Technology Networks for Socially Useful Production

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Abstract:

Though largely forgotten now, Technology Networks were community-based prototyping workshops supported by the Greater London Council from 1983 until 1986. They emerged out of a movement for socially useful production. Recalling the radical roots and conflicted experiences of the workshops brings to the fore issues still relevant today: tensions between prototyping activities for business development as distinct from more critical technological agit prop for political mobilisation; working at equitable relations between codified, formal expertise versus tacit, experiential skills; and the influences of broader political and economic changes and wider movements for alternatives. After careful historical contextualisation, lessons are drawn for workshops today, but which will inevitably play out differently, hopefully after learning from the past.

Keywords: socially useful production, Lucas Plan, human-centred technology, industrial democracy, Technology Networks, Fab Labs

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1: INTRODUCTION

With unemployment reaching one in eight workers, and manufacturing in steep decline in the city, Londoners voted an avowedly socialist Labour council into power in 1981. Left-wing leaders of the Greater London Council (GLC) were committed to a radically alternative economic strategy compared to the "free-market" right-wing agenda of the Thatcher government nationally. The GLC quickly instituted a Greater London Enterprise Board (GLEB) committed to job creation, industrial democracy, and socially useful production.

Amongst GLEB's first acts was the creation of Technology Networks. These community-based workshops shared machine tools, access to technical advice, and prototyping services, and were open for anyone to develop socially useful products. GLEB's aim was to bring together the "untapped skill, creativity and sheer enthusiasm" in local communities with the "reservoir of scientific and innovation knowledge" in London's polytechnics (Greater London Enterprise Board 1984a, 9-10). In keeping with the political ideals underpinning the initiative, representatives from trade unions, community groups, and higher education institutes oversaw workshop management.

Technology Network participants developed various prototypes and initiatives; including, electric bicycles, small-scale wind turbines, energy conservation services, disability devices, re-manufactured products, children's play equipment, community computer networks, and a women's IT co-operative. Prototype designs were registered in an open access product bank freely available to others in the community; and innovative products and services were linked to GLEB programmes for creating co-operative enterprises. Similar workshops were created in other Left-controlled cities in the UK.

Ideas and enthusiasm for these workshops drew upon a wider movement for socially useful production, which in turn drew together strands of thought and activism from broader social movements, old and new. These included, workplace democracy and alternative industrial plans, community development activism, left environmentalist networks, radical scientists and alternative technologists, and, to a lesser degree, feminism. Workshops were conceived in movement terms of providing human-centred, skill-enhancing machine tools; developing socially useful products; and democratising design and production. As such, workshop aspirations extended well beyond local prototyping and manufacturing: Technology Networks were an attempt to recast innovation and inscribe it with a radical vision for society.

A history of Technology Networks provides a longer view on two questions motivating this special issue of Journal of Peer Production:

> Are rapid prototyping practices changing the relationships to technology, research and development, and innovation?
> How do shared machine shops interface with the political economy of contemporary capitalism?

In an earlier article in the Journal, maxigas demonstrated how situating the distinct historical genealogies of hacklabs and hackerspaces in earlier autonomist movements improves appreciation of the strategic issues confronting spaces today (Maxigas 2012). Similarly, this paper provides historical perspective on issues relevant to community workshops now (Tosh 2008). Features in Technology Networks are not only relevant to FabLabs, Hackerspaces and other workshops, but also to current ideas and practices in participatory design and critical making (maxigas 2012; Smith, Hielscher, Dickel, Söderberg, & van Oost 2013; Tosh 2008; Sanders and Stappers 2008; Ratto 2011; Disalvo 2012).

The argument here is that Technology Networks, reflecting the wider movement for socially useful production, contained tensions in terms of social purpose, cultures of knowledge production, and political economy. The social tension was between spaces for product-oriented design activity, and spaces for network-oriented social mobilisation. The cultural tension was between professional and codified technical knowledge and the tacit knowledge and experiential expertise of community participants. And tensions in political economy – between socialism-in-one-space and the neo-liberal turn nationally and internationally – meant insufficient (public) investment was available to develop initiatives into significant economic activity, and especially without transforming the initiative into capitalist form.

A key lesson from this history is that radical aspirations invested in workshops, such as democratising technology, will need to connect to wider social mobilisations capable of bringing about reinforcing political, economic and institutional change. Otherwise, as we see in the case of

Technology Networks, diminished versions of these ideas and practices will become captured and co-opted by incumbents.

The movement for socially useful production generated its own literature, supportive and critical, and which this study has drawn upon. Archived material was also accessed in relation to the meetings and conferences, programmes and organisations, artefacts, lobbying, and other repertoires of action generated by the movement (e.g. film, reports, media articles). The author has posted two examples on the web: one is a promotional booklet for Technology Networks produced by GLEB in 1984, and that can be downloaded via this **link**; another is a 1978 film documenting the Lucas workers' alternative industrial plan, available via this **link**. Interviews were also conducted with protagonists and observers from the time. Finally, a draft of the history was circulated for comment, correction and reflection amongst a wider group of people with first-hand experience of the movement (Smith, 2104).

