Manufacturing by design: the rise of regional intermediaries and the re-emergence of collective action

Jennifer Clark

School of Public Policy and Center for Urban Innovation, Ivan Allen College of Liberal Arts, Georgia Institute of Technology, DM Smith Building, 685 Cherry Street, Atlanta, Georgia 30332–0345, USA, jennifer.clark@gatech.edu

Received on November 29, 2013; accepted on July 2, 2014

This article illustrates the role of regional intermediaries in the return of manufacturing to cities and the centre of policy debates. The article analyses how supply chain, labour market and innovation intermediaries maintain, embed and expand flexibly specialised production capacity and create spatial variation. The article demonstrates how regional intermediaries support small manufacturers and enable firms to develop as a localised, networked group—effectively operating as a cohort not tied by sector or technology but by process. These intermediaries recast manufacturing as a practice of working with rather than working for others, thus reintroducing both agency and collective action to the US manufacturing narrative. The typology presented highlights diversity among intermediaries and underscores their contribution to emerging 21st-century manufacturing models.

Keywords: regional intermediaries, advanced manufacturing, supply chains, labour markets, innovation

JEL Classifications: O2, O43, R38, R58

Introduction

After decades of disinvestment, manufacturing is again at the centre of policy debates in the USA and the UK (Bryson et al., 2013; O’Sullivan et al., 2013; Pisano and Shih, 2012). This discussion involves manufacturing firms, researchers in advanced and emerging technologies and a network of institutional and policy actors responsible for shaping regional and national economic policy. The renewed interest in manufacturing is related to debates about economic resilience in the wake of the global recession and a growing recognition that service-dependent regions lack the institutional infrastructure and responsive governance regimes necessary to ‘bounce back’ from exogenous shocks (Christopherson et al., 2010; Clark et al., 2010).

In particular, evidence of the slow economic recovery indicates that both high-technology regions and older industrial cities lack the capacity to provide and sustain export-oriented employment over time. The slow recovery has prompted a rethinking of regional economic
development policy and practice and a national policy reorientation towards job creation in the USA. A series of policy studies since 2012 have underscored two keys issues: (i) the importance of manufacturing to the US national economy and (ii) the policy gaps in what is a regionally varied and industrial system organising labour markets, supply chains and innovation intermediaries (Berger, 2013; Duesterberg, 2013; Helper et al., 2012; PCAST, 2012; US General Accountability Office, 2013; United States Department of Commerce and National Economic Council, 2012).

This article focuses on the role of regional intermediaries in the rebound of manufacturing—to urban economies and to the centre of regional policy debates. Specifically, this article analyses how supply-chain intermediaries, labour market intermediaries and innovation intermediaries maintain, embed and expand flexibly specialised production capacity in regions and create variation in capacities across places. The article presents a typology that highlights the diversity among intermediaries with examples from the USA that underscore regional variation. The analysis and the resulting typology focus on how intermediaries are governed and funded and what services they contribute to the emerging regional ecosystems that characterise the developing 21st-century manufacturing models, and specifically what is now called ‘the Maker’s Movement’ (Hatch, 2013).

Throughout the last quarter of a century, many economic geographers emphasised the promise of emerging technologies as the target for export-oriented strategies (Cooke, 2007; Robinson et al., 2007). Policy discussions highlighted product innovations in industries such as software and biotechnology and the importance of research and development in industrial policy (Tassey, 2010). Simultaneously, many engineers pointed to innovations in materials and processes like lightweight composites, additive manufacturing and digital fabricating (including computer-aided design (CAD)) as the future of advanced manufacturing. References to ‘high-tech manufacturing’ by policymakers and economic developers often referred to the product rather than the process behind its manufacture.

In addition to the tension between the investments (private and public sector) in product rather than process innovation, the two strategies vary in their relationship to existing industries. Product innovation tends to privilege start-up firms, technology transfer and entrepreneurship. It emphasises disruptive technologies and new systems and institutions. Alternatively, a focus on process innovation emphasises how new materials, methods and productive arrangements alter and adapt the practices of incumbent firms and industries. The emphasis in process innovation is on adaption and ‘technology uptake’ within existing systems rather than disruptive shifts in organisational models and markets.

Interestingly, it is the process innovations enabled by 3-D printing, e-retailing and CAD that are behind the emergence of small-scale manufacturing seen in the Maker’s Movement. These process innovations allow a new generation of manufacturing entrepreneurs to make products that are familiar (textiles, furniture, household goods, consumer products) but to use these niche and project-based production methods rather than the mass production techniques. It is in this way that the shift in technology-enabled small-scale design plus manufacturing process innovations is moving a segment of the manufacturing in the USA towards a ‘flexible specialization 2.0’ model (Christopherson and Storper, 1989; Clark, 2013; Shaiken et al., 1986).

