Alternative technology niches and sustainable development

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Executive summary

This paper contrasts two niche-based approaches to sustainable development, both recommended for greening technology systems. One is new, the other is old. In fact, a gap of thirty years separates Strategic Niche Management (SNM) from the Alternative Technology movement (AT), yet both share a niche-based perspective on change. Their core approach is to generate knowledge and disseminate lessons about sustainable technological practices through innovative, bottom-up activities. The ambition for both is to seed a sustainable transformation of incumbent technological regimes. SNM proves to be more managerial in its approach; while AT conceptualises niches as a much more grassroots activity. This reflects their different histories. Comparisons between the two uncover some fundamental issues regarding alternative technology niches and sustainable development.

Keywords

Alternative technology; strategic niche management; grassroots innovation; sustainable development; technology policy.

Introduction

‘Policies for science and technology must always be a mixture of realism and idealism.’

(Freeman, 1991)

Recent social science research concerning innovation and sustainable development can be classified into related areas of work: cleaner technology (e.g. Howes et al., 1997); and systems innovation (e.g. Hoogma et al., 2002). Cleaner technology research tends to analyse the development of individual technologies whose throughput of energy, materials and contamination is lower per unit of output. Questions regarding the innovation of systems tend to shift attention upwards, towards the transformation of entire ‘socio-technical regimes’ into more sustainable forms (Berkhout, 2002). Cleaner technology research might, for example, look at greening individual farming techniques.
Systems innovation seeks to understand the transformation of entire food production systems into more sustainable ensembles.

One body of work prominent in recent systems innovation debates has been Strategic Niche Management (SNM) (e.g. discussions and papers under the auspices of the BLUEPRINT network of systems innovation researchers).\(^1\) SNM involves the planned creation of novel ‘socio-technical’ niches. Advocates argue that the knowledge created by these experimental niches can subsequently seed the transformation of the relevant technological systems. The key task for this paper is to contrast SNM with another niche-based approach to transforming technological regimes, namely the Alternative Technology (AT) movement, which flourished in the 1970s. Unlike SNM – in which academic research recommends an approach for technology policy-makers – the AT movement involved activists seeking out more sustainable ways to live with technology. Activists were grassroots innovators,\(^{ii}\) in the sense that they sought sustainable technological transformation through community-based action. This history suggests that niche-based approaches to transforming technology systems may not be as novel as is sometimes supposed. Indeed, by drawing comparisons and making contrasts between SNM and AT perhaps some more enduring and fundamental issues can be drawn out about sustainable niches.

Dunphy (1996) has suggested, in the context of approaches to organizational change, that comparative analysis be drawn using five elements: 1) the basic metaphor for the organisation; 2) the analytical framework for understanding change processes; 3) the ideal model of an effectively functioning organisation; 4) a theory of how best to bring the organisation closer to the ideal; and 5) identifying the change agent. This check list suggests comparative analysis must consider the way a problem is understood, the change objectives, and the model of change pursued. Such comparative analysis is strengthened when we place each approach in its social and historic context. A gap of 30 years separates academic/policy-oriented SNM from activist/community-based AT. Analysts must be sensitive to such differences in circumstance. Only then can comparison begin to identify more enduring, fundamental challenges confronting niche based approaches.

Given these methodological points, SNM and AT are compared along three common dimensions in this paper - origins, objectives, and model of change – beginning with SNM. SNM is illustrated in the case of Danish wind energy. SNM cites this as exemplifying how policy-makers can help nurture sustainable niches. It is relevant to this paper because it is also an AT success story, and so acts as a bridge between the two approaches. Comparisons between the two are discussed after a section analysing AT. The paper concludes by considering the implications of the analysis for niche-based research and practice in sustainability.

**Strategic Niche Management**

SNM has been promoted since the late 1990s (Kemp et al., 1998; Weber et al., 1999). Work has been conducted in several areas, including transport, energy, and wastewater. Many of these are *ex post* analyses in which a SNM interpretation is made for the success or otherwise of experiments in sustainability (success being niche growth, branching and
influence upon the incumbent technology system). SNM is, however, proposed as a forward-looking policy approach. As such, it has been discussed in a Working Paper by the Science & Technology Foresight Office of the European Commission (von Schomberg, 2002). The Dutch government is beginning to incorporate it into its technology policy (Hoogma et al., 2002; Rotmans, 2003).

Origins

A number of researchers have contributed to the intellectual development of SNM. While researchers from several European countries have been involved, many of the seminal ideas for SNM came from the Netherlands (e.g. Kemp et al., 1998; Kemp et al., 2001). Collective research experience in a number of areas was drawn upon. These areas include evolutionary approaches to innovation, Constructive Technology Assessment, and sociological studies of past transformations (e.g. Kemp & Soete, 1992; Shot & Rip, 1997; Schot, 1998; Geels, 2002). Thus ideas about socio-technical regimes and trajectories, the value of widening participation in innovation, and the role of niches as crucibles for change are all present in SNM.

