



LauraGrantAssociates

Public engagement
with science and
engineering

Synthetic biology dialogue Interim evaluation report

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Executive summary

Introduction

Synthetic biology takes an engineering approach to biological systems and is emerging as a platform technology which greatly increases the degree of control humans can take over such systems. It represents an advance in biotechnology which goes beyond manipulation of the genome and allows living organisms, biologically based parts and biological systems to be constructed. Their man-made construction means that these biological components can also be designed and engineered.

With these developments come risks and concerns, including safety, pollution, bio-security and whether access to the benefits of the technology will help address poverty or further widen the gap between rich and poor. There are also questions around ‘messing with nature’ or ‘playing God’ and whether it is morally right to create new life in this way.

In 2009 the Biotechnology and Biological Sciences Research Council (BBSRC) and the Engineering and Physical Sciences Research Council (EPSRC), with the support of the Department for Business, Innovation and Skills’ Sciencewise programme, commissioned a public dialogue on synthetic biology. The dialogue had the following aim:

To allow the diverse perspectives of a range of UK residents to be articulated clearly and in public in order that future policies can better reflect these views, concerns and aspirations.

TNS-BMRB were commissioned to deliver the dialogue, and Laura Grant Associates (LGA) was appointed as the external evaluator.

The dialogue consisted of:

- Twelve **deliberative workshops** that brought 160 members of the public together three times in four locations (London, Llandudno, Newcastle and Edinburgh) along with scientists, social scientists and representatives from the Research Councils;
- A **reconvened workshop** involving eight public participants (two from each location);
- Forty-one **stakeholder interviews**.

A smaller group of stakeholders including scientists, engineers, social scientists, Government, Research Councils, Sciencewise-ERC and NGOs were involved through membership of the dialogue’s Steering and Oversight Groups.

Evaluation methodology

The evaluation approach included the following elements:

- **Structured observation and snapshot interviews** during the public workshops;
- **Questionnaire surveys** with public participants;
- **Interviews** to capture and understand the expectations of and outcomes for experts, stakeholders and policy makers;
- **A mini-workshop** (conceived by the Research Councils and delivered by LGA) where the Oversight Group discussed the effectiveness of the dialogue.

To explore outcomes over a longer period, we will be completing the evaluation work six months after the report is launched. This will comprise:

- **Follow-up research and analysis** to explore the impact of the dialogue and its recommendations on policy deliberations, as well as to explore outcomes for participants.

We collected 124 exit questionnaires from the 130 participants that attended all three workshops. In addition we conducted ten interviews with members of the Oversight and Steering Groups over the course of the dialogue. These were added to observations of and feedback on the Oversight Group meetings to evaluate the group's role in the process.

Summary of findings

Learning points were identified under a number of headings:

Learning points: workshops

I believe the workshop really had a blend of people from all walks of life and it was well structured and timed (Public participant)

- A large number of groups and effective sampling enabled a valuable range of views to emerge and helped mitigate the risk of a minority of groups where participants did not engage fully with the issues;
- Video ethnography (short films made by scientists about how they work) was highly effective and had a strong impact, however videos of presentations were less effective;
- Public and expert participants valued face-to-face interactions highly;
- Public influence on workshop design is a valuable aspiration, although needs can be anticipated to some extent to aid planning;
- A greater focus on engaging ways to communicate the scientific principles at the core of synthetic biology may have empowered public participants still further;

- The focus group approach built trust between participants, but inherent in this method is the establishment of social norms that may have limited the expression of some views;
- The reconvened workshop was an effective means of checking the dialogue findings with public participants, although only a relatively small number were able to be involved;
- Research Councils and others should remain realistic about the advantages and limitations of dialogue. Including these in balanced communication about the dialogue will help avoid any criticism of the method (for example from perspectives that value quantitative over qualitative approaches) undermining the findings.

Learning points: public participants

Initially I was unaware of this concept. But now I can quite well talk about this with my family and friends. (Public participant)

- Participants felt the process was worthwhile and many are keen to remain involved in dialogue about synthetic biology;
- The extent to which participants feel their views are listened to will affect their perception of the process;
- Plans for continued engagement should be agreed and communicated to participants.

Learning points: expert participants

Often in these circumstances you get asked questions somehow you never got round to asking yourself. (Social Scientist, Workshop 3)

- Experts found their experiences worthwhile;
- Scientists were pleased that the public were broadly supportive of their research;
- Social scientists valued participating in a process they might usually critique and the opportunity to see some of the methods in action;
- Experts were conscious of their capacity to introduce bias and some might have appreciated more support or advice on this ahead of the workshops;
- A tool such as a short film giving an insight into a dialogue could be a useful briefing aid;
- Encouraging experts to prepare plenary input beforehand could limit the risk of spontaneous misleading remarks;
- The roles of experts and observers (especially experts attending in the capacity of observers) should be clarified during workshops, perhaps creating a space where observers can highlight misconceptions that moderators may wish to address without interjecting in group discussions;
- A less pressured timescale and/or more effective planning overall may have allowed exploration of further ways to include industry and NGO voices (as well as through the actors).

Learning points - Oversight

*Because these are such important issues people want that [interpretation of public] opinion to be right and want to be sure about what the public think and that makes them a little bit wary about anything innovative.
(Interviewee)*

At this stage of the evaluation, with more follow-up work to do with public and expert participants, the issue of oversight is where we have the most detailed findings.

- Management and Oversight did not always run smoothly, although impacts on the dialogue workshops themselves were modest;
- The Oversight Group needed longer to build trust. It would be useful to explore ways that this group could have greater ownership over the dialogue principles, which were passed on to the Oversight Group from the Steering Group;
- Diversity in the membership of the OG was seen as a strength, but extra time and resource is required to make any process inclusive;
- Research Councils (especially BBSRC) developed a stronger role as the dialogue progressed. More planning and direction from the RCs on how the process will be managed and the respective roles in decisions for SG, RCs, OG and contractors would be valuable in future;
- Committees tend to be conservative, how does this link with innovation?
- Oversight Group members dedicated considerable time to the dialogue, which was valuable;
- Consider ways to better manage discussions over email;
- Capture and share learning among Research Councils and others about this aspect of the dialogue.

Next steps

The true value of the dialogue will depend significantly on who and what is informed and influenced by the findings and how. The next stage of the process is crucial and may change participants' constructions of the dialogue. Participants and SG/OG members hoped that the views expressed during the dialogue would add to the evidence used to inform policy, not only in the UK but also internationally.

We look forward to contacting a sample of participants again to further explore the outcomes of the dialogue.

1 Introduction

1.1 Background

Synthetic biology takes an engineering approach to biological systems and is emerging as a platform technology which greatly increases the degree of control humans can take over such systems. It represents an advance in biotechnology which goes beyond manipulation of the genome and allows living organisms, biologically based parts and biological systems to be constructed. Their man-made construction means that these biological components can also be designed and engineered.

The construction of the first man-made virus was published by Cello *et al.* in 2002, to great controversy. Much more recently Craig Venter's team in the US synthesised a full genome and implanted it into a living cell, which was then able to reproduce (Gibson *et al.*, 2010). The next anticipated advance in synthetic biology will be the development of organic 'components' – building blocks with particular functions which can be combined to construct biological systems; as electrical components can be added to a circuit. The development of 'biological machines' would allow organic substances which can only be produced through biological processes to be manufactured more easily, and engineered to better suit our purposes. In the future, it also raises the possibility that entirely new, man-made life forms could be designed and constructed.

With these developments come risks and concerns, both technological and societal. Concerns include safety, pollution, bio-security and whether access to the benefits of the technology will help address poverty or further widen the gap between rich and poor. There are also questions around 'messing with nature' or 'playing God' and whether it is morally right to create new life in this way.

Rapid advances in biotechnology present society with serious ethical concerns, and it is important that these are addressed fully and openly, in a public forum as well as within academic and policy circles. Failure to engage with the public on ethical issues raised by new technologies leads to fear and mistrust; creating barriers in communication between academics and the public. In a worst case scenario public mistrust can seriously hinder new developments and prevent the use of valuable technology. On the other hand, the wider public often raise legitimate concerns over the rapid adoption of new technologies by scientists, industry and governments and it is vital that their views are understood and taken on board.

Dialogue is seen as important because it allows policy development to be framed by many different issues and interests, including those of members of the public. This allows impacts on different groups or areas of uncertainty to be understood. Inclusion of a range of perspectives allows better decisions to be made that benefit more people.

As well as being a new area with no established policies synthetic biology has the potential to impact on many different fields in specific areas such as medicine, food or fuels, but also more broadly in terms of new manufacturing processes. It is still early enough for the subtle impacts of dialogue to make a real difference and shape the research, while major scientific discoveries are already opening the debate more widely.

1.2 Dialogue objectives

Aim

- To allow the diverse perspectives of a range of UK residents to be articulated clearly and in public in order that future policies can better reflect these views, concerns and aspirations.

Objectives

- Facilitate discussions from diverse perspectives, which are undertaken by people who are inclusive of a range of people in society;
- Support a diversity of key stakeholders and people with relevant knowledge (e.g. industrial, regulatory, NGOs, civil society) to oversee the dialogue to ensure its fairness, competence and impact.
- Draw on and seek participation of a diversity of knowledge by working with a wide range of groups, including researchers, research council staff, social scientists and NGOs with an interest in issues related to technology options and/or synthetic biology.
- Ensure that the content and format of the dialogues are open to influence by all of the participants.
- Allow institutional learning about dialogue processes, including the diversity of views, aspirations and attitudes that exist with reference to scientific, economic and social policy and economic aspects of new technologies.
- Develop a capacity amongst all of the participants for further dialogues in the future and seek views about priority areas/issues which would merit further substantive dialogue, debate and information.
- Improve on what is seen as good practice and thus provide a foundation on which broader future engagement can build and inform the development of a longer term project of engagement.
- Raise awareness and capacity within the Research Councils, policy makers and the scientific community of aspirations, concerns and views in relation to synthetic biology and the importance of dialogue.
- Ensure that participants in the dialogue have a meaningful route to potentially influence policy makers and thus feel their involvement has been worthwhile.
- Devise novel ways of dealing with an area of technological development in which very few specific details are known.

2 Evaluation methodology

2.1 Evaluation questions

We have identified the following questions based on the project aims:

1. **To what extent did the project meet its aim and objectives?**
2. **How effective were the approaches, methods and tools used within the dialogue? What factors contributed to their effectiveness (or lack thereof)?**
3. **How effective were the steps taken to engage the diverse knowledge of participants and stakeholders, and participants and with diverse backgrounds? To what extent was the dialogue inclusive?**
4. **Linked to question 3, what role did the Oversight Group, Sciencewise ERC and others play in the dialogue development process? How did those involved in development feel about the management of the process?**
5. To what extent are the dialogue's outcomes specific to synthetic biology or related to general trends across emerging technologies?
6. **What mechanisms were used to identify and incorporate good practice? How effective were they?**
7. What mechanisms were used to maximise policy impact (e.g. direct contact between public participants and policy makers) and how effective were they?
8. Did the process and results of the dialogue have an impact on policy? In what way and to what extent?
9. What did scientists/engineers/Research Councils/policy makers and other stakeholders learn about...
 - a. Public attitudes, aspirations and concerns regarding synthetic biology?
 - b. Dialogue tools and processes?
 - c. The advantages and limitations of public engagement with these types of issues?
 - d. Any other aspects?
10. What were the outcomes for the various participants (including members of the public, scientists, engineers, policy makers and Research Councils) and how did these compare to the outcomes anticipated at the start of the project?
11. **What learning and good practice should be taken forward for future dialogues?**

The evaluation questions highlighted in bold text (1, 2, 3, 4, 6 and 11) are fully or partially addressed by this report.

2.2 Approach

The focus of the evaluation is on both process and outcomes for public participants, scientists, engineers, Research Councils, policy makers and other stakeholders. Our approach is primarily qualitative and aims to understand how participants' backgrounds, cultures and experiences shape their opinions about synthetic biology and how accessible the dialogue processes were to them.

Our approach included the following elements:

- **Structured observation and snapshot interviews** during the workshops;
- **Questionnaire surveys** with public participants;
- **Interviews** to capture and understand the expectations of and outcomes for experts, stakeholders and policy makers;
- **A mini-workshop** (conceived by the Research Councils and delivered by LGA) where the Oversight Group discussed the effectiveness of the dialogue.

Further evaluation research will be undertaken six months after the report is launched. This will comprise:

- **Follow-up research and analysis** to explore the impact of the dialogue and its recommendations on policy deliberations, as well as to explore outcomes for participants.

The largest proportion of the evaluation work will take place at the six-month follow-up stage. This will include some in-depth qualitative work with public and expert participants, and stakeholders.

2.3 Scope of this report

This report focuses on the dialogue processes, with some feedback on immediate outcomes for participants; addressing the evaluation questions 1, 2, 3, 4, 6 and 11 as indicated earlier.

