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RESEARCH ARTICLE

Ensuring durability of community-university engagement in a challenging context: Empirical evidence on Science Shops

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Abstract

Universities' community engagement is confronted with growing pressure from increased competition and marketisation of knowledge, along with widespread adoption of New Public Management measures. This context is notably challenging for forms of engagement that are based on such principles and practices as cooperation, knowledge democracy and public value. Within this framework, this article identifies competencies and strategies that may ensure durability of community-university partnerships.

The article presents the results of two different, yet coherently connected, research endeavours on Science Shops in Europe. Science Shops are a unique way to organise relationships between science and society mainly by responding to research questions arising from citizens and/or Civil Society Organisations (CSOs), usually by means of a participatory methodology and active involvement of students.

Empirical evidence for this article was gathered by means of a wide range of different techniques, such as structured questionnaires, focus groups, interviews, direct observation and document analysis. In the first research effort, a questionnaire was delivered to European Science Shops in order to produce mainly descriptive statistics prior to progressing to case studies and focus groups which would generate more in-depth knowledge and understanding. The second study program was connected to formative and summative evaluation of a European Commission funded project aimed at embedding Responsible Research and Innovation (RRI) in Higher Education curricula through Science Shops (namely EnRRICH

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– Enhancing Responsible Research and Innovation through Curricula in Higher education). Participatory evaluation was carried out mainly on pilot projects run by project partners.

Results are discussed in the light of relevant literature regarding possible strategic assets that may enable Science Shops and Community Engagement units to overcome observed fragility and ensure durability. This can be pursued through systematic mobilisation of specific knowledge, competencies and abilities. Combinatory capacity and boundary spanning are pinpointed as specific components of Science Shops' action, which – we maintain – are also key strategic assets to consolidate their role and ensure durability. The distinction between the 'instrumental/operational' and 'strategic' function of boundary spanning is introduced in order to analytically develop this argument.

Keywords:

community engagement, higher education, Science Shops, knowledge brokers, boundary spanners, systemic alignment

Introduction

The extent and pace of change faced by societies across the world in the last two decades of the 21st century has been unprecedented, and this has deeply impacted the way knowledge is now produced and shared. Higher Education Systems (HESs) and Higher Education Institutions (HEIs) have faced profound transformation, and the life of people working in these institutions today is extremely different from that of their colleagues 30 or 40 years ago.

While some authors have pointed out a progressive shift from what they called Mode 1 to Mode 2 of scientific work (Gibbons et al. 1994), a parallel shift was also observed to be taking place at the very heart of the world's leading economy as to its core components. In 1994, economist John W Kendrick observed that the stock of gross capital and gross real investments in the immaterial sector of the United States business economy was, for the first time in history, higher than that of the material sector. According to Kendrick (1994, p. 6), the same shift was observable in the economy of the USA between 1980 and 1990 and, subsequently, in several other countries (see Roth and Thum 2010 for a literature overview). Official statistics account for knowledge and information as relevant components of the immaterial sector, hence their growing relevance as strategic assets and economic goods.

The notion of a 'knowledge economy', an expression coined in the early 1960s by Fritz Machlup (1962), has grown progressively crucial to the research and education policy agenda (Godin 2002). The neoliberal orientation of public policy and the ensuing changes in the private sector favoured by progressive market deregulation, along with transformation of world trade and new forms and distribution of labour, are some of the most relevant components of structural change that have led to progressive commodification and marketisation of knowledge throughout the latter part of the 20th century and the first two decades of the 21st. In parallel, and both as a consequence and a driving factor, public institutions across the world – HEIs among them – have been called upon to adopt new organisational and governance arrangements in line with the directives of New Public Management (Clark 2002; Hood 1995). We see this context as challenging to forms of engagement that are based on such principles and practices as cooperation, knowledge democracy and public value.

Furthermore, along with the profound consequences of the radical technological shift came totally different approaches to the way knowledge is governed, produced and used. Stilgoe, Owen & Macnaghten (2013, p. 1568) note that 'In the second half of the 20th century, … science and innovation have become increasingly intertwined and formalised within research policy …, and … the power of technology to produce both benefit and harm has become clearer.' This, they argue, implies the reframing of the public value of science and of knowledge production regimes. In parallel, technological advances in collecting and sharing information have opened up the possibility for an increasing number and variety of people to participate in science; hence, the rise of research practices which tend to hybridise expert and non-expert inputs and, more generally, the increasing spread of Open Science.

Object and rationale

The scenario synthetically sketched above is a challenging one for engaged research and community-university cooperation, notably for intentional initiatives that aim to achieve structural continuity. It sets the contextual framework for a broad research question as to whether and how community-engaged research and teaching can persist and eventually evolve within such a challenging setting. To address this wide-ranging issue, our research focuses on the durability and vulnerability of the 'Science Shops', which originated in the Netherlands in the early 1970s. This makes them an interesting case study for our questioning, since their existence spans the last 50 years, which is when the major changes outlined above took place. We highlight some key moments in the history of the Science Shops movement; examine current practices and modes of operation; and draw on empirical research to identify competencies, actions and strategies that can strengthen organisational capacity to ensure the durability of these university-community partnerships into the future. To do so, we discuss some results from two separate empirical research and study programs concerning Science Shops in Europe. We anticipate that one main finding will be that responses are very context specific. This is a partial answer, which we will try to enrich by highlighting some regular patterns that emerge from empirical observation. In this way, some inferences arising from our evidence can be extended beyond that geographic area.