SNM injects normative purpose by conceiving niches as a compass for guiding future regime transitions in sustainable directions. Given its intellectual heritage, SNM understands technology in a sociological sense. It argues discussion of technology must include relations between the hardware/technological artefact and the software/social organisation that enables the overall ‘socio-technical configuration’ to work. Technologies are shaped by society (the knowledge, values, skills and resources of the societies producing them); whilst, at the same time, technologies shape society.

The term ‘socio-technical regime’ captures this co-evolutionary perspective. A regime is the set of ‘rules of the game’ which guides the direction of technological innovations for meeting human needs, such as the fossil-fuel-based regime currently dominating energy. Socio-technical regimes tend to filter expectations and constrain the realms of the realistic. Innovations consequently follow a trajectory set by the regime, both of which are sustained by social processes and institutions. A socio-technical regime includes, by definition, both a narrow element associated with engineering routines and knowledge (Nelson & Winter, 1982), and a wider element associated with the social context in which the technology is customarily used (Rip & Kemp, 1998). Therefore, analysis of regimes should include: technology; user practices and application domains; symbolic meanings of technology; infrastructures; industry structure; policy; and knowledge (Geels, 2002; Schot, 1998).

Objectives

The key objective for SNM is to transform regimes in accordance with a sustainable development ‘vision’. Transformation results in a new selection logic and innovation trajectory (e.g. greater stress on environmental criteria). New incentives, social organisation and consumption patterns must interact with the innovation of technological hardware in order to make this transition (Kemp et al., 1998: 184). Strategic niches are
sites where these new rules can develop. As we shall see, these broad ambitions are not too dissimilar to those of AT activists thirty years ago. There is a difference in the expected pace of change. Where SNM anticipates an evolutionary process of transformation over many years, led by government and business; AT perceived the imminent ecological crisis (e.g. *Limits to Growth*) as demanding revolutionary change.

The SNM literature does not provide a single, precise definition of what a sustainable regime will look like. It understands sustainable development in a very broad sense: concerns for intergenerational justice; trade-offs between economic growth and environmental sustainability; more equity within generations; and society, government and business working longer-term (Hoogma et al., 2002). This sits a little uneasily with the SNM requirement that a guiding consensual ‘vision’ be the basis for building coalitions of support for niche experiments (Berkhout et al., 2003). In practice a vision for sustainability is inevitably and implicitly present in the way the niche is configured.

Model of change

Historically, innovative socio-technical configurations that regime transformations are understood to begin as novel niches, emerging at the margins of the incumbent, mainstream regime (Kemp et al., 2001). The transition from sail power to steam power in maritime shipping provides an archetypal example (Geels, 2002). This long transition process required the perfection of steam ship technologies. It also needed infrastructure change (a network of coal stores at ports suited to take the new boats), as well as new skills, and novel organisational routines (amongst other social innovations). Early steam technology could not compete with sail ships, and a niche role as tugboats proved important in developing technology use. The steamboat niche grew into other areas as the socio-technical configuration improved: mail shipments, and then into the new, higher value market of transatlantic passenger shipping. Ironically, sail ships retreated into a niche shipping coal to the global network of depots for steam ships (Grübler, 1990). Eventually the performance of steam became sufficiently attractive to compete in markets shipping lower value bulk goods (Geels, 2002).

Historical examples prompted SNM advocacy of the purposeful nurturing of niches. Whether such niche-based transformations are universal historically or not is not the point. Rather, it is the case that a niche-based model has inspired the SNM advocacy for purposive transitions in socio-technical regimes.

‘The introduction of novelty has been studied in great detail. However, the adoption of novelty is decisive for society, not its introduction. Adoption is an active process, and has elements of innovation itself. Individual behaviour, organisations, and society have to rearrange themselves to adopt, and adapt to, innovation. In this sense, the introduction of a new technology is an unstructured social experiment.’

(Rip & Kemp, 1998: 338).

SNM is an attempt to help adoption. Lessons learnt from niches will enable sustainable socio-technical configurations to breakthrough and become mainstream practice. The
literature is at pains to point out that niche experiments that fail to grow and branch nevertheless succeed in generating useful experience. Little is wasted in their probe and learn strategy (Hoogma et al., 2002). Two sets of lesson are drawn from the niches, both of which can help advocates promote niche growth and regime transitions.

