

Evaluating „Mode 2 research: The case of The Engineering Exchange and its work related to air quality



Source: The Engineering Exchange Annual Report, 2015

Exam ID: PRHX7

Supervisor: Dr. Russell Hitchings

Submitted September 2017

This research dissertation is submitted for the MSc in Environment, Politics and Society at University College London.

Abstract

This dissertation is a study of „Mode 2 engineering research in order to explore experimental approaches to tackling problems of the environment in new ways. This is achieved through an evaluation of The Engineering Exchange s work related to air quality. The Engineering Exchange is a UCL-based initiative that facilitates the collaboration of UCL-based engineers with community groups so that they can work together to find solutions to environmental problems.

Inventive research methods have become increasingly popular in relation to matters of the environment due to an increasing understanding of the complex nature of such problems and therefore the need to include a broader range of perspectives. The idea of a changing culture of research is expressed by the notion of a shift from „Mode 1 (theoretical, experimental science) to „Mode 2 (trans-disciplinary, application-focused, socially responsive) research as described in the work *Rethinking Science: Knowledge and the Public in an Age of Uncertainty* (Nowotny, Gibbons, Scott: 2001). However, existing qualitative work on „Mode 2 practice has focused on its ability to produce robust outcomes and does not resituate these practices within the ideals described by the „Mode 2 thesis.

Through a study of the work produced by The Engineering Exchange and semi-structured interviews with engineers, community participants and staff of the initiative, this study has evaluated „Mode 2 in new ways.

Acknowledgements

Firstly, I would like to thank Russell Hitchings for his supervision and feedback during this process. Secondly, I would like to thank Sarah Bell and Charlotte Barrow of The Engineering Exchange for both supporting my project and in providing such a fascinating case study for my research. Their work is both captivating and inspiring. I would also like to thank all my interview participants for taking the time to share their stories with me as I learnt something from them all. Finally, I would like to thank all of my family and friends for trying to keep me calm in moments of panic!

Contents

1.Introduction	2
<hr/>	
1.1 „Mode 2 research	2
1.2 „Mode 2 and Environmental Science	3
1.3 Engineering research and publics	3
1.4 The Engineering Exchange	3
1.5 Research questions and aims	5
2. Conceptual Framework	6
<hr/>	
2.1 The „Mode 2 thesis	6
2.2 A new language for research	8
2.3 Evaluation of „Mode 2	10
2.4 Recasting engineers in society	12
3. A case study: The Engineering Exchange	14
<hr/>	
3.1 Aims of the Engineering Exchange	14
3.2 Engineering Exchange projects related to air quality	15
3.3 The Engineering Exchange as „Mode 2	17
4. Methodology	18
<hr/>	
4.1 Data generation	19
4.2 Data analysis	22
4.3 Confidentiality	22
5. Data analysis and discussion	23
<hr/>	
5.1 Contextualising Engineering Research	23
5.2 Towards more „Socially Robust knowledge	31
5.3 Facilitating „reverse communication	35
5.4 Recommendations	

1.2 „Mode 2 and environmental sciences

„Mode 2 inspired research has gained particular traction in the field of environmental science as it offers a way to grapple with the complex objects of environmental research (Barry & Born 2008) and increase the accountability of environmental experts (Whatmore 2009). Despite the tag of „Mode 2 being used by both policy-makers and research institutes (e.g. the UK Treasury s Science and Investment Framework¹, The Earth Institute, The Tyndall Centre²) limited empirical evaluation of these practices has been conducted. Furthermore, existing evaluations of said research

An example of „Mode 2“ research is taking place in UCL’s faculty of Engineering that provides an opportunity to start such a conversation. The Engineering Exchange is an initiative based at UCL that aims to improve the engagement of local communities in engineering research.

1.5 Research aims and questions

This aim of this dissertation is therefore to explore the practice of „Mode 2 research using the case of The Engineering Exchange s work related to air quality. This topic will be explored through

2. Conceptual framework

This section describes the background for understanding the „Mode 2 thesis, highlighting its role

for scientists to adapt the way they communicate their research so that it prepares the public for the degree of variability of results (Pielke 2007, Sarewitz 2011). Pielke argues that scientists should act as „Honest Brokers (2007) who present a range of policy options as a result of their research; likewise Sarewitz highlights the lack of transparency of consensus reports and calls for scientists to present dissenting evidence in

described to be the process whereby society and science interact in a greater number of locations [e.g universities, industry, think-tanks, consultancies] (Nowotny et al. 2001) As the two are integrated this leads to an expansion of the presence of „people in research producing greater social awareness in the process (ibid: 262) . The variety of circumstances in which research is produced has enabled

