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I would like to start with a question: did you know that you can get depressive from working on the Internet? It was an item in a number of Dutch newspapers. I did not actually read the item myself, but people told me about it. And now I am telling you.

Clearly, knowledge from research is utilized here, but not in a straightforward, instrumental way. This introductory example may be anecdotal, but readers will recognize it as something which happens all the time - and which may be more important than direct utilization. In other words, the utilization of research results is diffuse: it contributes to a repertoire of orientation in the world, of signals to take into account, in addition to the more recognizable production of specific knowledge with an instrumental function. This is not limited to ordinary citizens drawing their information from newspaper items or hearsay. Scientists, when questioned about the sources of knowledge about new developments in their fields, put professional magazines rather than scientific journals up front, and are interested in non-professional reporting about science as well.

If uptake and utilization are diffuse, people will often not realize where they got their knowledge from. The head of the Criminological Research Unit at the British Home Office (a member of an Economic and Social Research Council working party on the impact of social research) told of administrators coming up with bright ideas which they considered to be their own - but which were actually traceable to research from the Unit.

What these examples indicate is that knowledge utilization does not occur as tidily packaged bits of knowledge being transmitted, and then recognized for their value and taken up in policy and practice. It is, to use Carol Weiss' phrase, 'knowledge creep'. And its complement is 'decision accretion', the gradual accumulation of bits and pieces (including orientational and instrumental knowledge) which prepares the ground for what is then stamped as the official decision.

What I am trying to demonstrate is that the utilization of knowledge in policy (and in practice) is not a singular relation between an identifiable knowledge source and another identifiable decision in the world of action. These are really the tips of two icebergs - which may actually be linked underwater. To understand what is happening, one has to know about these icebergs and their linkages.

Complexities of knowledge transfers

We should add to this the distance between research conducted in relative isolation (in laboratories and institutes, and often in donor countries rather than developing countries themselves) and the practices of actual and potential users. A complex picture emerges of precarious linkages between various practices - of research, of policy-making, of local practices and the knowledge production involved. This is shown in diagrammatic form in figure 1.

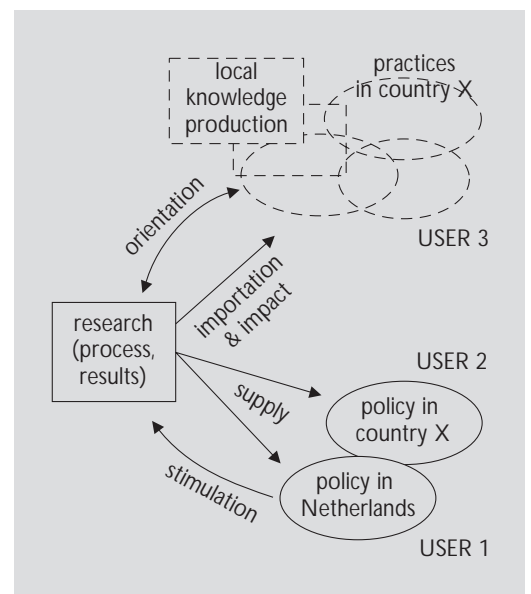


Figure 1: Transfers of knowledge

Research, in the way it is conducted and in the form of its results, may well orient itself to the issues and problems important in a specific country (country X), but will have, almost by its nature, a certain distance from local practices. It is policy-makers and their staff who are the more accessible users (in the Netherlands, the users of such research are interested in eventual utilization in policy and practices in country X). Local practices are then a reference point, rather than locations of uptake. Research results may be transported into such practices, and have impacts, but the projected beneficiaries will not necessarily be happy about it.

This is a brief, much too brief, sketch of a complex set of interrelated problems. Figure 1 also shows that there are gaps and/or tensions: between the policy level (with users 1 and 2) and the practices in specific countries (with users 3), and between established modes of research and local knowledge production. Both types of gaps are now recognized for what they are, but there are no easy solutions.