3 Findings – Project context and governance

Six interviews were conducted between 30th November 2009 and 25th February 2010 with members of the Synthetic Biology Public Dialogue Steering Group (SG) to capture and better understand the processes and ideas which led to the project's development. Some of these interviewees were also on the project Oversight Group. The findings related to the project's history are presented here; findings related to the dialogue itself and the operation of the project Oversight Group (OG) are presented later in Section 7.

3.1 Project inception

In 2006, BBSRC was leading the setup of a cross council working group aimed at establishing Synthetic Biology Networks to embed social science in scientific research.

The first working group meetings were held at the beginning of 2007, and stakeholders identified by the Research Councils as having an interest in synthetic biology were invited. From these workshops, which led to the development of the Synthetic Biology Networks, it became clear that there was no consensus on what 'synthetic biology' meant. The technology was at a very early stage of development, making the best approach to understanding the related social and ethical concerns unclear.

Synthetic biology had been identified by the BBSRC Bioscience for Society Strategy Panel (BSS) as a subject that raised ethical and other social issues, including some

analogous to those raised by genetic modification (GM). BBS established a subgroup in 2006 to look at synthetic biology and the issues it raised. This BBSRC subgroup commissioned the Balmer and Martin report (2008) to look at the field and make recommendations. The report was well received and public engagement on synthetic biology was thought to be necessary. Meanwhile, a regulators workshop held in 2007 raised the notion of a public dialogue on synthetic biology.

Publication of the Balmer and Martin Report in 2008 prompted discussion of engagement on synthetic biology by the EPSRC's Societal Issues Panel (SIP). There was support for the idea of early public engagement, but members also felt there were considerable risks associated with upstream engagement. Around this time the Royal Academy of Engineering independently commissioned a small-scale public dialogue on synthetic biology.

At a subsequent meeting of SIP the idea of public engagement with synthetic biology was revisited. Brian Johnson, who had previously chaired working groups on synthetic biology, spoke at the meeting and inspired enthusiasm for the idea. It was apparent to SIP that both BBSRC and EPSRC, as the major research funders, had a clear role in initiating this debate. This prompted Dave Delpy (EPSRC CEO) to write to Doug Kell (BBSRC CEO) to propose a joint venture building on the work that BBSRC had already begun. Early on in the planning Sciencewise were approached and they met informally with BBSRC and EPSRC to discuss the dialogue before agreeing to part-fund the initiative. Through the expert resource centre (ERC) Sciencewise was also able to provide the project with valuable expertise in effective delivery of public dialogue.

In preparation for this engagement, BBSRC encouraged the regulatory bodies to look at the robustness of existing frameworks, holding a regulators workshop that considered what would be required for synthetic biology. Regulators felt that most developments would be covered by GM regulations, although these do not cover the creation of new organisms, where there is no reference point.

3.2 Steering group

A Steering Group was set up in 2009 to give independent and credible advice on public dialogue for synthetic biology. The group was selected to have authority within scientific, social scientific and public engagement fields and involved academic scientists and social scientists, public engagement experts from the Royal Academy of Engineering and Sciencewise-ERC, representatives from Government and officials from BBSRC and EPSRC. Their remit was to scope the dialogue and to examine what success might look like.

The first few meetings of the Steering Group were spent trying to understand the purpose of the group as they agreed what they were doing the dialogue for and why. A one-day facilitated workshop was organised to tighten the remit of the group and allow them to design a dialogue. The role of the Steering Group was seen by some of the interviewees as ending with the decision to commission a dialogue, and the

commissioning process was undertaken by the Research Councils and a smaller Commissioning Group (a sub group of the SG) rather than the Steering Group itself.

The Steering Group in fact met twice more to discuss the findings from the dialogue and their implications. These meetings took place in May and July 2010.

3.3 Commissioning process

Elements of the dialogue design from the workshop were developed into a draft invitation to tender. A second Steering Group meeting was held, and the invitation to tender was re-drafted through this and further email correspondence. The final invitation to tender was acceptable to most people, and sent out by the BBSRC and EPSRC secretariat.

The invitation to tender was published in the OJEC, as advised by Research Councils procurement department, and met EU legal guidelines for procurement. The Research Councils and Sciencewise were also keen that evaluators should be commissioned early, in line with advice from the Steering Group, and an invitation to tender for the evaluation was also prepared. The applications to tender were assessed by the commissioning team which drew expertise from the Steering Group.

Some concerns about the tender process were expressed by one member of the Steering Group, and it was suggested that the process excluded small academic groups (that individual declined to be interviewed for the evaluation). There was no NGO represented on the commissioning team, although NGOs joined the Oversight Group later in the process.

All the stakeholders interviewed felt that the process worked well, and had confidence in the Research Councils' protocols. A good range of applications were felt to have been received. Some of the tenders were unsuitable and seemed focused on informing a communications strategy but five applicants with a track record in dialogue were shortlisted. There was a clear scoring system and consensus on the winning tender, which was selected based on TNS-BMRB's experience and ability to deliver the dialogue.

3.4 Oversight Group

The Steering Group felt that wider expertise was needed to oversee the dialogue process following the selection of the dialogue deliverer. An Oversight Group was established which was larger than the Steering Group, allowing a broader range of views, including NGOs, to be brought on board. Steering Group members could self nominate for membership or nominate others with justification. Some members self-nominated and others were invited without having nominated themselves, and these members joined others that were invited from outside the Steering Group.

A diverse group of stakeholders were selected for membership of the Steering and Oversight Groups. Most had previous experience of public dialogue, and others had a political interest in the dialogue, representing NGOs or Government. Initially there was a call to involve religious representatives, but these were not included. Synthetic

biology is not a priority for most NGOs, as there are no applications at present, but the inclusion of NGOs on the Oversight Group brought a more complete set of views to the table.

The first Oversight Group meeting was seen as a challenge by interviewees and those that responded to us by email. There were many different views and lots of broad discussion around dialogue and public engagement. Some members of the group were unaware of the Royal Academy of Engineering study. A large Oversight Group of expert stakeholders with differing, strong views was difficult to manage but seen as necessary to holding a meaningful dialogue. The diversity was thought to be positive, allowing civil servants and scientists to become involved in dialogue process. However, some OG members were unsure how much useful involvement they could have in a complex initiative such as dialogue which is outside their area of expertise.

The evaluation provided an opportunity to reflect on the efficacy of the dialogue’s Oversight. This is reported in Section 7.

4 Findings – Workshops

This section summarises the findings from our observations, snapshot interviews and brief questionnaires that were used after each workshop. The findings from the public questionnaires asking participants to reflect on the process overall are presented in Section 5.

Sixteen groups of ten participants were recruited across four locations in England, Scotland and Wales. Each group met three times over the course of the dialogue. The groups were recruited to reflect different cross sections of the population. Their characteristics are summarised in the table below.

Area/Group	Gender	Socio-economic group	Age	Children in household	Ethnicity	Faith	Environment	Community
Llandudno 1	Female	AB	18-34	Mixed	Min 2 BME	No	-	-
Llandudno 2	Mixed	C1 C2	35-54	Yes	Min 2 BME	Yes	-	-
Llandudno 3	Male	DE	55+	No	Min 2 BME	Mixed	-	-
Llandudno 4	Mixed	Mixed	18-55+	Mixed	Min 2 BME	Mixed	-	Engaged
London 1	Female	AB	18-34	Mixed	Min 4 BME	No	-	-
London 2	Mixed	C1 C2	35-54	Yes	Min 4 BME	Yes	-	-
London 3	Male	DE	55+	No	Min 4 BME	Mixed	-	-
London 4	Mixed	Mixed	18-55+	Mixed	Min 4 BME	Mixed	Pro-environment	-

Newcastle 1	Female	AB	18-34	Mixed	Min 3 BME	No	-	-
Newcastle 2	Mixed	C1 C2	35-54	Yes	Min 3 BME	Yes	-	-
Newcastle 3	Male	DE	55+	No	Min 3 BME	Mixed	-	-
Newcastle 4	Mixed	Mixed	18-55+	Mixed	Min 3 BME	Mixed	-	Bystanders
Edinburgh 1	Female	AB	18-34	Mixed	Min 2 BME	No	-	-
Edinburgh 2	Mixed	C1 C2	35-54	Yes	Min 2 BME	Yes	-	-
Edinburgh 3	Male	DE	55+	No	Min 2 BME	Mixed	-	-
Edinburgh 4	Mixed	Mixed	18-55+	Mixed	Min 2 BME	Mixed	Sceptic	-

Attendances at each of the workshops are presented in the table below.

		Workshop 1			Workshop 2			Workshop 3		
		Female	Male	Total	Female	Male	Total	Female	Male	Total
Llandudno	Group 1	9		9	8		8	6		6
	Group 2	6	4	10	6	4	10	6	3	9
	Group 3		10	10		9	9		9	9
	Group 4	6	4	10	4	4	8	4	4	8
	Total			39			35			32
London	Group 1	8		8	8		8	8		8
	Group 2	5	4	9	3	4	7	3	3	6
	Group 3		7	7		4	4		4	4
	Group 4	5	5	10	4	4	8	3	3	6
	Total			34			27			24
Newcastle	Group 1	10		10	10		10	10		10
	Group 2	5	5	10	5	5	10	5	5	10
	Group 3		9	9		9	9		9	9
	Group 4	4	6	10	3	6	9	3	6	9
	Total			39			38			38
Edinburgh	Group 1	10		10	9		9	9		9
	Group 2	5	5	10	5	4	9	4	4	8
	Group 3		10	10		10	10		10	10
	Group 4	5	5	10	5	5	10	5	4	9
	Total			40			38			36
Total				152			138			130

In preparing this report, we noted some discrepancies between our observations and the samples presented in the dialogue report (TNS-BMRB, 2010). These have been checked with the contractor, and we can confirm that the figures presented here are the accurate ones.

Attendance at the London workshop was poor especially in Workshop 3. However attendance was good at the other workshops.

Full reports on each workshop are provided in the Appendix to this report, but the next sections summarise our overall impressions of each workshop. These are based on observations, snapshot interviews with public participants and questionnaire feedback specific to the workshops.

4.1 Workshop 1

It made me think more about how science + technology and changes affect us. I also felt that I would like to know more (Public participant, Newcastle)

Aim (as explained to participants):

- To explore their views around the impact of science and technology on everyday life. These views will then be used to inform decisions around the regulation and development of a new area of science and technology.

Workshop 1 was sixteen focus groups, each with up to ten participants. Four focus groups took place in each of the four regions targeted by the dialogue, with the group demographics as stated in Section 3. Each discussion lasted two-and-a-half hours and the participants remained in their focus groups, there were no plenary sessions.

Focus groups are directed discussions around a topic which provide a rich source of information by allowing participants to discuss issues in depth, sharing their own opinions and listening to the opinions of others. A key advantage is that through the discussion opinions are qualified and challenged, although this can mean that individuals feel under pressure to conform to the ideas of more dominant group members, which is why skilled facilitation is crucial. Every participant contributes to the overall dynamic and the opinions that they express are the outcomes. Each of the Workshop 1 focus groups we observed had a very different dynamic, and participants expressed concerns about different issues, although some of the ideas raised in each were similar.

Our questionnaire feedback strongly indicated the way in which the process of deliberation about science and technology and its role in society had begun. All of the groups we observed had an opportunity to explore the issues in the topic guide in depth and bond, although different facilitation styles appeared to slightly favour either capturing outcomes or group self-direction and bonding.

It would have been valuable to have a clearer stated objective for the sessions for the Oversight Group as the version for the participants did not include the emphasis on group bonding; however we have evaluated that aspect. The objectives shifted from those written in the schedule of work to play down the focus on synthetic biology and to explore wider attitudes first. In fact synthetic biology was only introduced as the very last item for discussion.

The groups we observed were run professionally. However it was clear that there were some conflicts of opinion in one of the observed groups, and from the small minority of negative questionnaire responses it appears this may have also been the case in one or two of the other groups. Of course this is an issue with any group of individuals meeting for the first time, but as these groups were spending two further days together we recommended considering strategies to defuse potential tensions. This was taken on board by the contractor, and some feedback on where this had emerged was provided so that moderators could be briefed.

4.2 Workshop 2

Good information via presentations by expert and actor scenarios (Public participant, Edinburgh)

A little repetitive in places (Public participant, London)

The overall aim of Workshop 2 was to focus on the views of the public around the social and ethical issues surrounding synthetic biology in general, and then moving on to issues surrounding the governance, regulation and funding of synthetic biology. This workshop lasted about 6 hours and covered the following:

- General perceptions surrounding synthetic biology and science
- Exploring different visions around synthetic biology
- Exploration of how science gets done
- Regulation of synthetic biology
- Funding of synthetic biology

Workshop 2 was a full day session held in each of the four locations. Four of the focus groups from Workshop 1 met at each, so up to 40 participants joined each session. The main elements of the workshop and some reflections on them are listed below:

- Some **reflection on workshop 1** was an essential starting point to link the workshops. Where used, a word cloud was an effective tool to remind participants of earlier discussions.
- The **IML electronic polling** was well-received as a concept by participants, who found the technology engaging and appreciated that it gave everyone the chance to express an opinion simultaneously.
- The **experts' presentations** were effective. Some participants found them difficult to understand – although this was not the case for their input in the discussion groups. Participants warmed to the experts as people, but picked up on the nervous presenters. Overall, public participants listed the expert involvement as a highlight of the workshops.

