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The Roles of Science Shops in Enabling Civil Society Organisations' Societal Influence

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Abstract

The concept of Science Shops was developed in the 1970s at Dutch universities as a means to strengthen the influence of Civil Society Organisations (CSOs) on societal issues through access to scientific knowledge. Since then Science Shops have been developed in several European and non-European countries, mostly as university-based Science Shops but also some as community-based Science Shops. Based on examples within air pollution and an Actor-Network Theory (ANT) approach the article discusses what influence co-operation between Science Shops and CSOs can cause. The article concludes that scientific knowledge in itself is not sufficient to ensure influence. A report or another type of scientific product can be used by the CSO to open discussions related to an issue, but to obtain influence the involved scientists may need to apply an impact-seeking approach. This implies that the scientists discuss premises and possible implications of the produced knowledge with the CSO and maybe help developing dialogue with or pressure on the opponents in relation to an issue raised by a CSO.

The article bridges STS discussions on 'the relevance of science' and public engagement with ANT in order to contribute to an ANT-based understanding of scientific knowledge in controversies involving CSOs.

Keywords: *Science Shops, civil society organistion, community-based research, Actor-Network Theory.*

1 Introduction

The focus in this article is on how civil society organisations (CSOs) by forming alliances with Science Shops and university scientists are empowered to address and influence environmental problems of their concern. The article relates the discourses of 'the relevance of science' in CSOs battles for influence as well as CSOs opportunities for accessing science. The article builds upon case studies from Denmark, the Netherlands and US.

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Denmark and the Netherlands have a long tradition for debate and participatory democracy (Baark, 1997; Andringa & Schot, 1997), especially within environmental regulation and management. CSOs, the industry and scientists have had a voice in the debate. Baark (1997) concludes in a study of public participation and sustainable development in Denmark that all interested parties are assumed to have a legitimate right to negotiation, and to take part in decision-making, and this has been used both for raising issues, as well as for restructuring institutions and administration procedures. Another example of participatory democracy is the Science Shop concept which developed in the Netherlands in the 1970s as one of several means to democratize science and technology. By responding to a growing demand from both citizens and CSOs, as well as left-wing student activists and university scientists, to give citizens and CSOs a voice as well as access to and impact on scientific and technological knowledge, the Science Shop model challenged the traditional orientation of science and toward how knowledge is developed (Wachelder, 2003; Dickson, 1984; Farkas, 2002). The concept was spread to a number of European countries. The first Danish Science Shop was established at Technical University of Denmark in 1985. Later, they also spread to countries outside Europe, such as Israel in 1997 and South Africa in 1995 (Mulder et al, 2001).

The way Science Shops are organized depends on the context and the funding opportunities at the time the Science Shops were established. Many Science Shops became part of the official university structure (the term used for this kind of Science Shop is university-based Science Shops), which implied scientific staff members, offices and development and strategy plans (Wachelder, 2003). In contrast, we also find Science Shops with weak or no affiliation to universities, such as the Austrian Science Shop FBI (Institut für Gesellschaftswissenschaftliche Forschung, Bildung & Information) and the German Science Shop WilaBonn (Wissenschaftsladen) (both termed non-university-based Science Shops). This type of Science Shop is organized as a non-profit organization and may in some cases require a fee for their services (Jørgensen et al., 2004).

A similar initiative to the Science Shops was taken in the US in the 1960s. The so-called Community-Based-Research (CBR). The idea behind these initiatives is two-fold: to prepare students for a more active role in society; and to encourage research relations with CSOs and citizens as active partners in conducting the research. CBR projects are therefore based on problems or issues identified by the CSOs (Strand et al., 2003: p. xiii-xx; Chopyak & Levesque, 2002: p. 159). The CBR idea has become quite widespread in the US, meaning that many universities now have some sort of Community Outreach Unit. The aims of these units may vary, however, from strengthening university relations with society to communicating and translating science for communities so they understand how they can use scientific results in their own context (Hricko, 2007; HYDRA, 2010; NIEHS, 2010). According to Strand et al. (2003), higher education institutions in USA have begun a process of rethinking its relationship with civil society during the 1980s due to criticisms from students, some scientists and civil society that 1) education institutions were disconnected from civil society; 2) research seemed too narrowly defined; and 3) students lacked the competences that would make them capable to be democratic citizens (Strand et al., 2003: p. 1).

Despite the long tradition for citizen involvement and democracy in science and technology in the two countries, it seems like both Denmark and the Netherlands have reached a turning point with the transition to the 21st century. We see a shift in university policy that emphasizes commercialization of science and competitiveness (Jamison, 2008: p. 120). Some universities have even been turned into independent companies, and their main purpose is to serve industry (Wachelder, 2003). According to Jamison (2008: p. 119), this is causing a significant deterioration in scientists' academic freedom and universities' autonomy.

