INTERFACES BETWEEN SCIENCE & SOCIETY

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Joint Research Centre of the European Commission,
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Published by Greenleaf, Sheffield, 2006
ISBN-10: 1-874719-97-7
ISBN-13: 978-1-874719-97-7

6.2 Science Shops as Science – Society Interfaces

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Science Shops as a way of transferring knowledge are innovative and effective and have a positive impact both on universities and on the civil society. Most Science Shops are linked to universities and use the work of students under appropriate supervision to respond to the civil society (mostly NGOs) needs. This provides a symbiotic relationship between these two communities. This chapter draws on these experiences and on how these shops contribute to public access to science. Examples from the Netherlands, Romania and Denmark present some experience with university-based Science Shops, and an example from Germany presents experience with a community-based Science Shop. The relations of Science Shops with higher education, research and society are discussed. The portability of the method will be described in case reports from Germany and Romania.

Introduction: What is a Science Shop?

A Science Shop is *a unit that provides independent, participatory research support in response to concerns experienced by civil society*. For the most part, these units belong to universities, though some are organised as separate NGOs or not-for-profit companies. Science Shops combine research (and teaching where applicable) with service to society. Civil society organisations can simply approach a Science Shop with a problem in which they feel some research would be helpful for them to help solve their problem. The Science Shop staff will then transfer these requests into research projects and find students and/or staff to work on these projects, in close contact with the "client". The results are handed over to the client and the Science Shop staff will support the client in the use of these scientific results and will help to formulate follow-up proposals, both those relevant to the client and those relevant to further research. This process means that new knowledge is generated, or at least existing knowledge is combined and adapted to context.

Science Shops use the term “science” in its broadest sense, incorporating social and human sciences, as well as natural, physical, engineering and technological sciences. The word “provide” in the definition means that Science Shops make their services available on an affordable basis, free of financial barriers. Furthermore, Science Shops seek to create equitable and supportive partnerships with civil society organisations, hence the word “participatory”. The word “equitable” in this mission statement also means that knowledge and ideas from society are used as a cross-fertilisation to the research field; it's a two way street: the knowledge of lay people is

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We appreciate the support of: Ann van der Auweraert, University of Antwerp, Belgium; Cristina Ichimas, Intermediu, University of Bacau, Romania; Arie Fokkink, Green Grid Consultancy, Enschede, The Netherlands, and all participants in the EU-funded projects SCIPAS, Interacts and ISSNET (see more at www.livingknowledge.org).

considered as important as academic or scientific knowledge. “Research support” can include educational projects, but makes clear that there is a difference to regular social/welfare based support to society. The words “in response to” mean that it's not a science push type of operation. The word “concerns” makes clear that Science Shops are not there to answer curiosity-driven questions. On a meta-level, Science Shops not only want to support public access to science, but also want to promote public influence on science and technology and enhance understanding among policymakers and education and research institutions of the research and education needs of civil society. Finally, many aim to enhance the transferable skills and knowledge of students, community representatives and researchers. Sometimes, add-on tasks are performed, such as regular teaching, contract research, education and trainings for civil society, et cetera.

Box: Science Shop – daily work

Questions from civil organisations are rephrased to scientific research projects. Students, under supervision of a professor then perform the research, or a researcher does it. Students usually obtain credit points for their research. The research will lead to a report (or another type of product) which is made to be of use to the client. The student will have gained valuable skills (problem definition, project based working, communicating, planning). The professor and/or the researcher will have case material for either future publication or further theoretical analysis. Moreover, for the professor involved this supervision is part of the teaching obligation. So, in fact all actors are doing what they are supposed to do: teaching, learning and researching. This is why a Science Shop can be implemented at relatively low additional costs and why Science Shops can also serve the non-profit sector.

Science Shop staff usually performs these tasks:

1. Receive/solicit clients and (new) societally relevant questions
2. With the client, articulate problem (map the situation)
3. Preliminary research, leading to:
   refusal or referral / short advice / scientific research question
4. Find a scientific (co-) supervisor and/or suitable course/practical/thesis period
5. Find a student (+ options for credit points) or researcher (+ funds if required)
6. Maintain communication and support the process, from start to finish of research
7. Facilitate useable presentation/publication of results (popular report, brochure, website, seminar, press release, etc.)
8. Support client in implementing results and recommendations and formulate follow up actions (stakeholder meetings, legal procedures, conferences, follow-up research proposals)
9. Make inventory of follow-up research or research-themes (options for scientific publications, interesting themes for further research / research programs)
10. Evaluation (with student, supervisor and client).

