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## The ecosystem of expertise: complementary knowledges for sustainable development

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This article critically examines the approach of technical experts, including engineers, natural scientists, architects, planners, and other practitioners, who are attempting to create more sustainable forms of economic development, environmental protection, and social equity. The authors identify four principal characteristics of expertise—ontological assumptions, epistemological approaches, power inequalities, and practical issues—and employ this framework to test the capability of traditional experts to deliver sustainable development. The authors then provide four alternatives to conventional forms of expertise: the outreach expert who communicates effectively to non-experts, the interdisciplinary expert who understands the overlaps of neighboring technical disciplines, the meta-expert who brokers the multiple claims of relevance between different forms of expertise, and the civic expert who engages in democratic discourse with non-experts and experts alike. All of these alternative forms are needed to manage the often-competing demands of sustainable development projects and they can be described collectively as an “ecosystem of expertise.”

KEYWORDS: sustainable development, economic planning, ecosystem management, social change, political science, interdisciplinary research

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### Introduction

The dominant role of technology in modern societies requires the public to rely on individuals with specialized knowledge to invent, design, manufacture, and maintain increasingly complex artifacts and networks. The modern city provides numerous examples of society’s reliance on technology. Complex networks of transportation shuttle residents between their places of work, home, and play; wired and wireless communication systems transmit information at the speed of light; and sophisticated water networks regulate the hydraulic metabolism of the city. Clearly, many interrelated technologies are necessary to maintain our daily lives and to support political, economic, and social frameworks. This article refers collectively to the individuals who possess technical knowledge to design, build, and maintain these technologies as *technical experts*. It is no surprise that this “class” has an indispensable role as more sophisticated technologies require increasingly specialized individuals who understand the underlying scientific and technical principles.

In recent decades, it has become clear that civilizational progress, to a large extent facilitated by technological developments, has been accompanied by unintended consequences that threaten humanity

in the long term. Global poverty levels, climate change, social exclusion, accumulating toxins, and other issues are often subsumed under the heading of unsustainable human practices. It would be simplistic to indicate a linear causal relationship between technological development and these problems, but they are both, at the least, prominent features of the modern world. Thus, efforts to create more sustainable development require an examination of the opportunities and dangers of involving technical experts. This is the overarching question we pursue in this article. We explore the meanings and problems associated with expertise and sustainability to understand the implications of the compound term “sustainability expert” from a transdisciplinary perspective. The discussion highlights some of the inherent shortcomings of conventional expert-driven approaches to sustainability as well as possibilities for more effective applications of sustainability expertise.

### The Expert in Modern Society

The rise of “expertocracy” is rooted in the Enlightenment, when experts began to acquire—or were granted—the power to shape and direct societies via scientific and technological development (Brand, 2005a). And their efforts were very successful in-

deed. Large complex systems, including gas, electric, water, sewage, and transit, were designed and constructed by technical experts in American, British, and European cities in the late-nineteenth century, making engineers highly influential in public policy (Seely, 1996). Technical experts served as the “human face” of technology, symbolizing efficiency, stability, functionalism, objectivity, and progress, while seemingly enacting the values of modern civilization (Hickman, 1992).

The privileged status of the technical expert is embedded in most modern Western cultures. For example, vernacular German includes a number of proverbs about the superiority of the engineer, such as *dem Ingeniör ist nichts zu schwör* (no task is too difficult for the engineer), exemplifying the engineer as a symbol of national identity. The slogan “Made in Germany” was partially inspired to connect the recovering post-World War II nation to the earlier achievements of Werner von Siemens and other “genius inventors.” In the United States, a related trend at the turn of the twentieth century replaced the cowboy with the engineer as the symbolic figure of national culture (Hickman, 1992). Thayer (1994) describes the importance of the expert to the collective American psyche as follows:

We have never lost the myth that technological innovation and invention is America’s rightful spiritual territory...Clearly Americans place greater social value upon those people whose occupations involve scientific discovery and technological development than on those who deal with social issues or problems. Starting salaries for engineers are roughly twice those of social workers or teachers.

The most conspicuous technical experts in industrial societies include natural scientists and engineers whose specialized knowledge stems from the formal study of a scientific or technical discipline.<sup>1</sup> Subsequently, their social power is derived either from their professional status (as is the case with engineers) and/or from their adherence to a scientific method (as with natural scientists).