- The **first breakout group** followed the experts' presentations. There was a lot to cover in a short time and discussions lacked depth as a result. Also some groups jumped on to issues that would be covered later – such as regulation – and there was no way of capturing ideas or questions so they could be referred back to.
- The **actors** were a new approach. Some felt the material repeated elements of the experts' presentations, but for others (notably those that had found the experts' presentations less accessible) the actors were crucial in helping them understand the issues under discussion.
- The **second breakout session** looked at the different perspectives explained by the actors and explored participants' reactions to each. This structure to the session worked well, and again regulation came up as a strong theme.
- The **video ethnography** (short videos made by scientists about their work) was observed to have a strong impact on participants' perceptions of scientists. Most were surprised that they seemed so 'normal' and that some treated their jobs as a '9 to 5'. Misconceptions that all labs would be shiny and futuristic were also addressed: '[it's] not like it is in films'.
- The **third breakout session** followed the video ethnography. Initially discussions were lively but the funding for science discussion was difficult and not engaging – across all observed groups the energy dropped here despite the moderators' efforts.
- The **final breakout session** was devoted to discussion of regulation. This had come up previously in all groups – in some cases in the very first discussions of the day, so it didn't feel new here, and could relate to some of the feedback that the workshop was 'repetitive'.
- At the end of the day, groups came together again to complete the second stage of the **IML electronic polling**. Unfortunately technical issues meant it wasn't possible to display results from the earlier vote and this vote side-by-side as had been the intention.

Workshop 2 covered all the areas it set out to with lots of information provided, but there was limited space for in-depth exploration of attitudes and concerns. Our observations revealed that participants were given the opportunity to express initial reactions, rather than the opportunity to explore the issues in depth, although this was to be continued in Workshop 3.

Participants were pleased to receive more information on the topic and found the interactions with experts very rewarding. The experts also enjoyed interacting with members of the public.

The innovative tools (IML, actors, video ethnography) appeared to work well, although the main positive aspects that participants noted in their questionnaires were the expert input and opportunity for discussion. We noted that the video ethnography strongly challenged participants' constructions of how scientific

research is conducted. When asked for a poor aspect of the workshop, participants felt it was too long and that some of the moderators' questions were repetitive.

We suggested that identifying if and how synthetic biology / upstream technologies are framed differently to others be added to the workshop aims as this is a key question for the dialogue overall. This was more than adequately addressed in the final topic guide for Workshop 3. In addition, we felt it would be valuable to allow participants a little more space to consider their future role in this dialogue, and to reflect on the dialogue processes more generally.

4.3 Workshop 3

Scientists available for comment and honest first hand information (Good aspect, Llandudno)

Repetition of previous weeks, lack of stats, figures, guidance to make more informed opinion (Poor aspect, Newcastle)

The overall aim of Workshop 3 was to look at potential application areas in synthetic biology. Specifically it was intended to:

- Explore synthetic biology in relation to the following application areas
 - Medical applications
 - Energy applications
 - Environmental applications
 - Crop/food applications
- Highlight specific social and ethical issues associated with these applications
- Explore the boundaries of research; the conditions under which it should progress; and potential tipping points.

Workshop 3 was another full day session involving both plenary and breakout group discussions. The main elements of the workshop and some reflections are listed below.

- The **reflection on workshop 2** allowed participants to refamiliarise themselves with the ideas discussed.
- The **IML voting** was popular with participants, who found the technology engaging. The number of questions was reduced after the first workshops.
- The **experts' presentations** were well-received, and where expert presentations replaced or supplemented video presentations (as in Wales where Brian Johnson was available to answer questions on regulation, and in Edinburgh where no regulation video was available and participants received a presentation) the groups were more engaged with the topic.
- In general, **video presentations** were poorly received in the workshops. The quality was low, and without the opportunity to engage with presenters the

participants found the subject matter dry. The exception was the Artemisinin video, discussed later.

- Discussion of **environmental applications (London, Newcastle, Edinburgh)** was helped considerably by the use of experts as a resource by all three groups. Some groups found it difficult to grasp the concept of synthetic biology in this application, finding the science conceptually difficult.
- Discussion of **energy applications (Wales, London, Newcastle)** was an example where groups seemed to trust the regulators (with some expert input) to control this area.
- The video for the **medical applications (Wales, Newcastle, Edinburgh)** was the best received, as it included footage of the drug research and production facilities as well as of the communities affected by malaria. In the discussion that followed some of the groups focussed on the principle of whether drugs and medicines were socially beneficial, and concerns about the power of corporations, but were unconcerned about the methods used to manufacture the drug.
- The discussion on **food and crop applications (Wales, London, Edinburgh)** failed to engage participants with synthetic biology specifically. Groups had little trust in existing food regulations and some struggled to differentiate between synthetic biology and GM for this application.
- In **summing up** the groups felt that while issues such as garage biology and defence had been raised, there had been little opportunity for discussion. The participants felt that for regulation to be effective it must be international, and were wary of over regulation hindering progress. The participants felt that this was a complex topic where the experts needed to make decisions, and that the input of both scientists and social scientists would be important.
- At the end of the day, groups came together again to complete the second stage of the **IML voting**. This was a welcome activity which allowed to groups to see any shift in opinion, although it seemed quite long to us as observers.

Participants in all workshops began the day relaxed and lively. They were noticeably more engaged than in Workshop 2. There were four applications to cover (medical, food, bioremediation and biofuels) and not all applications were covered by all of the groups: each of the workshops covered three of the four potential application areas. Participants were asked to explore the issues in greater depth than in previous workshops. They were comfortable debating outcomes rather than the processes of the applications, but our observations showed that participants sometimes struggled to address ethical issues, where they did not feel that they had sufficient information to make informed judgements.

Interactions with the experts were effective and they provided a more critical voice in Workshop 3 than in previous sessions. Participants engaged with the experts well and often asked them to clarify points or to give their opinion on a subject. Although

this engagement may have influenced the groups' thinking, we observed groups where participants disagreed with or disregarded points made by the experts, showing that some participants were sufficiently confident in their own views to question the information they were given. However participants were reluctant to tackle the complexities of the issues, feeling that they had little to bring to discussions or that they lacked understanding and in some groups there was a clear power relationship between the participants and the experts. It may have been helpful to define the role of experts and observers at the workshops more clearly.

The range of media were effective when used in the right way, for example videos worked well in the ethnography where they were a window into another world (of scientists) but less well as a replacement for speakers. Participants appeared more informed and better able to discuss regulation in those workshops where they had the opportunity to ask questions of the presenter (Wales and Edinburgh).

The theme of what is 'natural' and 'unnatural' emerged strongly during discussions, as would be expected for this topic. Participants felt that synthetic biology was inherently 'unnatural' but the social and ethical connotations of this, although touched on, were not fully explored. This may have made it difficult for participants to articulate concerns in this area.

4.4 Reconvened workshop

I'm not a lawyer yet I can sit on a jury. If I can have that responsibility why can't I do this? (Public participant)

This reconvened workshop involved eight public participants, two from each of the regions included in the dialogue. The findings from workshops were presented to participants to see whether the results rang true for them. There was opportunity for comment and discussion following the contractor's presentation.

Although the presentation was largely one-way most participants were happy to speak. They were generally in agreement about the findings and about how the dialogue should be used. The group were also interested in the selection process for participation and the setup at TNS-BMRB. In fact a brief description of this in the earlier workshops may have been worthwhile.

Participants expressed concerns that science doesn't listen to the public and felt they should be more involved. They were supportive of science and new technologies but felt it needed to be explained. The group agreed with the contractor that the debate intensified around synthetic biology because the risks were seen as great.

Participants generally agreed with the findings – differing on the emphasis occasionally but nodding in agreement at the end of each slide. A point was raised that the idea of global responsibility came out strongly in the workshops but not in the presentation. There was also comment about profit from new technology and how benefits can be democratised. They also felt security was a significant issue in the workshops but was not raised in the conclusions.

The group were pleased that the input of lay people was valued but felt that more could be done, especially with respect to the Research Councils; it was felt that scientists and Research Councils have been insular for a long time and that this needed to change. BBSRC explained that previously there were lay members on BSS, but they gave up their positions because they felt unable to comment on the scientific process.

4.5 Stakeholder interviews

TNS-BMRB conducted forty-one telephone interviews with synthetic biology stakeholders. These included scientists and engineers, social scientists and ethicists, religious or faith representatives, Government, regulators, funders, industry, NGOs and consumer groups. These interviews were conducted ahead of the public workshops, with considerable input from the OG on the topic guide and list of stakeholders to be contacted.

The interviews acted to inform the contractors about the topic ahead of the development of the facilitators' guides, and the findings directly influenced some of the materials such as the scripts for the actors who represented viewpoints from a scientist/engineer, industry, NGO and social science.

This aspect of the dialogue was more like research than engagement, so was difficult to include in our evaluation methodology. While some of the findings were fed back to the OG, in the main they were presented along with the findings of the public workshops. While we are unlikely to evaluate the experiences of those interviewed directly, we would expect to include some of the stakeholders in our longer-term follow-up to explore their perceptions of the way their views were used in the dialogue and presented in the report.

5 Findings – Public questionnaires

A questionnaire was developed based on tools used by Shared Practice in evaluation of previous Sciencewise-supported dialogues (Warburton & Ordish, 2009; Warburton, 2008). This was distributed at the end of the final workshop. Shorter, less formal questionnaires were used at the end of Workshops 1 and 2, but the findings of these were used to support or challenge the findings from snapshot interviews or observations that were discussed in the previous section of this report.

5.1 Questionnaire sample

We had the following questionnaires returned:

- 132 / 152 from Workshop 1 (87% return rate)
- 124 / 138 from Workshop 2 (90% return rate)
- 124 / 130 from Workshop 3 (95% return rate)

At Workshop 1, questionnaires were distributed by moderators. The London sessions were split over two days, so respondents were asked to return their completed

forms by post. This reduced the response rate. In one group in Newcastle the moderator forgot to distribute the forms.

In Workshops 2 and 3 the questionnaires were distributed in the plenary session at the end of the day. The contractor had left a dedicated time for participants to complete them, so response rates were high. However participants that left early would have been omitted from the sample.

This section presents the findings across the four regions. Charts for each item broken down by region are provided in the Appendix.

5.2 Data analysis

Quantitative findings are summarised as frequencies in this section. Our questionnaires also yielded a large amount of qualitative data on which we have performed a category analysis. This involves grouping similar responses together into categories and exploring frequencies for each category. A single response can be coded more than once if it relates to several categories. Where we have used this approach, we have provided indicative quotes for the main categories in each section.

A full list of the responses available under each category is available, but was too lengthy to append to this report.

5.3 What would you recommend to the Research Councils?

Participants were asked to respond to this in an open question. Their responses were grouped into categories and are summarised below.

Theme	London	Llandudno	Edinburgh	Newcastle	Total
More or continue communication to / engagement with the public	6	5	10	9	30
More/ tighter/ better/ international regulation/ control	5	10	8	41	27
Comments on the workshop	6	8	6	3	23
Continue/increase funding / research	1	7	4	8	20
Pursue a specific application			5	4	9
Ethical/fairness	1	1	1		3
Less regulation			1		1
Other	2		1	4	7

Findings clearly indicated that of the four strongest themes, two related to public engagement, one was about improved regulation and one recommended further pursuit of synthetic biology research.

