Like poets in times of dearth: The legitimacy crisis of science and social movements

Authors

Turaj Faran, Lund University Centre for Sustainability Studies

turaj.faran@lucsus.lu.se

David O'Byrne, Lund University Centre for Sustainability Studies

david.o_byrne@lucsus.lu.se

LUCSUS, Lund University, P.O. Box 170, SE-221 00, Lund, Sweden

Abstract

In the face of economic, social and ecological crises what contribution can social scientists make to resistance in the form of social movements? Whether scientific knowledge has a particular contribution to make has, for some time now, been disputed, amounting to a crisis in the validity of science itself. In the face of compound crises this question has renewed relevance, but our answer is methodological rather than philosophical, as we feel befits the aim to contribute to practice. We begin with discussion of participatory action research (PAR) as a methodology exemplifying recent attempts to bring social theory to practice and find it often fails to provide for a contribution by social scientists, as scientists. We then outline our approach, which holds that while multiple forms of knowledge, both objective scientific knowledge and situated knowledges, can be involved in such resistance they have different roles. By objective we mean neither absolute nor perfect but rather demonstrably and communicably the case. This knowledge must be brought with humility to the movement but

can provide guidance on, for example, elements of movement strategy, such as the appropriate targets of demands and avenues for support. Next, we present cases which show how the receptive context for relativist theories of knowledge, and their application in practice is created and consolidated by funding regimes; streams of funds lend support to research and organizations promoting particular social theoretical approaches and, importantly, activist strategies, which ultimately undermine resistance. Finally, we conclude that opposition to this will an exercise of academic freedom and supplanting the concerns of generous funding foundations with attention to the successes and failures of social movements.

1. Social scientists in times of crisis

Holderlin, in his last elegy *Bread and Wine,* asked: "what good are poets in times of dearth?", and today we could ask the same of social scientists. In the face of economic, social and ecological crises what contribution can social scientists make to resistance to the production and continuation of crisis?

Whether scientific knowledge has a particular contribution to make has, for some time now, been disputed by post-structuralists (amongst others), amounting to a crisis in the validity of science itself. In the face of compound crises this question has renewed relevance but our answer is methodological rather than philosophical, as we feel befits discussion of contributions to *practice*. Given the continuing struggle of millions of people in the midst of the still ongoing 'Great Recession', the problem may best be typified in the instance of the relation of academic knowledge to social movements. We begin with the example of participatory action research (PAR) in environmental research as an exemplifying methodology of recent attempts to bring social theory to practice. We show the shortcomings of the relativist approach often entailed in PAR, and similar approaches, and conclude that it fails to provide for a contribution by social scientists, as *scientists*.

2. Straight Story

But first, it is maybe worth remembering at the outset that the relation between academic knowledge and social movements need not be problematic at all. Perhaps the most current perspective in social movements' studies is the one associated with Doug McAdam, Sid Tarrow, and Charles Tilly (2001). These authors have of course obvious sympathy of the democratic social movements they study, but their work points to much more than this. They provide an elaborate conceptual tool-kit corresponding to different components and moments of the social movements. This tool-kit, with concepts like collective, claims, target authorities,

framing etc. enables social scientists of different fields to bring in their particular expertise to contribute to the success of the social movements. For instance, a local environmentalist movement for clean, accessible water will articulate its demands differently, will target different authorities, or will seek alliance with different sections of civil society, depending on the movement's understanding of the drivers of the water pollution or water inaccessibility. All these obviously call for contribution not only ecologists, but even political economists.

It is a sign of the times that nowadays the relation between social science and social struggles is scarcely regarded as straightforward. It's ironic to remind ourselves that Marx's aspiration to 'scientific socialism' was motivated by the mission of providing the burgeoning labour movement in Europe with a scientific foundation. Not only the Marxists, but the economists of different suits saw no epistemological transgression (at least until very recently) to advise the labour unions on their wage demand.

3. Cognitive fogs

So, what stopped it being a straight story? When we see a leading figure in climate science bracket the role of natural science in determining our response to climate change and giving the future over to discussions of cultural constructions and warring values, it is hard not to admit that we are facing a crisis in science, or reason, and its societal role. Critics take aim at what is seen as the failure of reason to deliver the promise of modernity and indeed, in some formulations, its complicity in the disasters of modern times, from colonialism, to genocide and environmental destruction. But, this is not the first time that the principles of the enlightenment have come under attack. The German Idealism of Fichte and Schelling questioned the ability of reason to bring truth, favouring art and intuition. Almost a century later Nietzsche's perspectivism and declaration that God is Dead, rejected the possibility of universal truths in both the scientific and the moral sphere.