1. Lessons internal to the niche.

The first set of lessons is internal to the niche: how can the technological artefacts, social practices, and their underlying values, be improved so that the configuration works more effectively? More precisely:

- ‘to learn more about the technical and economical feasibility and environmental gains of different technological options, i.e. to learn more about the social desirability of the options’; and
- ‘to stimulate the further development of these technologies, to achieve cost efficiencies in mass production, to promote the development of complementary technologies and skills and to stimulate changes in social organisation that are important to the wider diffusion of the new technology’ (Kemp et al., 1998: 186)

2. Lessons external to the niche.

SNM recognises that top-down support can provide opportunities for niche growth. After all, it was socio-economic changes (mass migration to the Americas in the nineteenth and early twentieth century) that reinforced demand for regular passenger shipping, and sustained steam technology diffusion. The second set of lessons is consequently more outward looking: which types of institutional reforms can help niche growth? SNM advocates describe the purpose of this set of lessons as:

- ‘to articulate the changes in technology and in the institutional framework that are necessary for the economic success of the new technology’; and
- ‘to build a constituency behind a product – of firms, researchers, public authorities – whose semi-coordinated actions are necessary to bring about a substantial shift in interconnected technologies and practices’.
  (Kemp et al., 1998: 186)

Top-down intervention suggests, as a minimum, a supportive role from policy-makers and/or key economic interests is needed for SNM to succeed. The SNM literature tends to be non-prescriptive on who should actually ‘manage’ niche building. Wide participation is considered important. This ensures a diverse and widely relevant set of knowledge is created through niche learning-by-using, and that this knowledge becomes widely disseminated. The inclusion of groups beyond usual policy and corporate participants in technology policy is intended to move thinking beyond the constraints of the incumbent regime. SNM is the ‘collective endeavour’ of ‘state policy-makers, a regulatory agency, local authorities (e.g. a development agency), non-governmental organizations, a citizen group, a private company, an industry organization, a special interest group or an
independent individual’ (Kemp et al., 1998: 188). SNM is a technology policy approach, however, so government actors would appear, implicitly at least, to hold a key position in niche management.

As we shall see from the AT analysis, some civil society actors hold views on sustainability different to those held by members of incumbent technology policy networks. So whilst government and corporate organisations may appear to hold the ring, they will also need to have carefully thought-through strategies for responding to such diversity. It must be clear to everyone just how responsive different participants are prepared or able to be in the light of lessons generated by the niche, especially the more powerful participants from government and business. There can be limits to the degree to which strategic niche managers can respond to all lessons at any one time. Under which circumstances might a mainstream firm search for lessons from alternative niches? How are such activities brought to their attention? How easy, and by which processes, do these lessons become translated into a form more in accordance with the logic of the existing regime? As niche lessons get adapted, or if the niche grows, so what were once relatively clear distinctions between niche and mainstream may become blurred. This will be picked up in the discussion and conclusion.

An example – the David v. Goliath origins of the Danish wind energy industry

It is interesting that the origins of the Danish wind energy industry is interpreted positively by SNM advocates (Kemp et al., 2001). Wind energy began its international expansion in the early 1990s. The fact that Danish turbine designs could generate 70 to 100 per cent more electricity than competitors, owing to a robust and reliable design (Karnøe, 1996), meant the former were able to lead in the new markets. The Danish wind industry is the world leader, with a turnover of €3 billion, commanding 50 per cent of the world market.iii Advocates of SNM claim this success was due to Danish technology policy evolving an approach similar to their own: supporting bottom-up development in niches; in contrast to the large, technology push R&D projects elsewhere (Kemp et al., 2001; Douthwaite, 2002).

Modern Danish wind began with AT activists experimenting with small turbines in the mid-1970s. These idealists wanted alternatives to the nuclear vision of the electricity utilities. Social networks built up which shared experience in turbine construction and use. The Organisation for Renewable Energy held meetings, and disseminated performance information about different turbines through its magazine Naturlig Energi (Natural Energy). A social innovation – a new form of community-based wind co-operative – facilitated the purchase of turbines for local use, thereby creating a market. Local agricultural machinery manufacturers noticed this niche market, and began manufacturing turbines. In both cases, the designs drew on past, practical experience, and tended to be robustly made owing to the engineering skills and tools available.

The grassroots also lobbied government for support. The (pro-nuclear) electricity utilities needed persuading over the connection of community turbines to the grid. Government support to this effect eventually emerged, as did the creation of a public testing facility for turbine manufacturers at the government’s Risø laboratory. This standardised
practical experience. The well-tested Danish turbines consequently performed relatively well in the Californian wind-rush of 1980 to 1986. Policy support was by no means easily forthcoming, but what support there was seemed to help the niche. Indeed, learning-by-doing improved reliability and performance to such a degree that the government announced investment subsidies for turbine installations. This made it easier for wind cooperatives to purchase and install grid-connected turbines, and so helped sustain home markets through an international retrenchment in the late 1980s.

Today, the early 20-30 kW machines do not compare with modern 1-2 MW turbines. The industry has come a long way from the back-yard idealists. However, analysts argue policy support for grassroots innovation placed the Danish wind industry onto a favourable development trajectory. Policy for wind energy in other countries focused R&D around big, high-tech projects (MWs). This accorded with the prevailing regime for centralised electricity generation. While these projects contributed to wind energy science, all were practical failures. None were robust and reliable. The relatively simple, extensively road-tested Danish design performed better (Jørgensen & Karnøe, 1995).