A similar stance was adopted by Jasanoff (2003) who highlighted the practical problems of such conceptual innovation. She too understands the shift to „socially robust knowledge as a process whereby science gains strength through connecting its work to public ends (Jasanoff 2003: 235). However Jasanoff raises the question of how such a shift in knowledge production can be institutionalised, asking us how to „promote more meaningful interaction among policy-makers, scientific experts, corporate producers, and the public within our current unsympathetic structures (Jasanoff 2003). She raises the issue of new modes of knowledge production

to recast research agendas in the service of society (2009: 589). Barry & Weszkalnys show that the transition towards „contextualisation has not been straightforward, as in many cases the integration of „society has happened through the inclusion of political representatives instead of

report

environmental problems. Finally, through the insights that this work provides it

“Research: aligning engineering research with community needs.

The EngEx supports researchers in developing community based research projects and in working with communities to turn a specific need for technical knowledge into an appropriate research question and project. The EngEx supports researchers to incorporate upstream public engagement in their projects to better address the need for responsible, responsive research and innovation.”

“Skills: providing communities with access to engineering skills and knowledge.

The EngEx provides a brokering service to match specific community needs for technical expertise with staff and students in UCL Engineering. For instance, communities may have needs for environmental monitoring, mapping or support in developing local sustainability plans.”

(The Engineering Exchange Annual Report, 2015).

In practice this involves brokering engineers with

Oxypod	Development of an experiment to test this device which improves the efficiency of heating systems
--------	---

Table 1. Summary of Engineering Exchange projects included in evaluation

3.3 Engineering Exchange as „Mode 2

The work of the Engineering Exchange was chosen as a case study because it can be identified as an empirical example of „Mode 2 inspired research in order to address issues of sustainability. Its mission reflects the two related consequences of the redistribution of expertise in society. Firstly, its aim to work with communities to develop projects that match local knowledge with technical support reflects the need to combine diverse perspectives and create new methodologies in order to address trans-disciplinary objects of research. Secondly, its intention to influence the academic research agenda towards more problem-focused research exemplifies the imperative to increase opportunities for public participation in order to improve the accountability of UoA to the public that it serves. Therefore, through an evaluation of its activities through a „Mode 2 lens, this dissertation will both add to conceptual debates whilst offering practical

evaluates „Mode 2 in practice, this has focused on the sites of knowledge production by asking participants about the successes of trans-disciplinary collaboration and how this affected the research outputs produced (e.g. Boix-Mansilla, Tompkins, Bruce et al.). Furthermore, previous studies have focused on interviewing academics only, which differentiates them from this work (ibid).

4.1 Data generation

My fieldwork consisted of a combination of document analysis and participant interviews of those who had been involved in relevant projects. As a researcher I was aware that I was not approaching my case study from a position of disinterest and therefore I should remain mindful of my „standpoint (May & Perry 2014:4): I was viewing The Engineering Exchange with knowledge of the aspirations behind the initiative

and make sense of their own lives (199:111) which here would enable me to understand the experience of participation. I therefore conducted seventeen semi-structured interviews with a mixture of engineers, community members and staff, with a reasonable balance between the engineers and community participants. These interviews were conducted in locations of my participants choosing, and lasted between

me to understand the social dynamics of participating in The Engineering Exchange. Key to the success of this approach was effective listening skills as narrative interview approaches require that the interviewer „must be a good listener and the interviewee is a story-teller rather than a respondent (Jefferson and Holloway 2011: 8). Through drawing on such „confessional properties (Paul Atkinson and Silverman 1997: 12) of the interview this encouraged my interviewees to express personalised accounts of their involvement with The Exchange. By taking this approach I hoped to co-produce data with my interviewees in a way that was sensitive to socio-political and cultural dynamics. I remained aware that a risk in my approach would be the interview going off topic as participants were invited to tell stories in their own ways.

The semi-structured approach was conducted using an interview schedule as a prompting device to ensure that my interviews maintained a high degree of consistency across all the categories of participants (see Appendix 5). The narrative element of the interview was followed

All participants signed a consent form allowing for quotations to be used anonymously in my thesis. Therefore participants are referred to throughout the analysis using the labels „Community Participant , „UCL Engineer and „Staff , as this enables comparisons between the perspectives of the two groups, while not revealing their individual identities.