The two research streams actually originated from somewhat different research questions. However, looking retrospectively at the two relatively specific sets of data emerging from the two studies, we came to realise that they could be combined to converge into a common analytical framework, which is presented and discussed here. The first set of data provides descriptive statistics to illustrate some of the key features of Science Shops' organisational structure and modus operandi. Furthermore, it sets the argument for further analysis from the second research stream, since the questionnaire survey results provide evidence that a crucial component of both the work process and the outcomes of Science Shops is relationships. This provides the analytical key that is hereafter developed to present and discuss some of the evidence emerging from peer evaluation of the EnRRICH project, our second research stream.

Two analytical tools will be used in this respect: knowledge brokering and boundary spanning. The former is used mainly to shed light on the role of Science Shops in the knowledge (co)production process. We briefly argue that the use of this notion can contribute to the debate on abilities and competencies needed for organising and running engaged teaching and research. It is thus considered mainly for its heuristic value in analysing individual work and its organisational dimension.

Although partially overlapping with the notion of knowledge brokering, boundary spanning is hereafter used to articulate the analysis of the elements which characterise Science Shops' work at a more strategic level. Notably, we introduce a distinction between 'instrumental' and 'strategic' boundary spanning. The former refers to the operational and organisational level: this is the analytic declination of the concept which is commonly found in the literature. Our evidence brings to light a further functional dimension of boundary spanning which we define 'strategic' to delineate a specific ambit of actions which can be observed at different intra- and inter-institutional levels to ensure sustainability and durability over time.

Methodology

In the first research segment, a questionnaire was delivered to European Science Shops to secure mainly descriptive statistics prior to embarking on case studies and focus groups, which would generate more in-depth knowledge and understanding. All European members of the Living Knowledge network, as registered on the network's website at the time of survey (2016), were invited to fill in the questionnaire online. Notwithstanding several solicitations, only 25 out of 65 organisations responded. Five questionnaires were not retained for various reasons. Hence, results were drawn from a total of 20 questionnaires, which was around 30 per cent of the targeted population. This response rate is generally considered usual for self-administered questionnaires. Response rate and self-selection of respondents do not allow for generalisation of results.

A focus group was organised to discuss evidence emerging from the survey with three key persons in the Living Knowledge network who were chosen for their extensive knowledge and practice in Science Shops: Emma McKenna (coordinator of Queen's University Belfast Science Shop), Henk Mulder (coordinator of Bèta Wetenschapswinkel at University of Groningen) and Norbert Steinhaus (board member of Wissenschaftsladen Bonn: Bonn Science Shop). In addition, participant observation and structured document analysis of Science Shops in Ireland (seven months) and Italy (one year) was drawn on to complete our knowledge emerging from the survey and focus group and gain a more thorough understanding of issues and dynamics.

The second research stream considered in this article relates to formative and summative evaluation of the EnRRICH project aimed at embedding Responsible Research and Innovation (RRI) in Higher Education curricula through Science Shops (see the project's website at www.enrrich.eu). This research was primarily driven by key questioning, such as 'What works (or doesn't) work?' and 'How and why does this happen?' The study mainly concerned the piloting by EnRRICH Consortium members of activities aimed at embedding RRI in their own institution. In total, 150 pilots were run, engaging more than 6000 students mainly involved in Bachelor and Master's programs, and touching upon different disciplines within a total of 79 university courses. In accordance with the project's objectives, a total of 231 Civil Society Organisations (CSOs) were involved in the planning and delivering of pilots. The 11 EnRRICH Consortium members who ran pilots make up the 11 case studies that provided empirical data for what we hereafter will refer to as the EnRRICH study.

Empirical evidence was collected by participants in the project through mutual evaluation activities based on non-standard, in-depth research techniques such as unstructured and semi-structured interviews, focus groups, analysis of documents and participant observation. Interviewees and focus group participants were generally people responsible for pilots and other primary stakeholders, such as teachers, students and CSO members (see Vargiu 2018 for more details). Results emerging from peer evaluation exercises were shared with both EnRRICH Consortium and Advisory Board members by means of single reports that were progressively assembled and reorganised on the basis of insights emerging from cooperative analysis.

Origins and main features of Science Shops

Science Shops are engaged research units which together are often referred to as a 'movement'. As mentioned, they originated in the Netherlands in the 1970s, but are today organised across Europe in an informal network called Living Knowledge (LK). Science Shops are a distinctive way to organise the relationship between science and society. They act in different ways, yet often according to a collaborative approach (Mulder & De Bok 2006) and within a common operational framework conceived to respond to research questions arising from citizens and civil society organisations (CSOs). They are frequently university-based units, but several Science Shops are CSOs themselves and some are mixed entities. Usually, Science Shops act as intermediaries that drive research projects through synergic involvement of different actors, such as students, CSOs, citizens and researchers. The direct active involvement of students is one distinctive feature of Science Shops. A Science Shop project is usually run by students under scientific supervision of academic tutors. This way, activities are typically run in synergy with ordinary teaching and research endeavours (Mulder & De Bok 2006; Zaal & Leydesdorff 1987). This ensures the relatively low costs of the research process along with the scientific robustness of its outcomes, which are strengthened through the synergic articulation of the research, teaching and service mission.