It is clear that there are a number of additional skills required in operating a Science Shop, next to the overview on a specific scientific area, such as communicative, social, managerial skills and the ability to work in a multidisciplinary setting. All to ensure that the answers given in response to social concerns will be useable.

Box: Science Shop – history

The Science Shops were developed by critical staff and students in The Netherlands in the 1970s, where there are currently over 30 Science Shops, since the 1980s fully financed by the Dutch Universities. Science Shops arose together with project-based education at universities, and their development was fed on an emerging environmental awareness in society. The method, originating in Utrecht and Amsterdam, appealed to many colleagues all over the country, and in 5 -10 years all Dutch universities had established Science Shops as a bureau of university, and they were serving many scientific disciplines. In the 1980s the Science Shops professionalized further, and they managed to maintain their mission in the commercialisation of the 1990s; be it with some reorganisations (Mulder et al., 2001).

Publications by Ades in Nature in 1979, and Dickson in Science in 1984, triggered a lot of attention abroad. Publications by Leydesdorff, and Nelkin and Rip further clarified the benefits; the method was imported and sometimes adapted to many other countries, like Denmark and Germany. A publication by Sclove (1995) in the Chronicle of Higher Education linked the European developments to those of the Community Based Research Centres in the United States. Since 2000, over 30 Science Shops (Community-University Research Alliances) were started in Canada, based on the Dutch example and funded by the Canadian Research Councils. Since 1998 there are also Science Shops at Romanian Universities. They focus on environmental issues and use the name "InterMediu" (Mulder, 2001). They were started in a project financed by the Dutch Ministry of Foreign Affairs, which gave additional funding in 2002 to continue the development of Science Shops in Romania. Recently, the association of Science Shops in Romania "InterMediuNet Romania" was established. Romania now counts 8 Science Shops (www.intermediu.ro). Recently, co-operation was started with institutes in countries like Iceland, France, Greece, Spain, Turkey, and the Baltic States to establish more Science Shops.

Demand

Who are the clients of Science Shops? There are some general selection criteria that most Science Shops apply. The first one is that clients should have no commercial aims, and the research results must become public. Second, clients must be able to use the results of the research to achieve their mission – which means having some form of organisation to act within, and for the Science Shops it means that they must produce results that are clear and applicable in context-; and third, the clients may not have the (full) financial (and/or scientific) means to acquire their research otherwise (or they should finance part or all of the project). This distinction is made since there are already many possibilities for governmental organisations and business to have research done. Science Shops are all about balancing the scales.

Their target groups fit well with the EC's definition of civil society organisations as mentioned in the Science and Society Action Plan (2001): *organisations whose members have objectives and responsibilities that are of general interest and who*

also act as mediators between the public authorities and citizens. They may include trade unions and employers' organisations ('social partners'), NGOs, professional associations, charities, grassroots organisations, organisations that involve citizens in local municipal life; churches and religious communities.

For help to individuals, Science Shops sometimes apply the criterion that the problem should be of concern to more people. But, sometimes, if time or expertise allows, purely individual problems are solved. Science Shops themselves can try to disseminate the report to similarly interested stakeholders in that case. Sometimes questions are answered from others, such as small and medium enterprises and even industry, depending on the type of question posed and on the other facilities a host institute does or does not have to deal with these questions already.

In reaching clients, Science Shops may be confronted with unrealistic expectations that citizens have of science. Or, to phrase it differently, the public's awareness of science sometimes has the form of expecting a magic bullet to instantly solve all their problems. When this turns out to be different they'll turn away. This happened in France in the 1980s for instance.

The other extreme of this situation occurs when public awareness of science and technology is low. An example is the handicapped persons that are helped with appropriate technology. Research by Farkas (2002) showed that some organisations of disabled people knew how to ask questions relating to health care, but they never thought of applying for help to a technical university. In this case, the public can be said to be unaware of what science and technology could do for *them*. Science Shops can play an active role here.

Supply

To support the civil society organisations knocking on the Science Shops' door, there needs to be a supply of research. How is this supply harvested?

In many Science Shops, the Science Shop staff itself performs part of the research. The two other major sources of scientific research are students and scientists.

Most Science Shops can assign a subject to a student who has to write his or her diploma thesis. A smaller number of Science Shops offer students the possibility to do a research-internship with a client organisation. It may be clear that offering students to work on Science Shops projects in their curriculum, with regular staff supervision, greatly expands the capacity of a Science Shop. It then becomes part of the regular affairs of university. Moreover, it offers a unique learning experience to students.

There is a group of Science Shops that regularly uses voluntary researchers, and there is a group that benefits from paid researchers. "Paid" research applies when a scientist is allowed to work on the project during his working week at the university, either paid within the existing allocation model, or through subsidised projects.