Ironically, the pursuit of expertise has the social effect of elevating the individual to semi-god status while also narrowing these individuals’ perceptions through specialization. Technical experts and, in fact, all experts become adept at microscopic and special-

ized analysis at the expense of macroscopic, holistic perspectives. Cliff Hague (1997), former president of the UK Royal Town Planning Institute, remarks in this context that

Twentieth century higher education and research has been dominated by analysis. Ever more sophisticated ways have been found to break experience down into its constituent parts. New disciplines have been built by reducing scope while deepening, and making more particular, the knowledge and methodologies.

The sacrifice of breadth for depth seems the logical price to pay for the acquisition of expert knowledge. Such a strategy also facilitates the division of labor among different disciplines. The jargon of specialists, their concepts, terminologies, and theories, serve as heuristic proxies—Joerges (1999) might say *LogIcons*—for things (physical or mental) and therefore steer the perception and analysis of evidence. Dedicated experts thus can develop a solipsistic or hermetically sealed notion of a problem and, accordingly, of a solution. Louis Menand (2001), drawing on the philosophical writings of Oliver Wendell Holmes, characterizes the problem with modern modes of thinking as follows: “we know we’re right before we know why we are right. First we decide, then we deduce.” Those who exhibit this all too common symptom of expertise tend to scan the horizon of problems until they find a fit with the type of solution they can offer. The colloquial equivalent to this observation goes like this: For someone whose only tool is a hammer all problems begin to look like nails.<sup>2</sup> In other words, epistemology precedes ontology when, ideally, it should be the reverse.

## Critiques of Expertise

This tendency for technical experts to adopt specialized worldviews, and the drawbacks that modern forms of technical expertise entail, has not gone unchallenged. Criticism and analysis of expertise has come from scholars in many disciplines including sociology (e.g., Collins & Evans, 2002), political science (e.g., Bimber, 1996), political philosophy (e.g., Turner, 2001), risk assessment (e.g., Wynne,

<sup>1</sup> Experts from other fields, including but not limited to architecture, planning, policy, and law are often not perceived to be technical experts, but we include them here in our general notion of individuals with specialized technical or scientific knowledge.

<sup>2</sup> As interdisciplinary scholars, we are of course not immune to analogous criticisms that would accuse us of portraying sustainability as a challenge that requires all disciplines to work together simply because our services would be sought after in such a scenario. Although we have no means of refuting this allegation, we hope that reflection upon this danger sets us apart from unrepentant solipsists.

1996), environmental policy (e.g., Fisher, 2000), and feminist studies (e.g., Haraway, 1991). Below we have clustered these criticisms into four main groups: ontological assumptions, epistemological approaches, power inequalities, and practical issues. These groups do not include all critiques of expertise, but this typology summarizes some of the principle problems revealed in the literature.

The *ontological* assumption of traditional forms of expertise is that of a *knowable* and unequivocally *re-presentable* world “out there.” Harding (2000) describes this stance as the dream of “one world, one and only one possible true account of it, and one unique science that can capture that one truth most accurately reflecting nature’s own order.” Closely related to this assumption is the idea of universality, the hope that knowledge can be free from the shackles of context, its validity floating freely above time and space. Knowledge, then, manages to overcome immanence and reaches up to the realm of transcendence. This is the basis of a positivistic ontology, the idea that the world is a knowable place and, through knowledge, we can resolve its problems. Accordingly, experts share a teleological notion of progress and believe in the theoretical possibility of ultimate solutions that can be discovered by following the “proper path of science” (Moore, 2001). Those who adhere to this ontological position naturally dislike the counterarguments of poststructuralist and post-modernist scholars who argue that science is plural rather than unitary (Harding, 2000). Such a pluralistic perspective is incongruent with conventional scientific methods that call for the reduction to individual, discrete units of study.

While the boundary between ontology and epistemology is blurry at best and deceptive at worst (see Lincoln & Guba, 1985), we draw this distinction to emphasize the multiplicity of knowledge as well as the multiplicity of *forms of knowledge*. For example, competing expert knowledges are frequently marshaled by property developers and nongovernmental organizations (NGOs) to deliberate over the implications of environmental impact assessments (EIAs). In this regard, Fischer (2000) argues that

This newer configuration of circumstances redirects our attention more to the limits of our knowledge, in particular to the unanticipated consequences resulting from the application of modern technologies. Such uncertainties have shaken the public’s faith in the experts. After having long trusted experts generally, citizens are confronted with the task of choosing which experts to believe and trust.