I would recommend that this is properly regulated and also readily available (Regulation, Continue research)

To continue the project and make the world a better place (Continue research)

Keep on with sufficient funding as if we don't invest in the research we will be left behind (Continue research)

Be honest and open whilst communicating the work that is going on/or will be in the future (More communication)

Think about where you are going not about cash (Ethical)

5.4 Experiences of the workshops

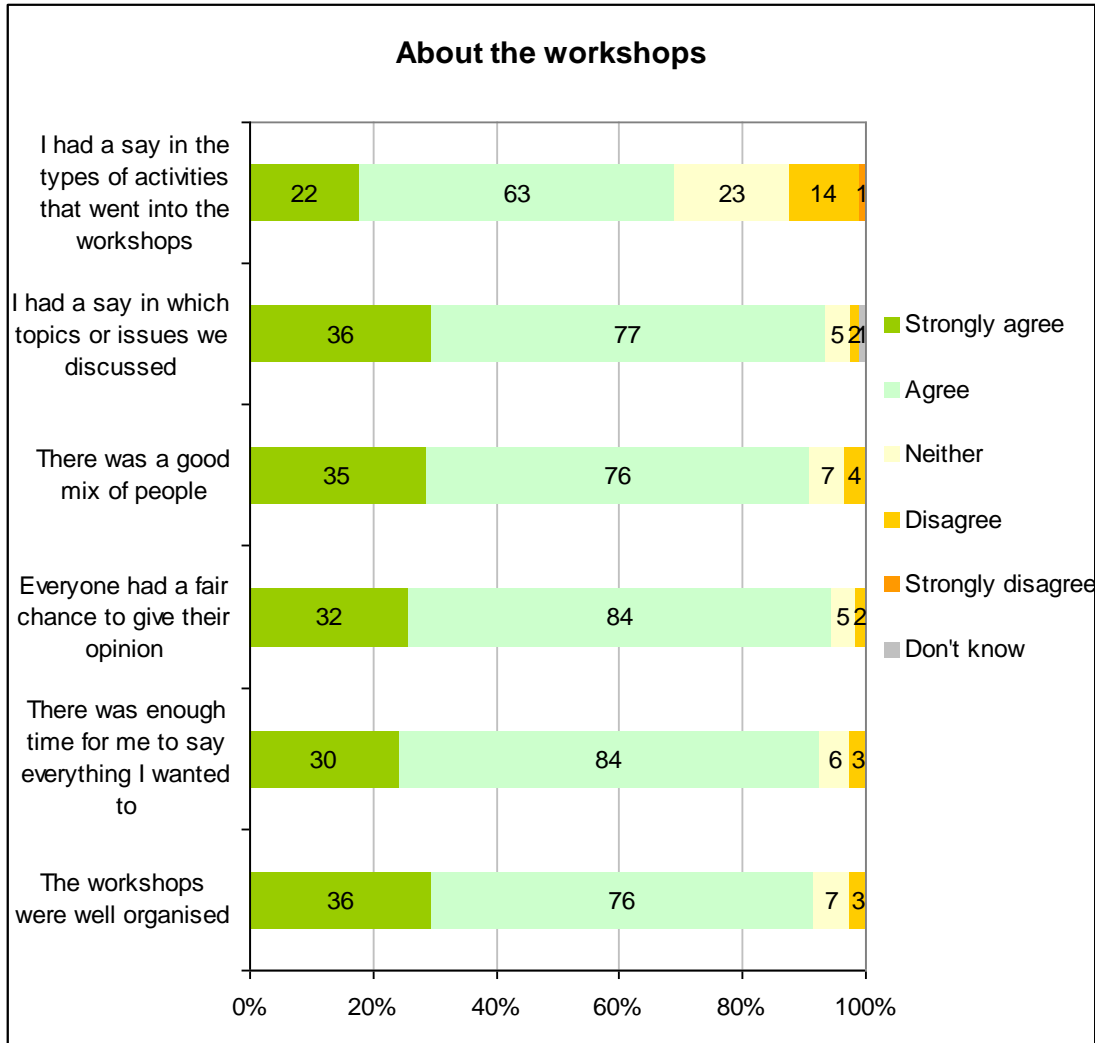
Experiences were captured in two ways. Firstly, participants were asked to write down three words that summarised their experiences. These were used to create a word cloud at www.wordle.net where the most commonly cited words are presented in larger text. Here is the word cloud for the responses:



Clearly the most commonly-cited words were 'interesting' and 'informative'. These were removed from the responses to reveal some of the other ideas, giving a broader sense of participants' views:



Respondents were also asked to rate various aspects of the workshops.



The first two items were included in direct response to one of the dialogue aims, which was to enable participants to shape the workshops. From our snapshot interviews and the open responses, we learned that participants felt their questions were taken on board well between workshops 1 and 2, but less so between workshops 2 and 3.

It is clear from these responses that participants had broadly positive experiences of the workshops. In some ways, this questionnaire feedback contrasted with the feedback we received in our snapshot interviews. Often in these interviews participants took the opportunity to be critical of aspects of the workshops. However the strong support for public engagement that emerged during sessions may be a factor in this: our sense was that respondents felt that the process was very worthwhile to be involved in and that this view has influenced the responses to questions about the dialogue overall to a greater extent than interview questions about specific elements of the process.

The table below summarises the open responses to the question.

About the workshops	London	Llandudno	Edinburgh	Newcastle	Total
Good group dynamic/mix of people	3	3	8	6	20
Good organisation / structure / topic guide	2	4	1	6	13
Good facilitation	1	2	3	1	7
Learning	1		1	2	4
Interesting		1	3		4
Poor facilitation / group dynamic	1	2			3
Comfortable giving opinions			2		2
Ideas not acted on				2	2
Other	3	2	2	2	9

Most people rated the group aspect as a strength of the process and a number also commented on the effective way they were led through the topics. A minority felt that the group dynamic was poor, and at least one group had a different moderator for each of the three workshops, which they found frustrating as they felt they had to repeat themselves (this was revealed through the snapshot interviews).

Comments included:

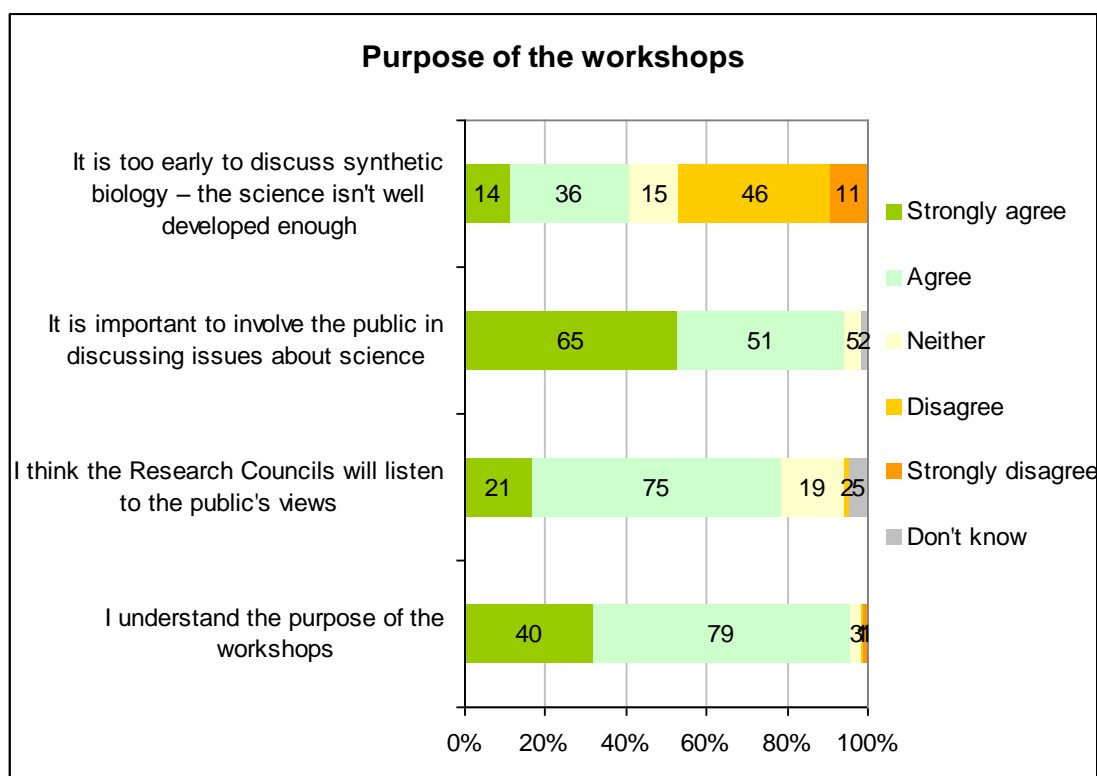
I believe the workshop really had a blend of people from all walks of life and it was well structured and timed (Group dynamic)

Everyone got a chance to speak (Good facilitation)

I would have liked the facilitator to have asked people who hardly spoke what their view was (Poor facilitation)

I think we had opinions from Workshop 2 which I expected to see in Workshop 3 but didn't (i.e. political opinion on syn bio) (Ideas not acted on)

5.5 Purpose of the workshops



This chart indicates that public participants understood the workshops and agreed that it is important to involve the public in discussing issues about science. Most agreed that they thought the Research Councils would listen to their views, although a minority neither agreed nor disagreed or were unsure. Responses were divided over whether it is too early to discuss synthetic biology.

The table below presents the themes from the open responses, where participants were asked to comment on the purpose of the workshops:

Purpose of the workshops	London	Llandudno	Edinburgh	Newcastle	Total
Listening to public views	5	6	2	2	15
Informing the public		3	4	6	13
Early discussion	2	3	4	2	11
About the workshops	1			5	6
About synbio				5	5
Understanding the purpose			3		3
Other			2	1	3

It was interesting that themes about receiving information and being listened to both emerged. A number of respondents also used the space to highlight that they felt early discussion was valuable. Quotes included:

Never too early but need more information to feel really confident about it (Early discussion)

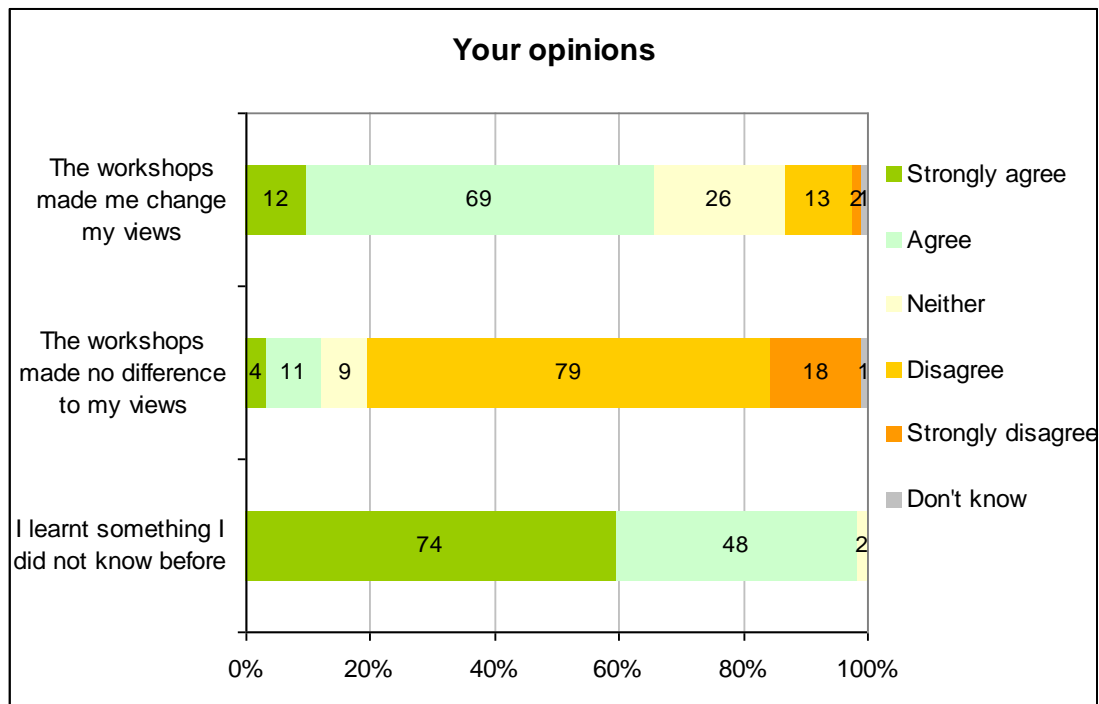
Pleased that public discussion was addressed and appears valued (Listening to public views)

I am a bit apprehensive as to whether our voices will be heard or not. (Listening to public views)

The public need to be aware of this research (Informing the public)

5.6 Public outcomes

The questionnaire explored early outcomes for participants in terms of learning and attitudinal change. Quantitative responses are presented in the chart below:



All but two participants agreed that they learned something new from the workshops, indicating strong outcomes in the cognitive domain. Over 60% agreed that the workshop had made them change their views, but 80% rejected the notion that the workshop had made no change to their views. The open part of the question asked respondents to describe the changes:

Your opinions	London	Llandudno	Edinburgh	Newcastle	Total
Awareness / understanding	5	5	7	13	30
Changed attitude or view	3	6	5	6	20
No change				3	3
Other	1	3		1	5

The open responses strongly supported the ratings; most cited a shift in awareness or understanding, although many also described a change in attitude. Comments included:

Initially I was unaware of this concept. But now I can quite well talk about this with my family and friends. (Awareness/understanding)

I never knew synthetic biology even existed before these workshops (Awareness/understanding)

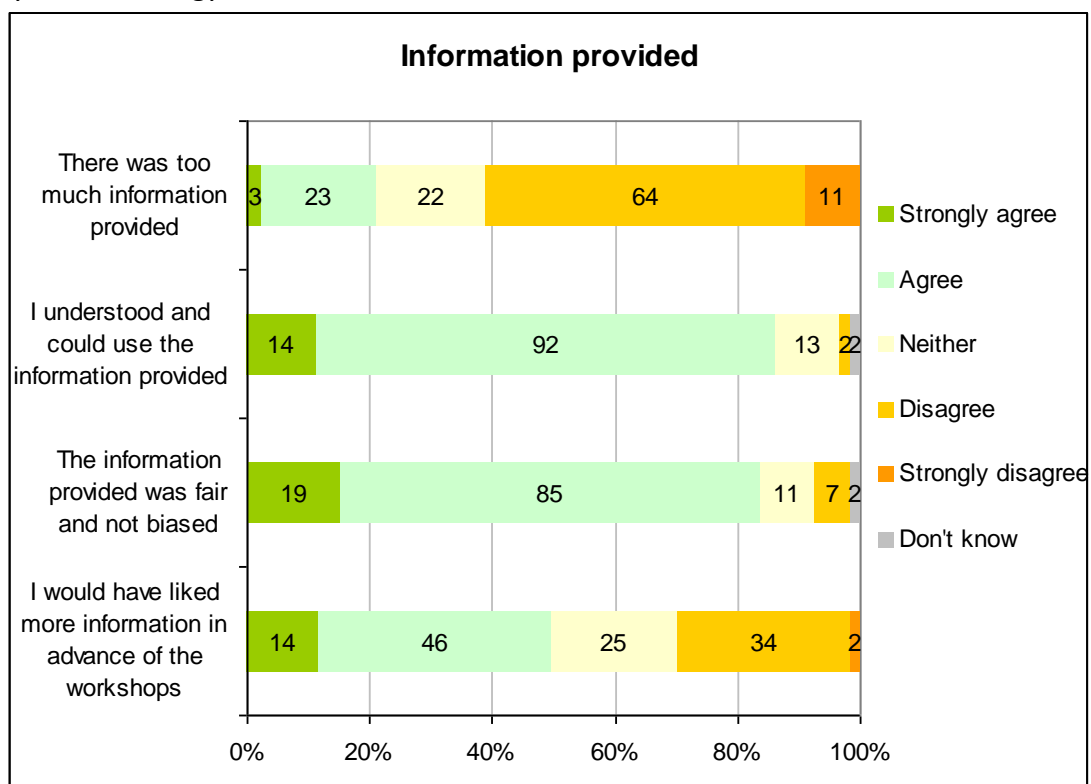
I am less worried about impacts (Attitude)

I thought bio fuels were good until they were explained (Attitude)

Eye opener (Other)

5.7 Information provided

One section of the questionnaire probed responses to the information provided during the workshop. This was especially interesting for an upstream issue like synthetic biology.