There are Science Shops that have their own research budget or matching funds available, and sometimes project finance is explicitly sought. By merging Science Shop subjects into regular university activities, Science Shops have influence on research and education. This means that universities clearly benefit from their co-operation with civil society as well, and achieve a continuous innovation in their research and education. This influence reaches even further than at this first sight.

Impact of Science Shops on Higher Education:

Most university students in Europe will not choose an academic career after graduation. Thus, higher education has to prepare its students in a flexible way, for many different kinds of jobs. Key elements in education therefore must not only be "acquiring knowledge", but the competence "to apply knowledge in context, in a rapidly changing society" as well.

In Science Shop projects, students learn valuable skills, such as communicating with non-experts and solving a problem in context. Students can earn credits for their work, which count towards their degree. There are some options that are used by Science Shops widely to include their work in curricula:

1. Creating a novel "course" or practical period called "Science Shop project" and awarding credits to this "course". This is what is possible e.g. at the Groningen Chemistry Shop; the course "Chemistry Shop project" is an optional course for final year BSc students or MSc students. The amount of credits awarded is 5 or more European Credits[6].

2. Incorporating the projects in existing courses or practicals, as a case study. At the Groningen Physics Shops, first year students work on noise measurements for clients of the Science Shop. They have to learn to get and process data; the noise measurements are a good case - simultaneously helping out many neighbourhood organisations. The students in the Master program Science Communication regularly work on finalising Science Shop projects in natural sciences, by making a brochure or website to make the results widely accessible. This is their final (assessment) project for the 10 EC course Communication and Presentation.

A mix of 1 and 2 was applied e.g. at Bacau university, where a new course was set up called "Science and Society" in which all biology students also work on a project for the Science Shop. This course changes now from an optional one into an obliged one, in the second year of studies.

3. Using a Science Shop project as the subject for a thesis, such as the MSc (or BSc/PhD) thesis. The MSc thesis is a very regular way of doing Science Shop projects. The PhD projects are only occasionally used. The Science Shop Tilburg (Netherlands), however, offers these regularly - they can co-finance PhD projects from their (university- allocated) budget (www.uvt.nl/diensten/dsz/wewi/).

In all these cases it is important to see that the supervision on these projects can be seen as standard supervision/teaching time for the professors, as long as the total length of the curriculum is not longer than without Science Shop projects. When introducing a new mandatory course it implies that something else in the curriculum has to be removed or reduced. When using existing courses or practicals, or modifying the subject of a thesis, there is absolutely no extra task involved: the student and the professor are doing what they would be doing anyway. Initiating contacts with social beneficiaries (the clients) and assisting in the process are the job of the Science Shop staff; appointing such staff can thus be seen as the only additional (overhead) costs to the university.

[6] One EC = 28 working hours for a student. A Dutch BSc has 180EC, an MSc has an additional 60EC (social sciences, arts) to 120EC (natural sciences).

Further impact is created by using Science Shop cases as examples in 'regular' courses. There are also examples of Science Shops developing methodological courses and even helping to restructure curricula[7].

The analyses of Science Shop case studies in the Interacts project show that through co-operation with civil society students may enhance or develop the following (employable) skills and competencies (see for example Teodosiu and Teleman, 2003):

- Social competences (Real life experiences)
- Communication and co-operation skills, also with non-scientists
- New knowledge and perspectives
- Knowledge and expertise within transdisciplinary research
- Skills to connect and bring together the various needs and demands of different groups, even with their rather theoretical scientific background

Impact of Science Shops on research

Science Shops can function as an antenna or even as an incubator for a new research theme. They can change or add to the focus of the research agenda and they can create dialogues in research. Science Shops introduce participatory research methods and some even develop into a participatory research centre (Hende and Jørgensen, 2001). We will highlight some of these processes.

The Science Shop as antenna for new research fields

An example from the Science Shop for pharmaceutics in Groningen illustrates the antenna function of the Science Shop, in which emerging themes have lead to focused scientific attention. Several small questions on medicine use in the tropics, posed by an NGO, led to two larger PhD projects. Both resulting publications were best sellers at the bookshop of the Royal Dutch Tropical Institute. Next, many individual questions on medicine use during pregnancy did not only lead to a PhD-thesis, but to an entire new research field at the Pharmacy Department, including the appointment of a full professor. In the Chemistry Shop Groningen, various questions on comparison of "green" production routes to chemical production routes led to a research program on sustainable agricultural routes to chemical compounds, organised by the Chemistry Shop Groningen with the Ministry of Agriculture, NGOs and Industry. This type of impact was reported by about one quarter of the Science Shops responding the survey in the SCIPAS project (Hende and Jørgensen, 2001).