The paper is organised as follows. Section 2 describes the wider movement for socially useful production from which Technology Networks emerged. Section 3 describes the creation and operation of Technology Networks, as well as discussing some of the tensions that existed. Section 4 considers whether and how lessons then might be relevant for community workshops today. Section 5 concludes by reiterating how any radical aspirations for workshop practices needs to connect cultural developments with wider social movements and influence reinforcing political and economic change. Something easier said than done.

2: THE MOVEMENT FOR SOCIALLY USEFUL PRODUCTION

In introducing a book about his involvement in socially useful production, Mike Cooley (1987) quotes Karl Marx from *Capital* to evoke the spirit of the movement, and to give Cooley's book its title, *Architect or Bee?*

> A bee puts to shame many an architect in the construction of its cells; but what distinguishes the worst of architects from the best of bees is namely this. The architect will construct in his imagination that which he will ultimately erect in reality. At the end of every labour process, we get that which existed in the consciousness of the labourer at its commencement

Ideas about labour process, skill, design and technology were at the heart of the movement for socially useful production. The movement sought a more democratic human relationship with technology that furnished tools for people to become architects in a deliberated societal vision, rather than perpetuating a situation where humans became scientifically managed bees tending machines in the service of capital (Cooley 1987). As Veronica Mole and Dave Elliott put it, activists wanted:

> to present a vision of an alternative paradigm that prefigured a different role for technology in society … To do this it is necessary to produce both a critique of the current shape and aims of existing technologies together with examples of alternatives that could lead to social and technological change (Mole & Elliott 1987, 82)

Mike Cooley was an industrial designer and trades union shop steward at Lucas Aerospace. He was aware of arguments and initiatives for industrial democracy, and a firm believer in creativity inherent to all people. It was at Lucas, and through the development of a worker's alternative plan for the company, that ideas for socially useful production found practical expression. It was a focal experience for many, and gave an impulse for the wider movement.

2.1 The grassroots trades union origins of socially useful production

Like many in manufacturing in the UK at the time, workers at Lucas Aerospace were facing redundancy and the decline of their communities in the face of industrial restructuring by capital, international competition and relocation, and increasing technological automation in design and production. In January 1976 workers published an Alternative Corporate Plan for the future of Lucas Aerospace. This innovative measure anticipated management cuts to thousands of jobs. Instead of redundancy, workers argued their right to socially useful production.

The Lucas Plan was unusual in that, through careful analysis of skills, machinery, work organisation, and economic potential, workers *themselves* proposed innovative alternatives to closures. It took a year to put the Plan together, including designs for over 150 alternative products. The plan contained economic analysis; proposals for training that enhanced and broadened skills; a less hierarchical restructuring of work that broke divisions between practical shop floor knowledge and theoretical design engineering knowledge. It challenged fundamental assumptions about how design and innovation should operate.

Half of Lucas Aerospace's output supplied military contracts. This business area depended upon public funds – as did many of the firm's other activities. Moreover, UK governments had since the 1960s been financing the "rationalisation" of manufacturing sectors, and paid the welfare benefits of those who became unemployed as a result of this restructuring. Activists argued state funds would be better put to investing in socially useful production. Arms conversion arguments attracted interest from the peace movement and social activists more widely. Additional proposals in the Plan, such as for human-centred technologies that enhanced skills rather than displaced labour, and for socialised markets for products, caught the attention of those associated with the Left. Here was a practical example for connecting new forms of trades unionism and grassroots initiative with ideals for democratic socialism (Wainwright & Elliott 1982).

The workers themselves, and especially their leaders in the Shop Stewards' Combine Committee, suspected (correctly) that the Plan in isolation would convince neither management nor government (Lucas Aerospace Shop Stewards' Combine Committee 1979). Both eventually rejected it. In the meantime, and as a lever to exert pressure, the workers launched a political campaign for the right of all people to socially useful production. The Plan assumed a symbolic role for alternative possibilities within a wider critique of the restructuring capital that was closing so many industries in the UK (Bodington, George, & Michaelson 1986).

2.2 Connecting with old and new social movements elsewhere

Aspirations for socially useful production permitted alliances between workers and the new social movements for peace, environment, community activism and women. As such, the movement for socially useful production consisted of an unusual (and sometimes uneasy) mix of people and organisations. Their ideas for design and innovation arose through a combination of unorthodox trade unionists revitalising arguments for industrial democracy and worker's control, and in so doing meeting with newer social movements for community activism, peace, radical scientists, and feminism. The latter had become prominent features in social and political life over the course of the 1970s.

Combine committees of shop stewards at other companies met to develop their own plans in response to redundancy threats. These included workers at firms like Vickers, British Aircraft Corporation, Dunlop, Parsons, and Chrysler (the latter proposing diversification into products for the Third World) (North East Trade Union Studies Information Unit 1980; Speke Joint Shops Stewards Committee 1979).

The movement connected with initiatives internationally (Rasmussen 2007). In West Germany, for instance, the metalworkers union drew upon the Lucas experience to inform Alternative Product Working Groups established in a number of firms, including Blohm & Voss, AEG, VFW, MBB, Krupp and MAK. Workers proposed combined heat and power systems, transport systems, and, at Voith in Bremen, designed tyre-recycling equipment. In an attempt to progress to prototypes, and help diffuse alternative initiatives, Innovation and Technology Centres were set up in Bremen and Osnabrück in collaboration between trade unions, universities and local authorities.