1.1 The Knowledge Needs of CSOs when Approaching Science Shops

Science Shop clients can be of various types, from local citizen groups to larger NGOs. Some Science Shops even accept requests from SMEs (Small and Medium-sized Enterprises) and local authorities. In the *SCIPAS*[i] project (which was one of the first joint international research projects conducted by the Science Shop community), one of the aspects investigated was client types. It was concluded that Science Shop clients fall within the following groups (Gnaiger and Martin, 2001):

- Community/Voluntary groups (including environmental groups and religious groups)
- Trade Unions
- Political Parties
- Individuals
- Public Institutions
- SMEs

Another international study of science shops, *INTERACTS*[ii] that the knowledge production that takes place in Science Shop co-operations is shaped by the conditions of the involved actors and their understanding of research. In some situations, existing knowledge is transferred to the CSOs by the Science Shops; in other situations, it can be characterized as knowledge supply, i.e. scientists and/or students produce new knowledge, which is then transferred to the CSOs. Knowledge production can also take place as co-produced of knowledge i.e. knowledge is produced through a mutual process between the CSO, scientists and/or students and Science Shops. This form of knowledge production implies that lay people's knowledge is considered just as important as scientific knowledge (Jørgensen et al., 2004).

According to Irwin (1995: p. 155-166) and Bellamy (2006: p. 258), Science Shops make a valuable contribution to CSOs by 1) providing technical assistance or knowledge to CSOs; 2) providing mediation between CSOs and scientific structures; and 3) facilitating 'self-help networks', i.e. establishing contact between CSOs experiencing the same problems; 4) raising societal problems among students and scientists at the universities; 5) impacting research agendas to meet societal needs; and 6) empowering CSOs to 'put science into perspective'. The CSOs themselves argue that co-operation with Science Shops contributes to their efforts to impact and effect policy making, because they become able to bring scientific knowledge and alternative solutions to the attention of politicians and initiate public debates. The CSOs further argue that through co-operation with Science Shops they become aware of research possibilities and limitations. In some cases, the CSOs also acquire the capacity to use scientifically grounded methods when carrying out investigations themselves (Jørgensen et al., 2004; Jørgensen, 2008).

Science Shops can therefore be regarded as a platform for bringing together scientific analytical principles on the one hand, and the lay persons' (with or without scientific background) knowledge about the issue on the other, thus contributing theoretically based systemization of lay knowledge or problem conception and lay insights on perceived problems to science. There is a strong need for understanding when and how CSOs are able to obtain influence on societal concerns through Science Shops and other types of Community-based Research units and what role scientific knowledge plays.

2 Methodology

The article builds upon research carried out as part of an EU-financed research network within atmospheric chemistry change, *ACCENT*[iii]. The aim was to understand how CSOs through alliance building and network constructions with Science Shops and similar community-based research units, engage with scientists in order to impact air pollution problems (Brodersen 2010).

The analytical approach is inspired by Science and Technology Studies (STS) in general, more specifically by the Actor-Network Theory and Callon's (1986a) sociology of translations, since this theoretical approach contributes to understanding why and how the actors sought to stabilize controversies, as well as the mechanisms contributing to the networks' success in affecting the problems experienced by the CSOs.

The research was based on Yin's (2003) approach to multiple case studies. Eight cases of co-operation between CSOs, Science Shops and air pollution scientists were analyzed in order to how these network alliances were shaped and which kind of influence the alliances gained on the issue of concern for the CSOs. The cases reflect and show different forms of influence as well as different approaches applied by the involved Science Shops.

3 Network alliances between CSOs, Science Shops and scientists

The discussions in this article are based on eight case studies of network alliances between CSOs, Science Shops and scientists within the environmental topic of air pollution. In the following the eight case studies and the attempts to obtain influence are described (Brodersen 2010).

Case A: In the **parent group case,** the network was created around the CSO's concerns about a local school's plans of constructing a new building close to a motorway. Despite the network being translated into scientific documentation that supported the CSOs worries, the network finally failed to persuade the local school board and authorities about the claim because these actors questioned the methodologies behind the scientific results. Later, after the network was dissolved, it was decided not to construct the school building right next to the motorway.

Case B: In the **pesticide case,** the network was created around the CSO's concerns about the possible health risks from airborne pesticides. Finally, the network was translated into a scientific

report with inconclusive results; it could not be concluded that airborne pesticides did not cause health risks, nor could it be concluded that airborne pesticides caused health risks. Due to the inconclusive results, and maybe also because it would cause a tremendous change of practise for the farmers, the network failed to create an alliance with the local farmers and thereby cause local effects.

Case C: In the **Scania case,** the reopening of the factory raised concerns among the citizens in the area regarding whether the painting procedures would cause odours. Finally, Scania agreed to reduce odour emissions from the factory. The means used to force Scania to agree to reduce their odour emissions seemed to be independent scientific documentation combined with threats of legal action.

Case D: In the **carpet factory case,** the CSO's original problem was related to health risks caused by two carpet factories in the community. Despite the fact that the network only succeeded in producing weak scientific evidence of odour pollution, it finally succeeded in persuading the local authorities to establish a complaint telephone through independent negotiations.

Case E: In the **board game case,** the network was created around the CSO's original problem of lacking knowledge about transition possibilities in the aviation industry. Finally, the network was translated into a board game, which did not meet the wishes of the CSO or succeed in convincing the actors that it could be used as a communication tool for debating transition possibilities.

Case F: In the **bicycle apparatus case,** the network was created around the CSO's problem of extending an already existing bicycle apparatus for measuring road quality to also measure air quality. Finally, the network was translated into a functioning apparatus that could measure both road and air quality.