The Romanian experience shows that scientific publications were published in peer reviewed journals (national or international) or communicated at different conferences and seminars. Some of the project data were integrated into the regular teaching activity and an interest in scientific follow-up topics and formulation of new project proposals were created due to the Science Shop projects. The Romanian experience also showed that the social dimension of scientific work was acknowledged, e.g. scientists acknowledged that problems can not be solved without considering the social context in which the problem are to be solved. The Science Shop activities have contributed to the ongoing modernisation of the curricula and research by providing flexible modules of learning and project based learning, post-graduate courses, inclusion of Science Shop project results into the regular teaching activity, multi-

[7] For further reading see Fokkink and Mulder (2004).

disciplinary research and formulation of new project proposals (Teodosiu and Teleman, 2003).

The Science Shop as incubator for new research fields

If a Science Shop has scientific staff employed, it gives the Science Shop the possibility to develop new research areas, although there might not be interest among the scientists at the other university departments.

Experience from one of the Danish cases has shown that Science Shop projects can lead to the establishment of new research and teaching areas, like in a case about organic food. Several requests from NGOs through the Science Shop at DTU resulted in the establishment of organic food as a research and teaching area at DTU. This case also shows that besides being a mediator the Science Shop has also taken the role as incubator for research and curricula development. This development has been an interaction between different stakeholder groups, the societal development in organic food, the Science Shop and its researchers and the food science researchers at the university (Hende and Jørgensen, 2001).

At the Centre for Urban Research and Learning at Loyola University (CURL), a grant from the U.S. Department of Education has allowed CURL to establish a participatory evaluation research collaborative in response to needs identified by CURL's community-based partners. The collaborative initiative is based on CURL's team-based model of participatory evaluation research that has been used for around 5 years. Faculty, graduate students, undergraduates, community fellows and community organisation staff are involved in shaping and completing all stages of research from conceptualisation of the issues to be studied to the writing of the final report. The model was developed as an alternative to the traditional evaluation research model, where the people, whose daily life or programmes are being evaluated, do not play an active role in the research process.

Impact on research through funding of Science Shop research

One way of getting impact on the research agenda is through access to funding for Science Shop based research. One of the schemes that have existed for quite a long time is at Tilburg University. In May 1984 it was decided that the university would make funds available for the Science Shop of Tilburg University, which would enable the Science Shop to finance long-term research projects. These projects should make scientific research at Tilburg University more committed to the needs of society. In the first years after 1984 the Science Shop allocated most money to projects, which had a duration of one or two years. Since the end of the 1980s most of the money has been spent on co-funding with university departments in Ph.D. projects. Also some money goes to 6-month preliminary investigations that should lead to proposals for Ph.D. projects. Each Ph.D. project that is co-funded by the Science Shop has its own steering committee, which consists of members from civil society organisations, such as environmental groups, civil servants of municipalities or departments, representatives of minority groups, etc. In this way the Ph.D. researchers get their input from society on the one hand and the members of these committees get the latest results from scientific research on the other hand (Hende and Jørgensen, 2001)

Impact on research through researchers' interest in new fields

Researchers at scientific departments can also be actors – without funding – in embedding Science Shop topics in research. An investigation from the mid 1980's of the spin-off from 10 years of 162 Science Shop projects in the Amsterdam Science Shops analysed the impact from Science Shop projects on the research agenda and showed that this impact was bigger than from "traditional" research activities (Zaal and Leydesdorff, 1987). For those not pursuing follow-up activities the reasons found were that the problem was either too narrow or did not match with the focus of the researcher; the problem was too "applied" or too familiar and therefore not challenging enough scientifically, or there was simply a lack of time for a follow-up.

Among researchers that took up projects for scientific reasons, the motivation was in some cases the possibility to get access to data that normally would not be accessible, like studying personal dossiers or doing participant observation.

In a few cases the researchers had reformulated the question as part of taking up the Science Shop project. These cases showed the highest relative number of publications and follow-up investigations. This method is also applied at the Chemistry Shop Groningen, were societal questions can either be separated in a number of smaller questions for a better fit, or can be enlarged or reformulated to include more theory and methodological development to better suit the research group (the client's case then being e.g. one chapter in a thesis).

The development of research on so-called green water management (local waste-water treatment and use of rain water) at the Technical University of Denmark is a recent example of a researcher and teacher within an established field, who developed a new field of research and teaching in co-operation with a Science Shop. This researcher's involvement was based on a combination of scientific and social interest.