Over the next few years, practical initiatives for socially useful production emerged from the bottom-up, in shop floors, in polytechnics, in local communities, and in workshops (Blackburn, Green, & Liff 1982; Collective Design/Project 1985). The new movements advanced overlapping, yet different, demands. Consequently, there were various strands to thinking and activism.

The first strand derived from the specific aims of the newer social movements. So, for example, socially useful production should focus on developing environmentally sound technologies, and produce devices for peace rather than weapons for war. Feminists raised gender issues as important absences in a framing of socially useful production arising initially in a male-dominated sector of manufacturing. Gendered perspectives within industry needed to be confronted; socially useful production should look beyond manufacturing settings, and recognise the importance of consumption activities as well as production in other sectors, including the undervalued services provided in homes (Huws 1985; Liff 1985).

Activists within radical science, centring on the British Society for Social Responsibility in Science, were also drawn to discussions about the Lucas Plan (Reilly 1976). Demands for more socially responsible technologies resonated with radical scientists' questioning of the institutional interests and priorities setting technological agendas in society (Asquith 1979; Levidow 1983). Some were drawn to Marxist analysis of the structures of science and technology, whereas others looked to the cultures and practices of knowledge production in society (Asdal, Brenna, & Moser 2007). What they shared was an interest in how the Lucas workers and emerging movement were trying to develop a very different framework for design and innovation. The movement for socially useful production was consequently not framed solely as a campaign for jobs and products, but rather about the culture, structure, locations and direction of innovation in transformed societies.

2.3 Participatory design and the democratisation of production

Movement arguments challenged establishment claims that technology progressed autonomously of society, and that people inevitably had to adapt to the tools offered up by science. Activists argued technology was shaped by social choices over its development, and those choices needed to become more democratic, more open to plural knowledge, including tacit and practical expertise, public decisions about the funding of product research and development, participation in design and innovation processes, and popular planning for social markets (Cooley 1987).

The movement clearly found its first expression in the workplace. Here, technological change, particularly computer integrated manufacturing (CIM), was seen to be deskilling and displacing workers (Brödner 1990; Noble 1979). The Lucas Plan and Technology Networks at GLEB were an inspiration for trade unionist and researcher projects in Scandinavia developing their Collective Resource Approach to participatory design (Ehn 1988). These trade unionists and researchers saw nothing automatic in the development of automated systems (Piore & Sabel 1984; Rauner, Rasmussen, & Corbett 1988). Automation required oversight, debugging and adaptation; systems designed without thought for user skills resulted in serious failures, as well as resistance from operatives; and production

programming in centralised offices could be inflexible, and lead to slow and costly re-tooling that was unresponsive to customer demands (Brödner 1990; Cherns 1976; Senker 1986). The practical know how underpinning such complex tasks provided potential levers for exerting worker influence over the design and implementation of new technology. Computer-controlled machinery should allow programming on the shop floor, machines should enhance rather than substitute operator skill and initiative, and production should be organised by teams of workers who schedule the work required (Rosenbrock 1989). Significantly, workers themselves should be involved in the design methodology for these socio-technical systems (Ehn 1988).

As such, the socially useful framing expanded to argue democratic control and direct participation was required over the design, development and social use of technology (Cooley 1987; Ehn 1988). Since the notion of "usefulness" was a matter of negotiation, workers and communities had to be involved. Design, development, investment and marketing decisions were a matter for participation, debate and negotiation. Brian Lowe at the Unit for the Development of Alternative Products in the West Midlands put it:

> The central feature of socially useful production is the development of ideas and organisation forms that encourage involvement, generate self confidence and release new found or rediscovered skills during the examination of how productive resources should be used to meet social needs. Initiatives promoting socially useful production must, in turn, be extremely responsible and very supportive throughout the complete process if working people are to successfully take on the tasks and challenges of responding with alternative plans. (Lowe 1985, 69)

Ideas about participatory design embraced community development and popular planning. The movement soon found institutional support amongst the leadership of a handful of radical local authorities, such as the Greater London Council, and who were able to provide resources and facilities for putting ideas into practice.

Mary Moore from the London Innovation Technology Network described the aim as

> …making sure that what you do is going to be of real use to the intended users which means somehow getting them to take part in the design process rather than just pop in with a product when you've produced it … So you wouldn't just market-research a new product, which puts users in a passive role. You'd actually get them in the workshop and enable them to learn more about how such things are made and designed and repaired and modified (quoted in Mackintosh & Wainwright 1987, 214)

The desire to produce in a socially useful way, and to place skills, design and production technologies at the service of communities rather than capital, found a willing audience amongst community activists and the Left. Community workshops were a crucible for this unusual amalgam. Early in the career of their Technology Networks, GLEB wrote, "Already there is no shortage of proposals for products and services … to excite interest, widen horizons, and ensure a continuing flow of practical and job-creating *challenges to economic fatalism*" (Greater London Enterprise Board 1984a, emphasis added). This quote is quite typical in blending practical, object-oriented activity with aspirations for alternatives to capitalism (Linn 1987). But it was a blend that also introduced tensions into Technology Networks.