Case G: In the **stove case,** the original problem of the CSO concerned whether or not particles from residents' stove use caused a health risk to their own community. Finally, the network was translated into a literature study. However, the study's conclusions: that the residents' stove use did not cause health risks to their community were not what the CSO had expected. The weak conclusions caused a conflict, between the CSO on one side and the scientists (including the Science Shop representative) on the other, concerning the credibility of the results and what could be concluded on the basis of a minor literature study. The weak conclusions also allowed the majority of the residents to conclude that their behaviour did not cause health risks to themselves or their fellow residents.

Case H: In the **Mira Loma case,** the original problem of the CSO was that their community was exposed to heavy truck traffic from warehouse activities and therefore to air pollution. Finally, the network succeeded in avoiding new warehouse development in the area, and the county board of supervisors recognised to some extent the health risks to humans that truck emissions can cause. The means used by the network were direct dialogue with the county board of supervisors. The network succeeded in establishing this dialogue due to independent scientific documentation of the problem, combined with community support through door-to-door campaigns in the community.

4 Analyses of Cases with Effect on CSO Problems

Influence was obtained in some of the cases, whereas in other the network alliance did not succeed in affecting the initial problems of the CSOs. We observed that effects on the CSOs' original problems were seen in the parent group case, the Scania case and the Mira Loma case. Furthermore, effects were partly observed in the carpet factory case, the bicycle case and the guideline case. In the following we discuss what led to influence. In later sections we discuss cases where influence was not obtained and where other types of impact was obtained.

4.1 Two Situations Motivating Scientific Documentation of Problems

In the Scania case, the carpet case, the parent group case and the Mira Loma case, the CSOs assumed that scientific documentation would contribute to impacting the problem in question. This scientific documentation was intended for legal actions against the industry and local authorities or for initiating dialogue in order to persuade local authorities to change plans. These case studies seem to reflect two different situations that motivated the CSOs to document the issue of concern: either because they had an opportunity to raise their concern through spaces for invited participation, or because they wished to convince the actors causing the pollution, through scientific documentation, that they were causing a health risk to the community. The Scania case illustrates the first situation: a CSO, through spaces for invited participation, strove to avoid future pollution. In this case, the CSO sought to influence the problem through existing channels of influence and participation. In spite of the provision by law ensuring citizens the right to influence future planning of infrastructure and industrial activities in their communities, the local authorities rejected the CSO's concern, arguing that it was ungrounded. This left the CSO in a situation where they saw scientific documentation of their concern as the only means to convince the local authorities and Scania that the proposed activities would cause health risks to the residents.

In other cases, the CSOs needed scientific documentation to support their concerns about being exposed to health risks and thus convince other actors about the risks connected with the industrial activities. This was exemplified by the Mira Loma case and the carpet factory case. In these cases, the CSOs had no possibility to act within the official channels of influence or participation; therefore, they assumed in the carpet factory case that scientifically documenting their concern would convince the local authorities and the carpet factories that their claims were legitimate. This indicates that it may be difficult in some situations for the CSOs to affect concerns that are based on people's experiences or assumptions; what seems necessary in order for the CSOs to succeed in affecting their concerns is that they are supported by scientific documentation.

4.2 Effects on Here-and-Now Problems without Sound Scientific Documentation of the Problem

One of the case studies – the carpet factory case – has shown that in some situations it may be possible to cause effects on here-and-now problems without having been able to document the problem scientifically. But as observed in the case, this required the Science Shop applied the impact-seeking approach that opened the possibility for the Science Shop coordinator to become engaged not only in the process of producing scientific data but also in a dialogue about how to

meet the CSO's concern. In this specific case, the network failed to scientifically document the problem, and therefore it did not perceive the CSO's initial intention of filing a lawsuit against the carpet factories for causing odour pollution as a solution. Thus, other means of solving the problem had to be found, such as dialogue and negotiations with the counterpart, in order to try to seek a solution to the problem experienced by the CSO. The way the Science Shop approached this was to acknowledge the technical data provided by the two carpet factories as correct, while arguing and working to convince the local authorities and the two carpet factories that despite the lack of clear scientific evidence, the problem still occurred in specific situations. The Science Shop's arguments were so convincing that the local authorities agreed to set up a complaint telephone line, which provided the community with the opportunity to report odour pollution when it was experienced.

4.3 Scientific Documentation Combined with other Means Caused Effects

The case studies also indicate that scientific documentation of a problem may not be enough in itself to cause effects, but that other means can be combined with the scientific documentation to contribute to an effect on the CSOs' original problems. This was seen in the Scania case and the Mira Loma case. In the Scania case, the network's first approach was to document the problem scientifically, and on the basis of this documentation, enter negotiations with the Scania management and the local authority. When this failed and Scania and the local authority refused to accept the documentation of the odour particles, the network decided to file a lawsuit. Thus, in this case, the network initially perceived 'scientific documentation' as the solution, but when this failed, the network had to combine the scientific documentation with a threat of lawsuit. Through these means the network succeeded in forcing Scania to set up an agreement with the network.