5. Data analysis and discussion

The following sections of analysis explore the effectiveness of The Engineering Exchange as „Mode 2 research, through analysis of both the project documentation and participant accounts of the process. The first section considers the success of the projects in achieving their outcomes, and considers their implications for how research becomes „contextualised . The second section analyses the role of „expertise amongst participants of the project. The final two sections consider t40>BDC BT1 0 0 1 340.75 626.02 Tm876>

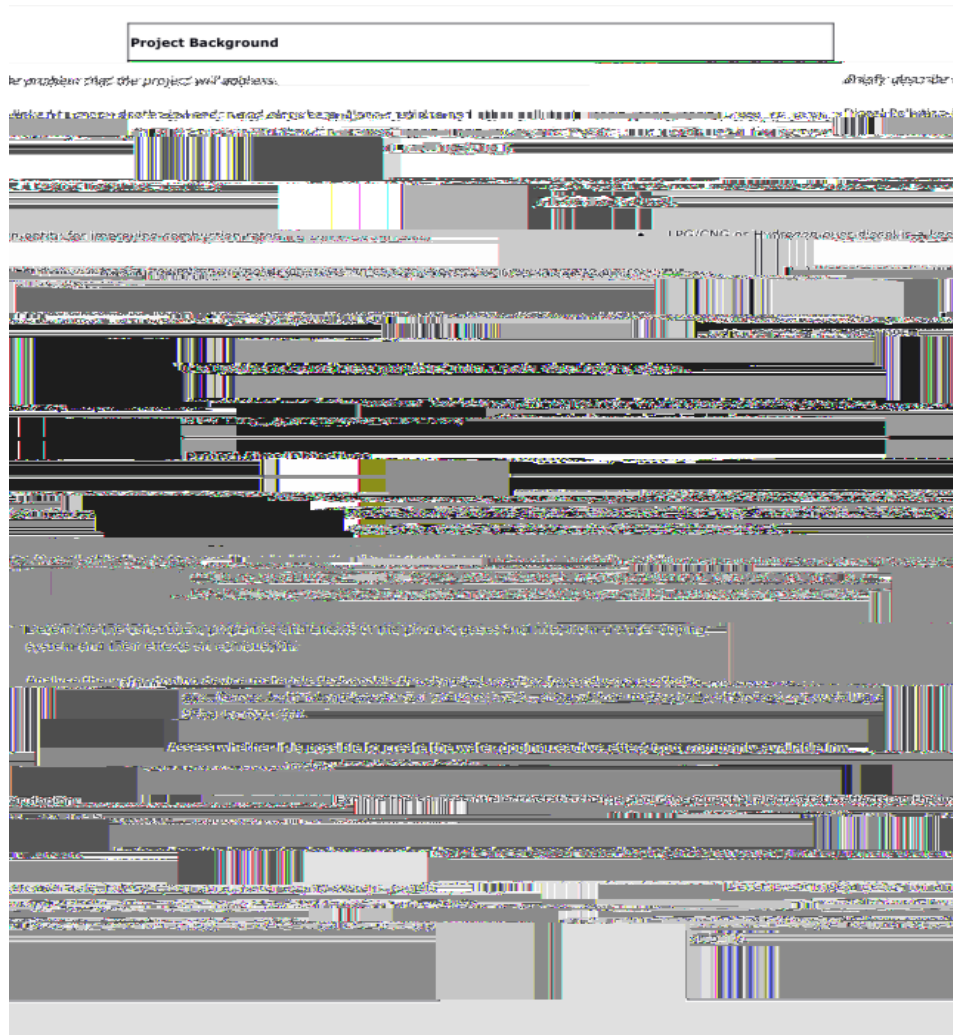
Integrating multiple perspectives around the issue of air quality led to the design of research projects driven by their „context . Both community participants and engineers related to the issue of air quality in varied ways, and as a result these understandings led to a variety of different projects (as listed in section 3.2). The community participants more commonly referred to the health impacts of air quality as evidence of how including „people in theof



Through a „Mode 2 lens, community participants can be understood to be in pursuit of „new social innovation in The Engineering Exchange (2001: 250) as they felt that their concerns were not being addressed through other societal mechanisms. However, the subsequent projects that were initiated achieved a mixed record of success with some of

Old Street Freight Vehicle Reduction: evaluate the viability of freight consolidation centre to reduce number of trips by polluting freight vehicles	Incomplete
Silverton Tunnel application evaluation	Incomplete
Regent s Park Estate Air Quality: empowering local community to monitor air pollution	Partially complete

Source: Excerpt from



Source: Extract from Pollution in Air Reduction Project (PARP) Project Scoping Document

Where a project scope did not involve the testing of a specific technology and was driven by a more overtly political agenda, the projects had not moved beyond the conceptualisation stage. Commonly, these were focused around mobilising a community to compile evidence relating to air quality in response to a new development happening, or to supplement evidence put forward by professional bodies (e.g. TFL) that might be viewed as inadequate.