The post-modern theoretical and epistemological attacks on reason and science at large are too various and numerous to recount here. What can be said is that, generally, the role that these critiques take up in political resistance, in place of reason dethroned, is limited to a certain kind. A typical example comes from Foucault's suspicious genealogies (following Nietzsche) of social norms, which reveal power to be diffused throughout society. Political resistance, lacking a target, becomes a matter of giving voice to marginalized groups, taking the side of the underdog. Similarly, Laclau and Mouffe's strategy for radical democracy raises *all* difference and dissent to the task of resistance, removing any solid determination and so any role for objective analysis, resistance becomes solely a "performance of collective will" (Rustin 1988). In both instances resistance *as* marginality or difference is celebrated, but cannot be assisted by rational thought.

Movements in environmental research

Similar patterns to those described above are seen with the approaches to social movements within environmental research. Within our particular field of study and teaching, sustainability studies, the approach of participatory action research (PAR) is the most prominent attempt to bring knowledge from academia to social movements and other contentious political struggles. The approach of transdisciplinarity is also popular but tends to be used mostly in engagement with state-politics and private enterprise. Recent work in both of these approaches commonly demonstrate the problems, described above, associated with post-modern scepticism of reason. Though while transdisciplinarity tends to depoliticize by assuming that problems can be solved through participation and consensus (e.g. Lang et al), PAR accepts a more contentious political reality. We will focus on PAR due to its more specific engagement with activism and social movements. We acknowledge that PAR is a field with a long tradition and multiple different approaches. For the purpose of this paper we are talking specifically about the branch of PAR researchers (e.g. ref) that deal with politically oriented movements. As such, the problems we

are talking about likely stem from the current research culture when encountering this particular research milieu, rather than the methodology itself.

The case of PAR

There are two problematic approaches within PAR to the production of knowledge with input from movements with the aim of furthering their goals. They both start from the recognition that in seeking to address environmental problems that have political dimensions, it is necessary to "takes sides". This generally means siding with those people who suffer the worst effects of the problem and often occupy the weaker social position. The aim with PAR is to produce knowledge, through deep dialogue and experiential interaction with these groups, which will further their goals in the political struggle that has emerged. The first of the approaches we examine is based on an intuitionist epistemology and the second on different varieties of standpoint theories and situated knowledges, both leave little room for social science to have a particular role in the resistance of crisis.

The first approach seeks to leverage an intimate understanding of people's subjective experiences (e.g. Brydon-Miller et al 2003; Glassman and Erdem 2014). Truth (if they are so bold as to use such a word) of the situation is established through sympathetic sharing of experiences and dialogue referring to lived experiences. While this is a plausible, if partial, research method, it is what is done, or rather not done, with this knowledge that renders the approach somewhat ineffectual. Firstly, it is unclear how conflicting knowledge generated through these methods can be decided between, reconciled or overcome. In fact there is small mention of the possibility of conflicting knowledge. Secondly, and more egregiously, this knowledge is not deployed in reasoned critique of the social drivers of the environmental problem but more for giving 'voice' and valorization of marginalized cultural practices. Resistance becomes mostly discursive and so research becomes more a form of advocacy than analysis. Streck (2014) summarizes the goal as being to, "develop knowledge that promotes

and strengthens a shared world view that aims at social justice and recognition of differences."
A subgroup of this approach builds on the work of Paolo Freire but the goal here is more pedagogical, toward a vaguer empowerment rather than concretely contributing to the achievement of movement goals.

The second type of approach builds on standpoint theory and situated knowledges, for example Rosendahl et al (2015). In the tradition of standpoint theorists and feminist work on situated knowledges i.e. from Lukasc (1971) to Haraway (1988), the epistemic privilege is not held to be immediately available to the marginalized, or those researching them, in the previous intuitionist sense. Rather, it must be uncovered through critique, particularly through the critique which occurs when the situated knowledge is deployed in political activity. Without getting into a long epistemological discussion, it appears that the conclusion of standpoint theory inspired PAR is that theory generated in political practice of the marginalized remains immune to external critique (meaning socially rather than paradigmatically external). This implies that it is not the intention that the force of the analysis be based in objectivity, or the strength of the better argument, to make its case and so, once again, this appears to amount to advocacy, at least it would to external observers, including those in power.