Most agreed that the information provided was fair and understandable. Most rejected the idea that too much information was provided, although a fifth agreed. Opinion was split over whether more information should have been provided ahead of the workshops: in the open responses some said that this would have helped them make more informed contributions, while others felt it had the potential to introduce bias. The categories for the open responses were:

Information	London	Llandudno	Edinburgh	Newcastle	Total
Good level and balance of info	1	2	3	6	12
Lots /too much info	2	1	1	3	7

Not enough info	1		3	2	6
Info in advance		3	2		5
Hard to understand / too technical		3		2	5
Some info / viewpoints missing / biased info	1			3	4
Interesting / relevant	2	1			3
Other	1	2		5	8

Interestingly, in the open responses several participants commented that there was a great deal of information provided, without necessarily thinking this was ‘too much’. In the snapshot interviews participants referred to the amount of information provided as affecting their levels of engagement and saw this as a factor that should be taken into account with respect to the length of sessions. For example, some felt that they needed time to process the information before being able to discuss it, while others felt that they needed more information (or a better understanding of the information they had been given) in order to clearly articulate their views. Feedback during the workshops indicated that when participants had searched for information about synthetic biology on the internet, the material was very technical. This is a challenge with dialogue on an upstream topic such as synthetic biology.

A minority of participants used the space to express a concern that some information (for example input from a regulator, or NGO) was missing from the dialogue.

Comments included:

Well organised leaflet about info which we talked on each subject (Good level of info)

Not enough information provided (Not enough info)

The day sessions were jammed with information (Lots/too much info)

Sometimes I found the scientific info difficult to follow (Hard to understand)

Information in advance may change your opinion (Info in advance)

Need to have a view against synthetic biology (Some missing/biased info)

5.8 Other outcomes

The questionnaire asked participants whether there was anything else they gained from taking part. These open responses were coded into the following categories:

Other outcomes	London	Llandudno	Edinburgh	Newcastle	Total
Knowledge / learning / awareness	9	4	9	13	35
Interaction with scientists / others		1	1	3	5

Broaden horizons / think differently		1	2	2	5
Involvement	1	4			5
Interest	2			2	4
Enjoyment		1		1	2

Comments included:

Awareness of science and where it is going (Awareness)

A sense of being involved in a new exciting area of scientific developments (Involvement)

An insight into a new science and talking to real scientists (Interaction with scientists)

A sight of the future? (Broaden horizons)

5.9 What would you change?

This open question asked about potential improvements to the dialogue. The responses are categorised below:

What could have been done differently?	London	Llandudno	Edinburgh	Newcastle	Total
No change	2	4	3	9	18
Shorter sessions		2	7	1	10
More/ simpler / different info / representatives	2		4	3	9
More / different types of interaction	2	1		2	5
Facilitator			2	2	4
More time	2	1			3
Venue / AV / organisation	2		1		3
Other	2			1	3

The largest proportion of respondents said there was nothing they would change. From those that made suggestions, the findings support some of the ideas about the sessions being somewhat heavy at times: shorter sessions and more variety were ideas put forward. Of the four respondents that commented on their facilitators, three expressed a desire to have the same facilitator between sessions. This was also raised during the snapshot interviews.

Comments were fairly diverse here so the categories are quite broad. Responses included:

Split the time into shorter days (Shorter sessions)

Maybe had a politician to answer questions (Different representatives)

Made it a bit more simple for the normal people (Simpler info)

Improve qualities of audio/video presentation (AV)

More different activities everyone tired by afternoon (Different types of interaction)

Having the same person running each workshop (Facilitator)

6 Findings – Experts

Workshops 2 and 3 were each attended by an expert scientist and an expert social scientist. The same experts attended Workshops 2 and 3 in Llandudno, Newcastle and Edinburgh, but different experts attended the two workshops in London. They gave presentations and were available to participants as a resource, circulating among the breakout groups. Workshops were also attended by a representative from the Research Councils, who was able to provide participants with an additional resource on funding, policy and the role of tools such as dialogue. Different Research Council representatives attended the different workshops.

The experts involved in the workshops highlighted:

- Lively discussions and the level of energy and engagement in the groups;
- The success of the electronic voting, which there had been scepticism about;
- That public participants drew contrasts between their own roles and work and the work of the Research Councils and scientists;
- The different views expressed by different focus groups of participants (each workshop involved four focus groups of public participants, and experts spent some time with each group);
- That they needed a clearer brief and felt conscious of their capacity to influence and to disturb the discussions. This was particularly true for the scientists, who all stated that they found public engagement challenging.

Workshop process and methods

The experts agreed that the process for Workshop 2 worked well, and that the discussions in the different groups were distinct. The groups were described as inclusive and well-moderated, and some experts commented that they had learned from the experience of watching several different groups. The diversity of methods used was seen as a strength of the workshops, with the video ethnography and the electronic voting seen as highlights which were engaging and offered insights into public perceptions of synthetic biology and science more widely.

Constructive comments on the methods used in Workshop 2 included the limitation of the ethnography to early career academics, meaning that it was not truly representative of the scientific profession, that there were a large number of handouts, making the breakout groups feel rushed and limiting discussions, and that some of the materials were oversimplified.

The experts felt that they would have benefited from a face-to-face meeting prior to the workshop, which would have allowed them to feel more prepared. One of the

experts recommended that a scribe would be useful during the breakout groups to keep a written record for participants to refer to.

Most of the expert comments on Workshop 3 focussed on the process. The agenda was seen as full, which sometimes limited discussion so that deeper concerns about 'naturalness' and the political economy were not fully explored.

It was hard for people to weigh all of the alternatives, I mean if they've got the syn bio solution and four other alternatives. They've got no data on what costs the most or is most effective so it's difficult for them to do a comparison. (Social Scientist, Workshop 3)

As with Workshop 2, facilitation was seen as a strong point of the sessions, but the stimulus materials were felt by some to be too detailed and difficult for participants to grasp. The videos in Workshop 3 were also seen as problematic as they were not engaging for many public participants. The experts that attended the workshops were asked to comment on the videos afterwards and take questions. This was difficult as in many cases the experts had not seen the videos beforehand so did not know what material would be covered. Again, the experts seemed to be unclear about their role and some felt underprepared for the workshops, not knowing what to expect.

Despite some concerns, impressions of the workshops overall were very positive. The experts liked the range of issues and ideas addressed and felt that they encouraged different perspectives.

Learning

During Workshop 2 experts were surprised by participants' level of interest and engagement with the subject. Many felt they had learned the value of conversation and of dialogue. Some identified key issues which had been discussed in the groups such as regulation and ethics. Experts commented on the impact of facilitation on the groups, and on the way that groups developed an accepted (by the group) view on the topic which was not necessarily inclusive.

It's interesting how a group dynamic develops that can take the question in a direction which is not necessarily representative of all the views of the group. (Social Scientist, Workshop 2)

Some felt that they had learned about public attitudes towards scientists, and that members of the public often mistrust scientists and their motivations, while retaining a high level of support for the idea of science more generally. This underpinned much of the discussion around regulation.

We need to unpick the realities of the wish for this regulation, and see how it would be imposed and the power that any governing body such as an international regulator would have. (Research Councils' Representative, Workshop 2)

In Workshop 3 the experts felt that they had learned more about synthetic biology from the other experts, the source material and through the participant discussions in breakout groups. The workshop also allowed experts to learn from the facilitators and to see how the discussion was directed, and from the questions that participants asked.

Often in these circumstances you get asked questions somehow you never got round to asking yourself. (Social Scientist, Workshop 3)

Attitudes

Some experts felt that their views had not shifted through participation in Workshop 2, while some felt that their views had been broadened or tested. The experts valued hearing a wide range of viewpoints, which allowed them to consider the subject in a new way and question their own assumptions. Several of the experts were surprised by participants' misconceptions, particularly around funding and the role of industry.

Although in my opinion the regulation we've got at the moment works well I don't pay much attention I just fill in the paperwork, but now I might pay more attention (Scientist, Workshop 2)

Following Workshop 3 the experts felt that they valued public engagement more. Most had enjoyed the opportunity for debate, and felt that the level of discussion in the groups was very high. The workshop challenged the experts' views while providing the opportunity to defend them. Experts learned that the participants were supportive of technological change, and saw a need for continuing dialogue with the public.

There has to be a continual dialogue and these one off events aren't sufficient. (Scientist, Workshop 3)

7 Findings – Steering and Oversight Groups

This part of the report draws together evidence from various sources to respond to the effectiveness of the dialogue, the role of the Oversight Group and aspirations for the next stages of the dialogue. The sources of evidence are:

- Feedback by email after the four Oversight Group meetings;
- Ten interviews with OG/Steering Group members (including Research Councils) throughout the dialogue;
- Analysis of email exchanges;
- Our own observations and reflections from meetings.

In addition, we collaborated with BBSRC to put together a 'mini-workshop' around the guiding principles for the dialogue (written by the SG before the OG was formed) at the final OG meeting. This presented an opportunity for the Oversight Group to pass comments directly to the Steering Group about their view of the process and the role of the Oversight group in it.

Each of the guiding principles was considered in turn as a brainstorming session, during which members of the Oversight Group were able to comment on each others' contributions. These comments were then themed during breakout sessions, and recommendations around the guiding principles were captured. These were framed in two ways:

- ***What does this mean for this dialogue?*** (things for the Steering Group to think about)
- ***What should we do differently next time?*** (things for the Research Councils to think about)

The Oversight Group were asked to prioritise recommendations they felt were most important.

7.1 Reflections on dialogue process

This section presents the findings from the mini-workshop, although comments from interviewees are also included where relevant.

Inclusivity

Principle: The dialogue should seek to be inclusive of the perspectives of a wide range of UK residents at all stages, in addition to being inclusive of the plurality of knowledges and interests in the topic area.

Both strengths and weaknesses were identified in the mini-workshop. Key strengths related to the **discussion groups**, which were felt to be well facilitated and brought a range of people together to encourage participation:

Good facilitation meant that 'shy' participants had their say in London and Wales (Strength, mini-workshop)

The **geographic spread** was felt to include both rural and urban areas; however, some felt that **access** was limited for some participants due to timing at weekends not suiting all and the absence of young people (under 18) in the sample.

Another aspect of inclusion discussed during the workshop related to the **experts** included in the dialogue workshops and those included through TNS-BMRB's **stakeholder interviews**, which were seen as a strength of the process in themselves. The range of viewpoints represented in the OG was also seen as a strength, but some felt that more expert viewpoints should have been included during workshops or in the stakeholder interviews:

Small, relative, size of dialogue might have missed some views (i.e. only Christian religious stakeholders perspectives) (Weakness, mini-workshop)

During the interviews, the **Oversight Group** was recognised by members as being very diverse with inclusion of a number of strong viewpoints. Several stakeholders noted that this led to difficulties, particularly at the beginning of the project, around chairing and decision taking, as it was difficult to maintain a balance of voices and ensure that the Oversight Group, while being critical, did not fragment or hinder the

delivery of the workshops through over-involvement with the process. Overall though this level of inclusion was seen as valuable, and is discussed in greater detail along with other aspects of the OG operation later.

At the end of the mini-workshop, OG members came up with recommendations for the Research Councils and the Steering Group. These were then prioritised; the level of priority is denoted by the number of asterisks next to the recommendation – each OG member was given three stickers that acted as ‘votes’ for which recommendations they wished to prioritise.

