	17%	1	17%
8	Very easy [Rating Podio]	29	29	100%	21	72%	18	62%
	Difficult in beginning	57	57	100%	41	72%	36	63%
	Difficult	7	7	100%	2	29%	1	14%
11	Excellent [Internet connection]	14	14	100%	11	79%	8	57%
	Satisfactory	40	40	100%	31	78%	26	65%
	OK, but slow	12	9	75%	7	58%	6	50%
	Sometimes on/off	27	19	70%	15	56%	13	48%

Looking at the resources and experience of aspirants compared to their success in engaging with the IFS social networking platform, forming a team and submitting a proposal, a number of themes emerge. There was a high motivation amongst those already involved in research involving neglected

and underutilized species, and a good performance of the small number who had attended an IFS workshop on the topic. Experience of collaborative research did not appear to be a good predictor of success in mastering the IFS system. Mastering the Podio software, whilst apparently simple, is critical, and whilst good internet access helps, success in submitting a proposal is highly achievable with a more limited connection.

3.2 The Grantees' survey

The grantees' survey was administered toward the end of the first year of collaboration on 24th October 2014 and closed on 14th December 2014. The response rate was 87% (33/38) and all respondents completed all questions. Because the survey was anonymous, the responses are not attributable to individuals or teams.

3.2.1 Promoting the benefits

Nudging from operational toward strategic benefits

The first approach by IFS to try to maximise the benefit from collaborative research, is one which addresses the level at which collaboration is encouraged. Conceptually, there are several levels at which collaboration can take place. According to Brousseau's (1993) contact theory, collaboration amongst different partners may be motivated by three main considerations: strategic, organisational and operational. As Traore and Landryn (1997) describe it, in *strategic partnerships*, partners determine the goals and directions of collaborative activities. In an *organisational collaboration*, collaborative activities are outlined, the budget requirements are determined, and the prospectus and the methodology of the research are defined. *Operational collaboration* concerns making decisions about the use of joint resources and the publication and diffusion of the results from collaborative research.

Detailed analysis by Traore and Landryn (1997) of collaboration by scientists reveals a complex set of intertwined factors that determine scientists' collaboration. Their conclusions from a research funding policy perspective suggests that "mechanisms should be put in place to encourage scientists to take an organizational and strategic approach concerning their relations with partners, as this approach will be beneficial to partners because strategic and organizational collaboration lead to increased joint outputs." Therefore, as IFS extended its support to research collaboration, we encouraged partners in the Collaborative Research Approach to determine the goals and directions of their collaborative activities, and to define together their budget requirements and the methodology of the research from the outset, that is at the application stage. Seventy-six percent (25/33) of the research collaborators supported by IFS reported that they determined the goals and directions of their collaborative research through working on these together¹. In other words, we were successful in encouraging three-quarters of the scientists to take an organizational and strategic approach concerning their relations with partners. This is an especially critical strategy for IFS-targeted recipients. They are scientists, early in their careers within the developing world, and as Traore and Landryn (1997) identify, scientists who start collaborating early in their careers are more likely to be operationally orientated in their collaborative decision-making. This then augers well for the application process to effectively shift an early-career scientist's orientation from the operational to the organizational and strategic and might be expected to enhance the benefits and productivity

¹ IFS 2014 Collaborative Research Survey (for questions, see Appendix 2)

of collaboration. The productivity of the research collaborations will be assessed at and beyond the end of the research period.

At the implementation stage, some of the potential benefits from research collaboration amongst early-career scientists were listed and characterized in our original rationale (Haylor, 2012). To shape and improve our approach to collaborative research support, the following seven specific benefits are being monitored and evaluated from the collaborative research pilot.

The sharing of knowledge, skills and techniques (proposed benefit 1)

Often, no single individual will possess all the knowledge, skills and techniques required in a research undertaking. Collaboration may therefore provide a more effective and cost-efficient use of the combined talents. After the first year of collaboration, 94% (31/33) of the research collaborators supported by IFS reported that collaborating together within their team was more useful in tackling the research topic than researching independently, with 79% (26/33) agreeing strongly or very strongly with this point.

Tacit knowledge transfer (proposed benefit 2)

Not all the details concerning new advances are necessarily documented. Much of the knowledge may be tacit (Collins, 1974; Senker, 1993) and remains so until researchers have had the time to deliberate and set out their findings in a publication. Frequently, considerable time elapses before the knowledge appears in written form. Collaboration may be one way of transferring new knowledge, especially tacit knowledge. After the first year of collaboration, 91% (30/33) of the research collaborators supported by IFS reported that collaborating has been a useful way of transferring tacit knowledge amongst team members, with 54% (18/33) agreeing strongly or very strongly with this point.