In these approaches, knowledge from the social sciences describing the dynamics of political struggles is mistrusted and seen as an exogenous imposition. As a result, the process of engagement tends to become the object of the research and so theory on this process is constructed and reconstructed. This leads to the process of engagement becoming conflated with the mechanisms of social change, leaving out other theory that refers more directly to the latter. We question if it is the most immediate or effective way that social scientists could contribute to resistance, or if indeed it provides a contribution outside of advocacy.

4. Academic knowledge and social movements

It would be simplistic to put down the legitimacy crisis of science to epistemological cynicism. The practice of science as a social institution must shoulder its share of the blame. In a further section below we will touch upon the sociology of academic institutions. In this section we take up briefly two opposite views current in the academic world that in our opinion have in opposite ways contributed to casting doubt on the role of academic knowledge in social movements.

The first view is the good old enlightenment role of science. Paul Reitan, Professor Emeritus from University at Buffalo, U.S.A., who likens society's environmentally destructive behavior to drug addition, echoes this point: "Effective education is the best treatment for blindness resulting from ignorance... Education helps to remove the scales from our eyes; it can cure our blindness" (Reitan, 2005). In the specialist educationalist literature this model is curiously dubbed as 'information deficit model', and its basic assumption, widely held in sustainability science (Wiek et al, 2012), is that a better understanding of the problem offers the solution to the problem. Maybe the only advance on the days of Enlightenment is the focus of the advocates of 'information deficit model' on the way scientific knowledge is transmitted to lay audiences, particularly regarding pedagogical and communication techniques. Hence the new field of 'science communication' (Bak 2001, Sturgis 2004). The preoccupation here is for science to influence policy or public opinion, hence the proliferation of handbooks and articles of popular writing and communication skills for scientists generally (Baron 2010). There is no need to recount the standard critique of such naïve version of enlightenment. It suffices to repeat that such beliefs on the part of the academy should certainly share the blame for the cultural clichés of ivory tower and superiority-complex ridden intellectual. The hubris associated with this view of the role of academic knowledge can only have the adverse consequence of making academic knowledge irrelevant to social movements.

The diametrically opposite view would reverse this privileged position of academic knowledge. The best-known version of this view is of course the one associated with Donna Haraway

(1998) and her celebrated term 'situated knowledge'. Ostensibly in the name of equal worth of all human beings, this view denies any objectivity for academic knowledge. Academic knowledge has no specific contribution to make to social movements. Scientific knowledge is simply one point of view among several, and its contribution is, as briefly discussed in the previous section, at best as an ingredient added to the indigenous, situated, or any form of non-academic knowledge.

This view, which we will use the shorthand of 'situated knowledge' for it, is indeed more dominant in the academy, and more pertinent to our discussion of examining the contribution of the academic knowledge to social movements. So we will discuss this in more detail in this section. Two introductory points may be useful to make here regarding the view of 'situated knowledge'. First, on different types of knowledge, and second, on the meaning of objectivity of science.

That science is not the only form of valid knowledge has been known at least since Aristotle. The point here is not of course the validity of Aristotle's typology of knowledge (with his inescapably pre-modern conception of science), but the fact that he saw no reason to compare or judge the superiority of different types of knowledge; rather, he simply assigned them different jurisdictions. In the contemporary schools of philosophy too there is usually a clear distinction between theory of science and theory of cognition as such. Nobody would deny the validity of the knowledge of the victims who may say, 'I know what it means to be hungry', 'I know what it means to be tortured', 'I know…' The experiential knowledge is obviously subjective, but its subjective-ness does not diminish of its validity. The validity of science comes from its objectivity. In view of much misunderstanding that comes with popularization of post-structuralism, it has to be repeated that 'objective' does not imply perfection or absolute. Objectivity of science simply implies that the scientific knowledge are *communicable* from one subject to the other, and in this sense are not subjective. In other words, objectivity of academic

knowledge simply implies that if the same protocol and procedure are followed, the same result will be reached.