During the period preceding the recession, business and policy commentators pointed to the potential of new products far more frequently than new processes. This was the case even when new technologies built off of an existing industrial base. For example, biotechnology was rarely cast as an evolution or merger of the underlying manufacturing industries of
medical devices or pharmaceuticals (Clark, 2013). Instead, advocates and investors promoted biotechnology as a market that was both new and novel. Similarly, nanotechnology was often cast as a new site of investment rather than an evolution of existing processes (Bozeman et al., 2007). Although referred to as ‘emerging technologies,’ advocates rarely identified where these technologies emerged from. An underlying production or manufacturing sector was not often emphasised.

This is, in part, simply a commercial bias towards new income streams from new markets (Kaplan, 2011). A bias that is expected rather than exceptional. What is surprising is how broad the shift away from thinking about and investing in process and material innovations became. It was not until the 2008 economic crisis that a rethinking of the potential for process innovations to increase efficiency (economic and environmental) really gained a foothold in policy discussions (Helper, 2009; PCAST, 2012; United States Department of Commerce and National Economic Council, 2012). Additive and digital manufacturing have become an important part of this discussion about the future of manufacturing for emerging firms, incumbent firms and even large firms (Bryson et al., 2013; Manyika et al., 2013). For small and emerging firms, the goal is to enter these new markets and for large or incumbent firms, the goal is to maintain market share in the face of both disruptive and incremental technology-driven change. As a matter of industrial ecosystems, the challenge is increasingly one related to technology adoption into an incumbent system rather than the emergence of a wholly new system and the receding of an older, seemingly antiquated one. The empirical question is thus two-tiered. First, how do intermediaries function as the mechanism by which technology is absorbed in the incumbent system? And second, how do intermediary models vary across regions and how do they create greater production capacities or contribute to their continued erosion?

### Emerging models of manufacturing intermediaries: confronting policy and market failures at the regional scale

The underlying debate among US national-scale policymakers over the past several decades has not actually been about the ability to make strategic policy choices about manufacturing capacity but about the desire to do so (Clark, 2012; Feller, 1997; Helper, 2009; Zysman and Tyson, 1983). Since the 1990s, advanced economies have often debated whether they could retain manufacturing. But at the centre of that debate was also a question about whether industrialised countries wanted to maintain broad production capacities in the new global economy or whether a service-oriented economic policy model would produce better outcomes in a world economy where wealth creation appeared concentrated in financial services and other high-value business services like marketing, advertising and intellectual property (Corbridge et al., 1994; Reich, 1992).

However, since the ‘Great Recession’ of 2008–2009, the voices expressing a conventional wisdom that advanced economies can sustain economic shocks without a strong production base have all but been silenced. This U-turn in macroeconomic thinking has returned policymakers to some persistent questions about how to understand the relationship between technological innovations and existing production processes (Amin, 1994; Bluestone and Harrison, 1982; Bluestone et al., 1986; Harrison and Bluestone, 1988; Noyelle and Stanback, 1983; Piore and Sabel, 1984). The research from the early 1980s highlights—again and again—how manufacturing processes adapt to new technologies incrementally and unevenly across time and place.

The adoption of new technologies is highly contingent (Camagni and Capello, 2005; Cohen and Levinthal, 1990). Technological adaptation depends on industry, sector, location, capital availability, labour skills and costs, policy and
individual firm strategies. Again, this nuanced, dynamic and non-linear experience of how new manufacturing transformed in the late 20th century and has re-emerged in the 21st-century economy points to the need for continued research into industries and sectors. It also means that generalisations are hard to justify about how manufacturing is changing and why and the role of these key factors: industry, sector, location, capital availability, labour skills and costs, policy and firm strategies matter so much. In a world economy often described as ‘flat,’ it is the uneven assets and factor conditions between places that often stand out (Friedman, 2006). And here, policy is a key determinant. Increasingly, policy variation shapes regional variation in costs, risks and capacities (Feldman and Lowe, 2008). Firms make production decisions based on a set of ‘knowable’ variables (Mudambi and Helper, 1998). A key conclusion from the previous and emerging literature is that manufacturing motives, incentives and choices are not a set of mysteries. The lack of commitment by policy actors to invest in learning about manufacturing processes and thus adapting policy models to support and sustain localised manufacturing creates a void in national policymaking now partly filled by regional intermediaries. It is these regional intermediaries that are the focus of this article.

Firms and industry intermediaries are often very clear about the production challenges and opportunities from industrialised countries. Although many small US- or UK-based manufacturers are unaware of the specific policy dimensions influencing demographic transition in China, they do know that production costs are increasing rapidly for outsourced production, thus making them more cost competitive. They also know that niche, craft and batch product modes favour small-scale domestic manufacturing and de-incentivise offshoring. Policies that support this method of production support domestic manufacturing as a whole and increasingly networks of small- and medium-sized firms are advocating for such changes (Milstein Symposium: Ideas for a New American Century, 2014).