The results of our data collection from 20 Science Shops via questionnaires largely confirms the above: the term 'Science Shop' actually does not designate a specific management, organisational model or institutional form, but rather a particular way to arrange science–society relationships within a common frame for action and a shared set of principles (Fischer, Leydesdorff & Schophaus 2004; Gnaiger & Martin 2001; Mulder et al. 2001). According to Fischer et al. (2004), this very much depends on four interrelated factors which are often related to where and when the Science Shop was set up: (1) the condition of civil society and the NGO community; (2) political culture and public discourse; (3) resources; (4) science policy. Similarly, in our results, of the 20 respondents, 14 were university-based units (of which 10 served the whole university, and four worked with a single department), while six Science Shops were non-university based (see Graph 1; all graphs are contained in the supplementary file). Further, as Table 1 below shows, most Science Shops worked on a relatively small number of projects per year which tended to involve limited numbers of students (mostly on projects involving one–two students) and tutors.

In this respect, the EnRRICH study allowed for distinction between what were defined as a 'light' and a 'deep' approach to students' engagement. Typically, the former allows for involvement of large numbers of students for relatively short time spans and generally implies feeble interactions with external stakeholders. This was the case, for instance, in hackathons that involved students for a whole day in addressing a community concern. On the contrary, a 'deep' approach is characteristic of a 'classic' Science Shop project which concerns just one to a few students who are called to effectively engage with community partners on a medium to long time span. These two ideal types require mobilisation of different capacities and result in rather diverse outcomes. Provided that operational resources are available, they are compatible with each other, and were observed to be generally used to involve students at different stages of their study course and level of engagement maturation.

Table 1 Projects, students and tutors involved: Median values and variability of distribution

		Median	Min	Max	Lower quartile*	Upper quartile*
Per year	**Projects**	5,0	3,0	63,0	3,5	10,5
	Students	15,5	2,0	273,0	3,5	44,5
	Tutors	5,5	2,0	25,0	2,3	10,8
Per project	**Students**	1,7	0,2	18,8	1,0	4,4
	Tutors	0,9	0,2	2,8	0,4	1,6
Per student	**Tutors**	0,5	0,1	2,0	0,1	1,0
	ECTS**	5,0	0,3	12,0	1,4	11,8

* Quartiles are calculated excluding extreme values.

** ECTS is the acronym for European Credit Transfer System: it designates a standard measure to calculate study workload associated with a learning activity.

Later in this article, we will argue that the diversity of the Science Shops concept seen on the ground, along with agility connected to its relatively small dimensions, might be two relevant factors that have allowed the persistence of these experiences over time despite both institutional and political turbulence.

One interesting result that emerged from our questionnaire survey was the change in disciplinary focus of the Science Shops' projects over time. The origins of the Science Shop movement in the Netherlands some 50 years ago were strongly connected to the growing attention at that time on environmental issues. Hence, the first Dutch Science Shops, albeit keen on interdisciplinary work, often focused on chemistry and other hard sciences (Wachelder 2003). This is not the case today for our survey respondents, who run projects that are almost exclusively centred on the social sciences and humanities (Graph 2). In our follow-up discussions with experts, this shift was thought to be most probably connected to the higher familiarity of social sciences researchers and students with community-based participatory approaches, thus entailing more interest and willingness to engage in a Science Shop project. Still, the shift points out the difficulty for 'hard sciences' to renew their commitment to working with societal stakeholders, at least through the Science Shop approach.

In terms of impact, respondents considered students as the principal beneficiaries of activities, followed by science and society (Graph 3). Quite surprisingly, community members and other non-academic stakeholders were considered to be the least impacted. For students, involvement in Science Shop projects resulted in learning experiences that, notably, touched upon all five relevant components of the Dublin descriptors (Graph 4):

- knowledge and understanding
- applying knowledge and understanding
- making judgements
- communication
- lifelong learning skills (https://ec.europa.eu/education/ects/users-guide/glossary_en.htm. Accessed July 30th 2019).

Besides the impact on students, survey respondents valued their potential to broadly affect science–society relationships and policies. This was made clear through the large direct involvement of the general public at open events, in which the number of non-academic participants at such events was almost three times higher than that of academic audiences (Graph 5). Methods of dissemination further confirmed this tendency to assign priority to forms of communication not necessarily intended for academics. Data from 15 respondents showed that, while the great majority of project outputs took the form of reporting 'grey literature', the bulk of the remaining forms of dissemination, such as conferences and press releases, were clearly conceived to reach non-academic publics, and amounted to about 36 per cent of the overall total (Graph 6).

In summary, the survey results indicate the enduring double focus of Science Shops' projects on students and non-academic stakeholders. This is consistent with the original inspiration and the general bottom–up research orientation of the Science Shops' approach, distinguishing them from other kinds of structures aimed at filling the gap between science and society. In accordance with the literature, Farkas (1999, p. 35) recalls that, in the early days, Science Shops' clients had to:

- have no commercial aims (and therefore allow all research to be public)
- be able to make a concrete policy change based on the research
- have limited financial means available to them to do the research.

Notwithstanding a small number of projects serving market organisations, this still seems to be the rule for a large majority of the projects (three projects out of four) mentioned by our respondents. The presence of projects originating from state or market actors indicates, once again, the variety of Science Shop activities possible within this common operational framework (Graph 7).