The Mira Loma case also reflects a situation where the produced scientific documentation of the air pollution caused by warehouse activities was not sufficient to affect the CSO's original problem. In this case, an opponent network contested the results of the scientists supporting the CSO, arguing that it was the particles blowing in from port activities in Los Angeles that were the source of the pollution and not warehouse activities in the village. This led the university scientists to defend their results publicly, although until that moment they had assumed the role of supporting the CSO behind the scenes. Publicly defending the results was not sufficient to convince the opponent network, it was necessary for the network to combine the scientific documentation with other means. The way the network approached this was to engage the CSO directly in gathering more evidence of the pollution levels, which the CSO then presented to the community through banners and door-to-door campaigns. In this way, the network succeeded in persuading the residents to support the network in their claim for a healthier environment. With the support of the whole community together with P-track measurements made at the county supervisor's home, the county building, and at an intersection in the community, the network succeeded in gaining access to a county board of supervisors meeting. At this meeting, the CSO presented the evidence collected and argued that warehouse activities were in fact the main source of the pollution experienced in the community. Thus, they succeeded in convincing the county board of supervisors that the community was facing severe health risks caused by air pollution from warehouse activities. This case shows that even though this network had sound scientific documentation of the source of the

pollution, it was necessary to combine this documentation with evidence that was not scientifically sound (i.e. the P-track measurements made by the CSO) together with massive community support before it could succeed in affecting the experienced problem.

4.4 The Role of Independent Scientific Research: The Roles Assigned to the Scientists and CSOs

The network alliances that succeeded in affecting the CSOs' original problems also present another interesting element that contributed to the networks' success: the role assigned to independent scientific research and thereby to the scientists and CSOs. In the carpet factory and parent group cases, the process of documenting the problem – and in the carpet factory case, also the process of negotiating with the local authority – was delegated to the scientists and Science Shops, while the CSOs assumed a more invisible role (even though the CSO in the carpet factory case also participated in the steering committee). These two cases led to an important observation that is also reflected in some of the cases that failed to affect the CSOs' original problems (the pesticide case and partly the stove case) – that some CSOs and scientists consider scientific documentation to be independent and objective, which means that it is produced with no interference from the CSOs. Claiming independence in relation to scientific documentation seems to be perceived as important for creating legitimacy for the network's activities.

Interestingly, the Mira Loma and Scania cases seem to reflect other roles, assigned especially to CSOs, than only that of invisible partners in the network. In the Mira Loma case, the CSO was assigned the roles of research partner (gathering data and carrying out measurements) and network spokesman in relation to the community, the media and the politicians. This seems to have contributed to the network's success, since by assigning the CSO this role, the network succeeded in mobilizing the community which the CSO use to put pressure on the county board of supervisors. And even though the county supervisor of Riverside questioned the scientific legitimacy of the P-track measurements, and the scientists (co-operating with the CSO) emphasized that the measurements were ad hoc measurements, it seems that the politicians accepted these data as reflecting the actual situation in the community. In other situations, assigning the CSO the role of negotiator contributed to the network's success in impacting the CSO's original problem. This was seen in the Scania case, where the CSO was assigned the role as negotiator with the Scania management and the local authorities supported by both the Science Shop and the Bureau of Legal Aid and the prospective of winning the lawsuit.

4.5 Student Projects can be Part of Successful Network Alliances between CSOs, Science Shops and Scientists

The successful cases also seem to indicate that network alliances based on project strategies that include student scientists can affect the CSOs' original problems, even though such projects may be limited in time and resources, and may even be questioned for their credibility. The cases on which the networks based their research activities on students as scientists were the parent group case, the carpet factory case, and the bicycle apparatus case. It is important when approaching research activities as student projects that the scientists supervising the research follow the process carefully and that they are willing to defend the research and the results, if the results or methodologies

subsequently are contested by other actors. This was for example observed in the parent group case, where the scientific results produced by the network, as well as their legitimacy, were questioned by the local authority and the hired consultant firm. By questioning the legitimacy of the results, the opponent also indirectly questioned the involved research group professor's scientific credibility. He therefore felt obligated to defend the results and the methodology.

5 Analyses of Cases without Effect on CSOs' Problems

The cases that failed to affect the CSOs' original problems seem to focus on the same types of problems as the cases where influence was obtained. I.e. problems the CSOs wanted to change here-and-now (the pesticide and stove cases) and problems dealt with as part of the CSO's existing agenda (the board game case) We also find the same types of CSOs as in the cases that succeeded in affecting the CSOs original problems: The CSOs involved in the networks that failed were also created due either to a specific air pollution problem (the pesticide case), or to an issue that was part of CSOs' already existing attempts to address issues related to creating a healthy and more Also the ways the CSOs approached the problem seem to reflect similarities between the successful and unsuccessful cases. In these three cases, as in the successful cases, the CSOs chose a strategy of documenting the problem scientifically.

The unsuccessful cases reflect the same types of CSO knowledge needs as in the cases that succeeding in affecting the CSOs' original problems. Documentation of a problem experienced in local communities, was reflected in the pesticide case and the stove case, while new perspectives to improve a social or environmental situation, was observed in the board game case, where the CSO needed knowledge about the possibility of more sustainable strategies in the airline sector.

Thus, the explanation of why these three networks failed to affect the original problems must lie in the specific ways the networks approached the problems. Based on the cases that failed to affect the CSOs' original problems, one conclusion is the significant role that translations of the original problem played in the networks' success or failure. The cases also seem to indicate the importance of acceptance of the translations and the link between the translations of the problem and the CSOs' original problems. The consequences for the networks' success can be fatal, if the translations do not related to the original problem.