Social movements and the contribution of social science

If one takes this view of science and experiential knowledge, it is easy to see that both social science of the academics and the 'situated knowledge' (experiential knowledge) of the activists have an important role to play for the success of the social movements. Every social movement occurs in a concrete situation. Every social movement is a specific case with some perceived issues. What social science can contribute to each case is certainly not repeating the generalities of whatever theories. Perhaps an apt metaphor is the relation between physics and what a car mechanic does. When you take your broken car to the garage you won't be impressed if the mechanic lectures you on the Newton's principles. You want your car fixed, and a good mechanic, precisely relying on the science of physics, can tell you how your car may be fixed. What is crucial in relation to social movements is not to take theories as what is on offer from social science to social movements, but as tools to be applied to concrete situations in order to make sense of the situation. Simplifying to the extreme, Charles Tilly's framework for the study of social movements may look like a list the components: the collective agent, the claims, the target authorities, the framing of the issue, the repertoire, and the strategy (McAdam et al 2001, Tilly 2004; Tarrow 2011; Kolb 2007). The application of concepts and theories of social science to the specific conditions of a particular social movement could, for instance, identify the drivers of the problem, and may contribute in bringing more clarity to any of these components of the movement such as framing the issue better or formulating its claims more precisely, etc.

Maybe this section should end on a note about the interaction of the academics with the social movement activists. If we accept that the experiential knowledge of the activists and the theoretical knowledge of social scientists correspond to different spheres, it is not simply a moral injunction that academics have no reason to be condescending towards the activists.

Unlike the advocates of co-creation of knowledge we saw in the previous sections, both the academic knowledge and the knowledge of activists are valid exactly because they have their own unique contributions. But are indispensable in their own rights and the truth is not somewhere in between. Making theoretical analysis accessible to social movements, to their leaders and activists is an art in itself, maybe we should call it another type of knowledge. So, academics who wish to be useful for the social movements as academics, must learn this non-academic knowledge too. They can only learn it the hard way, by getting their hands dirty and accepting the role of another non-privileged participant in the movement.

What we discussed briefly in this section might be controversial in some academic corners, but it is nothing new. As we stated at the beginning of this paper, the relationship between academic knowledge and social movements was a straight story for a long time. Maybe the more apt question is to ask is what happened that changed this.

5. Sociology of designed academic obsolescence

There is no shortage of critiques of the ability of post-structural theory to answer the questions it seeks to address, many are forceful and far more convincing than ours, see for example Anderson (1983) and Habermas (1987). Conversely, we may acknowledge incisive insights, such as in Foucault's (1978) history of sexuality which brought needed attention to the micro-politics of sexual norms and questioned the level of freedom sought through pursuing sexual liberation. However, whatever our judgement, the successful spread of theory is decided not only by academic debate. There are sociological reasons for the dominance of particular approaches (for Kuhn they are decisive). In this case, there are sociological reasons for the widespread dominance of approaches that limit the social scientists ability to support resistance within the academy. In delving into this sociology of designed academic obsolescence we will again refer to research that is actively engaged in trying to achieve social ends in collaboration

with social movements. It begins with the effect of financial crisis on the operation of universities.

Commercialization in the academy

Though the commercialization of universities has been going on for decades, the rate and extent of it increased around the late seventies and early eighties, in response to funding cuts and tightening relationships between universities and business (Bok 2009). This not-so-slow creep of the commercialization of education is visible around the world from the recent introduction of fees in Swedish universities, to the shutting down of economically unnecessary social science departments in Japan, to the recent crossing of the $1 trillion mark is U.S student debt. With it comes an incipient instrumentality (Giroux 2003), in which students are treated more and more like customers and quantity of publications becomes the central goal for research. As neoliberal governments and universities direct more attention to economic impact and innovation (Etzkowitz 2001) and private funding foundations grow in importance (Roelofs 2007) we fear the ability to carry out research outside of the interests of these bodies; the dependency on funding cedes immense power over the direction and concerns of social science to funding bodies and their agendas. As Giroux sum up the situation:

> "The traditional academic imperative to publish or perish is now supplemented with the neoliberal mantra "privatize or perish" as everyone in the university is transformed into an entrepreneur, customer, or client, and every relationship is ultimately judged in bottom-line, cost-effective terms. As the university is annexed by defence, corporate and national security interests, critical scholarship is replaced by research for either weapons technology or commercial profits" (Giroux 2009, p. 5.).

This this stifling academic climate has arisen in close relation to, and as part of, the continual crises that social movements resist.