What is apparent is how (unwittingly, perhaps) policy-makers acted as strategic niche managers. Unsurprisingly, this case has been used to exemplify SNM:

‘From the perspective of regime management, the Danish policy is very interesting. It confirms our model of technological transitions about the importance of the coincidence of successful niche policies against the backdrop of changing regimes. It also shows the importance of learning, the creation of new actor networks, and changes in the institutional framework. More importantly, it demonstrates some of the advantages of a flexible, sequential policy aimed at modulating the dynamics of socio-technical change into socially beneficial directions and using windows of opportunity within the evolving dominant regime.’

(Kemp et al., 2001: 287)

It is also a case whose roots lie in the AT movement. Here is a direct link between the two approaches. What SNM considers an exemplar, is considered a success story in grassroots innovation (Douthwaite, 2002). It was AT idealists opposed to nuclear power who seeded the billion-euro export-industry of today.

The Alternative Technology Movement

The AT movement flourished in the 1970s. A 1979 survey by the OECD Development Centre found 388 organisations from 79 countries were active in AT (Jéquier, 1979). A follow-up study in 1984 added 316 organisations to the list (in 90 countries) (Jéquier & Blanc, 1984). Just Faaland, President of the Development Centre, wrote how AT ‘was no longer the preserve of small marginal groups but had become a major preoccupation of national science and technology policy institutions, governmental research centres and private industrial firms’ (Preface to Jéquier & Blanc, 1984). The surveys included organisations with a developing country focus as well as those with a developed country focus. A concern for environmentally harmonious technologies attuned to local needs, and whose control is possible in a convivial, socially-inclusive manner is common to AT
in North and South (Schumacher, 1973). However, the circumstances under which AT sought influence in developed countries contrasted considerably with the situation in developing countries, and the legacy and impacts of each has been different (Willoughby, 1990). AT in industrialised countries is relevant here, with the UK serving as the example.

 Origins

The AT movement was the R&D department for Utopia. It combined the reality of environmental degradation with the idealism of the New Left and counter-culture (Veldman, 1994). Activists were interested in technologies that would serve a society radically different to industrial capitalism (Dickson, 1974). They demanded a transformation of technology systems (and society) into forms that did not threaten ecological catastrophe, and which were much more convivial in use. AT would not be as alienating or soul-destroying to work and live with, compared to the mass production and consumption offered by the large corporations. AT was utopian in the sense that widespread expansion of the niches they created ‘would be virtually impossible within the existing structure of society’ (Dickson, 1974: 99). Might the same be said of SNM?

Today, apart from a visitor centre in Wales (the Centre for Alternative Technology attracts around 60,000 visitors each year), the label ‘AT’ is rarely used. The Alternative Technology Group at the Open University - which was home for some AT movement intellectuals - became the Energy and Environment Research Unit in 1986. What was the Urban Centre for Alternative Technology in Bristol, is now the Centre for Sustainable Energy, with over 30 staff promoting community energy projects nationally. Nevertheless, alternative niches and ideas continue to be (re)created at the grassroots level. Beneath the slow evolution of government and corporate policies for sustainable technology, networks of grassroots innovators continue to create alternatives to the mainstream. Niches exist in community-supported organic food schemes, eco-housing and community energy projects. Not all participants will have heard of AT, nor SNM for that matter, and yet, in their own way, these grassroots innovators reclaim an approach last attempted by AT.

 Objectives

AT was, above all, a social movement, and consequently held a diversity of views together in a dynamic relationship. Consensus over objectives was sometimes present, and at other times not. AT activists were concerned with technology systems in so far as they would facilitate more sustainable communities. In contrast to SNM, some in the AT movement did attempt, however vaguely, to picture their ideal, sustainable vision. This tended to be based on decentralised, relatively self-sufficient communities; in which participatory democracy is widely practised in the management of steady-state economies; and in which goods and services were provided through local production, using low inputs and renewable resources in relatively closed cycles (Ecologist, 1972; Hollick, 1982). ‘The tools and machines required to maintain this alternative would necessarily embody a different set of social and cultural values from those we possess at
present. These tools and machines, together with the techniques by which they are used, form what is generally meant by the term alternative technology’ (Dickson, 1974: 96).

The practical objective of AT was, for example, to facilitate a switch to ‘soft energy paths’ (using diverse, local renewable sources) rather than the ‘hard energy path’ (centralised nuclear energy and fossil fuels) (Lovins, 1976). The gentle features of AT were defined in contrast to the brutish technologies perceived in industrial society: ecologically sound, not unsound; resource efficient, not materials intense; long-lasting, rather than throw away; participatory, not technocratic; supply based upon needs, not profits; using production cycles, not lines; and so on (Clarke, 1973).

Not everyone in the AT movement foresaw such fixed specifications as practicable or desirable (Harper, 1976; Willoughby, 1990). More critical advocates argued that blueprints and lists were misguided. Wind-pumps were of little improvement if they were still used, say, in the profligate over-abstraction of water resources from finite aquifers. Decentralisation without limits might be just as inappropriate as growth without limits. The smelting of ores into metals, and the production of items such as light bulbs, screws, spectacles, cement, and so on, might simply be better performed using mass production techniques (Harper, 1976). The focus on the small-scale, non-complex, and so forth ‘tends to bias the outcome of the inquiry in advance’ (Winner, 1979: 83).