5.1 Fatal Translations of the CSO Concern

Our argument is that in the board game case and the stove case, translations were made that were not returned or fully accepted by the CSOs, and this might be the explanation as to why the networks failed. The fatal translation in the board game case was when the Science Shop translated the CSO's original problem into the need to develop a board game. Through this translation, the Science Shop not only neglected the CSO's original problem or idea, it also neglected the knowledge possessed by the CSO. This had the effect that the CSO lost interest in the network and finally because the board game did not convince the CSO that it could contribute with new information or perspective, the CSO denied including the board game in their strategy for debating transition possibilities in the aviation sector.

In the stove case, the fatal translation occurred when the scientist argued that measurements were not possible due to the limited resources available for an introductory student project. Interestingly, the CSO seemed to accept this translation in the beginning, maybe because it was clear that this was their only opportunity to have the problem researched and scientifically documented. In this case, the CSO's intention from the beginning was to initiate debate among the residents about their behaviour regarding the use of their stoves. In order to motivate such a debate, the CSO felt they needed scientific documentation that showed that some residents' stove use caused health risks to their fellow residents. When the results of the network's activities turned out not to support the CSO's concerns, the CSO representative argued that conclusions could not be based entirely on a literature study and answers from a questionnaire, in spite of the fact that the scientist seemed to support the student's conclusions. This seems to reflect an interesting aspect – that although translations seem to be accepted at one point in time by an actor, the same actor can later reject the translation. It further reflects a situation where despite failing to document the problem, the CSO still experienced that the problem existed and therefore could not accept that the other actors in the network denied the problem.

5.2 Too Little Science Shop Involvement

Another interesting issue which the cases that failed to affect the CSOs' original problems seems to bring forth is that it might be difficult to cause effects if the involved Science Shops are not willing to engage themselves further in the issues than to provide the necessary scientific knowledge - also in situations where the networks' results may be inconclusive. For example, both the pesticide case and the carpet factory case failed to provide clear scientific evidence of the expected pollution, but the two networks, respectively, failed and succeeded in affecting the CSOs' original problems. One explanation to this difference is the Science Shop approach; in the carpet factory case, the Science Shop succeeded in convincing the carpet factories and the local authorities to accept the problem through negotiations, whereas in the pesticide case, although the Science Shop attended the meeting with the parliament member, it chose not to become involved in discussions with the bulb farmers or the local authorities.

This could point to one important conclusion – that network alliances such as these are more likely to succeed when the Science Shops apply a more impact-seeking approach – also in situations where the networks' results may be inconclusive.

The stove case also reflects an interesting aspect observed in the pesticide case – that community members may interpret the scientific results differently than the CSO itself. As seen in the stove case, the CSO contested the results, which indicated that the methodology in the research raised questions about how conclusive the results were. When the results were presented to the residents, however, they interpreted them to mean that their behaviour regarding stove use did not cause health risks to their fellow residents. This dilemma was also reflected in the pesticide case, where instead of being concerned about their own or their children's health due to their use of airborne pesticides, the farmers interpreted the network's results as meaning that their use of airborne pesticides did not cause any health risks.

Thus, this discussion seem to point towards that it is not the specific type of problem or the specific actors the networks fight against that determine whether the networks fail. Rather, what seems to contribute to the network alliances' success or failure is the way the networks approach the problems. The engagement of both the Science Shops and the scientists and their motives for becoming involved in the process to affect the problem also contributes to the process of making networks successful. Furthermore, it seems that some translations of the network's focus may be accepted at a certain time, maybe because this is the possibility for research the CSO sees at that time, but if the results do not support the CSOs' assumptions, they may be questioned. Relating this to the board game case and the stove case, we observed that the CSO in the board game case may at first have accepted the translation because of considerations that a board game could be an interesting way to open up for dialogue. And the CSO in the stove case may have expected that a well-argued scientific student report could support their concerns and fears concerning smoke from neighbours' stoves.

6 Analyses of Other Effects in Cases

Interestingly what we term as 'other forms of effects' were observed both in cases that affected the CSOs' problems as well as in cases that failed to affect the CSOs' problems. Figure 4 illustrates the other forms of effects we have observed in the case studies.

	The CSO's problem	Other effects due to network activities	Effects on the CSO's original problem
The parent group case (case A)	Avoid school building construction because they were concerned that their children would be exposed to traffic emissions.	Scientists obtained new and updated data indicating a relationship between traffic emissions and children's health.	+
The pesticide case (case B)	Concerns about health impact on humans from airborne pesticides.	Emerging interest among scientists, and a PhD project initiated.	÷
The Scania case (case C)	Concerns about odour pollution from planned industrial activities in community.	Local experiences with odour pollution disseminated in a national odour platform.	+
The carpet factory case (case D)	Concerns that toxicity from industrial activities in community could cause risks of cancer, odour pollution and water pollution.	Carpet factories interested in further co-operation with both the community and the Science Shop.	(+)
The board game case (case E)	Need for scientific documentation indicating sustainable transition possibilities for the aviation sector	Emerging interests within the scientific community about the board game idea	÷
The bicycle apparatus case (case F)	Develop an apparatus to measure road and air quality on bicycle paths	Measurements in 5 major cities in EU (as part of an EU funded research project)	(+)
The stove case (case G)	Concerns about whether residents in the community were exposed to air pollution from their stove use.	Science Shop tried to include the community case into a research project.	÷
The Mira Loma	Wish to stop air pollution in Mira Loma caused	Scientific evidence of the relationship	+

	The CSO's problem	Other effects due to network activities	Effects on the CSO's original problem
(case H)	by warehouse activities.	between truck traffic and children's health. Citizens employed in the CSO as community organisers. Education programmes initiated focusing on civil and environmental rights in communities with impoverished residents. Agreement between the CSO and the scientists about a new co-operation partnership dealing with goods distribution.	