The empirical challenge for researchers involves understanding the landscape of small manufacturers—their composition and their variation. What is increasingly evident in the case study literature is that the manufacturing landscape in both the USA and UK includes a set of small- and medium-sized firms that have survived the erosion of manufacturing over the past 30 years in addition to a set of emerging firms. These incumbent firms include the ACME Whistle Company in Birmingham, UK, which is among several manufacturers in and around the historic Jewellery Quarter who continue to produce specialised products and compete on quality rather than price (Pollard, 2004). In the USA, one example is WH Bagshaw in Nashua, New Hampshire, the oldest pin manufacturer in the country, manufacturing pins, pin assemblies and wire since 1840. The national narratives about manufacturing have all but asserted that these firms do not and cannot exist as a category. And yet, they do. They are competitive and innovative. In these specific cases, the firms have taken different approaches to innovation over time. Acme Whistle has innovated its product lines to constantly expand into new, niche markets like musical instruments and birdcalls. WH Bagshaw has been a process innovator building on quality and technology.

In addition to these established small manufacturers, there are new manufacturing firms emerging to meet a growing market for small-scale, design-driven consumer goods like textiles, personal accessories, recreational equipment and household items. These consumer end products require supply chains for everything from rivets to leather to ceramics. These suppliers must be geographically proximate in order to meet the scale and specifications of the end producers who necessarily locate near relevant consumer markets to respond to trends, taste and fashion (Bryson and Rusten, 2010; MacPherson and Vanchan, 2010). This re-emergence of demand for craft-based
consumer end products has instigated a new round of flexible specialisation. The challenge, however, is to re-connect and re-create these supply networks after decades of seemingly de-territorialised production systems. Online retail portals like ETSY enable small-scale producers to reach wider markets. And ETSY has begun to partner with other actors to connect its successful producers with the supplier networks they need to sustain and expand production. And here is where regionally embedded yet scalable intermediaries play a critical role in information sharing and coordination.

Making advanced manufacturing work: the rise of intermediaries at the regional scale

The role of institutional intermediaries in shaping regional competitiveness is not a new idea in economic geography. In fact, most recent theoretical turns in the discipline have emphasised the role of institutions (Christopherson and Clark, 2007a; Christopherson et al., 2010; Frenken and Boschma, 2007; Grabher, 2009; MacKinnon et al., 2009; Martin and Sunley, 2007). However, the theoretical literature has not yet led to a body of empirical work that illustrates the policy implications to a broader audience with tangible examples ‘on the ground’ (Doussard et al., 2009). What has become clear is that these intermediaries do not fit into easy policy categorisation and are therefore difficult to describe, replicate and model.

Many economic geographers have expressed concern about the application of research in the field to public policy generally and regional policy specifically (Malecki, 2004; Markusen, 1999; Martin, 2001). That concern has worked in two directions. First, there is the danger that theory will be led by policy rather than by more rigorous methodologies guided by evidence-based analysis (Lovering, 1999). This is a danger that is perhaps best illustrated by the policy applications of the work of Michael Porter on industry clusters and competitive advantage and Richard Florida’s prescriptive work on human capital strategies shaped by a focus on the ‘creative class’ (Florida, 2002; Porter, 1995).

The second danger is that the hypotheses driven by theory will never be tested due to a lack of empirical fieldwork. And thus, policy becomes led by theory rather than evidence. In both cases the outcomes are likely to include marginalisation of the academic field as an influence on public policy as well as dilution of the quality of the underlying research itself. The empirical analysis of the theories explaining how and why different intermediary models affect the spatial distribution of production is highly relevant to designing and evaluating regional policy.

For example, the evidence indicates that effective institutional intermediaries are territorially bounded but multi-scalar in capacity (Clark and Christopherson, 2009). In other words, they reach global markets (often through internet portals) but maintain specialised, localised knowledge about production networks and supply chains that are not just territorial but sometimes neighbourhood based. Further, they do not neatly fall into categories like private sector, public sector or non-profits. Private sector intermediaries engage in the sort of advocacy and organising once associated with non-profit organisations known for social innovation or social entrepreneurship. This variation and the complexity of its implications first appeared in the careful documentation of labour market intermediaries in the economic development literature, however, that research has subsequently extended to innovation intermediaries and ‘supply-chain’ intermediaries (Benner et al., 2007; Chapple, 2006b; Doussard, 2013; Treado and Giarratani, 2008). The following sections describe the variation in these three categories of regional intermediaries and why they matter in the resurgence in manufacturing.