Political motivation	Objectives not achieved
Crossrail development s impact on Bentham House	A review of Crossrail s area plan to flag up any environmental justice issues
Impact of HS2 on Regent s Park Estate	Community literature review and long term air quality monitoring plan
Impact of TFL s Silvertown Tunnel Development	Report to challenge plans to build Silvertown Tunnel

Reducing

So while the air quality related project ideas were evidence of how bringing together multiple perspectives can drive problem-focused research, these were not always deliverable by the actors involved. While „Mode2 research is expectant of research teams that can contend with the trans2

5.2 Towards more „Socially Robust knowledge

Both engineers and community participants attributed the success of their engagement with The Engineering Exchange around the idea of gaining „credibility . Therefore a changed understanding of expertise was observed in both participant groups.

Experiences of participants found power dynamics between „experts and „publics to have minimal significance to the ways in which individuals engaged and is suggestive of a mutual acknowledgement of the need to generate „socially robust knowledge (Nowotny et al. 2001). Furthermore, this highlights that future evaluation of „Mode 2 research should lessen its

needs (EngEx Engineer Protocol) while the Client Protocol provides no mention of this. Secondly, the Client Protocol asserts that „*We don t have expertise*

At an etic level this can be interpreted as the acceptance that achieving accountability is now understood by both participant groups as a social activity as opposed to a purely scientific one. Through the lens of „Mode 2 this is evidence of a shift towards „socially robust kn

vessels was not able to generate interest from Transport for London. As per Weingart's criticism (2008) of „Mode 2“, if we attach expectation to a normative concept of „socially robust knowledge“ this will leave us disappointed as it is not something that can be achieved through simply opening up knowledge creation to the „context“. Although the research produced was accountable to public problems, the route to influencing policy remains complex and

Furthermore, common understandings of success undermined the notion that the challenge of integration should be a focus of social science evaluation (e.g. Bruce et al. 2004, Tomkins 2005, Mansilla 2006). Engineers and community participants had mutual understanding of the reasons for BT9 > BDC BT1 he

At an emic level interviewees accounts highlighted that for participants The Engineering Exchange achieved a wider impact through creating the opportunities for

which participants spoke

Through

“Community groups are really good at

“One thing that has been nice to learn is that people really like this idea, which has been maybe a bit of a surprise. So that approach of giving people opportunities to engage rather than criticising them for not.”

Engineering Exchange Founder, interview

5.4 Recommendations for „Mode 2 research

Finally, this chapter considers how focusing on a case study of „Mode 2

“It s a platform for community engagement with the local community organised by the Engineering faculty. I don t think its exclusive to the engineering faculty but its useful to have a hub that does connect to the community in a formal way.”

UCL Engineer, interview

“Trying to mobilise that connection between engineering expertise and mainly university-based people at the moment, they have aspirations to get industry people involved too. To provide expertise to community

“So I don t know much about The Engineering Exchange except it seems to be very well established... in a way it would be good if they decided... you know we re getting all

Secondly, despite the ease with

Interestingly, none of the participants mentioned the need for greater promotion

summary of my findings to demonstrate that this use of the „Mode 2 thesis can deepen academic understandings of new research methods in an engineering context and more widely.

Considering whether or not The Engineering Exchange was able to successfully achieve its aims relating to air quality highlighted one of the challenges of „contextualising the research process. While the collaboration of engineers and community participants led to innovative ideas for tackling the issue of air quality, these

researchers is an unnecessary future focus for evaluation of interdisciplinary practice
(aaryunnecefocus

References

Baille and Catalano, B. C. (2009) *Engineering and Society: Working Towards Social Justice, Part III: Synthesis Lectures on Engineers, Technology and Society*, Morgan and Claypool Publishes

Barry, A., Born, G (2008) „Logics of Interdisciplinarity , *Economy and Society*, 37, 1, 20-49