3: TECHNOLOGY NETWORKS

Metropolitan local authorities under the control of the Left of the Labour Party in the early 1980s were supportive towards socially useful production. Some provided space for community workshops. Activity at the Greater London Council in the form of its Technology Networks was the most intensive in this respect; though other workshops included the Unit for the Development of Alternative Products (UDAP) in Coventry and the Sheffield Centre for Product Development and Technological Resources (SCEPTRE).

3.1 Establishing the Technology Networks

The Labour Party manifesto for the GLC elections in 1981 included the following commitment:

> Groups of workers such as the Lucas Aerospace Shop Stewards Committee have, with the support of the Labour Party, began to develop ideas on alternative production – using technologies which interact with human skills; making goods which are conducive to human health and welfare; working in ways which conserve, rather than waste, resources.

We believe that these initiatives – which constitute a fundamental rejection of the values inherent in capitalist production – must be supported by a Labour GLC. We shall therefore be prepared to assist groups of workers seeking to develop alternative forms of production, with finance, with premises, or in other ways." (Labour Manifesto, Greater London elections, 1981, quoted in Mole and Elliott 1987, 81)

Once in office, council leaders created the Greater London Enterprise Board (GLEB) to implement proactive economic policies aimed at fighting unemployment and revitalising industry, including through worker and community initiative (Eastall 1989). [1] The alternative plan was neither dedicated to community workshops nor socially useful production, but nevertheless provided an institutional space as well as political and economic resources for workshop activists. GLEB had an annual budget of £32 million. Given the Left political orientation of the council, GLEB's enterprise agreements and funds sought worker involvement and favoured co-operative forms of business development (Greater London Enterprise Board 1984b; Murray 1985).

Mike Cooley was hired as Technology Director for GLEB. Sacked by Lucas Aerospace, whose management rejected outright the worker's plan for their company, Mike's new position at GLEB provided a platform for him and the movement to continue to promote ideas and activity in socially useful production. Mike's team, drawn from the movement, created five Technology Networks with a GLEB budget of £4 million. Each provided facilities for prototyping socially useful products. Thames Technet was based in the South East of London, and the London Innovation Network (LIN) in the North East. The others were London Energy and Employment Network (LEEN), the London New Technology Network (LNTN), and Transnet (focusing on transport).

All workshops provided physical spaces, access to shared machine tools, and assistance from technical staff to local communities, workers, and co-operative enterprises. Attempts were made to recruit staff who "appreciate the tacit knowledge of local residents and workers" (Greater London Enterprise Board 1984a) (12). Workshops were governed by representatives of local communities, trade unions, tenants groups, and academia (Cooley 1985).

3.2 Participatory prototyping

Seeking to break down barriers between workshop staff and local communities, Network sites were sought away from "alienating" polytechnic campuses. The workshops provided walk-in venues open to anyone. Problem-focused training was linked to issues affecting the community. For example, training at LNTN explored how communities could use ICT networks to share information; augment their knowledge through expert systems; and, co-ordinate more effectively. A women's co-operative was established to address gender bias in the microelectronics sector. Training was provided for groups from developing countries as part of the GLC's Third World Information Network (whose procurement arm went on to pioneer Fair Trade systems).

Sharing of knowledge and prototypes was encouraged through a "product bank'.

> Each centre contributes a product-bank of innovations patented by the networks for use by working people and for socially useful purposes. Machine-banks, consisting of second-hand machinery refurbished as part of a training programme, will be available for use by client enterprises (Greater London Enterprise Board 1984a) (12)

Profit-making enterprises paid royalties on non-exclusively licensed products. This contributed to Network running costs and cross-subsidised the socially useful mission. Other sources of revenue came from the public sector, through provision of useful products and services, and returns from the spin-off development of co-operative enterprises under the wider activities of GLEB.

Successful prototypes were developed:

> As a result of all these activities, a product bank has now been built up containing some 1500 products at various stages of development, from the idea or concept to prototypes to ideas in production. The product bank is exciting, especially the way it has been developed. Special-interest groups concerned about energy conservation have been able to develop product ranges. The disabled have shown great creativity not only in thinking up alternative products for themselves, but in designing and, in many cases, making them (Cooley 1987) (146)

One example from the energy domain was user-friendly, electronic controllers designed to improve energy efficiency. The controllers were fitted to large refrigerators at the GLC headquarters. However, refrigerator manufacturers resisted ideas about wider commercialisation. The design reduced the need for lucrative after-sales servicing contracts. Marketing challenges like these could prove intractable. Some prototypes, including IT manufacture, and toys for schools, did go into successful local manufacture. Others, such as an electric bicycle, found developers and investors in other countries, including Germany and Italy. However, for many prototypes, even where a commercial market looked promising, the investment required to move into manufacturing was often beyond the means of GLEB, and financial institutions were either not interested or refused to locate production in London (Palmer 1986; Rustin 1986).