In relation to the field of rainwater usage, it turned out that the building of a coherent network with different actors outside the university operating within the field was important. Among these were local environmental groups, the National Environmental Protection Agency, engineers from consultant companies etc. The means of building a network was the arrangement of a number of seminars organised by the Science Shop and two departments (on environmental technology and on urban planning) in co-operation. As a part of an attempt of establishing a new research field, the seminars were intended to create a forum, where sporadic experience held by different social groups could be brought together with other people already knowing something about the alternative technology. The professor's contribution to the seminars included, among other things, the presentation of results within what he finds to be critical aspects of the use of rain water. This was done in student projects supervised by the professor or some of his colleagues. By being critical and formulating questions based on scientific thinking instead of practical problem solving, the professor not only contributed to a formulation of problems related to rainwater technology, he also participated and contributed to a process where this field became a part of research undertaken by the institute (Hende and Jørgensen, 2001).

Position of Science Shops at Universities

Science Shops have a special place in linking all three university missions: education, research, and knowledge transfer to society (outreach). Previously, we discussed the impact that Science Shops have on education and research through their interaction with civil society.

Universities have many relations with society, which can be structured as shown in Table 1. Four generic target groups can be distinguished, which all have their own dynamics and require specific attention. Towards individuals, there is a supply of existing information from university to society. Concerning service to organisations, Science Shops generally take care of non-commercial contract-research, whereas transfer offices or business service centres cover commercial research. The largest sums of money find their own way from national authorities and industry, through public foundations and their funding programmes, or through paid research contracts or by industry paying a professorial chair at university. The entrances for industry and civil social groups are separated and thus the risk for conflicts of interests is diminished. Moreover, serving these different sectors requires different ways of working and likewise requires different persons to do the job properly.

Although they are commercial, Small and Medium sized Enterprises are sometimes served by Science Shops as well, depending on the organisation of the specific university, and depending on the type of the questions asked by this group of clients (i.e. not directly commercial questions are considered). In Romania, Science Shops also accept questions from SMEs, because the current economic situation in Romania makes them a suitable target group as well. In the social segment served by Science Shops there is generally little financial backing and little subsidies exist.

The reasons that Universities do support Science Shops are many. Next to "pro deo" or PR reasons, universities will also support Science Shops as a way to obtain interesting research topics for scientists and students. Even though professors and students are doing what they should be doing anyway (supervising and learning, respectively), Science Shop projects are a little more work to organise than text-book cases, which can give problems within the decreasing university budgets and trends towards commercialisation of science. Still, by linking to education and research Science Shops can be implemented at low additional costs.

For university renewal it is interesting that in principal Science Shops can exist in all university faculties where societal need can be met by university expertise. For instance in the Netherlands there are Science Shops on environment but also law, health, pharmacy, physics, social affairs et cetera. In the UK, as in The Netherlands, Science Shops can be seen as relating to the so-called third mission activity in higher education, which is outreach. All managers from the universities involved in the UK part of the Interacts project case studies recognised that these issues were now on the agenda of government, and expressed a personal interest in developing them, and publicising staff expertise visibly to external bodies. University managers increasingly accept that teaching and learning must be combined with community outreach in order to justify public funding. But at present the third mission is almost exclusively dominated by the contribution of universities to scientific knowledge production on behalf of the economy. This is expressed within a business / innovation orientation whereby the scientific advances of academia are exploited commercially (Jørgensen et al, 2004).

Table 1: Relations university - society

Target Group	Facility
Individuals (e.g. students, pupils, seniors, other individuals, general public , journalists,)	Courses, Public Courses, Higher Education for Seniors, Distant Learning Courses, Public Lectures, Science Week, Open House, High-school desk, University Museum, PR Department
Civil Society Groups NGOs Non-profit sector Local authorities	Science Shop (Internship Service)
Small and Medium Enterprises Regional authorities	Transfer Bureau (Business Service Centre), Business Incubator (Science Park) (Internship Service)
National/International authorities Industry	Liaison Office Contacts to NSF (National Science Foundation) Contracts, Paid chairs

The Head of Department of Manufacturing Engineering and Management at DTU pointed out, that a tendency within the university structures is, that more and more knowledge is produced within the universities, but the understanding of the knowledge and for which purpose it is produced is lacking. He sees Science Shops as a way to promote and connect knowledge production and knowledge application (Jørgensen et al, 2004).

Science Shops' budget comes from a number of sources; though in the end also budgets that are noted here as being from university have mostly come from the National Government, when we think of public universities. Funds in the NGO type Science Shops come from memberships, grants, subsidies or charities (though the latter can also be obtained by university based Science Shops, as is proven by the Science Shop for Northern Ireland). The structure depends on the structure of financing in a specific country.