As is well known, there are communication problems between (established) knowledge producers and policy-makers, and in another vein, with local practitioners. In the literature, these problems are often characterized as a 'two communities' problem: researchers form a community of their own, with its own language and rationality, which is different from the community of policy-makers (or of practitioners). While the diagnosis is correct, the commonly proffered solution, better communication, is insufficient.

It is insufficient on two counts: communication is not ad-hoc, but requires a communicative infrastructure; and (cognitive) translations between local and general are necessary. Research findings always aim at a certain generality: of methods which are applicable in a number of cases, of results which are valid for a larger domain. This is what makes research findings interesting and applicable in other cases elsewhere. Utilization, however, is concrete and locally specific. Thus, utilization requires translation: cognitive translation, to a form and a content which is applicable, and social translation, from the locus of production (or storage) to the locus of utilization. Locally specific research tries to include these translations in its design and its ongoing work, but will still be linked with more general, cosmopolitan achievements through its use of general methods and skills of the researchers.

Effective communication requires ongoing interaction and trust, as well as relevant infrastructure. Examples are collaborative networking (if the right capacities are there), partial codification of knowledge, and people (embodied knowledge) moving about.

Modes of knowledge production

The utilization of knowledge must be seen as a double translation: at the site of knowledge production, translation from local to general, and after transport of the knowledge, adoption and adaptation, the translation of the general to the specific. The transformation of local experiences to findings with a cosmopolitan status is an essential ingredient of the scientific mode of knowledge production: it is the basis of scientific claims of universal validity. I am introducing the idea of 'cosmopolitan' here to refer to the circulation of what originated as local knowledge and having some validity in other places and times, without having to assume its inherent universality. Such transformations are not limited to the specific mode

of knowledge production of modern Western science.

Professional forms of knowledge are one example, while craft knowledge and folk knowledge can also fall under this rubric.

The local-cosmopolitan combination typical for modern (Western) science is often seen as the answer to the challenge of creating cosmopolitan, transportable knowledge, where the ascent from local to cosmopolitan is what counts. As practitioners of science very well know, this requires interaction and infrastructure (from visits to other laboratories, partial standardization of conditions to improve replication, to codification of measures and protocols), and the utilization of such cosmopolitan knowledge is conditional on the existence or build-up of the relevant infrastructure. The ideology of universal knowledge claims and the generalized applicability of modern (Western) science neglects what happens locally, however. This is already a problem for Western science itself because the quality of cosmopolitan knowledge depends on what happens in the local situation. An additional problem is that the return route, from the cosmopolitan to the local, is seen as unproblematic (because whatever has become cosmopolitan must be good, so that any problems must reside in resistance of the local to the good message from the cosmopolitan). In other words, the translations necessary to return to the local are neglected as epistemic challenges in themselves.

The translation back to the local is easier if the context in which research results are taken up resembles that of the research process. The controlled conditions of production in chemical plants, for example, as well as the chemical specification of the feedstocks, allow the easy transfer of laboratory findings to chemical production practices. But this is a historical achievement, based on a variety of efforts (partly driven by economic and political circumstances) in the late 19th and early 20th centuries. And the achievement depends on the transformation of industrial practices, to make them more like the controlled experiments in laboratories. A similar trend is visible in agricultural research, where the applicability of experimental studies is predicated on the transformation of agricultural practices, and of the land itself, into something resembling laboratory conditions. Seen in this way, there are clearly advantages (productive set-ups) and disadvantages (distortion of earlier practices, the neglect of side-effects).

Thus, there is a colonial element in utilization of research, if the original context of knowledge production dictates the circumstances of its application. This is not intended as a blanket indictment, however: colonialism had its positive side. But it leads to unnecessary neglect of the knowledge accumulated in local practices; transfer of knowledge is never from 'full' to 'empty'. To provide a balanced view, I would like to introduce a typology of modes of knowledge production which become independent of local practices and then have difficulty in linking back to them (see figure 2).