A final question focused on outcomes from one year of activities: responses from 13 Science Shops indicated new products and new services as the most common outcomes (Graph 8). In the longer run, outcomes generated wider impact – indeed, some of the changes reported by our respondents are rather concrete, such as the creation of new Science Shops or participatory research centres (Graph 9). Yet, the great majority of reported impacts are immaterial and prevailingly relational in nature. This clearly connects with the role played by Science Shops and gets to the very heart of their specific character.

Knowledge brokering, boundary spanning and system alignments

As said, Science Shops' main role is to act as intermediaries between universities and society. They typically do so by activating relationships between students, teaching staff and organisations outside university. Hence, the very heart of the Science Shop's function is relational. One detailed study of the Dutch Science Shops over time (Wachelder 2003, pp. 262–63) evidenced that brokering is a constant key activity which is independent from structure, organisational form or aim of the Science Shop. This was also observed throughout the EnRRICH case studies, where mobilising different actors, and their capacity and knowledge within and outside university, required expert knowledge brokering and adequate operational/organisational infrastructure. Knowledge brokering originated as a peculiar form of knowledge management in the private sector to facilitate circulation of knowledge within and between organisations (Cooper 2014; Oldham & McLean 1997).

For instance, the newly established Science Shop in Vilniaus Technologiju ir Dizaino Kolegija (Lithuania) ran different pilot activities within the EnRRICH project. One pilot engaged 4 BA Graphic Design students in work on promotional graphics for a popular flower market in Vilnius. Another pilot brought in another BA student to conceive a visual information system for the Lithuanian Archives of Literature and Art, while two more Graphic Design students worked on valorising memorial sites of horse-drawn trams in Vilnius. In reporting on this case study, the peer evaluator stated that:

> **During all of the CBR/RRI pilots, students engaged in a real-life learning experience while working with the partners on projects which were developed in collaboration with partners. In all cases, the lecturer worked extensively with the partner to design the brief for the pilots to make sure they were useful for […]. In each case, students were expected to respond to the brief created by the lecturer and partner, and to continually reflect upon and communicate their own and the partners' expectations, and to evaluate and incorporate feedback into the project as the project developed.**

This whole process required continuous and intensive brokerage work by the local Science Shop's personnel. This was needed, notably, to activate and facilitate relationships among different individual and collective stakeholders, ensure quality of engagement, regulate expectations and potential conflicts, provide a safe learning environment for students, and set up and strengthen the basis for future cooperation with and among involved actors.

As Ward, House & Hamer (2009, p. 268) point out, 'knowledge brokerage can reside in individuals, organisations or structures'. Science Shops are structures that act as knowledge brokers, and knowledge brokering competencies are a key requirement for people working in Science Shops, as well as in any public engagement unit. The concept of knowledge brokering acknowledges the complexity of intermediation, thus overcoming the simplistic views sustaining such concepts as knowledge transfer or knowledge translation (Davies, Nutley & Walter 2008); hence, the large diversity of competencies that are needed for effective knowledge mobilisation to ensure larger impact of research activities. In the engaged scholarship context, knowledge brokering is connected to such concepts as knowledge democracy and epistemic justice (Hall & Tandon 2017).

Bayley et al. (2018) go as far as identifying a set of 80 different competencies retained in 11 categories that compose what they define as a 'knowledge mobilisation competency framework'. Throughout the EnRRICH study, this variety of competencies was observed at work in several contexts and as a key feature of Science Shop personnel that complements researchers' skills in ensuring that different kinds of knowledge are mobilised throughout the research process. These are typical bridging and enhancing functions of knowledge brokers; yet some more specific functions can be observed in Science Shop projects. In fact, the involvement of students in activities implies that brokering competencies mobilised throughout the process become a key component of the students' learning experience. This was observed to be the case for both learning outcomes and pedagogic principles.

This induces us to consider that brokering not only specifically implies working with relationships, but also working out relationships. To put it another way, brokering is a process which relies on relationships, and a process which produces relationships. Graph 9 clearly shows that among the main results of brokering relationships are … relationships. What we did not detect through the questionnaires, but was possible to perceive through close observation of case studies, was the meta-relational impact of brokering upon teaching. A further observation emerging from the EnRRICH study and which aligns with some of the evidence shown in Graph 7 is the more general impact that some Science Shops' projects can have not only between organisations but also within organisations. This is an issue which is often raised in the literature on knowledge brokering and is also specifically addressed through the notion of boundary spanning (Meza-Guarneros & Martin 2016).

Based on seminal work by Friedman and Podolny (1992), Weerts and Sandmann (2010, p. 638) conceptualise boundary spanning as follows:

> [boundary] spanning is best viewed at both the individual and organizational levels. At the individual level, spanners are actors who are primarily responsible for interacting with constituents outside their organization. … In the context of community engagement, university spanners perform teaching and learning functions to promote mutual understanding among the institution and community representatives.

They further suggest that:

> … boundary spanning is not confined to an individual job description; rather, it refers to broader institutional strategies to engage with external partners. This broader definition of boundary spanning suggests that institutional relationships with community partners are multilayered and may serve various purposes at multiple levels.

Building on an empirical study based on close observation of six institutions, Weerts and Sandmann identify four ideal types of boundary spanners that perform different kinds of functions depending on pre-eminent kinds of tasks and on prevailing orientation towards institution or community. The different types are synthetised in a four quadrant diagram, as shown in Figure 1.