Impact of Science Shops on society

Imagine you were the parents of a child with Down's Syndrome, and you were living in a country where the government spends millions on research on this syndrome, be it only on pre-natal diagnostics and termination of pregnancy? Imagine you were living in a poor neighbourhood and some factories that are vital to your income are threatened by new waste disposal standards they don't seem to be able to comply with? Imagine you were a handicapped person and you would need some dedicated adapted technology to allow you to live well on your own? Wouldn’t a Science Shop be exactly what you would want to have?

Luckily, the Science Shop at Eindhoven Technical University regularly adapts technology for use by handicapped persons. The CBR Centre for Neighbourhood Technology in Chicago brought together scientists, industrial developers and metal workers, which together identified an affordable waste management system for the factories in their area, and thereby saved thousands of jobs vital to the low-income neighbourhood. The Science Shop in Leiden counterbalanced the preoccupation of the Dutch national government with prenatal diagnostics and termination of pregnancy for children with Down's syndrome, by initiating research to improve the quality of life for families, who did have these children with Down syndrome born, for instance by studying education, social care and financial arrangements.

Table 2: An overview of various types of focus in Science Shop projects (Jørgensen et al, 2004)

NGO/community initiated projects: Type of knowledge process wanted
Scientific documentation of known problem to convince authorities about need for action
Enhancement of knowledge around a topic as part of NGO activity
Facilitating or improving networking with other organisations
Access to knowledge from governmental organisations/institutions
Development of solutions to a problem
Evaluation of NGO or community service and project
NGO wanting to develop own services
Researcher/Science Shop initiated projects: Type of knowledge production
Research of impact of governmental project
Developing NGO knowledge about funding opportunities

The case studies in the Interacts project reveal that NGOs might have expectations, when they approach a Science Shop (Jørgensen et al, 2004):

- Research and methods which are simple, so that findings would be transferable throughout the organisation
- Research that provides information enabling changes in practice
- Access to free or affordable research
- Access to impartial and independent research

The case studies in Interacts show that a barrier perceived by NGOs for co-operating with a Science Shop can be whether students are capable to meet the needs of the NGOs. One of the cases mentions doubts from the client (NGO) to what extent a master thesis would be able to yield useful results in terms of findings, which would really enhance the knowledge of the NGO and provide useful information for the daily work. The results produced by the students resolved the problem and satisfied the expectations of the NGO by far. The student commitment is mentioned in several cases. Another barrier mentioned is that when NGOs approach the Science Shops with project proposals, they cannot be sure, whether or when students decide to work with their project proposal (Jørgensen et al, 2004).

In general Science Shops are perceived by NGO representatives as an efficient way to connect universities and communities. Through mediation by Science Shops NGOs gain access to science and research, which they would not have had if Science Shops had not existed. In the Interacts cases from Innsbruck[8], Science Shops are perceived as more accessible and less bureaucratic than a university department owing to their explicit openness to the public (Jørgensen et al, 2004).

The majority of the Interacts cases show Science Shop projects, their findings and the co-operation with a Science Shop contribute to the future practice of the NGO. The impact is not always planned or foreseen in the initial project idea and planning. However, some cases also show that a scientific report is not enough to convince e.g. municipal authorities about the need to deal with a problem (Jørgensen et al, 2004).

The cases show the following types of impact

- Projects are not only broadening the "store of knowledge" in general, they are also enlargement of the capacity to act for the NGO.
- The capacity of NGOs are built up through 1) provision/ mediation of relevant contacts and knowledge, 2) support for the building-up of networks, e.g. by bringing

[8] A non-university based Science Shop.

people together, and 3) provision of organisational frames and experts for workshops and other events and 4) by showing opportunities for funding.

- Citizens feel empowered to analyse their own societal living and they were able to implement some of the results in their own local communities.
- NGOs feel capacitated to bring forward the research and its results in order to debate the topic of concern, and thereby maybe impact the political sphere.
- Influence on national /regional and local government.
- NGOs learn to apply methods or theories used by the researchers or the students.

In general, the impact of Science Shop projects for civil society can be summarised as follows:

- Media / public attention
- Influence on policy / legal success
- Contribution to new products, services and organisational capability

Generally one can label this as empowerment. There are many examples in which the client may not achieve its pre-conceived goal, but at least they are happy that their voice was heard in the discussion.