Barry & Weszkalnys A. G. (2013), Multiple Environments: Accountability, Integration and Ontology in *Interdisciplinarity: Reconfigurations of the Natural and Social Sciences*, Routledge London and New York

Bruce A, Lyall C, Tait J, Williams R (2004) Interdisciplinary integration in Europe: the case of the Fifth Framework programme. *Futures* 36:457-470

Flick, U. (ed) 2013. *The SAGE Handbook of Qualitative Data Analysis*, Sage, London

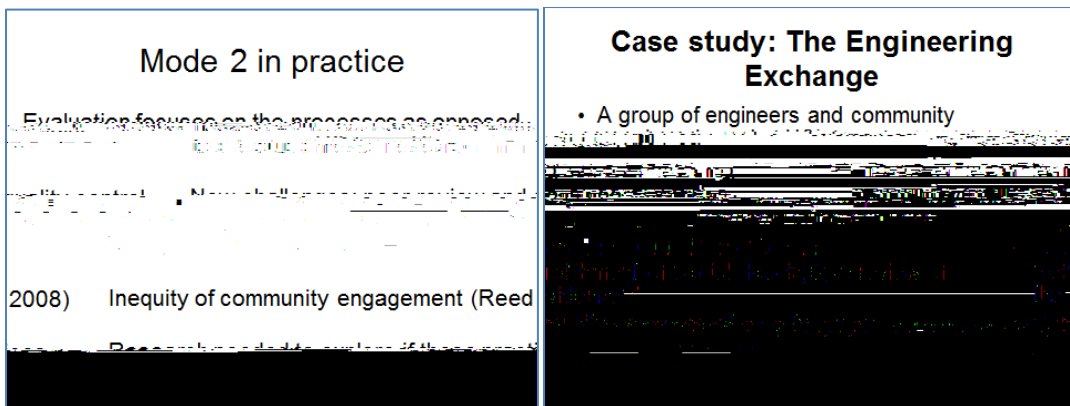
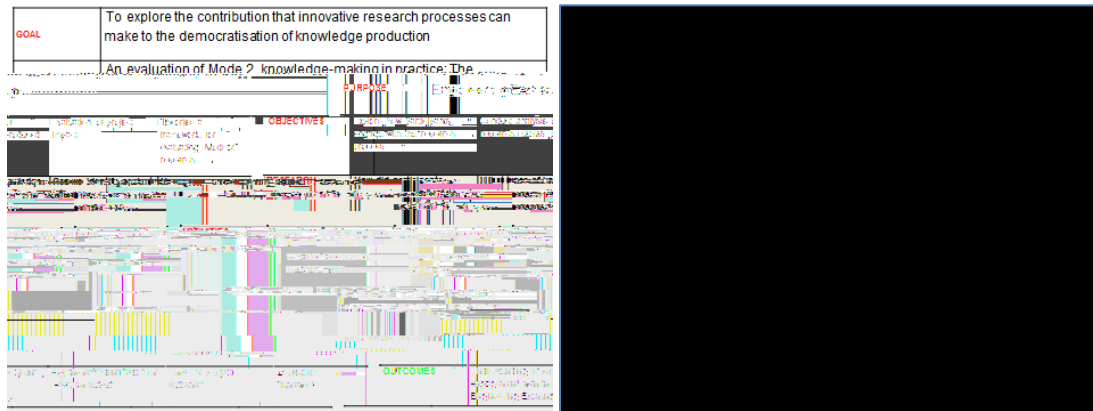
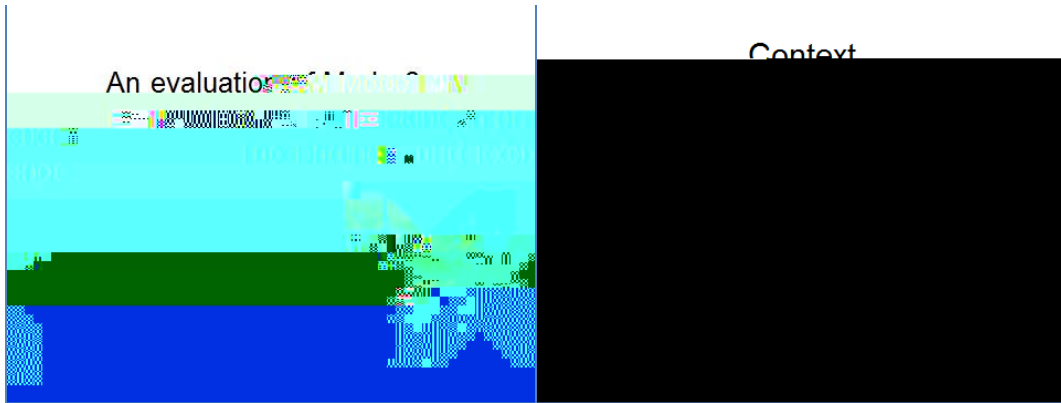
Gubrium & Holstein, J. J. (2001) *Handbook of Interview Research*, Sage, London