At this point in the debate, alternative principles for technology choice, and ensuring their appropriateness for specific social and environmental circumstances, became the objective for AT (Willoughby, 1990). Indeed, it is these critical AT principles, rather than AT artefacts per se, that still strikes some resonance for today. We continue to grapple with principles for economic and ecological balance, and forms of socially responsible production. Questions keep being raised about received wisdom, such as ‘economies of scale’ and narrow conceptions of ‘economic efficiency’. In this light, AT contributed to ‘the awakening of a widespread realization that technology is a controllable force for human betterment, rather than an autonomous juggernaut’ (Hollick, 1982: 226; see also Winner, 1979). So the common objective of the AT movement was to transform technology use into a strong form of sustainability. Precise strategies were shrouded in debates about what did and did not constitute an alternative technology, and whether AT should deliver a social blueprint or develop principles for participatory technology choice.

*Model of Change*

A further debate within the movement was over the purposes of AT niches in relationship to social change. Some activists foresaw the widespread diffusion of AT, but recognised that this would not be possible without a radical transformation of society. Others were primarily interested in developing the ecologically-harmonious technologies that would facilitate their retreat from the system into relatively self-sufficient communities (usually in rural locations). The idyll created by the latter might or might not be intended as a beacon for others to follow, if they so wished (Rivers, 1975).
An accommodation was reached between the social revolutionaries and the back-to-the-land folk because they could meet around the locus of AT niches. For the first group, niches prefigured the technology systems needed in the more progressive, sustainable society of tomorrow. For the second group, AT provided tools for retreat from the society of today. A stream of practical initiatives emerged. Grassroots innovators experimented with organic farming techniques, solar heating systems, wind energy, recycling, low-impact housing, and so on. Whatever the philosophical differences, a unifying objective was the creation of practical, AT niches. It is the aspiration to wider transformation held by the first group that orientates their approach to technology along a broadly similar bearing to SNM.

AT networks shared their experiences in developing a wide-range of ‘human centred’ technologies (Boyle & Harper, 1976). Practical education was mixed with political consciousness raising in publications like *Undercurrents* magazine, which began in 1972 and served as a forum for the movement. Annual AT gatherings organised by the COMTEK group in Bath attracted hundreds of activists in the 1970s. The Network for Alternative Technology and Technology Assessment (NATTA), created in 1979, continues to produce a regular newsletter to this day.

Activists pursued a twin-track approach. On the one hand, they set about creating AT niches. These offered practical examples of the sustainability that could diffuse more widely and effectively under the right conditions. It was therefore important to lobby for those conditions. Here the activities of the wider environmental movement were important. Groups such as Friends of the Earth and the Socialist Environmental Resources Association were advocating AT-friendly policies as solutions to the environmentally destructive industries they criticised. Other political alliances were less successful. Few AT activists joined trades unionists in their campaign to avoid industrial redundancies by switching to socially-useful, AT production - such as the Lucas Plan in 1975-76 (Wainwright & Elliott, 1982). Union initiatives received positive coverage in some AT circles, but attempts at building bridges (e.g. a Conference on Industry, the Community and Alternative Technology held in November 1975) became mired in political dispute (*Undercurrents*, Issue 14: 12). Back-to-the-land activists saw the unions’ ‘mass production’ of AT as contradicting key lifestyle principles; while unions became frustrated over limited practical help from AT ‘dreamers’ (*New Scientist*, 20 November, 1975: 472).

Local government initiatives at alternative economic development in the early 1980s provided another opportunity for some in the AT movement. The Greater London Enterprise Board’s (GLEB) technology networks included NATTA and other AT activists amongst its membership. The networks attempted to use AT in economic development plans (Mole & Elliott, 1987). However, neither local government initiatives nor trades union greening survived the rightwing Thatcher government. Some niches did manage to survive political hostility and business indifference and a less hostile political climate today is encouraging grassroots initiatives to re-emerge.
Often, AT niches were really experimenting with relatively straightforward or already-existing technologies. The grassroots innovators were exploring how to live with AT, trying to improve performance, assessing limitations, learning-by-using.

‘having realised the non-neutrality of technology, they consciously seek to design the life-style, and the technology that would go with it, as an integrated whole ... [their] ideals are firmly placed in technological practices that, in many cases, have already been successfully developed, albeit in piecemeal and fragmented fashion.’