3.3 Commercial pressures

Recognising the difficulty of developing products so directly, the Product Bank idea was adapted along commercial lines. A Technology Exchange was created that matched prototype designs to firms seeking new products or processes. This technology transfer service opened up to commercial technology offers. Learning from the limitations of Lucas and GLEB Technology Networks, and involving people from both initiatives, the Technology Exchange provided catalogues and exhibitions to subscribers

internationally. It won support from the European Community and UNIDO. According to Brian Padgett from the Exchange, the problem with the Lucas Plan and Networks was that many viable prototypes and designs were frustrated by dependency upon unsympathetic manufacturers and investors (interview, 07/10/2013). The Exchange opened things up to a wider network of potential developers, but also span off in a very commercial direction. It operated until 2002.

Technology Exchange was deemed a success amongst the business-oriented participants in the Technology Networks. GLEB provided office space to a UK appropriate technology programme under the auspices of ITDG. The latter actively promoted a business-oriented approach. [2] They brought in business leaders and expertise, such as John Davis from Shell, and linked to their interest in small enterprises (Davis & Bollard 1986; McRobie 1981). In contrast to more radical aspirations, the business emphasis rested unsurprisingly in using workshop facilities to develop small enterprises (Palmer 1986).

Some enterprises clearly had socially useful orientations. Brass Tacks, for example, repaired and reconditioned furniture and domestic appliances for distribution to disadvantaged households. The Technology Networks helped Brass Tacks to design and manufacture replacement components on a bespoke basis. Brian Padgett recalled other Network activities:

> We introduced a waste paper recycling activity producing art papers and the low-cost injection mould-making business which later transferred to commercial premises. We also introduced a polymer stamp making system, using a UV hardening process, coupled to an affordable rotary label printer, a recycling system for sheet glass offcuts using a thermal sagging technique, etc. etc. All of these were very much in the area of Socially Useful Products but aimed at small start-ups with low capital cost. (personal correspondence, 5th November 2013)

Nevertheless, investment at scale remained difficult.

3.4 Technological agit prop and social mobilisation

A different, more radical framing sought to direct workshop activity towards addressing political and economic issues, including the difficulties under capitalism of redirecting investment for social use value (cf. exchange value). In some cases, activism took the form of "technological agit prop', in which prototyping technologies remained a focal activity, but were presented as a catalysing device for mobilisation around associated political, economic and social issues (Cooley 1987). So, for example, projects involving new microelectronics would be encouraged to debate the threats of automation, and the skill-enhancing possibilities of more human-centred shaping of new technologies. Practical difficulties for investment in the latter provided a material critique of capitalist innovation (cf. Braverman 1974; Noble 1979) as well as demonstrating through practical example the possibilities for more socially useful alternatives.

Developing prototypes and enterprises in workshops was all well and good, but more radical activists considered commercial investment dependencies to result in participants working as bees for capital, rather than architects of their own economic activity. A more radical agenda sought in the workshops a mobilisation of popular activity for a fuller and deeper transformation towards socially useful production. Reflecting from their position in popular planning at the GLC, Maureen Mackintosh and Hilary Wainwright wrote:

> GLEB, for its part, put an increasing emphasis on commercial skills and product development, worried that money might be wasted, and the networks not survive, if products were not produced and marketed fast enough. They saw the products themselves as providing a sort of "technological agitprop" capable

of stimulating a further input by example. They argued that such practical demonstrations of the potential for socially useful job creation had to take priority over open-ended outreach work…

Network staff, members, and users, however, take a more complex view than this. They acknowledge the importance of commercial skills, and having a plan of development of the networks. But they see on the whole a too early concentration on new products as counterproductive. What GLEB calls "outreach', they see as the essence of networking, and the factor which can in the end generate real innovations. While recognising the tensions, they [network staff] see them as creative: the only way to democratise inputs to technological development." (Mackintosh & Wainwright 1987) (212-213)

Starting in 1983, LEEN was one of the first workshops to manifest prototyping-mobilisation issues. As various community, tenant, and energy organisations became involved in the network, bringing different experiences, so the focus of the workshop opened up. As Veronica Mole and Dave Elliott explained:

> It was found that the rationale for the establishment of the networks, the promotion of alternative products and the provision of access to workshop and technical facilities leading to socially-useful employment was not the main problem regarding energy related issues discovered by LEEN. In the field of energy at least at the local level the main factor is not the lack of socially-useful technologies; rather the technology exists, but what is required is the political, institutional and financial commitment to the redistribution of resources that would allow the implementation of these technologies. (Mole & Elliott 1987, 87)

Strategy shifted towards building a campaign, with local authority support, that would put pressure on central government to invest in existing energy conservation technologies addressing community needs (London Energy and Employment Network 1986). Susie Parsons from LEEN explained how, "Partly in light of these problems, many people involved in the technology networks quickly came to the conclusion that they had other useful roles besides product development. One of these was the use of existing technology to provide services to people, and helping people to understand and use existing technology more effectively." (Mackintosh & Wainwright 1987) (208-209). Mobilising groups under a "Right to Warmth" campaign, LEEN provided energy audit and advice services for people, which included developing convenient energy monitoring and modelling devices, and assembling packages of energy conserving technologies for installation in homes. The campaign drew attention to particular needs in apartment blocks, and organised community energy initiatives aimed at job creation through community energy co-operatives (Greater London Enterprise Board 1984a).