In relation to inclusivity, the OG had two thoughts to share with the Research Councils:

*Bear in mind – this is based on adults views. Include young people in the future – in the same or different workshops? **

Complex subject needs more face to face time.

(What should be done differently next time? Mini-workshop)

They had two things to say to the Steering Group:

We think sample was diverse and recruitment was appropriate.

Bear in mind this is based on adults’ views.

(What does this mean for this dialogue? Mini-workshop)

Innovation

Principle: The dialogue process should be innovative and imaginative in order to capture the interest of as broad and inclusive a range of participants as possible – including so-called ‘hard-to-reach’ groups, drawing on knowledge of good practice.

There was a diverse mix of comments in response to this principle. The group that discussed this asked **what do we mean by innovation?** In terms of what innovation is and why it’s necessary:

*Unclear across the group what we meant and wanted from innovation
(Comment, mini-workshop)*

Three further themes relating to innovation were then identified. The first was about techniques within the workshops. Firstly, some felt that the **mix of techniques** (such as actors and video ethnography) were innovative and successful in WS2, and that these could have been built on in breakout sessions which relied mostly on *‘response to written info and talking only’*.

Secondly, there were contrasting views about whether the **recruitment** was innovative. A success cited was the grouping of participants, while another comment was that recruitment was standard and may not have reached past the ‘usual

suspects', especially given the aspiration to include hard-to-reach groups in the guiding principle.

*Recruitment was standard, therefore did we reach past usual suspects?
(Comment, mini-workshop)*

Thirdly, there was some criticism that the innovation was **technology-driven**, rather than a more holistic approach to innovation:

BMRB tended to focus on innovative technologies rather than a holistic approach to considering innovation (Weakness)

Finally, the OG recognised that their own role had not been conducive to fostering innovation. This is discussed in greater detail in Section 7.2.

Committees are inherently risk averse (Comment, mini-workshop)

Interviewees at both stages of the process highlighted a potential tension between innovation and rigour:

*Because these are such important issues people want that [interpretation of public] opinion to be right and want to be sure about what the public think and that makes them a little bit wary about anything innovative.
(Interviewee)*

There was just one comment for the Research Councils on this principle:

*Variety of methods in workshops worked well.
(What should be done differently next time? Mini-workshop)*

However it was seen as a more important message to go back to the Steering Group:

*Was 'innovation' a relevant guiding principle? Did lack of innovation matter if the objectives were achieved?**

Lack of clarity for OG in terms of what innovation was and why it was asked for. Did the dialogue deliver the type of innovation you were after?

Not obvious what innovation was and wasn't.

(What does this mean for this dialogue? Mini-workshop)

Influence

Principle: The dialogue must include mechanisms that ensure it has clear means of influencing relevant policy making processes.

The OG were not sure to what extent creating mechanisms for policy influence was their role; we felt the timing of this question was a little unfair and may be better revisited after there has been some time for OG members to act on the dialogue findings. As one OG member pointed out:

If RCs are committed to this it will become clearer once the report and recommendations are received – the workshops are not the end of the process! (Comment, mini-workshop)

As indicated by the comment above, much of the policy impact was seen as relating to the **Research Councils**, where the launch and other planned processes were seen as strengths in this regard. However several participants raised ideas about influence **beyond the councils**, which were all framed as weaknesses and included regulators, Government, learned societies, industry and international policy. Related to this was a theme about **uncertainty**, where participants were unsure about where the influence would be and how it would happen:

Uncertainties over how and whether will influence Research Council Government policy. Need next steps. (Weakness, mini-workshop)

However these lines of influence should become apparent over the coming months and we will return to this issue in our follow-up study.

The strongest recommendations to the Steering Group from the OG related to this principle (NB the asterisks denote the extent to which each recommendation was prioritised):

How does the report get effectively translated to: Policy makers; industry (medical, insurance); regulators; NERC/consumer; public/media; researchers etc. *****

*Should this influence RC or Government policy? ***

*Do SG understand the audiences for the outputs and are they properly matched (for the report launch) may need multiple outputs. ***

*Where do the strategic discussions about this happen, who with and how wide is the remit? ***

(What does this mean for this dialogue? Mini-workshop)

Openness, honesty and transparency

Principle: Honest about the science and its uncertainties and open and transparent about the engagement process and its aims. Clear about the different roles of different stakeholders and how key decisions are reached within the dialogue.

Four strong themes emerged from the mini-workshop in response to this principle. Firstly, the **materials and case studies** were praised and criticised for effectively communicating uncertainty and being complex or inaccessible respectively.

The complexity of some of the case studies obscured the issues in question (Weakness, mini-workshop)

Secondly, the **participants** were seen as being important - as in any dialogue – but specifically in this process some of the comments related to their ability to shape the

content of the workshops and provision for their ongoing involvement. A weakness was that they couldn't influence the workshops as much the OG would have liked (although the questionnaire findings reveal that most public participants were satisfied with the level to which they were able to do this) and an aspiration was that they would see how their ideas influenced decision-making.

Thirdly the **scientists** were commented on, with the opportunity for members of the public to question them seen as a strength, but again the restriction in the range of experts seen as a weakness.

Finally, openness with **stakeholders** was seen as a strength across the board, despite the acknowledgement that this transparency was not always easy to achieve:

Generally a feeling of openness and honesty but sometimes had to labour on concerns (e.g. environmental concerns) (Strength, mini-workshop)

There was some discussion of **bias** in the follow-up interviews with OG and SG members, who felt it is easy to introduce bias and to sway public opinion. The role of the Oversight Group was seen as crucial in limiting this bias, particularly as the dialogue was funded by the organisations that fund the research. It was also noted that this transparent approach requires a greater level of structure and organisation to handle the diversity of views, and this had been a particular difficulty during this dialogue.

Linked to the notion that it is easy to introduce bias, it was noted that opinions, including the public views expressed as outcomes of the dialogue cannot be taken in isolation, and are only meaningful as a part of the debate. This was emphasised by the contractors who felt it was important that polling and other 'hard' data was not read in isolation, but this can be difficult to control.

Two points were raised to pass on to the Steering Group:

No recommended reading for both participants and Oversight Group

Feedback to participants and scientists.

(What does this mean for this dialogue? Mini-workshop)

The 'recommended reading' referred to above was meant to include reading about synthetic biology for public participants and OG members, and potentially reading about dialogue theory and approaches for OG members.

Researcher participation

Principle: Researchers from a broad spectrum of disciplines must be involved not only as unbiased experts but also as participants throughout the dialogue.

Some interesting ideas were raised in response to the principle about researchers. OG members raised positives and negatives about the **roles of experts**. Some highlighted the range of involvement methods as a strength (i.e. through

ethnography and other films), while others were clear to draw a distinction between expert involvement in the OG or stakeholder interviews with involvement in the workshops themselves.

This linked to the second theme about the **diversity of experts** included in the workshops themselves. Generally, it was felt that this group lacked diversity. The OG would have liked to have seen researchers at different stages of their careers and from a range of backgrounds not just academia. A few also questioned the extent to which experts were briefed or had the opportunity to address misconceptions during workshops:

*Process would have benefited from wider range and diversity of researchers.
(Weakness, mini-workshop)*

*Were researchers engaged early enough and had adequate briefing?
(Weakness, mini-workshop)*

The final theme was about **bias** which was raised in relation to several other principles. One OG member felt that researchers were too biased. Others felt that bias was inevitable and praised the way this was addressed in the workshops:

*Bias is in everyone – balance was the issue. Facilitators did well to reveal bias.
(Strength, mini-workshop)*

The subject of bias and ‘selling’ synthetic biology to the public was also raised during the interviews as a concern which group members felt had been negated well through the inclusive nature of the Oversight Group, although it was noted that it was impossible to remove bias completely. The challenge of introducing contrasting ideas and philosophies to participants with a limited understanding of the subject was seen as a key problem to be addressed in the process.

The people that they had were intelligent people but they weren't all educated in biology or synthetic biology. So there was a big tendency to go off at tangents, whereas if we'd been able to say: that's factually incorrect for the following reasons, it would have gone a lot better. (Interviewee)

The following recommendations were made to the Research Councils (listed in order of priority):

Longer lead time needed to recruit experts, think of new ways to recruit and ensure briefing is effective. ****

More in depth engagement with scientists from the beginning.*

Clarity on role and expectation of experts is needed.*

Good brief and long lead in to participation (for researchers).

Consider level of involvement of researchers and how this will impact the dialogue.

(What should be done differently next time? Mini-workshop)

Steering Group recommendations were (listed in order of priority):

*Involve a lot more researchers in the next steps.**

Encourage the experts who took part to share their experiences, both good and bad, and show that although they weren't huge in number they were a representation.

Be aware that a small proportion of researchers have been involved

Implication for dissemination to researchers.

(What does this mean for this dialogue? Mini-workshop)

Oversight

Principle: Policy makers, research council staff, Oversight Group members and the Evaluation Team should also be able to hear first hand the views that are being expressed during the dialogue process.

Participation in the workshops was strong and requests to attend could not always be met. The fact that the evaluation team and OG were represented at all workshops was seen as a strength, but one weakness raised was that more policy makers could have attended.

Another theme was information: some OG members felt that TNS-BMRB's distillation of the outcomes was good and a valid alternative to attending workshops:

Distillation from BMRB very good. First hand not really necessary although quotes very informative (Strength, mini-workshop)

An opportunity to bring findings from the different dialogues together was also seen as a potential strength, but the limited amount of information fed back about the stakeholder interviews was cited as a weakness.

Our interviewees included OG and SG members that attended the workshops, some as experts and some as observers. Those who attended the workshops felt that they worked well, and others that did not attend commented that the workshops were key to the success of the dialogue, and more important than the dialogue oversight. Observers were surprised by the level of interest and debate shown by the public participants. They said the methods reduced the divide between experts and public, giving the participants the confidence to see scientists as human beings. The scientists and engineers we interviewed valued a new level of insight into this area, which allowed them to understand how the public view their work, and to some extent be critical of it. Overall the participation of public participants, scientists, social scientists and stakeholders from the SG and OG led to the beginnings of a dialogue process on synthetic biology, while the variety of expertise among the SG and OG gave strength to the process.

For me an important aspect of this is that it will act as the basis for a continuing dialogue with the public because I believe in a two way street in this (Interviewee)

Those interviewees who had not visited workshops felt that they had missed an important part of the process, and some felt that if they were to begin the process again they would ensure that they attended at least one. Some who had participated in the workshops felt that the role of the experts and observers was unclear, and that they would have benefited from more information about the process, so that they could understand their role better. Without a background in social science or public engagement some interviewees found it difficult to conceptualise the idea of dialogue, and so to become fully involved with overseeing the process.

One of the difficulties I had was I have never been involved in a public dialogue before and what I think would have done me good would have been to go along to one of the sessions and see how actually it worked because I wasn't sure about the set up and how it was all going to fit together. (Interviewee)

One interviewee noted that the Steering Group (who were not members of the Oversight Group) were disconnected from the process of the workshops, and that those who attended the workshops as experts and observers would have benefited from a deeper understanding of the concepts behind them.

During the mini-workshop, OG members made the following recommendations to Research Councils:

*It is important policy makers should hear first hand if possible. ***

*It's important to have observers at all meetings – as many as possible without being too many! **

If Research Councils are looking to include dialogue in more strategic decision making, it would be useful for Research Council staff to experience first hand.

(What should be done differently next time? Mini-workshop)

However this issue was seen as a lower priority for the Steering Group:

Be aware that ownership of the report / recommendations may be diluted if not involved in OG / participated in workshops (especially policy makers).

If you are there much more powerful.

(What does this mean for this dialogue? Mini-workshop)

Other feedback

Prompt: Successes and challenges that don't easily fit into one of the other principles

A few points were raised in this section:

- The lack of time for planning, especially between workshops 2 and 3;

- Whether voting questions were too simple and risk being quoted out of context;
- The potential to draw together findings from different dialogues, or produce an academic paper based on this one;
- Whether participants' sources of information on synthetic biology could have been more effectively explored, and whether they should have been provided with more information like a resource list.

There was just one suggestion for the Research Councils that didn't relate to the key principles or the OG itself:

*Research Councils need to engage in wider discussion of social impacts of emerging technologies.**

(What should be done differently next time? Mini-workshop)

7.2 Reflections on involvement in the process

This section combines findings from interviews, email feedback and the mini-workshop. The themes relate to SG and OG members' reflections on their role in the dialogue.

Motivations and expectations

OG and SG interviewees became involved in the dialogue for a variety of reasons related to their particular areas of expertise. These included: experience in public dialogue, through their roles at BBSRC or EPSRC and related scientific expertise with an interest in public engagement. Involvement was seen as giving benefits from both personal and organisational perspectives, although the two were linked. Personal reasons for involvement were an interest in learning about dialogue, the chance to learn more about how social scientists can be more involved in a scientific field, networking and meeting people. Involvement in this dialogue gave those OG and SG members who did not work directly for the Research Councils an insight into their working, raised their profile in public engagement and ensured that their organisations' voices were represented in dialogue discussions. One interviewee felt the dialogue might help 'firefight' should there be a future public outcry. It was felt that using the outcomes to inform key messages for future communications was acceptable, as long as the dialogue wasn't developed with the intention of suppressing public concern. Others described the way in which the public voice should be one of a number of evidence sources used to inform (rather than form) policy.