Potentials and barriers in the future development of Science Shops

Science Shops have impact on higher education, research and society. To cite the Dutch Minister for Education, Culture and Science Maria van der Hoeven: "In a knowledge society that aims to be more than a knowledge economy, Science Shops have a special place. By supporting citizens in their quest for knowledge, people are given more possibilities to take responsibility for shaping their own life and their living environment", she says. "Citizens' demands for knowledge also provide an important input for research that complements other scientific or commercially-driven ways of finding research topics" (European Commission, 2003).

Currently, universities are rewarding staff mostly for peer-reviewed publications, even education usually comes second. There is no reward for community-based research[9], and there is no civil society assessment of universities (contrary to the traditional assessments of research and teaching). The only current option is to supervise Science Shop projects as part of the teaching obligation for professors (or to get outside funding). Therefore the possibility to reward students with credit points is important, for either a short practical, a project, or a MSc-thesis. Since students have to obtain credits anyway there are no additional costs to the higher education system apart from the co-ordination work of a Science Shop office.

However, it would be good to reward scientists more for this activity, either by allowing some working hours per year dedicated to Science Shop work and counting other project output than peer reviewed journals.

Some case studies have also shown that it may be difficult to involve scientific staff in Science Shop projects, if they do not see any publication possibilities in a project through a Science Shop. Most of the Science Shop projects analysed in the Interacts project have contributed to “grey” literature, but have achieved less notice within the

[9] During the conference Interfaces between science and society in Milan, one participant said that even without these incentives, scientists should acknowledge the fact that they are paid with public money and that they form a privileged class anyway – they should also do some social service without incentives. They have an individual responsibility as a scientist.

wider scientific community. If a Science Shop project mainly is seen as based on a practical problem rather than a scientific problem, some researchers express that they have no scientific interest in this kind of projects.

The German case studies show that universities are more interested in "big projects" with a high amount of third-party-volume and in contact with big companies or other relevant institutions than smaller NGO-related projects, and due to this, it is difficult to engage scientists in Science Shop related activities.

The case studies in Interacts show that many Science Shops, due to their small size, lack visibility, both towards the public and towards researchers, students and decision makers at the university and in national research planning. The cases from Vienna point out that the contribution of a Science Shop to a successful project is not visible enough (e.g. the mediation is not visible). However, too much publicity could trigger a demand which smaller Science Shops would not have the resources to cope with. A future task for the Science Shops will be to solve this dilemma of making the Science Shops work more visible.

The Danish case studies further point towards a barrier related to the Science Shops position at the universities. The Science Shops are perceived as a separate institution at the university, and not as an integrated part of the university. This make some students think that the Science Shop is not fully accepted at the university and doing a project through the intermediary might be less scientifically sound than doing a project directly for a researcher at one of the institutes at the university.

The Interacts studies generated a number of recommendations for all stakeholders to strengthen Science Shops (Jørgensen et al, 2004). This strengthening of Science Shops is also done by the European Commission in its Science in Society Program. To end with a quote from Rainer Gerold (2001), former Director Science and Society at DG Research of the European Commission: *Every science – and every society-needs a Science Shop.*

Box Portability: Experiences in Germany and Romania

Germany

There are Science Shops, e.g. in Germany, that are not associated to an university. What are the differences between them and their university-based colleagues? What are strong and weak points, what "best practices" could we apply to other situations/countries where co-operation with universities is not going on smoothly? In some projects, these Science Shops nevertheless do work with universities – how is this arranged?

Transferring the "Dutch Model" of university-based Science Shops to Germany was almost impossible. Universities in Germany saw Science Shops as something of lower rank. There were not many groups at universities that would actively support Science Shops. This caused Germany's first Science Shop in Essen to close as early as 1983.

More successful were Science Shops that were established as non-profit associations what lead to almost 30 Science Shops in Germany during the 80s. But depending on volunteers who could not spend much time on projects during their studies or their times of unemployment and a lack of permanent subsidy for their work 70% of the Science Shops closed. Currently there are 7 active Science Shops in Germany. A national exchange and discussion forum formally exists but co-operation takes place

via single projects. The EU-Science and Society discussion has increased the interest in the Science Shop Model within the German universities.

Likewise, the Bonn Science Shop – as one of– was founded, despite of no public funding, in 1984 by a handful of environmentally concerned students who wanted to reduce the chasm between university and citizens. It quickly turned into a professional centre promoting citizen involvement in knowledge transfer. The Bonn Science Shop is a self-administered, non-profit organisation.. It cooperates with NGOs, universities and government authorities both within and outside the city of Bonn. With a staff of 25, the Bonn Science Shop gives special emphasis to the topics of civil society and sustainability, environment and health, as well as the labour market. The Bonn Science Shop does not receive any permanent subsidies or institutional financial support. In addition to grants for specific projects, the core of its work is funded by the income of paid information, measurement, and consulting services, as well as through training activities such as the classes, seminars and lectures offered by its education centre.