Learning the social and management skills needed to work as part of a team (proposed benefit 3)

Collaborative research requires not only scientific and technical expertise, but also the social and management skills needed to work as part of a team. These cannot be readily taught in the classroom; they are best learned “on the job” by engaging graduate students or young postdoctoral researchers in collaborative activities. IFS team application procedures emphasize the capability-building element of such learning by specifically giving preference to teams where the Team Coordinator is an early-career scientist. The IFS on-line and written support for team applications encourages consideration of different organisational models suited to small teams, team roles (IFS, 2012a), intellectual property, publication and authorship, credit and data availability issues (IFS, 2012b). After the first year of collaboration, 94% (31/33) of the research collaborators supported by IFS reported that collaborating has been a useful way of learning the social skills needed to work as part of a team, with 55% (18/33) agreeing strongly or very strongly with this point. Similarly, after the first year of collaboration, 100% (33/33) of the research collaborators supported by IFS reported that collaborating has been a useful way of learning the management skills needed to work as part of a team, with 67% (22/33) agreeing strongly or very strongly with this point.

Source of creativity (proposed benefit 4)

Collaboration may bring about a clash of views, a cross-fertilisation of ideas which may in turn generate new insights or perspectives that individuals, working on their own, would not have grasped (or grasped as quickly) (Hoch 1987; Hodder, 1979/80; Mulkay, 1972). The act of

collaborating may thus be a source of stimulation and creativity. Hence, collaboration is greater than the sum of its parts. Such benefits are likely to be largest when the collaboration involves partners from more divergent scientific backgrounds. However, the difficulties in working productively together may then be greater.

Whilst it was not prescribed by the call for proposals, the first cohort of IFS-funded research collaborations were all multidisciplinary teams, with 85% (28/33) having three or more disciplines involved. After the first year of collaboration, 94% (31/33) of the research collaborators supported by IFS reported that collaborating has been a source of stimulation and creativity, with 73% (24/33) agreeing strongly or very strongly with this point.

Intellectual companionship /Expanded networking (proposed benefit 5)

Research can be a lonely occupation, probing the frontiers of knowledge where few, if any, investigators have been before. An individual can partly overcome that intellectual isolation through collaborating with others, forming working and perhaps also personal relationships with them. Moreover, the benefits of working with others are not confined to the links with one's immediate collaborators. Collaboration also has the effect of “plugging” the researcher into a wider network of contacts in the scientific community. An individual researcher may have good contacts with some other researchers in his or her field around the world whom he or she can contact for information or advice. By collaborating with others in another institution or country, the individual may greatly extend that network. Before collaborating, the cohort of researchers reported an average of 11.52 \pm 4.74 (n= 33; p=0.95) “useful contacts,” defined here as “research colleagues that one could easily contact for information or advice.” After the first year of collaboration, 55% (18/33) of the research collaborators supported by IFS reported that they had made useful contacts beyond their collaborative team members. The contacts made at the IFS Collaborative Research Workshop (in Ghana in 2013) were especially highlighted by several respondents.

Greater scientific visibility (proposed benefit 6)

After the first year of collaboration it was too early to discuss scientific visibility changes as a result of collaboration.

Pooling equipment (proposed benefit 7)

In many fields, scientific instrumentation costs have jumped appreciably with the introduction of successive generations of technology. As a consequence, it has often become impossible for funding agencies to provide the necessary research facilities to all the research groups working in the area. Resources have had to be pooled, either at local, regional, national or (in the most expensive cases) international levels. Consequently, the researchers involved have been able to share equipment and maybe to collaborate more closely (see IFS, 2012c). After the first year of collaboration, just less than one-quarter of the research collaborators supported by IFS reported that they pooled equipment, whereas 39% (13/33) were collaborating in a way where pooling equipment was not applicable.

3.2.2 Reducing the costs

In addition to benefits, we felt it is important to identify, and, where possible diminish, some of the costs to potential collaborators. We identified at the outset five potential costs and asked in the survey about the impacts of the IFS Collaborative Research Approach on these costs.

Finding collaborative partners (expected cost 1)

Finding collaborative partners and identifying those with whom one might work is an *a priori* cost of research collaboration. Historically, close proximity has been known to promote collaboration, and physical distance separating partners to reduce its incidence. Contemporary enabling factors include the Internet, digital communication and the phenomenal rise in social networking. Today social networking and other digital tools may be effective distance-spanning tools. IFS is piloting an on-line collaborative environment for use by prospective applicants for IFS Collaborative Research Grants (IFS, 2012d). One-hundred percent (33/33) of collaborative research grantees reported that the IFS on-line collaborative environment was useful to their ability to find potential collaborative partners with whom they could work. Forty-two percent (14/33) considered it essential and 46% (15/33) considered it very important. Collaborators reported that the site designed on the PODIO software platform by IFS made it easy to find collaborators from diverse disciplines and international backgrounds and that without it collaboration would most likely not have been possible. A number expressed surprise that it was possible to work together and prepare a winning proposal without ever physically meeting.