Need expertise from various sectors to make decisions. One slice of the cake should be public opinion, [although it is] important to say that decisions should not be made based on public opinion alone, but public voice should never be lost. (Interviewee)

The role of the group

The Terms of reference said: *The Oversight Group's role is to facilitate this dialogue process drawing on the wide range of expertise and perspectives represented in the Group's membership.*

In our formative evaluation report presented to the OG at their second meeting, we suggested that the term 'facilitate' does not give sufficient detail on the level or type of support, and that it would be useful to provide some additional guidance on where the group has a role, and where TNS-BMRB should work independently. This lack of clarity was clear from two of our interviewees near the start of the process. One said:

The Steering Group wanted the Oversight Group for operational input. (Interviewee, formative evaluation)

Another said:

Oversight Group should be more strategic less operational (Interviewee, formative evaluation)

The dynamic of the relationship between the Oversight Group and the contractor was initially untrusting. This improved throughout the process, but was initially unhelpful as decisions were changed and undermined. This situation came about because due to lack of clarity between the Oversight Group, the contractor and the Research Councils on how decisions would be made. Two email respondents raised this as an issue after the first OG meeting:

Understanding the complex relationship between the Oversight Group, BMRB, The Steering Group and the RCs (including Sciencewise). (email after OG meeting 1)

It was also highlighted as a weakness of the OG's role in the mini-workshop:

BMRB seen as an adversary rather than partner (Weakness, mini-workshop)

The level of power that the OG had in making decisions was a factor in this, and the group evolved to have a great deal of discussion over email between meetings. This meant that discussions were dominated by those with the capacity (or that had prioritised the role) to read and respond to messages, excluding others. Several respondents raised concerns about the ways in which decisions were taken, and our brief analysis of email exchanges revealed many messages on issues related to the workshop content and delivery.

Email communication (i.e. between meetings) method never clarified (Weakness, mini-workshop)

At the second meeting a decision register was introduced that highlighted the decisions that needed to be taken ahead of the meeting, with a formal structure for capturing these. The Research Councils developed a stronger lead at meetings and over email between meetings: highlighting response deadlines in email headings and

providing summaries of email discussions with directed queries were helpful later in the process. This led one participant in the mini workshop to suggest:

Gone through a learning process as to how communication should work. Would be useful for Oversight / Steering group to write a document on lessons learnt as to how to do this (Comment, mini-workshop)

Our formative evaluation picked up on this point (which had already been noted by the group chair and RCs) and we supported the stronger lead from the Research Councils. Some participants in the mini-workshop felt that the OG had too much say in decisions for the dialogue. This was felt by some to have limited the openness of discussion at times, when raising an issue for critique was seen to necessarily lead to a decision rather than simply the chance to talk through the proposed approach.

Oversight Group members suggested that the group would have benefited from an introductory session to help understand each others' expertise and to be introduced to current thinking around public dialogue. One interviewee also suggested a video introduction to dialogue that would give some insight into what the process looked like.

A mini session on process / methodology upfront would have raised more of the issues that came up later when there was no flexibility to deal with them. (Weakness, mini-workshop)

In the formative evaluation, including a diverse range of perspectives on the OG was a goal echoed by all of our interviewees and those that provided feedback by email at the end of each meeting. Generally members seemed satisfied that this goal had been achieved and this should be recognised as a success of the process. In the closing interviews, stakeholders agreed that the role of the Oversight Group was clarified and that during the final few meetings the group worked together well, so any initial workshop could have accelerated this development.

Two interviewees highlighted the challenges associated with managing group discussions, with different people seeing these discussions differently - as strengths or weaknesses. With hindsight, several respondents identified that bringing in a wider range of group members earlier in the process would have allowed it to run more smoothly from the outset.

[Having] one group from the start but including everybody including constructive critics would have been better. (Interviewee)

The value of having both a Steering Group and an Oversight Group was questioned by group members during the later interviews. The role of the Oversight Group was to provide more inclusive oversight of the dialogue process and a range of expertise to ensure that the dialogue was fair and unbiased. In some cases it was felt that the Oversight Group was formed too late in the process to give members the level of steer over the dialogue that they needed to feel that their voice was represented. However, the Oversight Group had extensive membership, making it difficult to

manage, while the smaller Steering Group was composed to be more suited to directing the strategic nature of engagement around Synthetic Biology.

It's brave, I think, to adopt the attitude from the very beginning of populating the Oversight Group with everyone and thinking it would be functional (Interviewee)

In some of our email feedback, one respondent suggested that it might be unsatisfactory for OG members that are no longer involved in the dialogue now the workshops are complete.

Whilst there is a reason the OG is different from the SG in membership it is a shame that some of the members of the OG will not see the project through via the SG. In future and as often happens the OG should be a subset of the SG and not have new members. I suspect it might feel a little unsatisfactory for some to have no further involvement now even though there is still work to do. (Email feedback after OG meeting 3)

In summary, despite the six other guiding principles discussed during the mini-workshop, consideration of the role of the Oversight Group was highly prioritised, especially in the recommendations to Research Councils:

Improve dynamic / working relationship between OG - contractors – Research Councils ****

Make it clear what needs to be achieved from the beginning (not just doing a good thing). ***

*Invest time upfront with the oversight group about methodology / process so that any fundamental issues / concerns can be 'outed' early when there is flexibility to do something about it. ***

*Meaningful engagement of NGOs (influence over contractors at some point).**

*Do we need a Steering Group and an Oversight Group?**

*Committees / Oversight Group need clear responsibilities. Decisions should be devolved to Research Councils and deliverers. Allows space for debate within Oversight Group – pressure off **

(What should be done differently next time? Mini-workshop)

There was also one related point raised as feedback for the Steering Group, but it was not prioritised as highly as the others:

Clarify relationship between Steering Group / Oversight Group / Contractor

(What does this mean for this dialogue? Mini-workshop)

Time

There were two issues with timing. The first was the ambitious and short timescale for the dialogue itself, which meant that OG members needed to get up to speed quickly with the process and TNS-BMRB's workplan. The second issue was the time

allocated at meetings to take many decisions and ensure that the diverse views of group members could be expressed and discussed.

I think we need to ensure that future meetings do allow time to think about how the public participants are engaged and engaging in the process and this will be more pertinent when the work with them gets going. (Email after OG meeting 2)

The group took steps to address this issue when it emerged, increasing the length of meetings from half to full days.

The timescale of the process overall was influenced by an awareness of synthetic biology work that was going on in the US at the time of the dialogue. This led to an announcement by Craig Venter at the end of May 2010, just as the dialogue report was about to launch. One of the interviewees we spoke to in January 2010 also identified this:

There is the potential for a major scientific discovery, especially with Venter's group in the US... potential for massive pres coverage with commencement of huge number of questions and debate. (Interviewee)

There was a delay in starting the workshops, which began in January 2010, and a pressure to launch the report ahead of recess in summer of 2010, as this was the best opportunity to influence policy.

Christmas delayed the workshops. We could have insisted they started earlier but it was logistically tricky. (Interviewee)

This idea of time was reflected in two of the comments for Research Councils and the Steering Group respectively:

More time and better use of time for whole process.

(What should be done differently next time? Mini-workshop)

More time to think about science examples / applications used to illustrate.

(What does this mean for this dialogue? Mini-workshop)

7.3 Looking forward

Some of the findings from the dialogue, particularly around the creation of new life, were seen as surprisingly positive. Participants were concerned about regulation, and while this is an outcome that is not specific to Synthetic Biology, this may indicate that when dealing with an upstream technology members of the public are more concerned about the motivations of those developing the science, and how they are regulated. There was hope among public participants that the views expressed in the dialogue would add to the evidence used to inform policy, not only in the UK but also internationally.

Input into Research Council policy is already in process, and the OG and SG interviewees were hopeful that the public views would lead to impact on policy in various other arenas. A number of the aspirations for the next stages of the dialogue captured during the mini-workshop related to this:

To have real impact on the decisions that the Research Councils make towards synthetic biology.

Policy decisions that fully take into account uncertainties, knowledge gaps, environmental and social context – and public concerns about profit as a main driver.

(If there's one thing you hope the dialogue will achieve, what is it? Mini-workshop)

OG and SG interviewees expressed hopes that the dialogue outcomes would stimulate discussions among the regulators, and that they would be motivated to work more openly through the realisation that regulation of emerging technologies is a public concern. The NGOs involved in the dialogue are also concerned with monitoring regulation at an international level, and hoped that the dialogue would be taken forward as an example of public opinion, which would add to the voices speaking on this subject.

It is, hopefully, the opinion of the wide public and very valuable, but it is, for me, hopefully, I would have it on my bookshelf along with industry reports of synthetic biology and NGO reports of synthetic biology, so there would be a whole mix. (Interviewee)

Several OG and SG interviewees noted that there are few individuals with a scientific background (particularly genetics) in the current Government, making them difficult to engage. Dialogue on these issues can present Government with a solution rather than a problem as it places science in the context of public opinion, and it was hoped that an event for MPs to take them through the findings would be supported.

Hoping for an event in the House with MPs... to take them through the science and through the dialogue to give them an idea of how their constituents feel; give them a solution not a problem. (Interviewee)

A further opportunity was seen in the confidence that scientists can feel in the level of public support and enthusiasm both for science and technology and for synthetic biology which was shown through this public dialogue.

People are excited about the potential (Interviewee)

Aspirations that scientists would take note of the dialogue outcomes and continue to engage the public were also expressed during the mini-workshop:

The outcomes disseminated accurately to scientists so that as many as possible can be influenced by the dialogue outputs and invited to actively consider the wider implications of research.

(If there's one thing you hope the dialogue will achieve, what is it? Mini-workshop)

The influence of the dialogue on future public engagement was also raised during the mini-workshop.

That it provides a launch pad for continuing dialogue between civil society and the synbio community.

Develop best practice for future dialogue exercises (by RCs)

(If there's one thing you hope the dialogue will achieve, what is it? Mini-workshop)

When asked about opportunities and risks, many interviewees mentioned the media, as we were interviewing around the time of Craig Venter's announcement of the first synthetic genome successfully transplanted into a living cell (Gibson *et al.*, 2010). Risks were seen in terms of taking opinions forward in isolation, since the dialogue findings are only meaningful in context, and that the media may only report those aspects of a story that fit the view they want to portray. Media messages around synthetic biology were seen by stakeholders as confused or inflammatory.

Some tabloids tried to whip up a debate and failed. (Interviewee)

A positive aspect of engaging the public is that it allows views to be presented to the media that are informed by what the public think and what they would like to know. The flipside of this is that media engagement may be based on false outputs of the dialogue process, so that a factor that was misinterpreted at a workshop is skewed and becomes central to the way synthetic biology is framed. One such risk identified by OG and SG members was quoting the electronic voting results out of context, with the potential for them to be misinterpreted as the findings of a nationally representative opinion poll, which of course a dialogue is not. A further difficulty could be caused by tensions within the Oversight and Steering Groups leading to public criticism of the dialogue process.

The risk is even though the approach taken has been inclusivity on the Oversight Group, you still get people on the Oversight Group saying in public – I'm not happy, I haven't been listened to, I disagreed with that, all those issues. (Interviewee)

While the media has significant impact on public opinion, most stories do not last long, unless they are 'fed', for example by becoming campaigning issues for the mainstream NGOs. So in the case of synthetic biology the likely impact of stories for such an upstream process is limited.

It was a quick, sharp story then it disappeared. (Interviewee)

Different OG and SG interviewees have a range of interests in the ongoing dialogue. Several are concerned with the potential for regulation, and are watching for scientific developments. The dialogue may provide an opportunity to engage with regulators on how they will deal with synthetic biology. With more investment comes a need for ethical frameworks, oversight and dialogue. However, the lack of funding in Government currently may limit the impact of synthetic biology in the UK.

8 Conclusions

8.1 Workshops

The workshops were seen as effective and were well-received by public and expert participants. Overall they were methodologically sound and a diverse range of views were represented. Particular success factors in the workshops were: the mix of tools and media (especially in Workshop 2), face-to-face interactions between experts and members of the public and the mix of people involved in the groups. Most of the OG/SG members also felt that the workshops were well balanced and addressed potential bias effectively. It was also striking that in each of the sixteen breakout groups, quite different priorities and opinions emerged.