The problem of competing *formal* expertise is exacerbated by the existence of experiential, local, or tacit knowledge that arises from personal experience and exploration outside the confines of educational institutions and without full adherence to the scientific method. Scott (1998) refers to these different forms of knowledge in his distinction between *techne* and *metis*. *Techne* “is characterized by impersonal, often quantitative precision and a concern with explanation and verification,” while *metis* represents indigenous knowledge, meaning, experience, and practical results. Similarly, as Lane & McDonald (2005) explain, Levi-Strauss and Feyerabend are significant among the scholars who have observed that the “construction of [indigenous] knowledge is holistic, territorially oriented and concrete, whereas western science is abstract, reductionist, and separates the human from the natural.” Lane & McDonald sum up their perspective on technical knowledge by stating that “technical knowledge simultaneously sharpens our focus and obscures our vision.”

Recognizing different forms of knowledge poses the question of whether they are treated equally. Not surprisingly, *power inequalities* do exist frequently, if not systematically, between the possessors of differing knowledge forms. Holders of experiential knowledge are typically not granted a seat at the decision table due to favoritism for formal knowledge inherent in our decision-making institutions. At this juncture of the debate, the critique of technical expertise brings politics to the forefront of technical decision making. While many good reasons exist to depoliticize public environmental disagreements through professional mediation, these so-called deliberative formats favor technical experts over activists, citizens, and other stakeholders. The only acceptable language for use in such extra-parliamentary discussions is the scientific one and this directs the deliberative process toward technical and scientific, rather than democratic conclusions (Fischer, 2000). Furthermore, stakeholders without formal knowledge are portrayed as “incapable of grasping the technical nuance and methodological complexity of science” (Kleinman, 2000). From this perspective, Turner (2001) argues that “expertise is treated as a kind of possession which privileges its possessors with powers that the people cannot successfully control, and cannot acquire or share in.”

Related to democratic concerns of technical expertise is the inclination of experts to frame technical problems through the eyes of their elite employers (Fischer, 2000). De facto, technical experts often end up on the side of governmental and corporate power and they are, in effect, the “perceived handmaidens in science and technology” (Foreman, 1998), at times even working against the public that they are ostensi-

bly chartered to serve. A response to the institutional bias of experts has been the rise of counterexperts, individuals who can dispute technical experts on their own terms (Yearley, 2000). The emergence of the counterexpert is especially prevalent in environmental disputes because of the high degree of uncertainty that they engender. Environmental NGOs frequently employ counterexperts to muddy the scientific waters by introducing competing interpretations of a particular scientific or technical problem.

In addition to issues of epistemology, ontology, and power, there are *practical problems* that cannot be solved solely through technical expertise. For example, Beck (1992) argues that the question of whether we should use nuclear energy can never be answered with an objective “yes” or “no” because issues of risk and risk perception require “soft,” culturally specific responses. In other words, values and politics are embedded in sociotechnical developments (and vice versa) and no *pareto optimum* calculation can ever offset a collective preference for caution. Some experts attempt to portray such opinions as irrational and seek to educate objectors about the “facts,” or even ignore those who cannot see how things “really are.” Such a blunt technocratic and expertocratic approach is not merely an ideological concern. Peretz, Tonn, & Folz (2005) observe that there are “causal and temporal relationships between decision-making *processes* and program *performance*” (emphasis added). The buy-in of stakeholders is just one of the factors that externally imposed measures cannot guarantee. A top-down approach also leaves untapped the stochastic effect of harnessing the creativity of thousands of individuals. Based on Oliver Wendell Holmes’ notions of free expression and thinking as a social activity, Louis Menand (2001) succinctly states that “we need the resources of the whole group to get us the ideas we need.” Lane & McDonald (2005) summarize these pragmatic considerations as “harnessing local assistance and energy, and incorporating the ideas and wisdom of local people.”

An even more practical problem is that decisions that are made using scientific methods require enormous amounts of highly precise data. But such voluminous amounts of information typically require expensive and lengthy gathering processes. And even if all required data were obtainable, and even if they could be fed into an appropriate complexity-preserving model, developing such a model would likely require too much time and too many resources to resolve problems that demand more immediate action. This condition, often called “paralysis by analysis,” points to the sometimes incapacitating effects of decision making based on scientific and technical analysis.

## The Challenge of Sustainability

The challenges to technical experts in modern societies become more difficult when we consider the notion of sustainability or sustainable development. Sustainability has multiple meanings and interpretations, though most groups that subscribe to the notion agree that it is a holistic approach to solving complex, interrelated, and multi-dimensional problems. Dryzek (1997) observes that the main accomplishment of sustainability has been “to combine systematically a number of issues that have often been treated in isolation, or at least as competitors.” In other words, the principle advantage of sustainability is its pluralistic, inclusive approach to problem solving, as opposed to conventional problem solving with its limited focus on specific elements that overlooks unintended consequences as well as the proverbial “big picture.”