Figure 1: Comparison between other forms of effects and the networks' success in affecting the CSOs' original problems

So why are these other forms of effects interesting? We find them interesting because they show that network alliances between CSOs, Science Shops and air pollution scientists can lead to other effects than expected; effects that can contribute to raising awareness about the issue in question both among politicians, industries and scientists as seen in almost all the cases. For example, the pesticide case, the board game case (networks that failed to affect the CSOs' original problems) and the Mira Loma case reflect effects that influenced scientists' research interests. In the pesticide case, we found an emerging interest among the scientists that led to the initiation of a PhD project. This interest arose among the scientists involved in the network alliance, when they became aware of how little knowledge they had about the relationship between airborne pesticides and their impact on human health. The network activities also contributed to the scientists' research interests in the Mira Loma case, where they contributed to the scientists' knowledge base (by providing them with a clear understanding of the warehouse location in the community and by providing them with an understanding of the pollution hot spots in the community). And maybe more important, the network activities caused the scientists to understand the importance of co-operating with CSOs and that such co-operation can contribute new types of knowledge previously unknown to the scientists.

The case studies also seem to show that other effects of the network alliances can contribute to changing the Science Shops' position, both within the scientific structures and in relation to industry. For example the carpet factory case seems to indicate that the factories became interested in further co-operation with both the community and with the Science Shop, when they became aware of the Science Shop's expertise within the field of odour pollution and its ability to mediate dialogue between them and the community. And in the Scania case, the Science Shop researcher shared his experiences with fellow colleagues in a network he belonged to, which both contributed to the Science Shop's position among the network members, and also made the CSO's fight visible to others.

Finally, these other effects seem to contribute to building CSO capacity. This was particularly seen in the Mira Loma case, which in addition to contributing to the scientists' knowledge base also

succeeded in capacitating the CSO to set up an education programme focusing on civil and environmental rights in communities with impoverished residents. Furthermore, the A-team members that consisted of poor uneducated Latino women became capacitated through the network's activities to such an extent that they were offered employment in the CSO as community organizers. Finally, the guideline case can also be viewed as an effect of the network's activities, which finally contributed to acknowledgement of the need for guidelines for future warehouse planning as well as instructions for the truck drivers.

From this it can be concluded that other forms of effects than just direct effects on the CSOs' problems can result from alliances between CSOs, Science Shops and scientists. An important methodological lesson to be learnt from this discussion is that if the focus only had been on the effects of the stabilized network, we would not have gained an understanding of these other effects caused by the non-stabilized networks, and this understanding is just as important as understanding how the network sought to solve the CSOs' initial problems. This shows that problems experienced by CSOs can contribute to the opening up of new research areas, and also that such alliances more permanently can influence the relationship between industry, community and university (as seen in the carpet factory case).

7 Conclusion and Reflections

The discussions have concerned effects observed or not in eight case studies of network alliances between CSOs, Science Shops and scientists. Based on these discussions important aspects of such network alliances, the roles of scientific knowledge and the roles of Science Shops for CSOs influence can be identified. These aspects are summarized in the following.

7.1 Three Complexities in relation to Scientific Documentation

The case studies have shown that CSOs in several cases have the perception that in order to give their problem legitimacy, they need independent scientific evidence to support their claim. This perception may be based on the perception that scientific documentation to politicians and scientists reflects 'reality', free of the influence from subjective assumptions, and that scientific documentation cannot be questioned or contested. This perception seems to be widely accepted even though history presents many examples showing that science does not produce ultimate answers. The controversies around nuclear power and genetically modified crops are examples of controversial scientific research. Thus, scientific knowledge in itself does not provide a non-contestable truth. Nevertheless, it is clear from the case studies that scientific documentation is a central factor, when CSOs engage in network alliances with Science Shops and scientists. The case studies identified three complexities with scientific documentation and its use as a means to legitimize problems in Science Shop projects:

1) The methods applied to document the concern fails to provide documentation
2) The chosen methods do not support the CSO concerns – due to the limited resources available for sampling, analyses etc.

3) The concerns of the CSOs are documented, but the results are contested, because they are perceived as threats to on-going or planned activities by other actors, who therefore contest the applied methods and assumptions.

These three complexities indicate that scientific documentation in itself is not enough to strengthen the influence of the CSOs; something more is necessary.

7.2 Requirements to Scientists cooperating with CSOs

One important conclusion drawn from our discussions is that influence is not merely a matter of supplying the CSOs with scientific analyses. It is essential that Science Shop scientists and the other involved scientists (acting as supervisors or researchers) are willing to engage in the issue of CSO influence and not only rely on a scientific report produced by scientists or students will enable the CSO to obtain influence. This also implies that some CSOs believes in scientific documentation may not be a sufficient strategy. According to Jasanoff (1995) scientific results may not be used or agreed upon, because the basis for the scientific results are questioned by others; and if the scientists are not willing to enter into negotiations about the basis for the results, one effect can be that the results are useless. This implies that the Science Shop scientists and other scientists, if necessary, should involve them in discussions about the assumptions behind the scientific documentation as well as in strategic discussions of the usefulness of the research and how CSOs can use the results when trying to influence the decisions of government, industry etc. The approach the Science Shops should apply is an approach we call *impact-seeking.*

The case studies show that the framing and translation of the research question may be decisive for the success of the alliance co-operation. The challenge lies in framing research questions in such a way that they become interesting for scientists. This requires suiting requests to curricular activities or to research agendas without distorting them so that they are no longer recognizable to the CSOs. , The case studies indicate the Science Shops play an important role in this framing and translation of research requests to ensure that the framing suits both the scientific and teaching requests and the interests of the CSOs.