However there were some areas where the contractors, participants and stakeholders identified potential improvements. The mixed media worked well, and participants felt there could have been a greater mix especially in Workshop 3. The contractors used video very effectively in the video ethnography session in Workshop 2, where the camera provided a window into a world that is rarely visible to members of the public. This had a profound impact on public participants, with many commenting on significant shifts in their perceptions of science and scientists. However the video presentations in Workshop 3 were seen as less engaging; during the snapshot interviews some described 'switching off' or that they felt as if the scientist didn't have the commitment to attend the workshop (which was actually true in the case of the regulators). The exception here was the video on Artemisinin, which was more like a short documentary than a filmed presentation because it included footage taken inside research facilities and from communities that are affected by malaria. In contrast, the others were films of a single expert talking to camera. This feedback underlined how valuable public participants found the opportunity to interact with scientists and social scientists face-to-face, but was also a result of some of the timing issues with the dialogue; the contractors had a very short time to create the materials for Workshop 3. This is also linked to the dialogue principle about innovation. One intended innovation was to allow public participants to shape as much of Workshop 3 as possible. However with the benefit of hindsight it was clear that much of the content requested by participants could have been anticipated through the previous experience of the Oversight Group and the contractors. Such an approach could have enabled advance planning while allowing for some changes in response to participants. This could have alleviated some of the time pressure and helped make the workshops still more engaging.

The dialogue report is extremely detailed and reveals a sophisticated level of insight from public participants around the potential benefits and risks of synthetic biology. Some of the findings are specific to synthetic biology, but many could be applied to any emerging technology. The report is very interesting and the findings have been well received. However the quality of the report may mask some of the limitations of the process. Participants covered a large amount of ground over the three workshops and sometimes struggled to grasp the scientific concepts. Some issues were explored in less depth than they could have been, and not knowing enough

about the science was often given as a reason for holding back from more detailed discussions in the groups. We question whether participants were able to accurately articulate the reasons for this reticence, perhaps using a lack of scientific understanding as a reason instead. We feel that even if a greater understanding of the science is not necessary to discuss the various implications of a new technology, a somewhat stronger focus on communicating the science itself could have further empowered public participants, which in turn may have led to them feeling more confident to delve into further discussions – or at least it could have reduced one barrier to this.

We observed clear cultures in some of the groups where it may have been difficult for dissenting voices to be heard, for example there was relatively little discussion about morality or the nature of life. We are unsure whether this is because it genuinely was not an issue, or because the dialogue was framed in terms of existing technologies and how they are controlled or regulated. So: was this a product of the process and not the views of the groups? Were moral and/or faith issues too personal for participants to raise in the groups? Indeed, even if this is a failing, the purpose of a focus group is to explore how people behave in specific social groups, so perhaps it is irrelevant. Certainly it is an issue that we will be interested to follow up in our individual interviews with public participants.

This is not necessarily a criticism of this dialogue, but it is a limitation of a focus group based approach such as that taken during any public dialogue, and especially with this process where participants met in the same groups over the three workshops. We feel it is important to remain objective about the advantages and limitations of the dialogue approach; many of those involved in steering or overseeing the dialogue had not been involved in one before. In framing the dialogue findings, we feel it is useful to bear the following points in mind:

- Public dialogue is not designed to be representative as an opinion poll would be;
- Public dialogue has many advantages, including the opportunity to deliberate with input from specialists. However no method of capturing views from humans is perfect or completely free of bias;
- Cultures established in the groups may have excluded some views.

The reconvened workshop was valued highly by those that attended and further reinforced the high level of interest that participants have in the process, although only a small proportion of the total number of public participants were able to attend.

Learning points: workshops

- A large number of groups and effective sampling enabled a valuable range of views to emerge and helped mitigate the risk of a minority of groups where participants did not engage fully with the issues;
- Video ethnography (short films made by scientists about how they work) was highly effective and had a strong impact, however videos of presentations were less effective;

- Public and expert participants valued face-to-face interactions highly;
- Public influence on workshop design is a valuable aspiration, although needs can be anticipated to some extent to aid planning;
- A greater focus on engaging ways to communicate the scientific principles at the core of synthetic biology may have empowered public participants still further;
- The focus group approach built trust between participants, but inherent in this method is the establishment of social norms that may have limited the expression of some views;
- The reconvened workshop was an effective means of checking the dialogue findings with public participants, although only a relatively small number were able to be involved;
- Research Councils and others should remain realistic about the advantages and limitations of dialogue. Including these in balanced communication about the dialogue will help avoid any criticism of the method (for example from perspectives that value quantitative over qualitative approaches) undermining the findings.

8.2 Initial outcomes – public participants

Public participants felt strongly that the process was worthwhile and empowering. They were very positive about their opportunity to be involved in the dialogue and this may have biased some of the questionnaire responses: participants were more likely to be critical of specific aspects of the dialogue discussed in interviews. The questionnaire feedback, which asked about the process overall, was much more positive. Often we would expect a little ‘interviewer bias’ where some participants tell us what they think we want to hear. Perhaps the mood of open discussion in the workshops helped avoid this.

As described in the findings section, the key initial outcomes for public participants were in terms of learning and involvement, and to a lesser extent attitudinal change. A number expressed uncertainty about the extent to which their views would be listened to, and it appears that the level of influence of the report will affect participants’ ultimate views of the process. When following up in the next phase of our study it will be valuable to have some examples of how the report has been used to explain to participants.

One strong finding from our limited work with members of the public to date was the level of commitment to a continued dialogue on this issue. Participants were keen to utilise the knowledge of the topic they had gained through the workshops and many used the questionnaires to express their views of the importance of public dialogue. It is clear that the Research Councils and Sciencewise are also keen to continue involvement with this group, but it is not yet apparent what the continued engagement will look like or what resources will be associated with it.

Learning points: public participants

- Participants felt the process was worthwhile and many are keen to remain involved in dialogue about synthetic biology;
- The extent to which participants feel their views are listened to will affect their perception of the process;
- Plans for continued engagement should be agreed and communicated to participants.

8.3 Initial outcomes – expert participants

Expert participants were generally positive about their involvement in the process. They were impressed with the level of energy and engagement in the groups and the scientists were pleasantly surprised with the strength of support for their research among many participants. For some, participation in the workshops developed or reinforced a sense of the value of public engagement and dialogue. Interestingly the social scientists found it particularly valuable from a professional perspective to be participants in a process they would usually critique. It was also an opportunity to see some methods that they may have been sceptical about in action: the main example here was the electronic voting. The perception from some was that this would be used as an opinion poll, but actually it allowed space for individuals to give their opinions away from their groups and acted as a springboard for discussions.

Both scientists and social scientists were aware of the level of influence they could have in the discussions. Some felt they needed a clearer brief to reduce their capacity to influence and disturb the discussions. This was true for expert observers too: some found it difficult not to interject when the discussion veered into scientifically inaccurate territory. During the exit interviews some said it would have been useful to have a meeting before the workshops in addition to the telephone and email briefings, but we are not sure how realistic this would be. Given the constraints on academics' time it may have deterred some from participating. However one member of the Oversight Group that was new to dialogue suggested making a short film about dialogue in a similar vein to the video ethnography TNS-BMRB produced about synthetic biology research. This could give an insight into the types of questions and interactions that happen during deliberative workshops and could have been valuable for experts new to public engagement as well as Oversight Group members.

Despite efforts to be neutral, it was inevitable that some of the expert participants' personal opinions would be evident in discussions. However from our observations it appeared that public participants were well able to challenge these positions and put the experts on the spot with some searching questions. Several of the experts commented that the opportunity to be asked and respond to these types of questions was one of the most rewarding aspects of participating in the dialogue. It was telling that leading comments were identified in the workshops where experts were responding to videos rather than presenting material they had prepared themselves. If the goal is to reduce bias it may be preferable to encourage experts to prepare any plenary input beforehand as it is easier to make misleading statements

'off the cuff'. In smaller group discussions such statements can be picked up and challenged by a moderator, but they are likely to carry more weight in plenary.

Some Oversight Group members felt that the dialogue should have involved a greater diversity of expert voices, specifically NGO and industry representatives. This was difficult given the limited amount of time available to plan and run the workshops. However, if the timescale overall had been less pressured and perhaps with a more effective relationship between the contractors and the OG initially, there may have been more space to explore this.

Learning points: expert participants

- Experts found their experiences worthwhile;
- Scientists were pleased that the public were broadly supportive of their research;
- Social scientists valued participating in a process they might usually critique and the opportunity to see some of the methods in action;
- Experts were conscious of their capacity to introduce bias and some might have appreciated more support or advice on this ahead of the workshops;
- A tool such as a short film giving an insight into a dialogue could be a useful briefing aid;
- Encouraging experts to prepare plenary input beforehand could limit the risk of spontaneous misleading remarks;
- The roles of experts and observers (especially experts attending in the capacity of observers) should be clarified during workshops, perhaps creating a space where observers can highlight misconceptions that moderators may wish to address without interjecting in group discussions;
- A less pressured timescale and/or more effective planning overall may have allowed exploration of further ways to include industry and NGO voices (as well as through the actors).

8.4 Oversight

At this stage of the evaluation, with more follow-up work to do with public and expert participants, the issue of oversight is the one where we have the most detailed findings.

The role of the Steering Group initially was to see if a dialogue should take place, and to draw up some principles for it. Therefore the group would have needed to create new terms of reference if they were also intending to oversee the dialogue itself. This made the opportunity to set up a new group a logical step – inviting others with appropriate experience to lend support to the dialogue. The new Oversight Group needed time to come together and establish trust before getting to work. This had been achieved by the end of the process but understandably took time given the diversity of views involved. Most that participated felt the diversity was a positive aspect, but it did mean that extra commitment was required of members and this excluded some.

We also questioned the extent to which the OG felt ownership over the dialogue principles, and perhaps convening an Oversight Group at the point when it is decided to go ahead with a dialogue so they are involved in creating the principles would be valuable. There is also space for a more active role for the Research Councils, which again emerged over time with the implementation of the decision register and a stronger steer on email discussions. This was effective and it emerged later that some felt the group had too much say over the process and that a comment raised for discussion could turn too easily into an action. The role of the SG and its relationship to the OG was also unclear during the time the workshops were being delivered. The group chair and BBSRC were responsive to feedback throughout the process and worked to help the OG function effectively through the measures described above, allowing longer for meetings and suggesting the mini-workshop to provide space for further feedback.

There has been much discussion about the roles of the Steering and Oversight Groups and how these influenced the process. The initial lack of trust among the Oversight Group may have affected the dialogue, but the effects did not appear to be severe. A clearer transition between the work of the two groups could have allowed some more innovative techniques to be included in the dialogue, or perhaps the contractors would have had more space between workshops to add extra polish to some of the materials. However the basis of the dialogue as a series of professionally-facilitated, deliberative discussions about synthetic biology involving both experts and members of the public remained in essence unchanged. The innovation principle was questioned by the Oversight Group, as they were unsure what the purpose of any innovation should be. One member also highlighted that approaching innovation by committee was unlikely to yield success.

Clearly the organisation of the Steering and Oversight Groups was not ideal during this dialogue. However we are concerned that some might think this setup is inherently flawed, and completely abandon the approach because it didn't work this time. There were several benefits to having a separate OG, not least that many members devoted a considerable amount of time to the dialogue and reviewed the draft information materials for the public and other documentation in detail. In one case this picked up an unintentional error in the sampling method which could have adversely affected the dialogue had it gone unnoticed.

Our evaluation participants made several practical suggestions for helping bring the OG up to speed. One was to hold an initial workshop (perhaps as a handover between the SG and OG) to explain each member's perspective and what they hope to bring to the group. The experience of the Sciencewise ERC could have been valuable here, perhaps in sharing experiences of how other Oversight Groups have run, the challenges they faced and explaining the principles of dialogue. Others gave suggestions for introducing dialogue, such as more detailed briefing or the short film mentioned previously. Another suggested creating an online space for the group to exchange ideas such as a Yahoo group, which could have made email decision-making clearer. We feel that a more detailed consideration of the dialogue's

management structure by the Research Councils early on could have helped the process run more smoothly.

Learning from this process may allow diverse groups to work together from an earlier stage in future dialogues. This would be useful in providing a clear message to contractors and allowing them to deliver high quality work in the time available. BBSRC communicating the steer from the Oversight Group, rather than having the contractors involved in all discussions, worked well.

Learning points - Oversight

- Management and Oversight did not always run smoothly, although impacts on the dialogue workshops themselves were modest;
- The Oversight Group needed longer to build trust. It would be useful to explore ways that this group could have greater ownership over the dialogue principles, which were passed on to the Oversight Group from the Steering Group;
- Diversity in the membership of the OG was seen as a strength, but extra time and resource is required to make any process inclusive;
- Research Councils (especially BBSRC) developed a stronger role as the dialogue progressed. More planning and direction from the RCs on how the process will be managed and the respective roles in decisions for SG, RCs, OG and contractors would be valuable in future;
- Committees tend to be conservative, how does this link with innovation?
- Oversight Group members dedicated considerable time to the dialogue, which was valuable;
- Consider ways to better manage discussions over email;
- Capture and share learning among Research Councils and others about this aspect of the dialogue.

8.5 Next steps

The true value of the dialogue will depend significantly on who and what is informed and influenced by the findings and how. The next stage of the process is crucial and may change participants' constructions of the dialogue. Participants and stakeholders hoped that the views expressed during the dialogue would add to the evidence used to inform policy, not only in the UK but also internationally.

We look forward to contacting a sample of participants again to further explore the outcomes of the dialogue.

9 References

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