The innovative activity here was more about new forms of political organisation than socially useful prototyping. The experience at LEEN illustrated, for example, how householders had tacit knowledge about the thermal performance of their homes. Monitoring expertise developed at LEEN codified into a technically valid form (acceptable to public authorities) something that householders already knew: their homes were damp, cold, and inadequately heated at great cost. Conversely, it required the knowledge and skills of tenants associations, community organisers, and the households themselves to mobilise a political campaign to win the public funds for the requisite technical remediation. All were mobilised through the process, but it is worth emphasising how the technical experts would not have been able to implement their techniques and devices without the power of the tenants' campaigns. The workshop provided a space through which a combination of practical reasoning, technical

expertise, and political linkages could be mobilised.

Community workshops elsewhere were on a similar journey. Brian Lowe at UDAP in Coventry explained how,

> The original relatively simple aims of establishing technical feasibility of alternative products has widened to encompass a much broader activity. The Unit has now become absorbed into and became a distinct but constituent part of the popular planning movement. (Lowe 1985, 68)

This more radical purpose was at odds with more business-oriented interests in Technology Networks. Tensions emerged between those looking to the development of revenue through commercialisation of prototypes and services, a view associated with GLEB boards overseeing the networks, and the popular planners seeking to mobilise the networks for socialist transformation.

3.5 Innovation cultures

The challenges to realising a more politically oriented form of participatory design ran deep. "Constructing an open door to planning and decision making procedures is not enough" (Linn 1987) (116). The networks, and the resources for design, prototyping, and production development needed to be culturally as well as physically accessible to Londoners. Materially speaking, that meant transcending the daily demands on peoples' energy and time by providing them with the resources to participate when they wanted, and on their terms. Culturally, it meant the gradual process of building more egalitarian relationships that crossed lines of expertise, class, race and gender. Staying physically open during evenings and weekends was helpful, but enabling specific groups to use workshops required arrangements thought through carefully with those groups (such as, say, some women, particularly where religious or ethnic backgrounds restricted free association with men).

Workshop practices, attitudes and expectations needed open reflection to overcome unintended exclusions. GLEB appointed Boards overseeing the networks were accused of having "employed high numbers of technically experienced trade-union men whose language, bureaucratic ways of working and emphasis on the product rather then the community process act to exclude even technically qualified women" (Linn 1987 121). The practicalities of bringing diverse communities together with engineers, machinists, and designers proved considerable. As Mary Moore put it, "You will not find this group coming together naturally after a CND [3] demonstration or a football match, for a quick drink or an exchange of ideas" (quoted in (Mackintosh & Wainwright 1987) (214). Democratising decisions involves the negotiation and resolution of conflicts, between different groups of workers, between producers and consumers, between professionalised expertise and grassroots knowledge, and across other divisions including class, gender and race (Blackburn et al. 1982).

Some Networks did attend to the cultures of innovation and developed more inclusive and horizontal practices (Clark 1983). However, the Networks alone could not resolve deep-seated divisions in society. Pam Linn at ThamesNet described vividly, for example, the intimidating power relations in play when an unemployed grassroots innovator met the executives of a large manufacturer suspected of pirating his design for safety lighting (Linn 1987). That said, participating in workshops could be and was transformative for many people.

3.6 The decline of Technology Networks

Methodologies developed and fine-tuned in the workshops provided early experience in practices of participatory design and community development that went on to be useful in other areas. But the opportunity

to progress further in Technology Networks was short-lived. Hostile to radical local authorities, the Conservative central government abolished the GLC in 1986. The Thatcher government curtailed local government powers and budgets over economic planning more generally. In the polytechnics too, reductions in funding and a harsher environment eroded academic-activist alliances. Anti-trade union legislation and the decline of unionised manufacturing sectors also weakened alternative possibilities.

Some community workshop initiatives struggled on with reduced support, but those that did had increasingly to adapt to a commercial logic, such as the Technology Exchange, and training activities that aligned service provision to the needs of private enterprise and capital (Eastall 1989). Socially useful ideals for demystifying new technology (with a view to empowered democratic participation) were dropped. The provision of skilled operatives for firms could be inserted more readily into the spirit of enterprise that Thatcherism was trying to cultivate.

GLEB's Networks proved to be the high water mark for the movement for socially useful production. The experience of the workshops and movements was ultimately one of being overwhelmed and appropriated by more powerful political and economic forces (culminating in our present neo-liberal hegemony). The more challenging attempts at social shaping were closed down, such as direct democratic control of the technology development process, while other elements were co-opted and reconfigured by capital, such as ideas, methodology, and artefacts for flexible specialisation and user-centred design in manufacturing (Asaro 2000). Activists tired, or moved on.

Nevertheless, the movement had pointed to the social processes that shape technology, and insisted through the workshops that people have a right to participate in those shaping processes. What was practiced was a critique of naturalising views amongst political and economic elites about the apparent autonomy and neutrality of technological change. In so doing, activists anticipated ideas and analysis that was to consolidate into science and technology studies and participatory design over the coming years.