The interdisciplinary genealogy of the sustainability agenda is—for better or worse—a result of its conceptual comprehensiveness. A direct lineage can be drawn to concerns about the continual use of forests that was articulated early on by John Evelyn (1620-1706) in England, followed shortly by his German colleague Hans Carl von Carlowitz (1645-1714). Both argued that one should not harvest more wood than a forest yields, and thus these far-sighted naturalists might be characterized as *proto-sustainability* advocates.

The conceptual composition of the sustainability discourse also contains elements from nineteenth-century England’s calls for improved public health, championed by urban social reformers such as Edwin Chadwick (1800-1890). These individuals recognized that the poor health conditions of the British working class threatened economic development and, thus, they highlighted the link between sanitary conditions, human health of city residents, and economic prosperity. Even the work of physicists is reflected in the modern sustainability discourse, most notably the Second Law of Thermodynamics. This law, first formulated by Rudolf Clausius (1822-1888), stipulates that energy must be managed economically to protract the inevitable heat death of the universe, also known as entropy. Acting sustainably is thus interpreted as acting in a manner that minimizes entropy.

Finally, Ernst Haeckel (1834-1919) provided a crucial insight in his book *Generelle Morphologie* in which he introduced the term *ecology*. In Haeckel’s conception, living beings are inherently linked to their environment, implying that any damage to one part of an ecosystem affects the whole. We can identify a number of other disciplines and thought traditions underlying current discourse that clearly ground sustainability in interconnectedness.

Based on the interdisciplinary character of current sustainability discourses, it is not surprising that influential exemplars of sustainability scholarship and activism are conceptual hybrids that do not fit within traditional disciplinary boundaries.<sup>3</sup> A classic example is Rachel Carson's book *Silent Spring* (1962) that addresses not only health concerns and ecological problems of contaminated ecosystems, but also issues of environmental justice and freedom of information.<sup>4</sup> At times, the plurality of angles, concerns, and interests embodied in sustainability debates devolve into a confusing cacophony. This is a significant disadvantage in communicating sustainability's essence. A number of advocates have therefore attempted to distill sustainability to its elementary building blocks, a stratagem that inevitably runs the risk of trading richness for sloganistic value—the notorious problem of the lowest common denominator. Among the frequently cited distillates is the notion of widening the spatial and temporal horizon of human activities. In other words, we should not only consider the immediate effects of our actions, but also attend to ramifications in other parts of the world and in the long-term.

Perhaps the most commonly discussed explanation of sustainability is the *Three E* model that makes use of the triad of *Economic* viability, *Environmental* protection, and social *Equity*.<sup>5</sup> The model illustrates the challenge of simultaneously accommodating a multiplicity of competing demands. In other words, the openness of the sustainability concept to various claims and concerns comes at the price of compromise. Campbell (1996) highlights a crucial implication of this model by identifying the inherent conflicts between each pair of “Es” and the need for techniques to effectively resolve these tensions. As such, sustainable development cannot be the exclusive task of experts—technical or otherwise—because the management of conflict toward successful outcomes requires a “restless, dialectical process” of open discussion and negotiation (Healey, 2004).

Recognizing that the sustainability discourse is a negotiation between competing interests focuses attention on the inherently political nature of creating more sustainable societies. As Prugh and colleagues (2000) note, “sustainability is provisional; it is sub-

ject to multiple conceptions and continuous revision, the very stuff of politics.” Sustainability is also locally specific or, as Guy & Moore (2005) argue, “more a matter of local interpretation than of the setting of objective or universal goals.” Identifying the most suitable political system to facilitate successful conflict resolution and amicable exchange of interpretations then becomes a pressing concern for sustainability advocates (see Moore & Brand, 2003).

All forms of liberal democracy practiced in the Western world today rely heavily on technical expertise to tackle sustainability problems (see Tate & Mulugetta, 1998). Technical experts are tasked with developing more efficient or effective technologies to overcome stakeholder conflicts. For example, improved renewable energy technologies (solar, wind, biomass) are seen as key to resolving energy problems, challenges with chemical toxicity are to be resolved through developing less toxic chemicals (green chemistry), and so forth. This is the underlying message of advocates of ecological modernization in northern Europe and green business in the United States who argue that industrialized society's harmful aspects can be expunged through more effective science and technology applications (for example, see WCED, 1987; Hawken et al. 2000; McDonough & Braungart, 2002). Today, the *technical fix* approach to sustainable development is the dominant model in industrialized countries because it retains the existing power of political and economic elites. In this regard, Hajer (1995) criticizes ecological modernization as a modernist, technocratic strategy that does not require structural change, while Dryzek (1997) observes that “in its most limited sense, ecological modernization looks like a discourse for engineers and accountants.”