Financial costs (expected cost 2)

For inter-institutional, inter-sectoral and international collaborations, travel and subsistence costs are incurred as researchers move from one location to another. Equipment and material may also have to be transported. Once moved, the instrumentation may need to be carefully set up again, perhaps requiring the assistance of technicians from the original institution, incurring further costs. Digital communications options can be valuable to disparate researchers but also incur costs. IFS is piloting the provision of a specific budget for team coordination costs to be proposed within specified financial limits by the applicants (IFS, 2012c). After the first year of collaboration, 64% (21/33) of the research collaborators supported by IFS reported that collaborative research has not involved more financial costs than researching independently. However, 92% (30/33) reported that they could not have engaged in collaborative research without the provision of a specific budget for team coordination costs (which IFS provides).

Time costs (expected cost 3)

Time may have to be spent in preparing a joint proposal or securing joint funds from two or more sponsors, and in jointly defining the research problems and planning the approach. Different parts of the research may be carried out at different locations, again introducing time costs. Time must be spent keeping all the collaborators fully informed of progress as well as deciding who is to do what next. Differences of opinion are almost inevitable and time will be needed to resolve these amicably. Writing up results jointly may also take more time where there are disagreements over the findings and their significance, or over who should be included among the co-authors and in what order they should be listed. Moreover, besides these direct time costs, there are also such indirect time costs as recovering from the effects of travel (e.g., jet lag), working in an unfamiliar environment, and

developing new working and personal relationships with one's collaborators. These may be real costs which collaborators must weigh against their perceived benefits from collaboration. After the first year of collaboration, 70% (23/33) of the research collaborators supported by IFS reported that collaborative research has involved additional time costs associated with collaboration compared to researching independently. However, 96% (32/33) of the research collaborators supported by IFS that reported additional time costs also reported that the positive effects of collaboration outweigh the additional time costs.

Administrative costs (expected cost 4)

Collaboration brings certain costs in terms of increased administration. With more people and perhaps several institutions involved, greater effort is required to manage the research. If the collaboration is extensive or spans a considerable distance, it might need more formal management procedures, which may create bureaucratic burdens. One anonymous grantee reported that "even when the burdens are not bureaucratic, when difficulties arise, they may nevertheless be blamed upon 'bureaucracy', and foster a sense of grievance against other collaborators, which must be resolved by the project management." A more formal management structure may also stifle the creativity of the researchers, offsetting the benefits of cross-fertilisation outlined above. These may be real costs which collaborators must weigh against their perceived benefits from collaboration. After the first year of collaboration, 61% (20/33) of the research collaborators supported by IFS reported that collaborative research has involved additional administrative costs associated with collaboration compared to researching independently. However, 90% (30/33) of the research collaborators supported by IFS that reported additional administrative costs also reported that the positive effects of collaboration outweigh the additional administrative costs.

Reconciling different financial systems, management cultures and mechanisms (expected cost 5)

Where two or more institutions are collaborating, there is often the problem of reconciling different management cultures, financial systems, and rules on intellectual property rights. There may also be differences over reward systems, promotion criteria and time-scales, and even a more general clash of values over what is the most important research to pursue, how to carry it out, or over commercial or ethical implications. All these potential differences need to be reconciled if serious problems are not to disrupt the collaboration. IFS aims to reduce part of this cost to collaborators by continuing individual financial arrangements with each collaborator within the collaborative research approach (IFS, 2012c) and by encouraging team colleagues to draw up together and sign a Collaborators Charter. After the first year of collaboration, 36% (12/33) of the research collaborators supported by IFS reported that they had not faced this problem. Of those that had faced difficulties, these were reported to be related to different ways of working, nearly half the collaborators (10/21), different financial systems, nearly 40% (8/21), and different management systems 30% (6/21). However, 97% (32/33) of the research collaborators supported by IFS reported that the positive effects of collaboration outweigh the the problems encountered with different ways of doing things.

4 Conclusions

There appears to be little documentation in the literature describing the relative importance to research collaborators of different costs and benefits of collaboration. Réjean and Nabil (1998) demonstrated that the administrative burdens and the time required to coordinate collaborative research were unimportant factors in explaining the choices of institutional structures made by

university researchers when they become involved in collaborative research projects. Choices were much more influenced by perceptions of publication assets, coordination costs, and additional funding opportunities.