Although not being part of the university the Bonn Science Shop seeks for cooperation. In a recently successfully finished project on 'land use and land consumption' and its visualisation via the internet the Bonn Science Shop cooperated with the Centre of Long Distance Exploration of the University of Bonn, the University of Pedagogy in Karlsruhe, as well as the Giessen Science Shop and a media agency. This specific project was funded by the Federal Environmental Ministry of North Rhine Westphalia. The Bonn Science Shops' tasks included the responsibility for the project as a whole and the project management, as well as the organisation of meetings and workshops with different groups – from experts to lay people, from school representatives to Agenda 21 activists and environmental groups. Information specifically related to the different subjects of the project were contributed by the scientist from the universities. The Giessen Science Shop and the media agency ensured that the largest number of citizens will have access to an abundance of information. A follow up project is currently under discussion.

Romania

In 1997, there were no Science Shops in Romania, in 2003 there are eight. They have associated in a national network, IntermediuNet Romania (www.intermediu.ro). This example will describe the development of the Science Shop in Bacau.

InterMediu research centre for civil society, a part of the Biology Department within Bacau University, Romania is organised after the model of Dutch Science Shops in The Faculty of Biology. It was the first Romanian Science Shop, as the result of a mutual co-operation program between the Bacau University and University of Groningen, The Netherlands. Its founding was possible by means of the MATRA project, a fund from the Dutch Ministry of Foreign Affairs to support the new democracies in central and eastern Europe. The centre is a "window to society", its basic objective being to provide independent research advice and information, to organise expertise especially for non-profit organisations, residential associations and any organisation or group interested in improving environmental aspect of the region. Also it wants to offer possibilities for students to gain experience in working within a project, to co-operate with citizen groups and to develop their practical oriented approach of environmental problems.

Bacau's first projects had no direct clients, "just" partners. The International "pilot" was *Water pollution in lakes in The Netherlands and Romania***,** and the second, national "pilot" a brochure regarding all the books in connection with environmental protection from the libraries from Bacau city.

The clients in Romania (civil-society) are not so organised as in Netherlands. Our clients are different groups that collaborate with us and take a very important involvement in our projects, becoming an active part of the projects. Though the involvement of civil society in environmental issues in Romania is not very strong, we can notice a series of improvements in their attitude towards environment and decisions regarding environmental issues. But this is an area where lots of changes are still due.

Examples of projects and clients:

- SCHOOLS: Environmental education-2 Publications, Restoration of polluted soils with oil
- RURAL VILLAGE: Sustainable management of garbage from villages, Edible and non-edible mushrooms
- HOSPITAL: Micro organisms and better cleaning of rooms in Buhusi Hospital (Bacau County)
- MUSEUM: Micro organisms from the rooms of Natural Museum and the methods to combat their growth
- NGO: Antimicrobial activity of some essential oils over few pathogenic micro organisms

Many projects are done during the (new) course "Environment and Society". After the project, 95% of the students find this course very interesting and useful. Bringing this kind of projects into curricula of university courses has led to a growth in interest and involvement towards these projects. Also remarkable is the support given by university staff who realised that scientific research is more valuable if applied in everyday life of civil society, rather than just being a part of a volume of Studies and Research that is accessible only to some other researchers or scientists.

Lecturing, which is actual the dominant method of teaching in universities tends to be less effective than the new approach to co-operative learning and problem solving (Teodosiu and Caliman, 2000). Curriculum reform is a complex process that involves important changes in teaching approach, applied research and involvement in projects. Problem based learning appears necessary to change the passive methods of learning to fully engage the learner. This "active learning" determines student understanding of the key concepts studied in university, since these are best understood through concrete examples and active involvement.

Reflection

In this chapter we gave an example of how society can be an active participant in changing the role of science. Science Shops give access to those that would otherwise not have access to scientific research. Equitable partnerships are formed, in which research questions are phrased together, and there is an on-going dialogue and constructive interaction for mutual benefits (to society, and to students/researchers and universities).

Science Shops are a tool for strengthening democracy by involving citizens in governance of science, and, moreover, empowering them to participate in various decision-making processes where science and technology (can) play a role. Interaction between citizen groups and researchers can have more profound, long-term influence on the scientific process, by changing the focus of research.
Even though Science Shops are relatively small, they make a clear example of how to move from 'talking the talk' to 'walking the walk'. Every journey is based on individual steps.

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