The technocratic approach to sustainability is strongly criticized for its overt and allegedly naïve embrace of deterministic solutions to problem solving and its reliance on existing capitalist policies.<sup>6</sup> These critiques originate from opponents of capitalism, as well as from advocates of social justice, democratic politics, feminist studies, and critical theory, whose shared goal is to make existing power relationships more democratic and equitable. As can be expected, the ingrained position of many technical experts comes under fire because of their alignment with those in power. Critics of the technophilic approach to sustainable development do not argue for the wholesale abandonment of technical expertise, but contend that technology should be directed by

<sup>3</sup> For a recent discussion of hybrids, see Hård & Jamison (2005).

<sup>4</sup> Gary Kroll (2004), a historian who studies science and engineering ethics, describes Carson's book as “cut[ting] against the grain of...scientism, and the technologically engineered control of nature.”

<sup>5</sup> This is also referred to as the *Three P* model (people, prosperity, and planet) or the *Triple Bottom Line*. For example, see Zimmerman's (2005) brief discussion of the recent U. S. Environmental Protection Agency program that focuses on operationalizing the Three P concept.

<sup>6</sup> For a succinct critique of ecological modernization and green business, see Schatzberg's (2002) review of *Natural Capitalism: Creating the Next Industrial Revolution* by Paul Hawken, Amory Lovins, & L. Hunter Lovins.

society as a whole rather than imposed by powerful elites. Such a bottom-up approach emphasizes the creation of political communities to deliberate on conflicts and to transform them via equitable and lasting solutions.

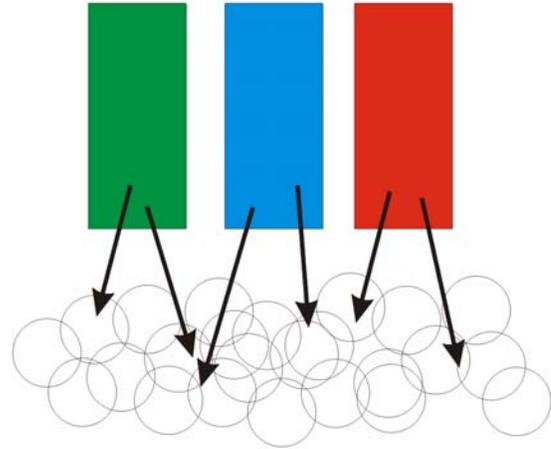
### The Sustainability Expert?

Those who accept the deliberative model of sustainability will probably agree that classical notions of expertise do not optimally *fit* sustainable development. In other words, we should be very careful when employing the term “sustainability expert.” Does this mean that there is no such thing as sustainability expertise? If we are convinced that we need people skilled at understanding and employing sustainability principles, we are compelled to return to the very concept of expertise and renovate it to better align with sustainability. Four types of experts seem possible for this purpose: the outreach expert, the interdisciplinary expert, the meta-expert, and the civic expert. Each makes different contributions to resolving the dilemma of applying technical expertise to sustainable development.

### The Outreach Expert

One response to the eroding credibility of technical experts has been to call for a more “informed” and “scientifically literate” public. The movement behind this idea is frequently referred to as the “public understanding of science” where the intent has been to improve the communication of scientific and technical knowledge to the public and to “educate” the citizenry about the primacy of technical knowledge (see Wynne, 1995). Jamison (2005) argues that “using science and technology appropriately means, for one thing, that we know how to talk about it and that we have what might be called a collectively shared understanding of the relevant science or technology, that is, that we are scientifically literate.” One model of imparting scientific and technical expertise on the public is the science shops in the United Kingdom, the Netherlands and other European countries (see Irwin, 1995). The concept has also been translated into the practices of several universities such as the Open Universities in the United Kingdom and the Netherlands where it emerged as the “outreach model.” Here, outreach is interpreted as “the provision of information or services to groups in society who might otherwise be neglected” (MSN Encarta, 2005). This model implies, then, that the university as repository of wisdom reaches out to those in need of knowledge and fills their empty jugs with the enchanting elixir of knowledge. This approach to improving the relationship between techni-

cal experts and the general public is illustrated in Figure 1.