The analysis, and particularly the typologies, presented in this article are largely based on site visits and interviews with firms and intermediaries in locations throughout the USA between
2010 and 2013. The dominant methodology is a fieldwork approach for the reasons outlined above (Patton et al., 2013). Fieldwork is characterised by a deliberate effort to identify the sites (places, firms and intermediaries) that illustrate the variables of interest and also vary in their composition. For example, this research included site visits to large and small firms, old and young producers and those producing both ‘high-tech’ and traditional products. This work represents a qualitative approach to policy analysis focused on (i) identifying regional variation in the character and function of the intermediaries present in different regions (their scope, coverage, funding structure and industrial focus) and (ii) subsequently assessing the relative character of these regions in terms of manufacturing networks. However, this analysis is not an evaluation of the economic effectiveness of different intermediaries. The empirical data is not conclusive enough to determine which intermediaries are the most effective. Ultimately, a credible assessment of the economic performance of the regions experiencing increased manufacturing activity will require more time to understand the endurance of these observed trends over time. Instead, this analysis focuses on the observation and categorisation of these intermediaries for the purposes of understanding regional variation and how that variation contributes to facilitating or inhibiting the return of manufacturing. This analysis is thus a step towards the ultimate evaluation of the role of regional intermediaries in the resurgence of manufacturing, particularly flexibly specialised manufacturing, in the USA.

Role of labour market intermediaries: coordinating skill and technology

The role of labour market intermediaries in creating and reinforcing regional variation in production and innovation capacity through efficiencies (or inefficiencies) in the system of labour reproduction and job matching is well documented in the economic geography and regional policy literature (Benner, 2003; Fitzgerald, 2004; Giloth, 2003). Although technology tends to capture the headlines, skill remains critical to firm strategies and a crucial aspect of policy design and implementation at the regional and national scales. Ultimately, the uptake of new technology is a skill question. Manufacturing firms substitute capital for labour when it is economically rational to do so. That rationale is calculated both within the firm and across the global supply chain. In practical terms, the promise of additive manufacturing depends not only on its own cost curve but also on that for its immediate and existing substitutes.

The debate about re-shoring or ‘repatriation’ of manufacturing is therefore a question not just of technology. It is also a question of the cost, quality and risk associated with production alternatives like the labour-intensive manufacturing processes that drove distributed supply chains into lower cost economies in the first place. Thus, the role of regional labour market intermediaries becomes central to the future of manufacturing and its ultimate distribution. Figure 1 illustrates some of the key variations in regional labour market intermediaries in the US context.

The transition in the Chinese labour market shifts the production cost calculus for manufacturing firms (Zhang and Goza, 2006). If exceptionally low-cost labour is not readily available, then technological solutions become more viable from a cost perspective. And, higher tech production processes generally require higher skilled labour. Unfortunately, the erosion of demand for manufacturing skills in countries such as the USA and UK for the last quarter of a century has led to atrophying in the workforce development system (Doussard, 2013; Lowe, 2007; Osterman, 1999; Tilly, 1996). One key policy question going forward is whether and to what extent advanced industrialised economies will take seriously the issue of skill development. In all likelihood, a sustained retooling of the existing institutional frameworks will
Manufacturing by design

be necessary. Innovative new approaches to skill definition and delivery by regional institutional intermediaries capable of collaborating between workers, firms, educational institutions and governments are essential to this process. Information gaps and asymmetries are the subject of increasing study in the workforce development literature (Lowe, 2007). There is a growing consensus among firms, workers and educators that the skill delivery system is not working efficiently. Innovations in this area include information technology firms deploying beta models to codify and transfer worker knowledge across industry and technology contexts. The most notable of these is Mozilla and the MacArthur Foundation’s ‘Open Badges’ project. The project works to establish transferable mechanisms for aggregating skills acquired from formal and informal training and present that array of skills as a legible ‘badge’ digitally attached to a worker. The goal is to facilitate job matching for firms and workers and career planning for individuals.

Increasingly public, private and non-profit labour market intermediaries prioritise job-matching functions over advocacy, direct skill training or other services (primarily access to traditionally employer–provided benefits like health insurance). Unlike the literature on supply chain and research/innovation intermediaries, the empirical research on the regional variation in labour market intermediaries is well developed and includes research on contingent work, new forms of union-led intermediaries, sector-based training consortiums and many others (Carre et al., 1994; Osterman, 1999; Peck and Theodore, 2001; Stone, 2004; Van Jaarsveld, 2004; Wisconsin Regional Training Partnership, 2007). The Wisconsin Regional Training Partnership is credited with providing Milwaukee area manufacturers with workers with firm and industry-specific training for skilled work like welding. The WashTech/Communication Workers of America project (sponsored by the Communications Worker of America) is the test of a model that provides advocacy for contingent high-tech workers without collective bargaining. The Freelancer’s Union, formerly Working Today, has over 200,000 members to whom it provides access to occupational benefits, industry information and political advocacy. Some of these labour market intermediaries overlap with the supply-chain category by providing information on suppliers and partners. However, there is a clear distinction in core function and scope.