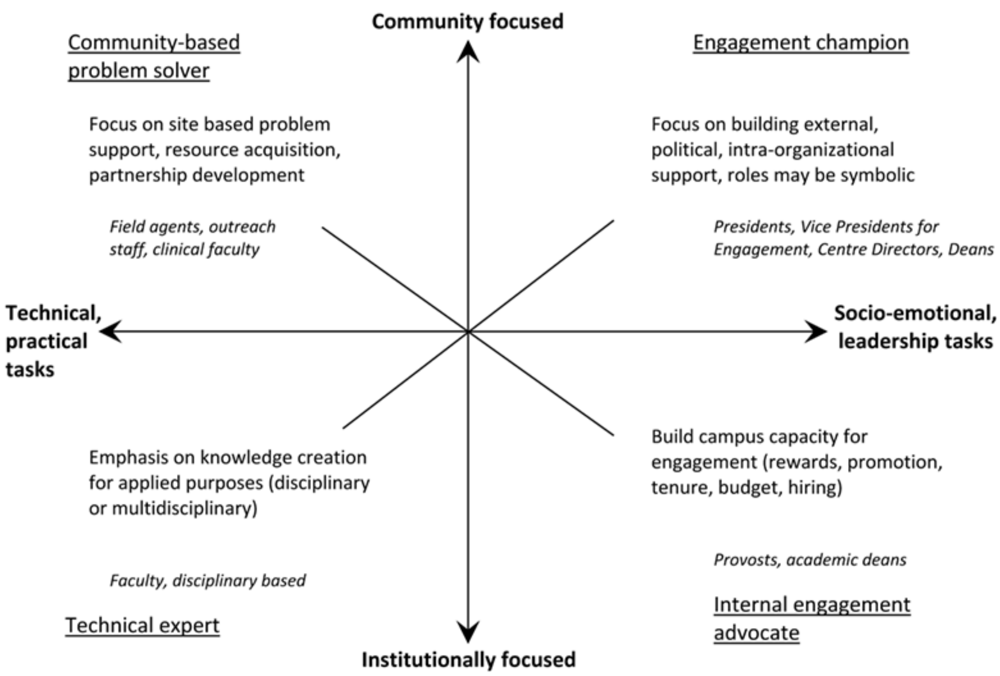

Figure 1 University-community engagement boundary-spanning roles at public research universities (Weerts & Sandmann 2010, p. 651)

The great majority of cases that were observed in the EnRRICH study can be located in the two left quadrants. Yet, Weerts and Sandmann's diagram suggests that other roles can also be played by Science Shops, albeit not as prominently. For instance, activities such as building external, political and intra-organisational support are sometimes undertaken by some Science Shops. We shall return to this later in this article.

Weerts and Sandmann associate ideal types on the right side of the diagram with leadership roles within institutions which are more connected to strategic planning and decision making. Hence, they are crucial for institutional uptake and enhancement of community engagement. This is clearly a schematic view which necessarily reduces the complexity of tasks and roles as they are actually performed. As knowledge brokers, personnel running Science Shop type of work would be engaging more as a 'community-based problem solver' or 'technical expert', whereas institutional responsibilities connected to actual sustainability of the Science Shop itself, necessitate what, in Weerts and Sandmann's scheme, are called 'socio-emotional, leadership tasks'. This right area of the diagram is clearly connected to power dynamics: an issue that we will address more explicitly further on.

The EnRRICH peer evaluation report on an experience of Vrije Universiteit Brussels underlines the crucial role played by intra-organisational support given by senior management in ensuring positive uptake of proposed pilots by academic staff. Furthermore, the report stresses the relevance of this relational work in ensuring structural uptake of initiatives through complementary boundary spanning, that is, vertical intra-organisational boundary spanning by senior management, along with Science Shop personnel's direct work with academics running pilots on the ground. This was associated with horizontal inter-organisational action enacted by Science Shop with community partners. Eventually, this experience favoured relevant institutional developments for the institution, as the peer evaluation report states: 'This project represents the first steps towards collaboration between the directorates of research and education', which were previously much more loosely connected. Overall, the report concludes, 'EnRRICH provided the incentive to start developing more links across the university and pushing for strategic inclusion.'

This case shows that relational work aiming at cultivating connections between the different sides of the diagram (left–right; up–down) is crucial to providing for enhancement and promotion of community engagement, but is also key to strengthening the overall institutional conditions for continuity and sustainability of community engagement units. This suggests that systematic boundary spanning across the different quadrants of the diagram is a key task in addressing consolidation and continuity of Science Shops.

Overcoming fragility and ensuring the durability of Science Shops

This leads our discussion to a crucial issue in institutionalisation of Science Shops and, more generally, community engagement units: durability. Along with the strengths of Science Shops, the EnRRICH study also evidenced potential for vulnerability. As seen above, most of the surveyed Science Shops are rather small entities that run relatively few projects per year. These are often units which rely on the work of a few people or even just one key person. Notwithstanding budgetary constraints, the complexity of tasks and competencies attached to knowledge brokering and boundary spanning, briefly highlighted above, makes the recruitment of skilled Science Shop personnel and their training particularly challenging. For instance, Wachelder (2003, p. 258) described the Eindhoven and Utrecht Science Shops in the Netherlands in the following way: 'At Eindhoven, the chemistry shop's management is still almost entirely in the hands of the students. … Shops that have opted for independent courses are hardly affected by financial cutbacks, but on the other hand, their financial means are limited. … Moreover, given the relatively short time students are enrolled at the university, the continuity of the shop poses a recurrent problem.' As Wachelder notices, this is a typical concern for voluntary organisations, which implies that a large share of resources needs to be devoted to systematic 'internal reporting and training to improve the continuity of […] activities'.