(Dickson, 1974: 100)

As with SNM, the role of AT niches was learning-by-using. The Danish wind energy industry is one example of the successful diffusion of a technology system initiated by grassroots innovators sympathetic to AT ideals. The initial turbine design was based on one used in the 1940s. The solar heating boom in Austria in the 1990s is another example that appears to fit the AT tradition. Over 100,000 Austrian homes produce hot water from the sun. A large network of do-it-yourself ‘solar clubs’ exist. The movement was inspired initially by motives similar to AT (i.e. a practical expression of living more ecologically). Grassroots user involvement in the testing of the different designs available, and information activities similar to the early days of wind turbines in Denmark, are attributed to the successful diffusion of solar heater technology. However, another important (and obvious) factor in this success was that this mode of diffusion helped improve technology performance for users and made it much more cost-effective for them (Ornetzeder, 2001). Thus, while the ideas and motivations that kick-started this example (as with wind energy) permits comparison with AT, it was less idealistic, more conventional factors that determined wider technological diffusion (albeit achieved in socially innovative ways, i.e. wind co-operatives and solar clubs). Would participants label themselves AT today? Probably not: times and terms change. An interesting question for such examples is, even if they do share features with the AT tradition, might they be labelled SNM too?

Discussion

There is a gap of thirty years between AT and SNM. The gap is felt in the language of each approach and the ideals associated with their experiments. So what can we learn from a comparison; and with what implications for future research? Table 1 compares the approaches in summary form. This section discusses the issues that a comparison with AT raises for SNM.

[NICHE PURPOSES]

Niche purposes

The core approach for SNM and AT is to generate knowledge, learn lessons and demonstrate alternatives based around niche socio-technical configurations. Members of the AT movement were willing to learn to live with sustainable technologies, such as solar water heating, even if initial instalment was costly. But participants sometimes
interpreted the niches differently. Some entrepreneurs sort to sell designs on a commercial basis (e.g. the firm Conservation Tools and Technology). However, given the radical roots of other activists, some were less comfortable embracing or creating markets. Niches can be nurtured for different purposes. Some in AT were developing and using technology that permitted an escape from industrial society, others saw it pre-figuring ecological socialism, and others still were green entrepreneurs. Depending upon the diversity of actors involved, SNM participants will also approach the experiments with a variety of purposes in mind.

**Widening participation**

Both approaches wish to open innovation to new participants. As one AT advocate put it many years ago: ‘[Our] approach differs from the ‘technology-push’ approach that underlies most of today’s technology promotion policies, by bringing knowledge and expertise of users and other actors into the technology development process’. Except that this was not written by an AT pioneer. It was written about SNM in 1998 (Kemp et al., 1998: 186). The list of participants suggested for SNM experiment is not that different to those involved in the ‘radical’ local government initiatives supported by AT activists. One big difference appears to be the provenance of niche initiatives. AT came from activists in civil society, who sometimes found it difficult to engage with business, government or unions. SNM calls for government and business to engage more with civil society in innovation.

It is interesting that, in practice, both seem concerned with the diffusion of existing sustainable technologies – which will then generate further innovation through use. Essentially, the focus rests in technology modifications and the practicality of wider change to turn niche practice into everyday practice. How they go about this reveals a big difference in approach. AT appears more political; SNM more managerial.

**Political activism, education, and innovation management**

Both approaches recognise that higher-level changes are necessary in order for their niches to breakthrough into everyday practice: evolutionary institutional reform, in the terminology of SNM, a revolutionary restructuring of society for AT. That AT language is very different to SNM reflects the different times and backgrounds of each. AT activists saw sustainable technology as a political task: they wanted a ‘radical science and people’s technology’ (as the Undercurrents slogan stated it). SNM is more reformist and managerial in tone: feeding lessons into policy and business strategies, in order to ‘modulate ongoing dynamics’ (Hoogma et al., 2002: 198).

After 30 years it is clear the AT movement did not build their original blueprint, ‘for Utopia remained persistently at the end of the rainbow’ (Rivers, 1975: 34). That said, the legacy of AT merits serious consideration. Not only do grassroots innovations continue to emerge today, but some AT ideas have made an important contribution to thinking about sustainable technologies (e.g. the design of greener homes, the distributed use of renewables). Having cut their teeth in AT projects, some individuals have moved into the
new environmental professions that AT had a hand in creating (Jamison, 2001). Some AT activists were involved in developing the first commercial wind farms in the UK in the 1990s, and some now advise government on renewables policy. Others continue to press for change through political involvement in the green movement or in journalism. Finally, activist involvement in university teaching and research is another route that influences thinking today. ix

Perhaps the most striking AT contribution is an explicit recognition that questions of political and economic power must be a concern in regime transformations. A constituency of political support will need to push for the necessary institutional and infrastructure reforms if, say, an electric vehicle system is to breakthrough. The agitprop role that the AT activists envisaged in their alternative niches is a useful reminder to SNM of the higher-level political challenges in sustainability.

On the other hand, by grounding recommendations in evolutionary economics (cf. revolutionary) and creating more measured expectations over the pace of regime change, SNM may offer a tool for sustainable technological transformation that is palatable within the status quo. Incumbent firms may consequently become involved in niche experiments in ways they found difficult with AT activists. SNM takes on the (no less Herculean) challenge of modulating the existing dynamics of innovation, rather than building a whole different rhythm (Rip & Kemp, 1998). Consequently, the SNM literature seems to devote more attention in nurturing endogenous niche growth, compared to AT interest in social and political change.