The case studies show that the alliances can contribute to opening new data opportunities, as seen in the parent group case, where the scientists' accepted being enrolled in the alliance due to the opportunity to gather new data about a subject researched years before. Another aspect revealed by the case studies is that alliances with CSOs can also contribute to publication opportunities, as observed in six of the cases. The reason for emphasizing this is that publication opportunities seem to be an important motivating factor for scientists to become involved in co-operations with CSOs as shown in the analysis in the INTERACTS project (Jørgensen et al., 2004). Here, the scientists emphasized that for them to become involved in such co-operation, the issue has to be of such character that afterwards they can use the knowledge produced in scientific publications, since it is on this basis that universities evaluate the work of their scientists.

7.3 Are the Science Shops Capable of Applying an Impact Seeking Approach?

That the Science Shops needs to apply an impact-seeking approach raises a dilemma, since some of the impact-seeking Science Shops (Science Shop Groningen and Science Shop DTU) have faced problems with budget reductions and integration in the general match-making activities of the university. To apply this approach requires that the Science Shop besides acting as mediator between CSO and university maybe also need to get involved in the interpretation of the data and facilitation in relation to the use of the results when the CSO tries to obtain influence on the issue in focus. Given the challenges facing the impact-seeking Science Shops, another option could be to develop the Science Shop's mediation approach so that the Science Shop's role also becomes to engage the university scientists and supervisors in discussions of research assumptions and methodologies, as well as the usability of the results.

That the Science Shops and scientists should reconsider their role and their willingness to become involved in the CSOs' issues of concern, beyond the production of scientific documentation corresponds to the conclusions from other studies with focus on science-for-policy. Jasanoff (1995) concludes an analysis of science and policy by emphasizing: *"Both scientists and policy-makers, therefore, must participate in the process of resolving disputes over regulatory science"* (Jasanoff, 1995; p. 292). Although Jasanoff has her focus on the relation between science and governmental policy, whereas our focus is on CSOs' opportunities for influence, the point is the same in relation to the role of the scientists. Scientists need to go beyond production of scientific knowledge as black-boxed results and contribute to negotiations of the interpretation of the results.

7.4 Future Perspectives for Science Shops

Despite the gloomy perspectives for the 'old' Science Shops in countries like the Netherlands and Denmark, new Science Shops are established in other countries. We see in other European countries, not least the Eastern and Southern European countries, an increasing interest in establishing Science Shops that mediate between scientific communities and civil society. This is one conclusion of the recently completed EU-financed project *TRAMS*[iv] (de Bok, 2008) and the recently started *PERARES project*[v] which both support the start of new Science Shops and support to young Science Shops in countries like Estonia, France, Greece, Norway, and the UK. The question is, however, which concepts these new Science Shops will apply. Will it be the mediation approach, which several Dutch Science Shops seem to have chosen in order to survive; or will they apply a more impact-seeking approach, with emphasis on assisting the CSOs in their efforts to influence the issues they find problematic and not only provide support with a scientific report? And on which actor groups will these new Science Shops focus? Will it be citizens and CSOs, or will it be a broader mix of societal actors, including for example SMEs? Our suggestion to these new Science Shops is that they should consider the impact-seeking approach, or consider strengthening the mediation approach by engaging and involving scientists and supervisors in discussions of research assumptions and methodologies as well as the usability of the results.

8 References

Andringa, J. M. & Schot, J. W. (1997): *Public Participation in Environmental Science and Technology: The Dutch National Experinces, 1960s-1990s*. In Jamison, A. & Østby, P. (1997) (ed.): *Public Participation and sustainable Development – Comparing European Experiences*. Pesto Papers 1. Aalborg Universitetsforlag.

Baark, E. (1997): *Environmental Technology Policy in a Consensus Mode: The Case of Denmark.* In Jamison, A. & Østby, P. (1997) (ed.): *Public Participation and sustainable Development – Comparing European Experiences*. Pesto Papers 1. Aalborg Universitetsforlag

Bauer, M.; Allum, N.; Miller, S. (2006): *What can we learn from 25-years of PUS research? Liberating and widening the agenda*. Public Understanding of Science [Special Issue]. January 2006.

Bellamy, J. (2006): *Community-based research*. In Pereira, A.; Vaz, S. & Tognetti (Ed.) (2006): *Interfaces between Science and Society*. Greenleaf Publishing. Sheffield.

Brodersen, S. (2010): *The Making of Citizen Science – Network Allainces between Science Shops and CSOs Engaging in Science and Air Pollution.* Department of Management Engineering. DTU. June 2010. PhD. Dissertation. ISBN: 978-87-90855-99-4.

Chopyak, J. & Levesque, P. (2002): *Public Participation in science and technology decision making: trends for the future.* Technology in Science, Vol. 24. Page 155-166.