The above refers to dealing with sustainability and continuity over time as being connected to factors that are intrinsic to the Science Shop itself. Literature on Science Shops (De Bok & Steinhaus 2008; Leydesdorff & Ward 2005; Wachelder 2003) maintains that such internal factors come to interplay with external ones to a relevant extent and determine organisations' durability. The Dutch experience is often reported in literature as paradigmatic (Farkas 1999). In the early 1970s, the strong emphasis that the student movement put on democratisation of universities led to the opening of the first Wetenschapswinkels (in Dutch, *wetenschap* means 'science' and *winkels* means 'shops') in the chemistry departments of the University of Amsterdam and the University of Utrecht where 'groups of active students started to do some advisory work for environmental and local groups' (Farkas 1999, p. 35). Such forms of activism were to rapidly expand to other universities in the Netherlands as they also connected with the widespread political orientations of organisations such as unions, but also environmentalists, patient groups, development activists and feminist groups, as well as dominant parties, hence national government. Thanks to the positive alignment of such factors, 'what was initially a rather loose association between science shops and university organisations gradually grew into a close relationship' (Wachelder 2003, p. 253) and 'by the end of the 1970s, almost all Dutch universities had a Science Shop in which staff worked on research requests from civil society groups' (De Bok & Steinhaus 2008, pp. 171–72). This experience eventually had an influence beyond national borders and the Science Shop movement gained a presence in other European countries and beyond (Leydesdorff & Ward 2005).

Yet, in the Netherlands, the initial political drive was eventually to change direction: 'Broadly speaking, in the 1990s, the Dutch political climate moved in a more conservative direction … In 2000, it was no longer true that each Dutch university housed a science shop' (Wachelder 2003, p. 255). Wachelder (2003) and, to a minor extent, Farkas (1999) present and discuss the different strategies adopted by Dutch Science Shops to cope with the new situation. Notably, Wachelder maintains that diverse responses to this problem more broadly depended on how each Science Shop addressed the issue of the democratisation of science and technology. A diffused debate on this is needed – Wachelder argues – to reach a deeper theoretical understanding of crucial issues that marked the Science Shop movement from its very origins, and which must be discussed in the light of changes that have occurred over time and of learning from past experiences. This opens a wide issue that cannot be dealt with here in much detail. Yet, it is a crucial one which has to do with the very capacity of the Science Shop movement (and of the engaged scholarship movement at large) to affect the research policy agenda, which, as briefly mentioned in the introductory notes, is presently challenged by a growing demand for democratic governance and, more broadly speaking, the need for a new social contract for research (Owen, Macnaghten & Stilgoe 2012).

This sets the debate called upon by Wachelder in a wider perspective and, at the same time, calls for engagement to be enacted at different levels: practical, strategic and political. As said, the Dutch example shows that alignment of various factors at different levels (student orientations, institutional preconditions, generalised support by political and civil society organisations, national policy orientations) is crucial.

Our evidence suggests that timing is a key component of how such alignment (or misalignment) can affect the very life of the Science Shop and the way people understand it and deal with it. During focus group discussion on the results emerging from the questionnaires, the Science Shop coordinator at Queen's University Belfast, Emma McKenna, noted:

> I suppose, for us, I think the changes in the UK system are in theory really good in a sense … this idea of public engagement … It's the European agenda … Well, all of that is good for us: when you talk about engagement, people get it, when you talk about students needing to engage, people get it … You know you don't have to spend … it used to be that the first half of any conversation was persuading them all … that public engagement was a worthwhile activity.

The Science Shop at Queen's University Belfast was set up in 1988 and is now one of the most established Science Shops in Europe, and a quite large one: over the last three years it has worked with 80 community organisations and 770 students from across 35 academic pathways to complete almost 200 community-engaged research projects with organisations across Northern Ireland.

McKenna's words clearly refer to recent changes in the UK's Higher Education policies concerning engaged research and teaching. Owen, Featherstone & Leslie (2016) pinpoint 2006 as a key date when specific funding was allocated to promote engagement through the Higher Education Innovation Fund. Two years later, in 2008, the Beacons for Public Engagement initiative and the National Coordination Centre for Public Engagement were set up. Much earlier than that – in the 1980s – when the Science Shops were flourishing in the Netherlands, the debate on science–society relationships in the UK was at a much earlier stage, still largely focused on the notion of public understanding of science (Royal Society 1985). At the same time, the UK was undertaking institutional changes that were yet to arrive in the Netherlands, such as New Public Management measures initiated under the first Thatcher-led government, which had started to inform organisation, funding and governance of UK's public institutions. Those changes would eventually affect British universities before national policies started addressing public engagement in higher education and research. The latter came to maturity at a time when New Public Management policies had been under scrutiny for a while and were thus undergoing relevant revisions. McKenna's words underline the indirect effects of a broad-based appreciation of the meaning and value of public engagement.