Mechanisms for purposeful regime transformation

Beyond creating knowledge about alternatives what are the precise mechanisms available for niche-based change? In SNM, niche growth generates transformations. Given its evolutionary orientation, it is unsurprising that growth is ensured through: a) a degree of niche compatibility with the dimensions of the incumbent regime; b) niche performance should be robust, and c) that the niche shows development potential, for example through extension to new applications and, especially, markets (Weber et al., 1999). Thus the idealists who might initiate a niche need to be joined by more entrepreneurial ‘systems builders’. The managerial challenge is to carry niche development through to the stage when it can attract the big capital needed for the niche to become a commercial prospect. The paradox is that the ‘good compatibility’ criteria can imply niches at radical odds with the incumbent regime will need to offer considerable positive returns if they are to attract investment. The alternative technologies developed in GLEB networks struggled because the social needs they served lacked purchasing power in markets (Mole & Elliott, 1987). In a sense, the AT movement’s attachment to higher level political change recognised that their niches would never attract such capital unless investment incentives (and institutions) were altered radically through public policy.

There is another mechanism by which niche initiatives might influence mainstream change (Geels, 2002). Some aspect of the niche activity may offer a solution to problems or ‘tensions’ experienced in the incumbent regime. Obviously, many technology systems
currently experience environmental tension, to the extent that social mechanisms (e.g. regulations, consumer boycotts) seek to constrain the degree to which they exploit the natural environment. The political focus of AT suggests one way that regimes be placed under targeted tension is political campaigning. Relevant and palatable components of the niche are adapted by incumbent regime actors, and thereby modify the regime.

We can see this in the way supermarkets are including organics in their food range, in response to perceived consumer concerns. One UK supermarket is even investing in organic R&D. Organic food, however, remains a niche product range (over 75 per cent of which is imported (Rigby et al., 2001)). Supermarkets are adapting organic farming to suit their business commitments. Some organic activists believe supermarket adaptation does nothing to deliver other sustainability principles evident in their niches: intensive farming remains dominant, imports cause polluting food miles, and local rural economies do not revive. The current growth in local food initiatives can be considered a response by some to continued inadequacies in the way supermarkets have incorporated organic farming into their dominant business model. In a similar vein, the giant (2MW) wind turbines built by electricity utilities in the offshore ‘wind fields’ of North Western Europe do not meet activists’ ideals for energy conservation and small-scale energy provision. Yet in both cases, the technology ‘solutions’ to incumbent regime problems can be traced back to niche origins.

Niche values and technology

The way the mainstream appropriates sustainable practices raises questions about values and technology. Indeed, the notion of sustainable technology becomes slippery. The supermarkets and local organic groups, and the utilities and community energy groups, each claim their initiatives as sustainable – even though each has a different socio-technical configuration, which embodies different understandings of sustainable development, and which prioritises different environmental, social and economic criteria.

Niche influence in regime shifts may relate to the degree to which the values and criteria originally forming the niche adhere to the socio-technical configuration. If values and criteria are tightly related to the socio-technical practice, will this limit the variety of contexts (values and criteria) to which the configuration can be applied without major modification? In other words, unless the mainstream buys into the values embodied in the niche, then the scaling-up of the niche will be distorted perversely or simply not happen – because adoption demands too much change to the mainstream. On the other hand, if socio-technical practices can easily be stripped of values, and adapted to suit incumbent interests and contexts, then the niche socio-technical configuration may well diffuse much more easily, but with key sustainability features becoming lost in the translation. Niche influence is wider, but less profound.

Conclusions

This paper has compared two niche-based approaches to systems innovation. Clearly, SNM and AT are quite different. Yet what they share in common is an aim to create knowledge about sustainable technology use in niches which can (hopefully) transform
incumbent regimes. Considered together they raise a number of issues for research and practice in niche-based approaches. Thinking about alternative technology niches and the sustainable development of mainstream society forces us to consider:

1. **Participation in niches**
   AT was rooted in civil society concerns, and was inclined toward political lobbying as well as grassroots initiative. The AT experience illustrates how innovative ideas can emerge through informed dissent. SNM is oriented more toward policy-makers and technology producers, and suggests how they may engage with change by including lead users and other participants. The ability to create niches with transformation potential is distributed, unevenly, across a variety of social actors. It makes sense to include technology producers, users, regulators and others with the necessary skills, money, tools, knowledge, and power to force legitimate change. However, as AT debates illustrate, there exists flexibility over how a sustainability problem gets interpreted. Diverse solutions are favoured differently by different actors, depending upon their ideas, interests and experience. How can the energies and capabilities of political activists and business processes be harnessed more effectively? Though both elements are important for progressive change, it may simply be unrealistic to expect them to co-ordinate neatly.