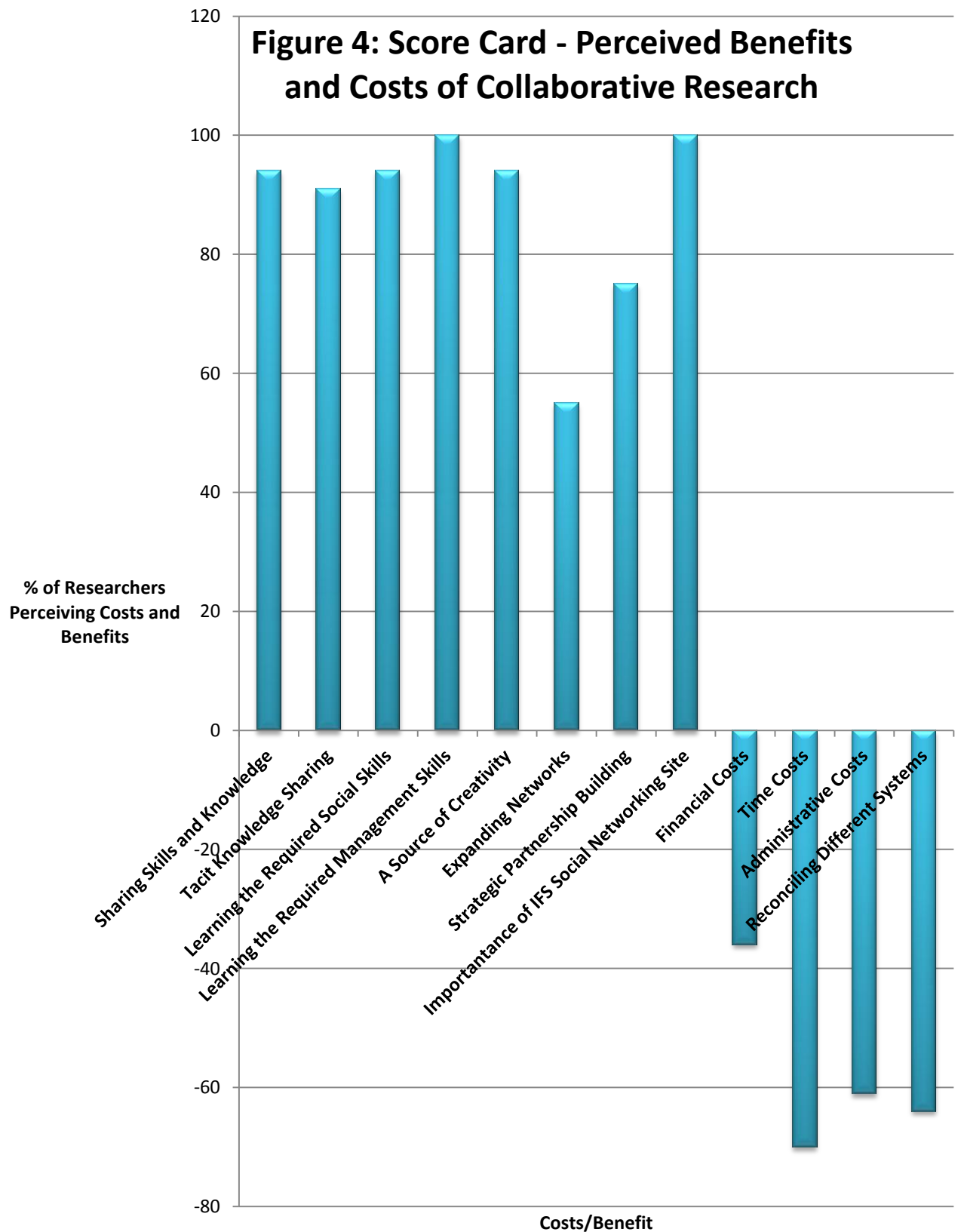
These early surveys enquiring about the efficacy of our approach to supporting research collaboration and the perceived costs and benefits of the IFS approach to research collaboration were conducted after the proposal stage and then after three key periods of collaboration had taken place, i.e., several months of connection and collaborating on-line, a face-to-face capability building workshop, and one year of collaboration within a commonly funded team. From the results it appears that the IFS approach put mechanisms in place that successfully encouraged more than three-quarters of the scientists to take an organizational and strategic approach concerning their relations with partners. Other research (Traore and Landryn, 1997) suggests this approach will be beneficial to partners because strategic and organizational collaboration lead to increased joint outputs. This will need to be investigated further at a later stage in the collaboration.

From the results, we can conclude that the social networking platform designed, built and administered by IFS is of vital importance in overcoming the barrier to collaboration of finding colleagues with whom to collaborate. It appears to bridge geographic and disciplinary boundaries and it is especially interesting to note that all ten successful teams in the collaborative research cohort involved at least three different disciplines from three to five different countries in Sub-Saharan African. The results also underscore the vital importance of *learning-by-doing* in helping colleagues to learn the skills required to manage research collaboration, which was universally valued by the researchers. Of the other expected benefits of research collaboration (as defined in IFS, 2012 and reported on above), sharing skills and knowledge, tacit knowledge sharing, learning the required social skills, and collaboration as a source of creativity were all highly valued benefits. The sampled cohort began with an average of around 12 +/- 5 research colleagues each, that is, "colleagues they could easily contact for information or advice." More than half the cohort expanded their network beyond their collaborative research team as a result of this collaboration. The most prevalent costs of research collaboration were counted in people's time, and in reconciling different ways of doing things and additional administration. Additional financial costs associated with collaboration, which was provided for in the IFS collaborative research grant, were highly valued and as a result additional costs associated with collaboration were not considered to be important by almost two-thirds of grantees. It is interesting to note that those who highlighted the additional costs in time, money, administration or in reconciling different ways of doing things in research collaboration overwhelmingly believed that the benefits outweighed the costs. A score card summary of the outcome is presented in Figure 4.