Role of ‘supply-chain’ intermediaries: firm networks, clusters and the Maker’s Movement

Supply-chain intermediaries come in many forms. Firm network and industry cluster groups are one familiar form for which there is an existing body of empirical work (Angel, 2002; Christopherson and Clark, 2007b;}

<table>
<thead>
<tr>
<th>Labor Market Intermediaries</th>
<th>Geographic Scale</th>
<th>Stakeholder Group Driving Organisational Model</th>
<th>Primary Funding Model</th>
<th>Substantive Focus</th>
<th>Organisational Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor Unions</td>
<td>Local/National</td>
<td>Employee-driven</td>
<td>Membership</td>
<td>Firm/Industry</td>
<td>SEEB 1 1999</td>
</tr>
<tr>
<td>Skill certification services</td>
<td>National</td>
<td>Employer or Service Provider-Driven</td>
<td>Fee for Service</td>
<td>Occupation</td>
<td>Digital Badges Project</td>
</tr>
<tr>
<td>Occupational Advocacy and Service Providing</td>
<td>Regional</td>
<td>Worker-driven</td>
<td>Membership/Fee for Service</td>
<td>Occupation</td>
<td>Freelance's Union/OWA/WashTech</td>
</tr>
<tr>
<td>Community Colleges</td>
<td>State</td>
<td>Public-sector driven</td>
<td>Public Appropriations/Grants/Fee for Service</td>
<td>Occupation</td>
<td>Miami-Dade Community College</td>
</tr>
<tr>
<td>Training Partnerships</td>
<td>Regional/State</td>
<td>Worker-driven</td>
<td>Grants/Fee for Service</td>
<td>Occupation/Industry</td>
<td>Wisconsin Regional Training Partnership</td>
</tr>
</tbody>
</table>
Feldman et al., 2005; Rutherford and Holmes, 2008; Treado, 2010). Like labour market intermediaries, supply-chain intermediaries vary in terms of their primary role. In general, these intermediaries perform one or more of the following functions: (i) advocacy or lobbying, (ii) brokering, matching or connecting suppliers and contractors, (iii) capacity-building through embedding (localising) firm networks.

In the wake of vertical disintegration, US policymakers and academics have studied how large firms have managed their supplier networks (Helper and Sako, 2010). However, with the decline of manufacturing overall, the policy attention to understanding and supporting supplier networks has been intermittent at both the national and regional scales. Some scholars have found unusual levels of collaboration between end producers and suppliers, while others have found this cooperation to be highly contingent by region, industry, firm and even time period. Susan Helper’s extensive work on supply chains in the auto industry highlights these changes over time period (Helper et al., 2000; Helper et al., 2011; Mudambi and Helper, 1998). In part as a consequence of this contingency, a variety of intermediary models have emerged.

In addition to the formal firm networks and industry cluster groups that often graft onto a framework inspired by the industry clusters model advocated by Michael Porter, there are several additional models (Clark, 2013). For example, the Rochester Regional Photonics Cluster a technology-specific firm network in Rochester, New York, is a non-profit bringing together small- and medium-sized firms in a shared technology area and coordinating advocacy, information sharing and events. There are also public sector technical assistance agencies like the Manufacturing Extension Partnership administrated by the National Institute of Standards and Technology in the US Department of Commerce. The Manufacturing Extension Partnership is administered at the state level and provides low-cost technical assistance to manufacturers interested in upgrading products and processes. Operating in this same space and providing technical assistance are private consulting firms offering managerial and organisational assessments. Figure 2 illustrates some of the key variations in supply-chain intermediaries in the US context.

More recent forms of supply-chain intermediaries closely associated with re-shoring and the Maker’s Movement are intermediaries brokering partnerships, providing advocacy for producers and acting as an information clearinghouse. Some of these intermediaries bridge the space between traditional production systems, new firm entrants and labour market intermediaries at the regional scale. A leading example is Nortech in Northeast Ohio. Nortech is a regional non-profit that coordinates technology-based economic development efforts across sectors with an emphasis on small- and medium-sized firms.