**Figure 1** The outreach expert imparts scientific and technical knowledge to the general public.

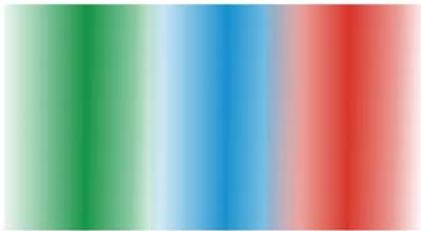
Undoubtedly, the effective dissemination of technical knowledge is important to rebuilding trust between the techno-scientific community and the general public. However, the outreach-expert approach has significant shortcomings. First, it does little to address power differentials between experts and non-experts, and instead adheres to the “sage on the stage” model of modern scientific and technological development. It reinforces paternalistic, modernist modes of technological development. Thus, this approach can be seen as token reform because it solely emphasizes the need for the public to better understand technical expertise while leaving expert practice unchanged. Furthermore, it implies that the public, through its ignorance, is largely to blame for scientific and technical failures. The program of fostering outreach is also apt to exacerbate the divide between experts and non-experts. Suffice it to say, an increase in expert-knowledge dissemination is not *per se* a complete solution to tackling sustainability, but, done properly, can effectively communicate scientific and technical knowledge, a crucial component to resolving the tensions between expertise and sustainability.

### The Interdisciplinary Expert

Another option for accommodating and aligning technical experts with the discursive, political nature of sustainable development is to increase the permeability of disciplinary boundaries. This proposition addresses the lack of communication among technical experts, colloquially referred to as the “disciplinary silo effect.” Particularly in large universities, researchers from different disciplines address similar

problems in parallel, rather than collaboratively, due to restrictive institutional and disciplinary norms.

One suggestion is to foster a more extensive general education program for technical experts, one that recognizes the overlaps between related disciplines and identifies strategies to transcend existing norms that discourage interdisciplinary work. This effect is illustrated in Figure 2 where the interdisciplinary expert blurs the boundaries between scientific and technical disciplines. The aim is not to abandon specialized technical knowledge, but rather to improve the experts' understanding of their roles with respect to other disciplines, particularly where commonalities exist. Undoubtedly, to truly realize interdisciplinary cooperation, multiple barriers need to be overcome, including but not limited to jargon, epistemological assumptions, funding protocols, and the portioning of reputational credit from joint projects. For example, the politics of "units of assessment" (UoA) of the UK research assessment exercise (RAE) creates disincentives to collaborate across disciplinary boundaries. The work of every researcher in the country has to be allocated to one of the 67 subject-based UoAs and critics argue that this mechanism poses problems for the practice of interdisciplinary research—although the responsible organization denies that this is the case (HERO, 2002).



**Figure 2** The interdisciplinary expert blurs the boundaries between scientific and technical disciplines.

An example of the benefits of interdisciplinary cooperation can be seen in the Belgium city of Hasselt, located seventy kilometers east of Brussels. Severe traffic-related problems triggered an engineering proposal to build a third-ring road around Hasselt to divert traffic from its historic center. The city council, however, ignored the proposal and instead narrowed the traffic artery in the inner city, increased public-transport services eightfold, introduced a five-minute interval on select bus routes, built several miles of new bicycle lanes and guarded bicycle sheds, installed showers for cycling commuters, storage facilities for pedestrian shoppers, and heated waiting rooms for bus passengers, planted hundreds of trees along the main pedestrian-access routes, es-

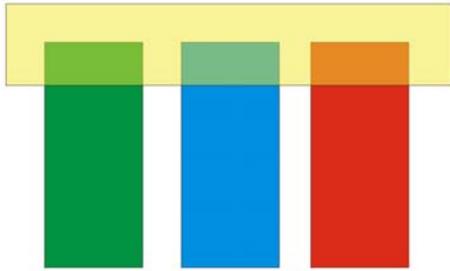
tablished bicycle pools in which adults volunteer to accompany children from their residential neighborhoods to school and granted a bicycle bonus to employees who cycle to work (see Brand, 2005a). In sum, the approach included "hard" infrastructure measures and "soft" solutions that, in combination, created a successful new transportation strategy on multiple levels. One of the people involved in designing these integrated solutions explicitly distinguishes the chosen strategy from the initial proposal. This respondent contended that the authors of the initial plan "made the mistake of only looking at the 'engineering' side of it...[For me] the success of the Hasselt project is all about a combination of measures, definitely not only by engineers: engineering, mentality, environment, city building, social issues, communication" (Moerkerk, 2002).

Similar to the previous notion of the outreach expert, the interdisciplinary expert has merit but again, fails to question the notion of a core element of expert knowledge—if the problem is not within one's own discipline, it at least should be within the confines of the alma mater. In other words, improved communication, understanding, and collaboration between disciplines do nothing to challenge the boundary between experts and non-experts.