4: DISCUSSION

Conceived through radical social movement aims, Technology Networks clearly had ambitions to change relationships between design, innovation and society. Activists had taken seriously the idea of pursuing a different kind of design, and to use concrete experience to explore, rethink and reconfigure the political, economic and knowledge institutions underpinning innovation. They wanted a restructured set of relations. However, the relationships sought did not come about readily. Participants found it required considerable work and thoughtful organisation to overcome prior divisions of class, ethnicity, education, and gender, and to forge equitable working relationships that recognised the pluralities of expertise, skill, knowledge and creativity of participants. Moreover, attempts to connect workshop practices and the alternative innovation cultures being sought with wider processes of political and economic change identified as necessary proved very challenging.

Technological agit prop activities were conceived on these more radical terms. Prototypes provided a practical means to engage people in political debates about the relationships of technology in society. Workshop activities permitted a richly textured expression of critical and tacit knowledge towards the meanings and purposes of production, compared to, say, more rarefied analysis and argument in manifestos, reports, and policy documents. Material projects involved hands and minds in combination. They opened inclusion by bringing in more varied, less verbal, yet no less skilled and intelligent participants. And they addressed audiences differently, compared to, say, speeches and texts evoking an abstract revolutionary agent, socially entrepreneurial state, or notional governance framework.

Workshops also enabled mobilisation as well as expression. Projects allowed the gathering and accommodation of new and unusual allies,

including engineers and community activists. Activists consequently saw workshops in relationship with wider campaigns for alternative economic strategies. Unsurprisingly, political economy favourable towards socially useful production, and in which Technology Networks could help catalyse democratic technology, was beyond the agency of the movement alone. The triple challenges of reforming and opening the institutions of innovation to community participation, re-directing substantial investment into the manufacture of socially useful products, and articulating economic demand to social use value, ultimately eluded those campaigns.

But workshops practices also accommodated less radical purposes. Prototyping products permitted the commercialisation of technological artefacts, the institutionalisation of participatory design methodologies, new service models for energy, and novel organisational forms like product banks. Technology Networks contributed towards a more pragmatic (and business-oriented) approach to prototyping products. Initiatives able to connect to state programmes for small enterprises and training outlasted the collapse of left alternative economic strategies.

So in a very practical, grounded and uneasy way, Technology Networks explored the possibilities and limitations for communities to exercise direct agency in technology development. Technology Networks enabled citizens to engage in extra-discursive ways, and offered spaces where material projects were connected to reflections on wider social, economic and political relations. Workshop aspirations for socially useful production may have proven to be more elusive than the capabilities actually cultivated, but they were nevertheless aspirations that nurtured workshop spaces in an otherwise hostile political economy, and provided an early site for debating relations between technology and society, as well as more grounded design and innovation practices.

Many of these features anticipate debates relevant to community workshops today regarding participatory design, critical making and design activism (Disalvo 2012; Ratto and Boler 2014; Thorpe 2012). One claim made for participant making in workshops today is that the co-creation one finds in these spaces presents an antithetical challenge to consumerism. There is a hope that participants find greater fulfilment through making and reduce their involvement in consumerism (Thorpe 2012; Sanders and Stappers 2008). Workshops might become seeds for more environmentally sustainable and socially inclusive material cultures (Schor 2010). Mike Cooley and others in the movement for socially useful production put a broadly similar aspiration (but clearly not identical) in the more Marxist light of alienation under capitalism. However it is cast, the experience in Technology Networks is that the development of alternative material cultures requires considerable work. Technology Networks emphasised tacit knowledge, skill, and learning by doing through face-to-face collaboration in material projects. Technology Networks had to work sympathetically to acknowledge, develop and draw out community involvement.

Moreover, local knowledge in communities caught the attention of earlier activists as a way of resisting industrial restructuring under capitalism and scientific management. Shared projects were about crafting solidarities of resistance, confronting power relations, and insisting upon a right to be involved in decisions about design and production. That is, participation aimed beyond the development of technical proficiency towards developing critical awareness and mobilisations. In this endeavour, Technology Network experience underscores the off-line, face-to-face cultivation of community building in democratising prototyping possibilities. It is important to be reminded of this, since it raises questions about the depth of possibilities opened up by codification and widespread transmission of know how through digital social media. Skilful design in social media can assist but not completely substitute face-to-face, hand-by-hand activity (Wood et al. 2009). Issues of crafting solidarities are just as important for digital fabrication technologies and on-line community mobilisations today (Söderberg 2013).

The wider social purposes invested in prototyping are being explored anew today through critical making. Ann Light's work with the Geezers in East

London, and the attempts by this group of retired working-class men to develop tidal power technologies, brought to light various assumptions and critical issues about how technologies are developed, and who is expected to participate. "But it did not seek to equip older people with technical skills. Instead, it treated participants as experts on life experience, social relations, and the ethics of technology. By doing making … our purpose was to stimulate an awareness of (and interest in) the designed nature of technology, and a willingness to engage in design decisions for its future, rather than create new designers or new design tools" (Light 2014, 260). In this the Geezers were successful. But it is telling that whilst Ann and colleagues helped the Geezers access grants for participation in the arts, eligibility for technology development grants eludes them, even though the project demonstrated a promising approach. Technology institutions remain relatively closed to many.