These coordination functions between regional economic development actors have

<table>
<thead>
<tr>
<th>Supply Chain Intermediaries</th>
<th>Geographic Scale</th>
<th>Stakeholder Group Driving Organizational Model</th>
<th>Primary Funding Model</th>
<th>Substantive Focus</th>
<th>Organizational Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm Networks</td>
<td>Regional (City-Regions)</td>
<td>Firm-driven</td>
<td>Membership/Grants</td>
<td>Technology/Industry</td>
<td>Quebec/Photonics Network</td>
</tr>
<tr>
<td>Industry Cluster Groups</td>
<td>Regional/State</td>
<td>Industry-driven</td>
<td>Membership/Grants</td>
<td>Technology/Industry</td>
<td>Rochester Regional Photonics Cluster</td>
</tr>
<tr>
<td>Information and Advocacy-Producer Networks</td>
<td>Regional (Urban Networks)</td>
<td>Firm-driven</td>
<td>Membership/Fee for Service</td>
<td>Technology/Process/Sector</td>
<td>Maker’s Row, SF Made</td>
</tr>
<tr>
<td>Manufacturing Extension Partnerships</td>
<td>State</td>
<td>Public-sector driven</td>
<td>Public Appropriations/Grants/Fee for Service</td>
<td>Sector</td>
<td>GMEP (Georgia Manufacturing Extension Partnership); Manufacturing Advisory &amp; Growth Network (MAGNET)</td>
</tr>
<tr>
<td>Regional Stakeholder Partnerships</td>
<td>Regional (multi-county)</td>
<td>Non-profits/Service Sector</td>
<td>Grants</td>
<td>Sector</td>
<td>Nortech</td>
</tr>
</tbody>
</table>

Figure 2. Examples of supply-chain intermediaries.
been increasing in the last two decades. The policy models remain in flux and are often updated and revamped (as they are in the UK currently through the Local Enterprise Partnership scheme). Less attention has been paid to an emerging set of firm network intermediaries that support localised manufacturing by brokering information, making connections and advocating on behalf of a geographically distinct membership (Rantisi, 2002). Among this group of supply-chain or firm network intermediaries are SF Made in San Francisco, California, and Maker’s Row based in Brooklyn, New York.

SF Made is a non-profit organisation that builds the San Francisco area’s economic base by supporting local manufacturing through information dissemination, advocacy, marketing, technical assistance and training.10 Maker’s Row is a for-profit enterprise that provides information on manufacturers to designers and other manufacturers in order to bring together supply chains.11 Supply-chain intermediaries connected to the Maker Movement have a particularly powerful, if subtle, effect of recasting manufacturing as a practice of working with others rather than working for others. This is consistent with a ‘flexible specialization 2.0’ approach to production in which a design-driven production model blurs the lines between development and deployment or innovation and production (Clark, 2013). In all these cases, the emerging model is one that provides a geographically distinct set of producers with more information about how to do what they do in partnership with producers, designers and innovators in their immediate community. Essentially these intermediaries are building tightly bounded networks of production practice in order to localise and embed manufacturing capacities.

**Role of innovation intermediaries: research centres and hubs**

Innovation intermediaries are a particularly complex form of regional hub that vary significantly across regional and national contexts (Christopherson et al., 2008; Shapira et al., 2011). They have also received a great deal of attention in the past 30 years as science and technology policymakers embraced the ‘research centre’ form as a mechanism to jump-start high-tech regional development (Clark, 2010). These centres are sometimes called ‘cooperative research centres’ (‘CRCs’) in the USA. They vary in terms of governance and structure ranging from national labs administered directly by federal agencies to an extensive network of university-based ‘basic’ research centres (Boardman et al., 2012; Stepp et al., 2013). Across forms, however, industry participants partner with research centres in order to access specialised research assets that are significantly subsidised by the public sector through federal (and increasingly state and local) grants. This includes the ‘cheap talent’ provided by graduate students and post-doctoral fellows used to operate facilities based in research universities. It also includes access to capital equipment that offsets the initial costs of acquiring specialised machines. CRCs allow firms to access the equipment on a user fee basis until and unless the research requiring these specialised assets becomes commercialisable and ultimately profitable enough to acquire the equipment for production. In a broad sense, innovation intermediaries function as institutional containers for tripartite research activities forming an umbrella under which actors from universities, government and industry collaborate (Etzkowitz and Leydesdorff, 1997). In their current form, US-based CRCs serve several key functions almost all of which tend to benefit and subsidise large-firm innovation rather than small-firm production. Figure 3 illustrates some of the key variations in regional innovation intermediaries in the US context.

In terms of function, innovation intermediaries do several things for regions. First, they invent things (principally materials and products). However, process innovations are far less frequent. Second, they train people. Usually
the people trained are elite graduate students and not incumbent workers engaged in current production work. This role separates innovation intermediaries from the workforce investment system and the network of labour market intermediaries and connects them closely with research universities. Third, innovation intermediaries acquire specialised equipment to support research programs. Fourth, they convene a set of research collaborators. And finally, they generate revenue by charging ‘bench fees’ for access to the centres themselves and for participation in a research consortium (Clark, 2013).