### ***The Meta-Expert***

Taken to its extreme, the preceding notion of the *interdisciplinary expert* begins to resemble an entirely new class of expert that we label here the *meta-expert*. The role of the meta-expert is to juggle the sundries of multiple technical knowledges and, in effect, to act as a broker of expert knowledge. The meta-expert is a generalist with a clear understanding of what specific disciplines can and cannot contribute to problems of sustainability. Understood in this way, meta-experts have not only the license but also the remit to "pick cherries"—they are officially approved "eclecticists" who have the skill to translate across different clusters of expertise. We can graphically illustrate the meta-expert with a transverse beam across different disciplinary silos (see Figure 3).

Meta-experts adhere to the ontological assumption that sustainability is neither a "problem of simplicity" nor a "problem of disorganized complexity," but rather is a "problem of organized complexity" in the sense described by Jacobs (1961). Under the first assumption, cause-and-effect chains can be fully explained, and thus solved, by formulaic management rules; under the second, these chains are too complex to be fully described and can be tackled only with stochastic evaluations of previous interventions. In contrast, a problem of organized complexity consists of patterns that can be understood—albeit not by a sole individual. Instead, organized complexity necessi-



**Figure 3** The meta-expert bridges scientific and technical disciplines

tates the pooling of understandings and knowledges to develop a shared asset base. It acknowledges that all types of experts are needed, as well as individuals who can weave these strands of thought together to construct the *whole*. This does not imply that the “weavers” know the *whole*, but they should be able to identify potential linkages and facilitate their co-discovery.

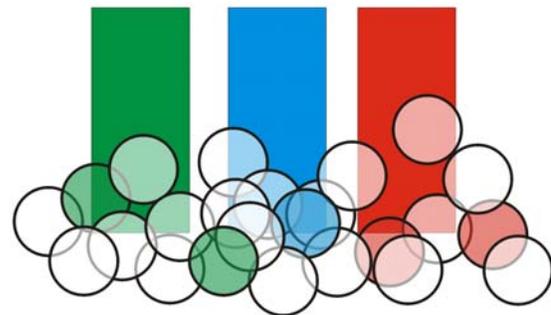
An example of the meta-expert can be found in sustainable building practices that have emerged in the United States, the United Kingdom, and Northern Europe during the past decade. The sustainable building expert juggles the multiple strategies of sustainable building (e.g., energy efficiency, materials selection, indoor air quality) to create a coherent set of interrelated goals for a particular project. Such an individual is not expected to have in-depth expertise in all the technical disciplines related to the project, but rather should understand the interrelationships among the different sustainable strategies and the overlapping responsibilities of each team member. In other words, the sustainable building expert recognizes that sustainability strategies are typically multivalent, with numerous implications for the project as a whole.

Other disciplines have also anticipated the need for meta-experts to manage sustainability activities and have perceived their members to be intimately qualified for this brokering position. Cliff Hague (1997), former president of the UK Royal Town Planning Institute, argues that planners are reasonably well equipped to play this role because “town planning...has [always] prioritized synthesis over analysis. Planners have been magpies across the disciplines, picking relevance where they found it.” One could also imagine that public-policy experts, sociologists, anthropologists, and geographers would be particularly appropriate for such roles.

### *The Civic Expert*

So far, our proposed renovations to the model of expertise are advantageous to its traditional counterpart because they increase communication and collaboration among experts or improve communication to non-experts. However, none of the models systematically challenges the privileged status of expert knowledge or attempts to engage in a substantive manner with non-experts. What is missing until this point is the idea of *listening* to so-called non-experts. Brand (2005b) describes such individuals who are familiar with everyday practice as “the ultimate experts in user behavior.”

A fourth model we refer to as *civic expertise* entails listening to and engaging with citizens to take advantage of their experiential knowledge and to inform technological and scientific development (see Figure 4). Sclove (1992) notes that the participatory model of expertise highlights the social contingency in technological endeavors, elicits critical reflection on social circumstances and needs, and allows for the recognition of non-focal technological consequences. Schot & Rip (1996) refer to this process as “second-order learning” that involves critical reflection upon the assumptions that underpin the pursuit of factual and technical first-order learning. In other words, the involvement of citizens in the design of technologies can broaden the traditional expert approach by not only asking *how*, but also asking *why*. The model of *Mode 2 Science* as proposed by Gibbons et al. (1994) addresses this challenge of involving users as well as researchers through *trans*-disciplinary endeavors. Only through such participatory, discursive, and multifaceted approaches can science become “socially robust” and accountable (Nowotny, 1999). The civic-expertise model is therefore the point where practical considerations about the feasibility, acceptability, and efficacy of technological interventions for sustainable development converge with the normative call for the democratization of technology



**Figure 4** The civic expert encourages deliberation between experts and non-experts.

(see Sclove, 1995; Fischer, 2000). The civic expert relies on the notion that “the rules for [the] *production* of scientific knowledge will have to change in order to enact civic science” (Bäckstrand, 2003, emphasis added).