Foundations, funding and resistance

Giroux, in the previous quotation, stops at the diminishment of critical research, but why might not the tone of this critical research also be influenced by commercialization? There is undoubtedly tension between the academic freedom to pursue scientific curiosity and the desire to secure funds, when the latter often hinges on selection of the approach favoured by the funding body, be it state or private.

In environmental research these days the resilience approach is such a favourite. Resilience is a concept that comes from ecology where it describes the ability of ecosystem functioning to persist in the face of disturbance. In recent years it has been applied to communities and nature combined, based on an ontology of complex adaptive social-ecological systems. Though the concept is unproblematic, and broadly accepted, in ecology, many (most) social scientists see it as highly problematic when applied to society for its depoliticizing and conservative implications (Cote and Nightingale 2012; Olsson et al. 2015). Nevertheless, resilience has become a popular buzzword with funding agencies. Foundations such as the Rockefeller foundation (Da Silva and Morera 2014) and the Meridian Institute (Meridian Institute 2016) have been pushing a program of urban development and climate change adaptation couched in this conceptualization. Both foundations have been partnering with municipal governments at the same time as providing funding to university researchers for research on resilience.

In response to Hurricane Katrina in 2005, money rolled in to New Orleans from such foundations, commissioning studies with policy recommendations and designing municipal action plans for resilience. These plans while nominally seeking to address inequality and improve the lot of the poor, in some instances ignored or dismissed their concerns. An article

co-authored by Robert Kates, a 'founder' of sustainability science, commissioned by the department of homeland security, depicted those critical of plans to build a "safer, better new Orleans", over concerns that this meant displacing poor black residents, as conservative and reactionary (Colten et al. 2008). A Rockefeller commissioned report, from which a city resilience plan was developed, pays lip service to inequality but looks more like a neo-liberal development plan with added emphasis on security (Da Silva and Morera 2014). At an ideological level Adams (2013) shows how promoting resilience fit well with the narrative of the hurricane as an 'act of god' to which the appropriate response is self-reliance. This echoes the use of the concept of self-determination that was used to co-opt African American resistance to the privatisation of public housing in the same city a few decades previously (Arena 2012). Thankfully, some activists have recognised the ideological force of this concept and are trying to switch the focus back from "resilience to resistance" (Gulf South Rising 2015).

Movements to defend public housing in New Orleans from privatisation provide another example of how foundations influence the application of theory to practice in social struggle. The interference of funding foundations through the financial support of particular theory in the practice of local politics directly hindered the action of social movements, and the efforts of a scholar working with them. John Arena is a sociologist who was actively involved in the resistance to the demolition of public housing in the aftermath of the hurricane. In his book "Driven from New Orleans" (2012) he recounts his experience as part of a coalition of grassroots activists – mostly residents of the public housing developments, women's organizations, some members of political groups and researchers – who campaigned and demonstrated to resist the latest step in the neo-liberal redevelopment of the city. He describes how they were attacked by more organized non-profit organizations on the grounds of their mixed racial make-up for not understanding the needs of black people, them not being black, and were declined support from potential allies on this basis. These non-profit organisations

later remained silent or even supported the redevelopment of public housing, delivering it into private hands. Arena explains how the funding regimes for these NGOs, with foundations as the co-ordinating organ at the top, supports them pursuing single issues based on the particular identities and suggests this as a reason for their disagreement of the cross-class cross-race coalition. The support of this version of identity politics by foundations, through how it distributes its funds, also gives power and money to the more organized NGOs, attracts potential activists with the promise of employment, and consequently inhibits the grassroots activist movements (Roelofs 2007).

6. Resistance in the academy and resistance in society

Now we come to reflecting back on our original question i.e what good are social scientists in times of crisis? Our short answer is that we can be useful for social movements, as *scientists*. We have detailed the approach to knowledge and theory that we believe would allow us to be so, but also the heft of social pressures that can inhibit us in practice. We recognise that to be practically useful to social movements in response to crisis, we must at the same time try to fight back the trend of commercialization and defend academic freedom and the independence of universities in the face of the infringement of economic powers, like those acting through private foundations. We are not trying to put the burden on individuals to sacrifice their livelihood in the name of integrity, rather that the response from academia should also be collective. The resistance in society that we seek to aid will have to be matched and united with a similarly organised resistance within the academy.

References

Adams, V., Markets of sorrow, labors of faith: New Orleans in the wake of Katrina. 2013: Duke University Press.