Difficulty prizing open technology institutions means ostensibly socially progressive practices can become co-opted by more narrowly sectional interests. This was the experience in Technology Networks, and has subsequently been noted for participatory design more generally. Reflecting on his own involvement, Rasmussen recalled how developments over time, "focused on the micro-level only. The societal perspective of the Lucas Workers' Plan or the attempts made by Greater London Council in the 1970s and 1980s get lost." (Rasmussen 2007, 491). Asaro's (2000) history of participatory design makes a similar observation (cf. Sanders and Stapper 2008, 7). As originally conceived, the development of work groups, use of mock-ups, and other design practices aimed for the democratisation of the workplace, and wanted to furnish working-class communities with the capabilities to influence technology development (Ehn 1988; Brödner 2007). Projects like that of the Geezers illustrate just how rich a set of methodologies have developed for revealing everyday democracy in technology, but they often remain situated in constraining institutional settings.

Considered in an historical light, then the kinds of democratising cultural changes sought by some in workshops today, are seen as having to connect also to institutional transformation and, ultimately, political economy. The eventual transformative effect of workshop practices rests in the degree to which they can disperse their practices into society through social movements, and push them out in to state administration and (socialized) markets. Grassroots fabrication needs to link to social movement, just as the Lucas shop stewards and Collective Resource Approach attempted when linking to workers movements. And any cultural shift needs to translate into political and economic reinforcement.

Of course, neither every workshop nor workshop participant will wish to consider these political matters, since workshops are about fun and creativity for many. It has been harder to access everyday Technology Network participants in this historical research. It has been easier to interview and read the views of higher profile activists and workshop managers. Studying how participants felt about the aspirations invested in them by workshop activists and managers has been more difficult. Clearly, the product bank and activities documented indicate high participation in Technology Networks. But just how entrepreneurial or politically active participants felt, compared to pursuing personal projects, remains unclear. It is a very live issue for workshops today. Observers, activists and managers make varied claims about the meaning and significance of participation; but the views of those doing projects is less readily available.

However, even the most personal projects, in aggregate, have social consequences and cultural affects. The more rapid, extensive, and versatile networking possibilities opened up by digital fabrication and social media today, recasts innovative possibilities into interesting new forms. The social meaning of this activity is something participants should be encouraged to think about reflexively. Moreover, new powers to do innovation in a self-organised way can still struggle when they fail to exercise power over the agendas and frameworks of prevailing innovation institutions: such as which innovations attract investment for production and marketing, and under what market and social criteria. The bigger issues debated in Technology Networks remain pertinent today.

5: CONCLUSION

Celebrated internationally at the time, Technology Networks are largely forgotten now. With hindsight, the Networks were part of a movement that was swimming against the deeper and broader political economic currents of an emerging neo-liberal hegemony. The Thatcher government abolished the GLC in 1986. Without funds and political support, the Technology Networks declined, and activism dispersed into other forms and projects. At the time, however, things were less clear-cut, and the workshops and movement instigated early debate in the social shaping of technology and participatory design.

It is important to remember just how radical a position it was to call for citizens to be involved in prototyping in the past. Technology was the exclusive domain of expert designers, engineers and production managers. Whilst such elite views are still held by some today, it is not so surprising to see citizens involved in co-design and participatory prototyping initiatives, nor so radical to call for it. State support for FabLabs and other workshops is testament to some opening and is a legacy of past activism. However, what remains, and still challenges, is when those co-designs and alternative innovation cultures imply unwelcome and disruptive political and economic changes.

The historical experience with Technology Networks suggests the prospects for workshops to transform the cultures of innovation will need simultaneously to address relationships with political economies. Activity in workshops has to be connected to wider mobilisations that challenge the prevailing political economy and offer alternatives supportive towards new innovation cultures. Recalling the conflicted experiences of Technology Networks in that endeavour brings to the fore issues still relevant today: tensions between prototyping activities for business development as distinct from more critical technological agit prop for political mobilisation; working at equitable relations between codified, formal expertise versus tacit, experiential skills; and the influences and opportunities presented by broader political and economic changes and wider movements for alternatives.

Of course, drawing specific strategies from these historical lessons is difficult. Any attempt would require very careful and contextualized translation across quite different situations. Otherwise lessons risk being anachronistic. This paper has analysed the situation for Technology Networks, which arose from a movement whose conception of workshops embodied a social vision for technology particular to its time, and which had to contend the restructuring political economies in which they were situated. The ideas in play today, including social visions for workshops, not to mention the institutions and technologies to hand, are different. But some of the fundamentals remain the same and demand attention; a point historical reflection brings to the fore.

6: ACKNOLWEDGEMENTS

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[1] Enterprise boards were also created by Labour authorities in the West Midlands, Sheffield, West Yorkshire, Lancashire and Merseyside. Each attempted to leverage private sector funding in addition to public funds, including (local authority) pension schemes. The GLC went furthest in its socially useful conditions attached to investments.

[2] Intermediate Technology Development Group – initiated by Fritz Schumacher and inspired by his ideas. John Davis of Shell was involved in the UK programme.

[3] Campaign for Nuclear Disarmament.