It would appear that the IFS collaborative research approach delivers the expected benefits and reduces or compensates for the expected costs of research collaboration.

This survey involved IFS Aspirants and collaborative research grantees. It will be important to investigate further in future rounds of IFS research collaboration with those who are unsuccessful in the application process, including those who expressed interest but then were not active within the social networking site. It will also be important to identify after the granting period the outcomes and impacts of the research collaborations once teams conclude and share their findings.

Figure 4: Score Card - Perceived Benefits and Costs of Collaborative Research



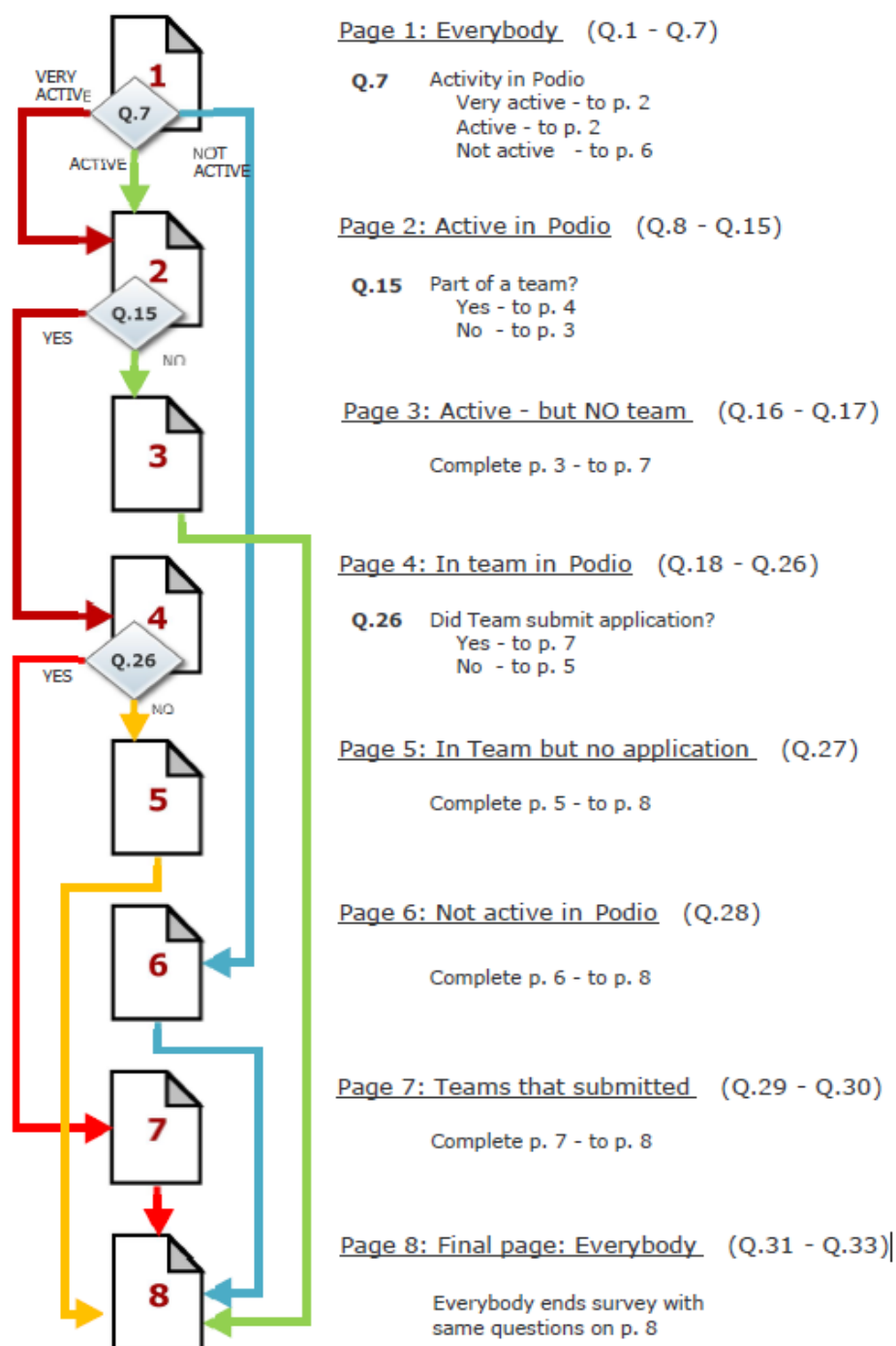
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Appendix 1: 2013 Survey Distributed to IFS Collaborative Research Aspirants

This survey of all participants in the online Podio environment was conducted in March-April 2013. Different pages of the survey were directed to different categories of participants, using the built-in skip logic in SurveyMonkey. The categories targeted and the relevant pages can be seen in the logic diagram on the next page.