Arena, J., Driven from New Orleans: How non-profits betray public housing and promote privatization. 2012: U of Minnesota Press.

Bak, H.-J. (2001). Education and Public Attitudes toward Science: Implications for the "Deficit Model" of Education and Support for Science and Technology. Social Science Quarterly, 82, 779-795.

Baron, N. 2010. A Guide to Making Your Science Matter: Escape from the Ivory Tower, Washington D.C., Island Press.

Bok, D. (2009). Universities in the marketplace: The commercialization of higher education. Princeton University Press.

Brydon-Miller, M., Greenwood, D., & Maguire, P. (2003). Why action research?. Action research, 1(1), 9-28.

Charles Tilly (2004). Social Movements 1768 - 2004. Paradigm Publishers.

Colten, C.E., R.W. Kates, and S.B. Laska, Community Resilience: Lessons from New Orleans and Hurricane Katrina. 2008, Community and Regional Resilience Initiative. p. 1-31.

Cote, M., & Nightingale, A. J. (2012). Resilience thinking meets social theory situating social change in socio-ecological systems (SES) research. Progress in Human Geography, 36(4), 475-489.

Da Silva, J. and B. Morera, City Resilience Framework. Ove Arup and Partners International Limited, London, 2014.

Etzkowitz, H., The second academic revolution and the rise of entrepreneurial science. Technology and Society Magazine, IEEE, 2001. 20(2): p. 18-29.

Felix Kolb (2007). Protest and Opportunities. Campus.

Foucault, M. (1978). The history of sexuality, Volume 1: An Introduction. New York: Pantheon Books.

Giroux, H.A., Democracy's nemesis: The rise of the corporate university. Cultural Studies↔ Critical Methodologies, 2009.

Giroux, H.A., Public pedagogy and the politics of resistance: Notes on a critical theory of education nal struggle. Educational philosophy and theory, 2003. 35(1): p. 5-16.

Glassman, M., & Erdem, G. (2014). Participatory Action Research and Its Meanings Vivencia, Praxis, Conscientization. Adult Education Quarterly, 64(3), 206-221.

Gulf South Rising. 2016, 20th January 2016; Available from: http://www.gulfsouthrising.org/#about.

Haraway, D. (1988). Situated knowledges: The science question in feminism and the privilege of partial perspective. Feminist studies, 14(3), 575-599.

Lang, D.J., Wiek, A., Bergmann, M., Stauffacher, M., Martens, P., Moll, P., Swilling, M. and Thomas, C.J., 2012. Transdisciplinary research in sustainability science: practice, principles, and challenges. Sustainability science, 7(1), pp.25-43.

Lukács, G. (1971). History and class consciousness: Studies in Marxist dialectics (Vol. 215). Mit Press.

McAdam, D., Tarrow, C. and Tilly, C. (2001). Dynamics of Contention. CUP.

Meridian Institute 2016. Available from: http://www.merid.org/en/Content/Projects/Community_and_Regional_Resilience_Institute_CARRI.aspx

Reitan, P. H. 2005. Sustainability science- and what's needed beyond science. Sustainability: Science, Practice, & Policy, 1, 77-80.

Roelofs, J., Foundations and collaboration. Critical Sociology, 2007. 33(3): p. 479-504.

Rosendahl, J., Zanella, M. A., Rist, S., & Weigelt, J. (2015). Scientists' situated knowledge: strong objectivity in transdisciplinarity. Futures, 65, 17-27.

Rustin, M. (1998), Absolute voluntarism: Critique of a post-Marxist concept of hegemony. New German Critique No. 43, Special Issue on Austria (Winter, 1988), pp. 146-173

Sidney W. Tarrow (2011). Power in Movement – Social Movement and Contentious Politics. Cambridge University Press.

Streck, D. R. (2014). Knowledge and transformative social action: the encounter of selected traditions of participatory (action) research. Globalisation, Societies and Education, 12(4), 457-473.

Sturgis, P., Allum, Nick (2004). Science in society: re-evaluating the deficit model of public attitudes. Public Understanding of Science, 13, 55-74.

Wiek, A., Ness, Barry, Schweizer-Ries, Petra, Brand, Fridolin S., Farioli, Francesca (2012). From complex systems analysis to transformational change: a comparative appraisal of sustainability science projects. Sustainability Science, 7, 5-24.