2. **Shifting boundaries between niche and mainstream**
   Real world change is far more messy, challenging and context dependent than neat processes of niche growth and their bottom-up displacement of incumbent regimes (Berkhout et al., 2003). Only aspects of niche practices might breakthrough into the mainstream, for technical, institutional or ideological reasons. The mainstream appears a shade greener as a result, but darker green fundamentals remain unaddressed. More radical, challenging niches can persist or re-emerge. System building entrepreneurs in government and business can try and bridge these two worlds. This is a challenging position to be in because, on the one hand, the systems builder is trying to cajole an incumbent regime into change and, on the other hand, they are having to compromise over niche principles.

3. **The appropriate role of niches in technology policy**
   Further translation efforts, enabling more challenging niche ideas to cross into mainstream practice, can be facilitated through higher-level policy and institutional changes. However, there may come a point, however, as argued in some AT debates, when the only way to progress a radically sustainable idea is to challenge existing structures. At some point, and in some way, technology policies for bottom-up niche creation must be augmented with top-down changes that favourably restructure the selection environment. This paper has illustrated how the intrinsic properties of green niches alone can struggle to drive a breakthrough. They need the assistance of higher level changes and the opportunities these create. In multi-actor governance settings, the challenge is to get these top-down and bottom-up processes operating in relative harmony.

As the history of AT reminds us, the grassroots provide a rich stream of niche sustainable initiatives. Some have asked, how many alternative niches provide an optimum degree of
diversity (koko – Elliott)? Should resources be dispersed so that a ‘thousand flowers bloom’; or should resources be concentrated in a few chosen ‘winners’? Approaches to optimising diversity do exist. However, activists are likely to be impervious to such measurements; so long as they have energy and time, they will try and lever in the resources to create their ideal niches. A technology policy committed to sustainable development might better support this innovative zeal. This paper has tried to argue such support is not merely quantitative. There is a qualitative dimension in the way policy transmits lessons to the mainstream and facilitates action for their incorporation. Indeed, new interest in niche-based approaches rekindles a challenging research and policy agenda.

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Notes

i  http://www.blueprint-network.net/.

ii Grassroots innovators develop bottom-up solutions to public problems. They tend to come from outside mainstream firms, and operate instead in civil society arenas. They are often idealists, and experiment with social innovation as much as technological hardware. Indeed, limited access to financial and other resources can force interest to focus upon the software issues of social organisation and new rules.

iii Data supplied by the Danish Wind Industry Association.

iv The focus now is limited to sustainable energy issues, but it retains AT sensibilities with a concern for community action. See http://eeru.open.ac.uk/natta/welcome.html

v Amory Lovins, a high-profile ‘soft energy’ advocate, worked as Energy Campaigner for FoE in the 1970s.

vi Which later affiliated to the Labour Party.

vii The Conservative government introduced legislation restricting trades union activity; local government spending was brought under tighter central control; and GLEB disappeared with the abolishen of the Greater London Council in 1986.

viii Community groups running home insulation schemes, for example, have evolved into regional dissemination centres, such as the Centre for Sustainable Energy mentioned earlier.

ix Such as the thousands of students who studied AT as part of courses at the Open University.

x Of course, uncoordinated socio-economic trends and changes might also manifest ‘tension’ in particular socio-technical regimes, e.g. demographic changes and water demand. Niches may still offer solutions.

Biographical Note

Dr Adrian Smith is a social scientist who specialises in researching issues in technology, society and sustainable development. He sits on the Editorial Board of Sustainable
Development; and Theomai – Estudios Sobre Sociedad, Desarrollo y Naturaleza. He is an Advisory Board member of the International Bibliography for the Social Sciences.

References


<table>
<thead>
<tr>
<th>Feature</th>
<th>Strategic Niche Management</th>
<th>Alternative Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Origins</td>
<td>Emerged in late 1990s. Takes ideas from evolutionary economics, constructive technology assessment, and sociological histories of past technology transformations.</td>
<td>Emerged in the early 1970s. Developed its ideas from radical science, environmentalism, counter-culture, New Left and critique of technocracy.</td>
</tr>
<tr>
<td>Objective</td>
<td>The transition to socio-technical regimes that meet human needs more sustainably.</td>
<td>Demonstrate technologies that could function in a less alienating society more in harmony with nature.</td>
</tr>
<tr>
<td>Understanding of technology</td>
<td>The technological and social are bound together in a co-evolutionary relationship.</td>
<td>Technology is not neutral. It embodies social values.</td>
</tr>
<tr>
<td>Change agents</td>
<td>Strategic niche managers. Focus is on business and policy-makers.</td>
<td>Grassroots innovators. Focus is on civil society.</td>
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<tr>
<td>Style</td>
<td>Managerial.</td>
<td>Political.</td>
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<tr>
<td>Impact</td>
<td>Probably advocated more niches than actually created. Contributing to ideas about steering technological trajectories in a more sustainable direction.</td>
<td>Probably advocated more niches than actually created. Challenged faith in technological progress and contributed to critical technology assessment.</td>
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