In short research centres tend to function as innovation intermediaries subsidising private sector research and development and provide a national backdrop for less market-oriented scientific discovery. At this functional level, CRCs are central institutional actors in a broader policy debate at the intersection of science and technology policy and economic geography about (i) the spatial organisation of research and development intermediaries—the location of individual research centres and the formation of distributed networks of CRCs—and (ii) the governance of sites within regional innovation systems. Ultimately these research centres are critical intermediaries reproducing the specialised labour markets (through the training of science and engineering students) and providing the accessible R&D infrastructure that makes regions distinct in their technological and sectoral capacities.

However, there is a long-standing critique in the USA that technology transfer from these non-profit and public sector facilities is episodic and incomplete (Feller, 1997; PCAST, 2012). The failure to get innovation out of the lab and onto the assembly line is a central concern of policymakers, particularly in the context of a global recession. In this context, every innovation not able to realise its full commercial potential represents lost jobs.

In June 2011, the Obama Administration launched the first Advanced Manufacturing Partnership (AMP 1.0).12 The AMP recommended the implementation of a new, networked cooperative research centre model: the National Network for Manufacturing Innovation (NNMI). President Obama announced the implementation of the first pilot in Youngstown, Ohio: the National Additive Manufacturing Innovation Institute (NAMII) focused on additive manufacturing in the fall of 2012. Nortech is a partner within NAMII, thus illustrating the complicated and integrated character of the regional intermediaries. The goal is to implement 15 such centres. Six more are expected in 2014. And, unlike previous initiatives, these research centres are explicitly required to engage firm networks of small- and medium-sized firms and regional development actors. In September 2013, the Obama Administration announced AMP 2.0 to continue the policy-drive toward enabling the NNMI network and supporting scale-up

---

**Figure 3. Examples of US innovation intermediaries.**

<table>
<thead>
<tr>
<th>Innovation Intermediaries</th>
<th>Geographic Scale</th>
<th>Stakeholder Group Driving Organisational Model</th>
<th>Primary Funding Model</th>
<th>Substantive Focus</th>
<th>Organisational Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>State-level Innovation and Development Centers</td>
<td>Regional/State</td>
<td>Public-sector/university driven</td>
<td>Public Appropriations/Grants/Fee for Service</td>
<td>Technology/industry</td>
<td>College of Materials Science and Engineering (CMSE) of the University at Albany - State University of New York (SUNY)</td>
</tr>
<tr>
<td>Translational Research Centers</td>
<td>Regional/National</td>
<td>Public-sector driven</td>
<td>Public Appropriations/Grants/Fee for Service</td>
<td>Technology/Material/Process/industry</td>
<td>Manufacturing Innovation: example National Additive Manufacturing Innovation Institute (NAMII)</td>
</tr>
<tr>
<td>&quot;Basic&quot; Research Center</td>
<td>Regional/State</td>
<td>University-driven</td>
<td>Grants/Contracts</td>
<td>Technology</td>
<td>University Research Center (e.g., Center for Organic Photonics and Electronics-COPe) at Georgia Tech</td>
</tr>
<tr>
<td>Corporate Research Lab</td>
<td>National</td>
<td>Firm-driven</td>
<td>Firm-financed</td>
<td>Technology</td>
<td>Xerox PARC, Bell Labs</td>
</tr>
</tbody>
</table>

Downloaded from http://cjres.oxfordjournals.org/ at Georgia Institute of Technology on November 17, 2015
for small- and medium-sized manufacturers (PCAST, 2012).

Initiatives in the UK by the Technology Strategy Board also recommended revamping cooperative research centre models resulting in the introduction of the Technology and Innovation Centres (Perry, 2007; Perry et al., 2007; Technology Strategy Board, 2011). The Canadian CRC system experienced similar adaptations in the 1990s and 2000s. In the USA, the challenge is that established CRCs receive high marks in evaluations of their design and development capabilities. It is the capacity for the deployment of innovations to commercialisable applications that appears limited.

Furthermore, it appears to be particularly limited in terms of engagement in process innovations relevant to small- and medium-sized manufacturers. And, it is this last category—moving innovations into small- and medium-sized firms—that relates most directly to the importance of research centres as innovation intermediaries. TechWorks and DesignPDX are examples of these SME-oriented innovation intermediaries that bridge the space between design-driven production and the provisioning of shared innovation spaces. TechWorks started in San Francisco and has expanded its model into several cities (Hatch, 2013). DesignPDX is a project specific to the textile and apparel firm network in Portland, Oregon (Clark, 2013). This gap in the innovation infrastructure points to another reason why regional intermediaries have emerged and adapted territorially specific forms to fill the void and meet the needs of incumbent and emerging manufacturers through collective action.