Collaborative Research Pilot - Participant Survey 2013 Logic scheme



1. You responded to the IFS Call for Interest in Collaborative Research on Neglected and Underutilized Species, and were invited into the Podio online collaborative environment which IFS set up for the purpose. Please tell us why you responded to this call. [Mark all that apply.]

I was already involved in NUS research

I had previously received an IFS Grant

I had previously attended an IFS workshop on NUS research

I had not been doing research on NUS as yet, but would like to

I was interested in collaborative research

I was looking for funding for my research

Other reasons for responding:

2. Which other organisations dealing with Neglected and Underutilized Species (apart from IFS) have you had contact with?

3. What is your nationality?

Ghana

Nigeria

South Africa

Tanzania

Uganda

4. Have you had experience with collaborative research before this project?

No

Yes

5. IFS used the online collaborative software Podio to create an environment for this project. It has certain similarities with other social media sites. Had you used social media before this project?

Yes

No

6. If 'Yes', which ones? [Mark all that apply.]

Facebook

Twitter

LinkedIn

Google+

Badoo

ResearchGate

SkillPages

Other (please specify)

7. How would you rate your level of activity in Podio?

Very active leading to participation in 1 or more team building attempts

Active conversations with some people did not participate in any team building attempts

Not active at all

8. How would you rate Podio generally?

Working in Podio was:

Very easy

Difficult in the beginning, but easy to learn

Difficult

Very difficult, it didn't work for me

If you had difficulties, what were they?

9. When you came into Podio for the first time, what were the first things you did?

10. What type of devices did you use to access Podio? [Mark all that apply.]

Your own laptop computer

An institution or library computer
 A computer at an Internet cafe
 A smart phone
 Another telephone
 A tablet device (such as Apple iPad, Sumsung Galaxy, Google Nexus, etc)

11. Generally during this time, how was your access to Internet?

Very bad
 Sometimes down, sometimes usable
 Usually up and running, but slow
 Satisfactory
 Excellent

12. Rate how well the Podio environment enabled you to do the following:

	Excellently, Podio was very good for this	OK, I used Podio only to some extent for this	Not helpful, I did not use Podio for this
Get an overview of who was here and their interests			
Find suitable collaborators you did not previously know			
Communicate with people once you had identified them			
Collaborate with multiple persons around a central idea or plan			
Build a team			

If you used other channels as well as Podio (e.g. email, texting, Skype, telephone, etc) please specify which and for what purpose:

13. The Podio environment had many parts, used differently by different people. The 'Candidates for Collaborative Research Grants' workspace was where everyone began. Please rate the following parts of that workspace:

	This was useful, I used it a lot	I didn't find this so useful, used it only sometimes	This was not helpful, I didn't bother about it	I didn't know about this/didn't understand it/ couldn't find it
The Activity Stream				
The apps in the workspace				
The documents library				
The 'Candidates' app				
The 'Q & A' app				
The 'Discussions' app				
Searching according to specific criteria				
Instructions and documentation				
Profiles of people				
The videos				
Podio's internal messaging system				

14. Do you have any comments about specific parts that might help us improve this system for the future?

15. Were you part of a team that had its own private workspace?

Yes

No

16. What were the factors that hindered you from building a team? [Mark all that apply.]

I could not find people with similar interests

After starting conversations, people stopped replying

I had other commitments/time constraints and could not participate fully

I thought we had a team, but then people dropped out at the end

We couldn't agree on subject matter

We had communication difficulties due to bad Internet connections

Other reasons (please specify):

17. Did you at any time form a team outside of the Podio environment and workspaces?

Yes

No

If 'Yes', what led you to do that?