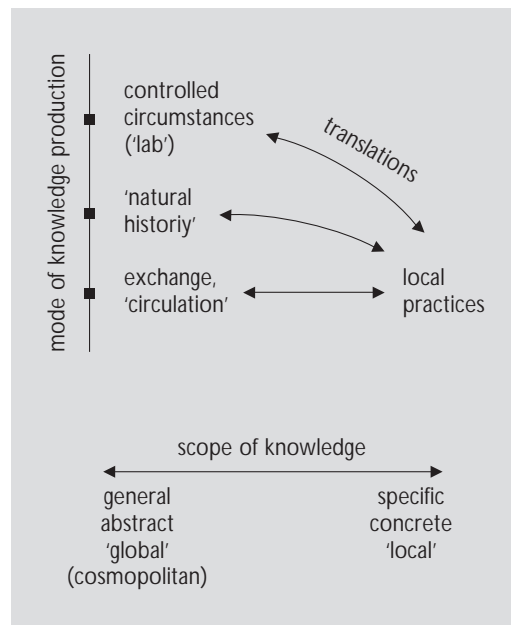


Figure 2: Modes of knowledge production

The sketch in Figure 2 could be filled out further, but it is sufficient to understand the examples of the chemical industry and agriculture which I mentioned above. It could also be applied to the tensions between practical medical diagnosis, clinical research (an attempt to transform the pattern knowledge produced in the natural history mode to experimental knowledge with the help of clinical trials) and so-called pre-clinical research in the experimental approach predominant in natural sciences.

When the local situation and its complexities are given precedence, the drive to change the world so that it resembles the laboratory has to be reversed. For the philosophy of knowledge, as well as for practitioners of various kinds, the challenge is then to make natural-history modes of knowledge production more robust without going in the

direction of experimental, laboratory-based science, with the consequent distance to other types of local practices. As the philosopher Ian Hacking has phrased it: experimental science is lab science, and can tell us a lot about the lab world. The complexities of the world outside the lab may well be outside its reach. The movement for evidence-based medicine, and the second thoughts about its actual scope which are being voiced recently, provides a useful example, and one that can be recognized in the reflections on transfer of modern scientific insights into local practices in less developed countries.

Replacing the linear model

My arguments for considering two-way traffic in modes of knowledge production rather than the top-down elaboration of lab-based experimental research have focused on the cognitive or epistemic issues. There is a sociological component as well, and I would like to highlight one key element by discussing, what is called the linear model in innovation studies and science policy studies. The linear model suggests that the dynamics go from a source (new knowledge, new options) through its elaboration to eventual adoption, diffusion and effects. The top-down model is a version of the linear model because it says that one can transfer only by somehow transforming the complexities of the situation so that the cosmopolitan knowledge becomes applicable. (It does, however, make explicit the work necessary for utilization).

As sociological and management studies have shown abundantly, the linear model is really an extreme case of a more general, interactive model. I add the dynamics of cosmopolitan knowledge production to the interactive models in the literature, which results in a three-part interactive model, as visualized in figure 3. Each part indicates typical activities, which are linked through a diffuse 'reservoir' at a more collective level. This linkage-through-reservoirs can be short-circuited in strictly goal-oriented research, and in dedicated applications, to a quasi-linear model, but even then there will be spin-offs into the reservoirs.

In the first part of the model, the activities are oriented towards research agendas and resource mobilization. There is negotiation on the market of promises and options, very visible in the world of strategic research, but always present. The effect is that a repertoire of anticipations (about the relevance of various research projects and directions) emerges and is continually added to.

This repertoire provides feedback to the strategic decisions of scientists, the sponsors of science and, increasingly, prospective users and beneficiaries (cf. the mutual orientation of (separate) research and local practices, indicated in Figure 1). Explicit priority setting for research occurs against this background, and is actually successful only when it accommodates itself to the repertoire or consciously orchestrates a change.

The activities of knowledge production in the second part of the model are not limited to the creation of packaged research results on the basis of laboratory or fieldwork. There is already some communication with trusted assessors, with comcolleagues (competing colleagues) who may be the reviewers of the research results etc. There may be immediate, 'linear' uptake in practice, but the general effect is an addition to what has been called 'the pool of knowledge' - in which others (researchers, practitioners, journalists) can fish.