Given, L. (2008) *The Sage Encyclopedia*

Irwin, A. (1995) *Citizen science: A study of people, expertise and sustainable development*.

Valentine, G. (1997) 'Tell me about...: using interviews as a research methodology' ,in Flowerdew, R.& Martin, D. (eds) *Methods in Human Geography*. Longman, London. pp110-126.

Annex 1. Original Research Proposal



An evaluation of Mode 2 knowledge-making in practice: The Engineering Exchange

Background/context

The quest for sustainable development has thus far focused on a reengineering of the built environment. However, these solutions cannot be designed by engineers alone. Technicians are increasingly aware of the need to engage communities in theTechnicians

“The EngEx believes that community

Methodology

This will incorporate the five aspects of Mode 2 Science (Nowotny et al.)

Knowledge is generated within the context of application

Trans-disciplinarity

Knowledge produced at a diversity of sites

Reflexivity

Novel forms of quality control

The following methods will be used:

Semi-structured interviews: engineers who participated in the project.

A discourse analysis of research outputs and toolkits.

.2 ref*EMC /P A/CID 108 023999 ref541.56 4 /P 2me/CID 10 nEMC /P A/CID 64-BDC BT1 ef04.39 4801 T

Annex 2. Research diary

Date of entry

Discussion/task

		reinforcing the failings of the „Mode 2 argument
--	--	---

18/87/17-28/08/17

Reworked literature review
and continued to write
analysis

Starting to



DISSERTATION INTERVIEW CONSENT FORM

Project title:	An Evaluation of the Engineering Exchange
Location(s):	London

The transcript of the interview will be analysed by Hannah

Annex 4. Interview Excerpt: Giles

H: Could you outline your involvement with the Engineering Exchange?

G: Just a single project, which was all about trying to increase the amount of freight being mov

to put freight on how would it actually work, so we came up with a technical solution to that.

H: So what were the outputs?

G: So there was a report. The logistics, how far you might try and go and in what time frame. How that might lead on to the design requirements. Then come up with drawings and technical specifications. This is the kind of vessel that could actually do it.

H: Costing?

G: That s kind of hard, some costing, that s kind of hard without going to a much higher level of detail.

H: What happened next?

G: The following year, I asked one of the group design teams (engineering MSc) to do a more detailed de

H: This directly influenced your teaching? Is that a new influence?

G: The difference is, I've done a lot of work in the

H: I understand. Do you think the department might do more of this type of work?

G:

G: Community groups are really good at defining some of these problems. Probably too often, Industry takes a commercial viewpoint, community is thinking from a totally different perspective. No industry is going to think of putting freight on the canal, no industry is going to think about changing pedestrian crossing, it takes people to come from a different angle.

H: Do you think EE is a good idea?

G: Oh yes yeah.

H: Do you learn anything personally?

G: I hadn t thought about doing anything like this before, I ve had many projects over the years that were interesting, but nothing from a community.

Annex 5. Interview Schedule

Interview schedule: An evaluation of the Engineering Exchange

I am a master s student of Environment, Politics and Society and I am conducting an evaluation of the Engineering Exchange for my dissertation. This evaluation aims to explore

What were the strengths of the process?

What would you change about the process?

How would you

Can you describe any subsequent happenings that you think the project influenced?

Has any more work happened following the project?

What would you like to see happen?

Have you planned any additional activities?

Were there any political/social achievements?

Would you work with engineers/community members again?

How would you describe the work of the Engineering Exchange?

Have you come across anything like this before?

What do you think the strengths of the idea are?

Would you have any suggestions for improving its work?

Do you think it's a good idea?

What did you learn from the experience?

What progress has been made? What has been completed?

Have you developed any new skills or recognised any strength?

What are your interests?

Do you have any further comments/insights that you would like to share?

Did I miss anything?

If that s accurate, what other points are there to consider?

Anything you want to add or correct?

Is there anybody else you would recommend that I talk to?