A number of promising techniques have been developed to foster deliberation between technical experts and the general public, including constructive technology assessment, strategic niche management, citizen panels, and the *L’Epreuve* initiative at the University of Lausanne.<sup>7</sup> The intent of these experiments is to open policy-making procedures to actors other than technical experts by including citizen voices in scientific and technological debate (see Rip et al. 1995).

This discursive model of technological development is perhaps the most ambitious option due to ingrained power relations, a lack of commonplace practices, and inexperience at deliberation among all individuals, experts and non-experts alike. It is no coincidence that more democratic forms of technology development have emerged in political cultures such as Denmark, the Netherlands, and Germany that are sympathetic to the notion of increased citizen participation in political decision making. However, even in these countries, participatory technological policy making is an exception to the rule and their experiences highlight the challenges to expanding the number of voices in technological decision-making processes.

Democratic deliberation, in effect, requires that all participants, both experts and non-experts, take citizenship seriously because technologies constitute states and societies (Sclove, 1995; Barber, 2004). The ultimate benefit of the civic-expert model and increased input from non-experts is the potential for better decision making via the “intelligence of democracy” (Lindblom & Woodhouse, 1993). Searching for agreement among multiple stakeholders allows consideration of diverse opinions and extends the simple notion that “two heads are better than one.” This makes the civic expert uniquely suited to tackle what we described above as a practical problem of conventional forms of expertise, the “stochastic effect of harnessing the creativity of thousands of individuals.” As such, the civic expert recognizes the polyvalent nature of technologies and enlists all stakeholders in the process of characterizing and considering a technology’s social implications (Sclove, 1992).

<sup>7</sup> See Labo “L’Epreuve” at <http://www.unil.ch/interface/>

## Conclusion: Synthesis of the Expert Models

What, then, should we tell our students who ask for advice on becoming sustainability experts? Should we portray their career goals as a *sui generis* new role in yet untouched areas of the social, cultural, technical, political, and academic landscape? Alternatively, should we mumble something about the concept of the “sustainability expert” being an oxymoron and, instead, encourage them to learn as much as possible of what their respective disciplines have to offer to discourses on sustainability? Or should we urge them to “pick cherries” of relevance wherever they find them, irrespective of their disciplinary allegiance? We believe that it would be best to present the idea of an *ecosystem of expertise* where different niches need to be filled—and no one can fill all of them. The goal is to define our individual roles in ways that take advantage of our strengths and, thus, we have to train and encourage our students to find and vitalize their individual niches.

None of the above models alone is sufficient to tackle simultaneously the ontological and epistemological problems, the power issues and practical difficulties regarding expertise and sustainability. But there are clear merits in each approach. We argue that the most viable way forward is to attempt to embrace all of the models, as illustrated in Figure 5. The importance is not in determining which approach to expertise is most effective at creating more sustainable societies, but rather how each of us can best orient our work towards one or more of these models.

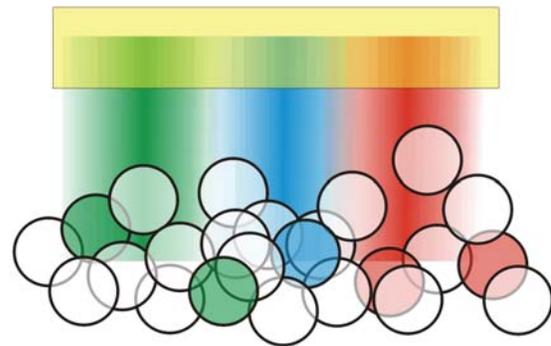


Figure 5 The ecosystem of expertise.

However, we would like to issue two general pieces of advice to anyone who intends to play a role in the ecosystem of sustainability expertise, regardless of which niche he or she inhabits. First, it is important to maintain a bird’s-eye view on the whole system and to resist the temptation of adopting old (or new) exclusivity claims. Only if we are aware of the importance of different niches will we appreciate

and seek strategic collaborations with them and respond productively to their invitations. The second piece of advice is to lobby for the dissolution, or at least the lowering, of institutional barriers that inhibit multi- and trans-disciplinary collaboration. The first point is an individual agenda, the second a political one.

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