The timing of public engagement and of relevant institutional changes in the UK was the inverse of what happened in the Netherlands (see Pollitt & Bouckaert 2011 for a comparative overview). Incidentally, it must be noted that, on the other hand, the Living Knowledge network played an active role in the shaping of the European research policy agenda, leading to what was finally named as the Science with and for Society programme (SwafS). In parallel, the LK Network acted as a catalyst for Science Shops to interact, so as to join EU funded projects under the SwafS programme (and EnRRICH among those). These are two forms of, respectively, vertical and horizontal boundary spanning which, further on in this article, we will define as 'strategic'.

Both our research streams evidence that alignment of factors at different levels is a key contextual enabler for Science Shops, as it provides the chance for them to prosper and eventually grow (or decay and eventually perish, in the case of misalignment). A good example of positive alignment of factors is the case of CARL, the Community-Academic Research Links initiative, which operates as a Science Shop based at the School of Applied Social Studies of University College Cork (UCC) in Ireland. First established in 2006, CARL began its first projects with community partners in 2010. It was established as a small unit, which eventually started evolving thanks to European funding through the PERARES project (https://www.livingknowledge.org/projects/perares/), which eventually also provided CARL with the possibility to reach out to international connections in a more stable way, while gaining visibility and relevance within its own institution. Evidence from the EnRRICH study is clear in this respect: besides economic resources, all EnRRICH project consortium members insisted on the relevance of EU funding in providing a policy and conceptual framework, along with legitimation and credibility. Some explicitly remarked that the EU's legitimation was a key factor in overcoming resistance to change and institutional inertia. This can be regarded as a truism, but which nonetheless acquires a different relevance if considered in relation to other factors.

Among consortium members of the EnRRICH project, CARL could eventually build further on this contingency when UCC delivered its Civic Engagement Plan 2017–2022, titled 'Together With and For Community' (https://www.ucc.ie/en/media/centralmedia/UCC_Civic_Engage_2017a.pdf). Institutional strategy at UCC aligned with policy focus at the national level on community engagement, which was set by the Irish National Strategy for Higher Education to 2030. Within this national policy focus, an action plan named 'Campus Engage' was agreed, to secure funding and support for capacity building in university-community engagement (Bowman, Adshead & Morris 2018). CARL had expertise, capacity and legitimation and was therefore actively involved at all stages of this process.

This case points out also how positive alignment of factors can be pursued through engagement enacted at different institutional levels: within one's own university and among universities, as well as across a wider policy context, by including different kinds of public and private actors, both at national and international level. Albeit very different in some relevant respects, the history of the rise and (partial) fall of the Dutch Science Shops, briefly recalled above, can be regarded as a sequence of alignments and misalignments. Those experiences, along with others observed in the literature (Millot 2019) and other evidence from the EnRRICH study, suggest that excessively relying on a single source for existence may be fatal for what are often fragile structures; be this an exclusive source of funding or the presence of one or a few key people. As with business and territorial development, diversification of resources was observed to be a beneficial strategy for Science Shops' continuity.

Agility and boundary spanning as strategic assets

System circumstances were observed to play a relevant role as contextual enablers. We have seen that alignment can be considered one such contextual enabler for Science Shops to develop their potential, and to eventually endure and prosper. The heuristic usefulness of this notion couples with its strategic relevance.

Other overall circumstances were observed to be playing a relevant role as contextual enablers, eventually in combination with alignment. For example, regulatory stability and flexibility. The EnRRICH study showed that overruling, bureaucratisation and unnecessary formalisation of procedures played a negative role. It could not be otherwise. Instability of regulatory arrangements generates turbulent operational conditions that exacerbate power asymmetries and hamper cooperation. This was observed to particularly affect Science Shops as they usually have limited power within academic and institutional hierarchies (and typically advocate for the powerless) and base their action on cooperation.

Furthermore, overruling hinders flexibility and agility, which are often strategic assets of small units such as Science Shops. During a reflective evaluation meeting involving all EnRRICH partners and the project's Advisory Board members, several comments identified agility and flexibility as key factors which can be observed both at operational and strategic level. Furthermore, this was observed to be related to the diversity of Science Shops' experiences, along with another of their key features: combinatory capacity. Typically, Science Shops combine different resources to serve a common interest: they bring together researchers, students and community members and work to harmonise and optimise their aptitudes. They combine classic Higher Education missions of teaching and research to pursue a third one: community engagement. Creative combination of factors and resources that are at hand is therefore a key feature of Science Shops' work and of their role. Resources and constraints are very context dependent, hence the variety of combinations leading to the diverse organisational and operational solutions observed among Science Shops. The common feature is centrality of this combinatory capacity, and the guiding principles to put it to work.

The EnRRICH study showed that, when combinatory capacity is at its best, positive alignment of factors can be exploited to the full. This leads to advance some considerations which are connected to the notion of 'adjacent possible'. This concept originates from the work of Stuart Kauffman (2000) on biological evolution and from his interest in the mechanisms which guide a system's organisation and its adaptation to the surrounding environment. Kauffman's conclusions can be applied to any complex system. The concept of adjacent possible refers to all the elements that are outside but close to the system that can be used to drive the system's change. Hence, adjacent possibles are elements that are located just near the system's boundaries: they are opportunities for innovation, which come to their full potential once the system builds new connections and expands to incorporate them and turn them into system components. This makes the notion of adjacent possible particularly interesting for understanding how innovation processes work.