**Policy implications of manufacturing intermediaries: agency, advocacy and reclaiming production for the producer**

In the aggregate, the emergence of this set of intermediaries addressing labour, innovation and supply chains at the regional scale signals a reconceptualisation of manufacturing. In other words, these intermediaries, and particularly the emergence of new forms on supply network intermediaries, indicate more than a renewed interest in manufacturing. They signal a new model. The often-told story of deindustrialisation in the USA is a narrative about large firms, labour alienation, declining wages, the erosion of benefits and a community disinvestment (Bluestone and Harrison, 1982). The rise of regional intermediaries—particularly those associated with small-firm production and the Maker’s Movement—points to a renewed sense of agency among producers. The Maker’s Movement intermediaries promote existing local capacities and seek out supply network partners close to home. When they find gaps in the supply chain or the intermediary structure in their regional ecosystems, these actors locate entrepreneurs to fill them. When they need skills, they acquire them. When they decide to scale-up to serve larger markets, they develop web portals and networks to reach the next level in internationalisation. Organisations like TechWorks, Freelancer's Union, SF Made and Maker's Row serve as examples.

Fundamentally, the effort to solve the problem directly rather than lobby policymakers to structure public sector solutions underscores an underlying sense of agency is different from the sense of alienation that accompanied the deindustrialisation of the 1980s. The Maker’s Movement looks as global production systems not as adversarial but simply as part of the landscape. Global competitive challenges are to be navigated around and negotiated with. The response to competition is redesign, rebranding and increased distinction. It remains unclear whether this model will prove successful in the long run. In the short-run, it is clear that it is a different approach.

In this approach, political advocacy is highly localised and focused on issues very close to the city: light industrial zoning, live/work buildings and information technology infrastructure. In many ways, these small-scale manufacturers understand that it may be more important to
embrace their own strategic production decisions as the political act rather than developing a parallel practice of acting politically. What you produce, how you produce it, with whom you partner and where you choose to produce, partner, live and work are the overt political acts that demonstrate awareness and agency.

Of course, this consciousness of manufacturing as more than a response to cost and risk imperatives on a spread sheet is an opportunity open to a specific type of small, private firm. And, the strategic decisions of this set of small production entrepreneurs (owner, designer and producer) may not prove to be significantly different than the decisions made by older, small-scale manufacturers who have survived deindustrialisation producing high-quality, design-intensive, branded products over decades (like Acme Whistles and WH Bagshaw). However, the distinction is that the small-scale producers in the Maker’s Movement are emerging and growing as an embedded, localised, networked group. They are effectively operating as a cohort not tied by sector or technology but by process—how they produce not what they produce. Again, it is the emphasis on process innovation rather than product innovation that stands out as distinct from the dominant discourse.

Returning to the point that the over-emphasis on product innovation in the 1990s and 2000s obscured the importance of process innovation not just as a site of technology adoption but as a site of solidarity formation. And, it is worth noting that this solidarity is both to place and to process but is not particularly tied to a nationalistic conceptualisation of production. The localisation of manufacturing in this movement is not about national competitiveness but about community and place as well as a blurring of the line—and the perceived hierarchy—between design and production.

**Funding**

This work was supported by the following institutions: (i) the Institute for Advanced Studies (IAS) at the University of Birmingham and particularly the IAS funded project on ‘Regeneration Economies: Transforming People, Place and Production’ and (ii) the Center for Urban Innovation at the Ivan Allen College of Liberal Arts and the Office of the Executive Vice President for Research all at the Georgia Institute of Technology.

**Endnotes**

1 For a definition of the Makers Movement, see Anderson, C. (2013) Maker movement, Wired, 21. Anderson describes the movement as follows: “The maker movement is a term coined by Dale Dougherty at O’Reilly Media. You can think of makers as people creating physical things using the Web. Now there are digital tools for manufacturing and design. These include the 3-D printer, the 3-D scanner, the laser cutter and CAD software. Makers can take advantage of the Internet’s collaborative innovation. Another element of the movement is the rise of the factory for hire. Factories are taking orders of any size at any scale.”


3 Fieldwork interviews and site visits conducted in the USA and UK between 2010–2013 in addition to interviews with intermediaries mentioned.


References


Freelancer’s Union (2013) History. Available online at: [https://www.freelancersunion.org/about/history.html](https://www.freelancersunion.org/about/history.html) [Accessed 25 November 2013].


PCAST (2012) Report to the President on Capturing Domestic Competitive Advantage in Advanced Manufacturing, Washington, DC: Executive Office of the President: President’s Council of Advisors on Science and Technology (PCAST).


Perry, B., et. al. (2007) Building Science Regions in the European Research Area: Governance in the Territorial Agora. Manchester: Centre for Sustainable Urban and Regional Futures (SURF) at the University of Salford.


Clark