De Bok, C. (Project co-ordinator) (2008): *TRAMS – Training and Mentoring of Science Shops*. Final Report. Project no. SAS6-013654.

Dickson, D. (1984): *"Science Shops" Flourish in Europe.* Science, New Series, Vol. 223, No. 4641. Page 1158-1160. American Association for the Advancement of Science.

Farkas, N. E. (2002): *Bread, Cheese, and Expertise: Dutch Science Shops and Democratic Institutions*. PhD. Thesis. Rensselaer Polytechnic Institute. May 2002.

Gnaiger, A. & Martin, E. (2001): *SCIPAS Report 1: Science Shops Operational* Options. Utrecht: Science Shop for biology, Utrecht University. Online: http://www.bio.uu.nl/living-knowledge/reports.html

Hagendijk, R. & Irwin, A. (2006): *Public Deliberation and Governance: Engaging with Science and Technology in Contemporary Europe*. Minerva, vol. 44. Page 167-184. Springer 2006.

Hess (2007): *Alternative Pathways in Science And Industry – Activism, Innovation, and the Environment in an Era of Globalization.* The MIT Press. Cambridge. ISBN 978-0-262-58272-8.

Hricko, A. (2007): Director, Community Outreach and Education, Southern California Environmental Health Sciences Center. Interview 21.07.2007

HYDRA (2010): *Community Outreach and Education Program.* http://hydra.usc.edu/scehsc/coep.asp. Download 09.03.2010.

Irwin, A. (1995): *Citizen Science – A study of People, Expertise and Sustainable Development.* Routledge. 1995.

Irwin, A. & Michael, M. (2003): *Science, Social Theory and Public Knowledge*. Open University Press. McGaw-Hill Education. UK. ISBN 0 335 20947 5.

Irwin, A. (2007): *The Politics of Talk: Coming to Terms with the 'New' Scientific Governance*. Social Studies of Science 36/2. April 2006. SAGE Publications. London. Page 299-320.

Jamison, A. (2001): *The Making of Green Knowledge – Environmental Politics and Cultural Transformation*. Cambridge University Press. Cambridge. ISBN 13 978-0-521-79252-3.

Jamison, A. (2008): *To Foster a Hybrid Imagination – Science and the Humanities in a Commercial Age*. N.T.M. 16. 2008. Page 119-125.

Jamison, A. (2010): *In Search of Green Knowledge: A Cognitive Approach to Sustainable Development*. In Moore, S. A. (Ed.): *Pragmatic Sustainability – Theoretical and Practical Tools*. Routledge. ISBN 978-0-415-77937-1.

Jasanoff, S. (1995): *Procedural Choices in Regulatory Science*. Technology In Society. Vol. 17, no. 3. Elsevier Science Ltd. Page 279-293.

Joss, S. (1999): *Public participation in science and technology policy – and decision-making – ephemeral phenomenon or lasting change?*. Introduction. Science and Public Policy. Vol. 26, No. 5. October 1999. Page 290-293.

Jørgensen, M. S.; Hall, I.; Hall, D.; Gnaiger, A.; Schtoffenegger, G.; Brodersen, S.; Heiden, K.; Reimer, R.; Strähle, M.; Urban, C.; Endler, W.; Teodosiu, C.; Rojo, T. & Leydesdorff, L. (2004): *Democratic Governance through Interaction between NGOs, Universities and Science Shops: Experiences, Expectations, Recommendations*. INTERACTS. Science Shop DTU. ISBN 87-91035-26-0.

Jørgensen, M. S. (2008): *An introduction to the concept of Science Shops and to the Science Shop at the Technical University of Denmark.* The Science Shop c/o DTU Management Technical University of Denmark. Spring 2008.

Mulder, H. A. J. (2001): *Science Shops: An overview of improving public access to science*. Paper presented at the Living Knowledge Conference. Leuven, 26 January 2001.

Mulder, H. A. J. (2006): Co-ordinator of the Science Shop Chemistry, University of Groningen. Interview 16.08.2006.

NIEHS (2010): National Institute of Environmental Health Science. http://www.niehs.nih.gov/research/supported/centers/core/coe/index.cfm. Download 09.03.2010

Rootes, C. (1999): *Environmental Movements – Local, National and Global*. In Rootes, C. (1999) (ed.): *Environmental Movements – Local, National and Global.* Frank Cass Publisher. London. ISBN 0 7146 5008 0.

Strand, K.; Marullo, S.; Cutforth, N.; Stoecker, R. & Donohue, P. (2003): *Community-Based Research and Higher Education – Principles and Practices*. Jossey-Bass. 1st ed. ISBN 0-7879-6205-8.

Wachelder, J. (2003): *Democratizing Science: Various Routes and Visions of Dutch Science Shops*. Science, Technology & Human Values, Vol. 28, No. 2. Sage Publication. Page 244-273.

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[ii] The INTERACTS project (Improving Interaction between NGOs, Universities and Science Shops: Experiences and Expectations) was financed by the European Commission and was conducted 2002-2003.
[iii] ACCENT: Atmospheric Chemistry Change. The European Network
[iv] TRAMS: Training and Mentoring of Science Shops was financed by the European Commission and was conducted 2005-2008.
[v] PERARES: Public Engagement with Research and Researchers' Engagement with Society is financed by the European Commission and runs 2010-2014.