18. How did you identify the people with whom you built your team? [Mark all that apply.]

We all knew each other from before

Some knew each other from before, and others met in Podio

None of us knew any of the others from before, we all met in Podio

In Podio, we found each other simply from the posts in the Activity Stream

We actively searched by specific criteria and used the apps and profiles to find suitable team members

Other ways (please specify)

19. How much of the team communication did you do with Podio?

Podio worked well for us, we did almost everything there

We used Podio sometimes and other channels sometimes

We did almost all communication through other channels

20. Which other channels of communication did your team use? [Mark all that apply.]

Telephone

Skype

Email

Facebook

Twitter

An instant messaging/chat service

Other (please specify):

21. When you used other channels, it was because: [Mark all that apply.]

We couldn't do what we wanted with Podio

Internet connectivity was a problem

We had concerns about the privacy of the Podio workspace

We could not reach everybody with Podio

Podio was too slow

Other reasons (please specify)

22. With regard to communication within your team, mark all the following that apply:

We had Internet connectivity problems

We had some personal conflicts which we WERE able to resolve

We had some personal conflicts which we WERE NOT able to resolve

The team coordinator did a good job bringing people together and moving the team forward

The team coordinator did not do a good job bringing people together and moving the team forward
Some members were not responding or communicating satisfactorily
We did not communicate enough to really understand each other and our proposal
Communication worked very well in our team
It was difficult to really communicate with people you don't know
Would you like to tell us anything more about the communication in your team:

23. How did you collaborate on your proposal in your team? [Mark all that apply.]

We defined the problem together and then worked out what each person would do
Each person had their own ideas and research before we came together in the team, then we formulated the common theme for the team together
One person came with the suggestions for the proposal and the others followed
If you collaborated in other ways, please describe:

24. Considering the known difficulties involved in pursuing collaborative research, we would like to know more about your experience with collaboration in your team. [Mark all that apply.]

We had difficulties due to the different working procedures used in different research disciplines
We found it difficult to create a common language across our different disciplines
We had disagreements about the sharing of data and materials
We had difficulties due to differences in our styles of investigation
We had very little difficulty with collaboration, we were able to reach agreement fairly easily
Our research disciplines are quite close to each other
Our research disciplines are quite distant from each other
Any other comments on the collaboration in your team?

25. Please rate how well the following parts of your team workspace in Podio helped you and your team to prepare your proposal:

Very useful Somewhat useful Not useful Didn't know about this
The Activity Stream
The Draft Texts app
The Team blog
The Experiments app
The Team tasks
Podio's internal messaging system
Do you have any suggestions about how we might improve a team workspace for the future?

26. Did your team submit an application?

Yes
No

27. What were the factors that hindered your team from submitting an application? [Mark all that apply.]

We got started too late and couldn't make the deadline
We were not in agreement about some things and couldn't resolve these issues before the deadline
Some people in the team did not deliver as expected/promised
It was very difficult to communicate in this way and we did not reach consensus about the proposal
We found writing the application more difficult than expected and would have needed more time
We had conflicts in the group near the end and couldn't resolve them
External commitments were such that we could not devote the required time to it
One (or more) persons left the team during the process and we could not repair the damage
Other reasons for not submitting an application (please specify)

28. What were the main reasons for your not being active in Podio? [Mark all that apply.]

I had other commitments and could not devote the time to it
I did not want to participate in a collaborative environment on the Internet
I had such a bad internet connection there was no point

An unexpected external circumstance hindered me
My participation was not approved by a superior
I don't believe it's possible to collaborate in that way
Other reasons (please specify)

29. Would you like to comment on the Application Forms or the submission process?

30. Would it be helpful for your team to continue to use Podio if you are successful in obtaining an IFS grant?

Yes

No

31. In your opinion, what was the best thing that came out of the whole experience?

32. ... and what was the worst?

33. Thank you for your participation in this survey.

If there is anything more you would like to tell us about your experience in this Collaborative Pilot project, please write in the box below:

Appendix 2: 2014 Survey Distributed to IFS Collaborative Research Grantees

1. Our approach required you to use our social networking platform. However, we would like to know, how important was the IFS online collaborative environment to your ability to find potential collaborative partners with whom you could work?

- Not important, I already knew those with whom I collaborate
- Not important, because I consider it to be easy to find collaborators
- Useful but not essential
- Important, because I consider it difficult to find collaborators
- Very important
- Essential, I would not have found collaborators without it

2. How many different scientific disciplines are involved in your team?

- One, we are all from the same or similar scientific disciplines
- There were two different scientific disciplines in our team
- There were three different scientific disciplines in our team
- There were four different scientific disciplines in our team
- There were five different scientific disciplines in our team

3. This question relates to what the research partners in your team decided on as your way of working together at the time you put your proposal together. Which of the following statements best describe the way your team decided to organize your research collaboration? (You can make multiple choices if this is relevant)

- The research partners determined the goals and directions of collaborative activities.
- The research partners outlined the collaborative activities, determined the budget requirements, and defined the prospectus and the methodology of the research.
- The research partners made decisions about the use of joint resources and the publication and diffusion of the results from collaborative research.

Different teams have defined different timeframes and will be at different stages in the completion of their collaborative research.

4. How far into your part of the collaborative research project are you currently?

- About one third of the way through the time.
- About half way through.
- Almost complete.

5. How far into your team project is your team?

- About one third the way through.
- About half way through.
- Almost complete.