At the time of case study visits for peer evaluation, for instance, EnRRICH partners at Wageningen University (NL) were building on relational opportunities provided by the project's activities to contribute to the setting up of a responsible innovation centre and were working at involving diverse people in many different ways in this initiative. This once again connects with evidence presented in Graph 9.

Spanning across boundaries, which we have spotted as a specific feature of Science Shops, is a key constituent of adjacent possible. This makes it an argument for Science Shops and, more broadly, community engagement units that act as boundary spanners to be seen as bearers of innovation potential. This can be declined at three different levels: practical/operational, strategic and political. Albeit not absent from the former, the last two levels clearly raise the issue of power relations and power dynamics.

Building on Meza-Guarneros and Martin (2016), we observe that boundary spanning takes place among as well as within organisations. As stated above, Science Shop's boundary spanning among organisations is typically seen as an operational function which serves the knowledge co-construction process. Yet, the EnRRICH study evidenced intra-organisational spanning to be taking place to support and enhance collaborative work. This is reflected in Sinclair (2017), who adds a further analytical dimension as he introduces a difference between vertical and horizontal boundary spanning. This produces a quadripartite diagram, as shown in Figure 2. As said, typical Science Shops operational activities concentrate on the lower left quadrant.

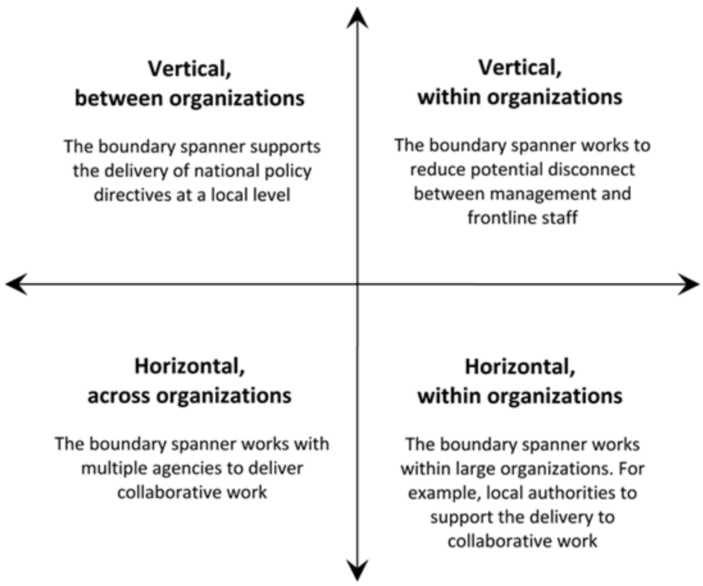

Figure 2 Examples of boundary spanning activities (source: Sinclair 2017, p. 14)

Yet, we argue that another relevant issue can be explicitly raised by the introduction of differentiation between horizontal and vertical boundary spanning, and this concerns power relations and strategic action. Examples proposed in Figure 2 refer to actions which typically address practical/functional issues. Yet, boundary spanning can also serve strategic or political aims. For instance, as briefly mentioned above, the LK Network acts both as boundary spanner at EU level, pursuing policy change (vertical, among organisations) and promoting collaborative work (horizontal, among organisations). More generally, the vertical axis is the one where the kind of alignments pointed out above take place. Yet, both alignment and combination of adjacent possibles can take place at the horizontal and vertical level to pursue positive change and innovation, for instance regarding university-community engagement policies. This is a totally different kind of work from boundary spanning to enhance the collaborative enterprise, which requires the mobilisation of an often similar (yet not totally identical) set of relational competencies within rather diverse contexts to serve significantly different objectives. We believe that CARL's experience, briefly mentioned above, showcases how these multiple movements across axes can fit into a more general strategy aimed at impacting the policy context while reinforcing one's own organisational stability. This calls for an explicit differentiation between an 'instrumental/operational' function of boundary spanning and a 'strategic' one. This only partially coincides with Sinclair's distinction between horizontal and vertical boundary spanning, which accounts for the prevailing ambit for actions rather than the purpose that such actions aim at.

Concluding thoughts

In summary, we have seen that combinatory capacity, knowledge brokering and boundary spanning are constitutive components of Science Shops' role and main functions. They imply the mobilisation of specific knowledge, competencies and abilities. These precious resources should be seen not only as having a practical function in the running of basic activities and projects (instrumental/operational boundary spanning), but also as key strategic resources to address sustainability and continuity of Science Shops themselves, as well as a means to promote institutional and policy change towards more systematic engagement with communities. We defined this strategic boundary spanning as a kind of action which requires a thorough understanding of the overall context, which, as we briefly argued in the introductory notes to this article, is one of increased complextity in the relationship between scientific research and technological innovation and in the progressive marketisation of knowledge. All of which demands a new social contract for science.

In order to play an active and conscious role at both strategic and political levels within such a challenging context, a solid theory of change is needed. In his analysis of the history of the Science Shops movement in the Netherlands, Wachelder (2003) remarked that diverse understandings of the political and social issues at stake led to different adaptive strategies which resulted in rather diverse outcomes. Hence, the need for a thorough conceptualisation of what democratising science means and implies (Hall & Tandon 2017), to lay the foundations of a general theory of change for the Science Shops movement – and, more broadly, engaged scholarship – to thrive.

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