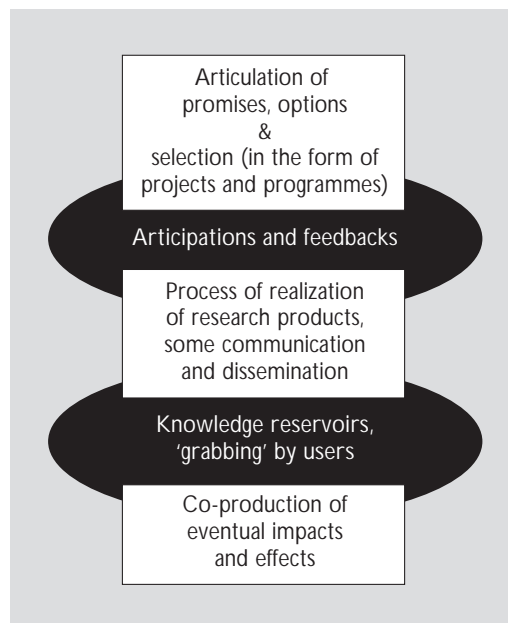


Figure 3. Three-part interactive model

The various and overlapping knowledge reservoirs are accessible to different potential users in different ways, in terms of their absorptive capacity and competencies for translation which I discussed above, and for other reasons. Still, whatever utilization occurs in the end is not a matter of the force of the research results, but of how users 'grab' items from the knowledge reservoirs and combine them for their own purposes. They are agents, not patients.

The third part of the model relates to the activities which turn a novel combination of knowledges into a going concern, as part of practices, as a component in a successful innovation, as an element in decisions and their implementation. This is how the effects originally promised are actually realized. As I emphasize in figure 3, such effects are co-produced, and the attribution of impacts to sources (causes) within the world of science is indeed the result of a struggle to apportion praise and blame. Jerry Ravetz once noted: 'Science takes credit for penicillin ... but Society takes the blame for the Bomb.'

In conclusion

The key points in this brief sketch of a perspective based on insights from the sociology of knowledge are the emphasis on activities (also on the part of prospective users), on the work that must be done to transport and translate knowledge between practices, and on the cosmopolitan character of knowledge (or better, a cosmopolitan-local aggregate); and the function of repertoires and reservoirs which undermines any simple linear picture.

The current striking, and increasing, role of information and communication technologies will be embedded in these interactions and patterns and derive their effects from them. They will also modify them, for example when databases and geographical information systems (GIS) require sharper definition of categories (an 'ontology') at the cosmopolitan level.

This last example is interesting also for the issue of combining distantiated research and local, perhaps traditional, knowledge production. In a number of examples, one sees GIS and other databases taking up local data of a natural-history type, and sometimes modifying categories or even rules to suit local and traditional usages. This shows that the combined, syncretic use of knowledge produced in different practices and following different modes is possible if adequate structuring is developed. This might well be an important cognitive challenge for issues relating to utilization of research.

The other main challenge is to increase the capacities and underlying competencies of local actors to access knowledge reservoirs and 'fish' in them productively. Development aid, whether to less developed countries or in the form of scientific education and public understanding of science in

the own country, has a built-in asymmetry. This may be acceptable in so far as the knowledge on offer is indeed relevant to the local situation. But this is not automatic, and it requires active participation from the local situation to realize its promise. We might then also accept other promises and claims, deriving from the local situation, as legitimate in principle.

These points about utilization of research cut across the present policy emphasis on research being oriented to use and users, and showing its 'performance' in this respect. There might be

occasions where such policy pressure has a function, when earlier ways of conducting research have to be changed. But there is a definite risk: a continuing pressure of this kind will linearize interactive practices and limit the scope of the research, as well as the variety in uptake by 'fishing' in knowledge reservoirs. Instead of research becoming more directed (and thus directive with respect to local practices, because it must prove its usefulness), I emphasize the proactive role of the user, and the necessary competencies to go with it.

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