6. How many useful contacts with researchers did you have before this collaboration? ('Useful contacts' is defined here as research colleagues that you could easily contact for information or advice)

7. As a result of this research collaboration, by how many contacts have you extended that network?

Please check each of the boxes that are relevant to your experience.

- I have no more useful contacts than before beginning the collaborative research.
- I have useful contacts with one of my team members.
- I have useful contacts with some of my team members.
- I have useful contacts with all of my team members.
- Through this research collaboration, I have made useful contacts beyond my team.

8. 'I think that collaborating together with my team is more useful in tackling the research topic than researching independently'. Please select your level of agreement/disagreement with this statement:

- Disagree very strongly
- Disagree strongly
- Disagree
- Agree
- Strongly agree
- Very strongly agree

In science not all the details concerning new advances are necessarily documented right away. Much of the knowledge may be tacit (tacit knowledge is defined here as knowledge that is currently unwritten, or difficult to transfer) and remains so until researchers have had the time to deliberate and set out their findings in a publication. Getting tacit knowledge is a bit like finding something out like a technique or a finding from a researcher before it is set out in a publication.

9. 'In my experience of collaborative research supported by IFS so far: 'Collaboration has been a useful way of transferring tacit knowledge amongst team members'. Please select your level of agreement/disagreement with this statement:

- Disagree very strongly
- Disagree strongly
- Disagree
- Agree
- Strongly agree
- Very strongly agree

It is commonly believed that collaborative research requires not only scientific and technical expertise, but also the social and management skills needed to work as part of a team.

10. In my experience of collaborative research so far: 'Collaboration has been a useful way of learning the social skills needed to work as part of a team'. Please select your level of agreement/disagreement with this statement:

- Disagree very strongly
- Disagree strongly
- Disagree
- Agree
- Strongly agree
- Very strongly agree

11. In my experience of collaborative research so far: 'Collaboration has been a useful way of learning the management skills needed to work as part of a team'. Please select your level of agreement/disagreement with this statement:

- Disagree very strongly
- Disagree strongly
- Disagree
- Agree
- Strongly agree
- Very strongly agree

Research collaboration can be a source of stimulation and creativity.

12. In my experience of collaborative research so far: 'The act of collaborating has been a source of stimulation and creativity'. Please select your level of agreement/disagreement with this statement:

- Disagree very strongly
- Disagree strongly
- Disagree
- Agree
- Strongly agree
- Very strongly agree

13. In my experience of collaborative research so far: 'My collaborative research has involved sharing equipment'. Please select your level of agreement/disagreement with this statement:

- Yes
- No
- Not applicable

14. In my experience of collaborative research so far: 'Collaborative research has involved more financial costs than researching independently'. Please select your level of agreement/disagreement with this statement:

- Disagree very strongly
- Disagree strongly
- Disagree
- Agree
- Strongly agree
- Very strongly agree

15. In my experience of collaborative research so far: 'I believe that without the provision of a specific budget for team coordination costs, the financial cost of collaboration would have been a barrier to my research collaboration'. Please select your level of agreement/disagreement with this statement:

- Disagree very strongly
- Disagree strongly
- Disagree
- Agree
- Strongly agree
- Very strongly agree

16. In my experience of collaborative research so far: 'There were additional time costs associated with collaboration compared to researching independently'. Please select your level of agreement/disagreement with this statement:

- Disagree very strongly
- Disagree strongly
- Disagree
- Agree
- Strongly agree
- Very strongly agree

17. In my experience of collaborative research so far: 'The positive effects of collaboration outweigh the additional time costs'. Please select your level of agreement/disagreement with this statement:

- Disagree very strongly
- Disagree strongly
- Disagree
- Agree
- Agree strongly
- Agree very strongly

Some people recognise that there are administrative costs which collaborators must then weigh against the benefits that they perceive from collaboration.

18. In my experience of collaborative research so far: 'There were additional administrative costs associated with collaboration compared to researching independently'. Please select your level of agreement/disagreement with this statement:

- Disagree very strongly
- Disagree strongly
- Disagree
- Agree
- Strongly agree
- Very strongly agree

19. In my experience of collaborative research so far: 'The positive effects of collaboration outweigh the additional administrative costs'. Please select your level of agreement/disagreement with this statement:

- Disagree very strongly
- Disagree strongly
- Disagree
- Agree
- Strongly agree
- Very strongly agree

20. In my experience of collaborative research so far: 'I have had to reconcile different ways of doing things, including the following:' Please select the relevant options (you may select any that are relevant to your experience)

- Different financial systems at collaborator institution(s).
- Different management systems at collaborators institution(s).
- Different ways of working.
- I have not faced any of these issues.

21. In my experience of collaborative research so far: 'The positive effects of collaboration outweigh the problems encountered with different ways of doing things'. Please select your level of agreement/disagreement with this statement:

- Disagree very strongly
- Disagree strongly
- Disagree

- Agree
- Strongly agree
- Very strongly agree