Papers in Evolutionary Economic Geography

10.10

Transversality and Transition: Branching to New Regional Path Dependence

Philip Cooke

Utrecht University
Urban & Regional research centre Utrecht

Transversality and Transition: Branching to New Regional Path Dependence

Philip Cooke

Prepared for the 'New Path Creation' workshop at Trinity College, Oxford, 5-7 September, 2010

Abstract

Since Paul David published his economic histories of path dependent innovation the subject has exerted fascination upon scholars of innovation, technological change and, latterly, regional scientists and economic geographers. This paper speaks to the third and fourth of these communities in the main, though it may have theoretical and empirical elements of interest to the first two as well. The paper begins with an overview of recent perspectives and critiques concerning the relevance of the path dependence concept to the understanding of regional economic development and its associated governance. It then goes on to discuss the contribution of evolutionary economic geography to thinking about 'branching' from path dependence and the creation of new paths. Evidence for key generic spatial processes of path transition is provided before the main content of the paper concludes with new insights into the contributions of regional innovation policy to path evolution. Conclusions are then drawn.

1. Introduction

Path dependence is treated as an important concept in economic history, innovation studies, socio-political history and by evolutionary economic geographers. This is clearly due to its attempt to conceptualise why 'history matters' rather than simply supply narrative accounts to that effect. Like historians, geographers have repeatedly felt the need to proclaim that 'geography matters' too, and the recourse to theory has been important in underlining that assertion as much as theory-building has been in some aspects of history. By far the most serious effort has been made by the evolutionary economic geography/regional science community (Cooke & Morgan, 1998; Cooke, 2005; Martin & Sunley, 2006; Belussi & Sedita, 2009; Martin, 2010). Absent from that list is Storper & Walker (1989) not because their book had no relevance to thinking about path dependence, written as it was from a Marxist perspective, but rather because it has, with its notion of 'windows of locational opportunity' had perhaps too much. This is shown in the recent regional evolutionary

economics volume on 'cluster emergence' (Fornahl, Henn & Menzel, 2010) where that concept is of key importance in seven of the thirteen contributions. It will be argued in the concept review section of this paper that follows, that heavy reliance on such a passive category detracts from rather than contributes significantly to evolutionary science.

The paper then goes on to advocate a more agency-centred perspective drawing theoretical inspiration from the fields of evolutionary urban economics (Jacobs, 1969) and evolutionary innovation economics (Schumpeter, 1975) both of whom have lately been shown to be important architects of a powerful theoretical framework capable of explaining regional evolution. The two master concepts or axes of this frame are, first, the Jacobian concept of 'diversity' or its evolutionary variant of 'variety', especially (after Boschma, 2005; Boschma & Frenken, 2006) 'related variety'. The second axis of the frame is Schumpeter's concept of 'regional innovation' as rendered in Andersen's (1994; 2007) magisterial reconstruction and synthesis of Schumpeter's complete political economy (see also, Andersen, 2002; 2009). Together, these give a clear insight into the dynamics of regional evolution. As we shall see, from Jacobs can be deduced explanations of both firm and, more importantly, cluster mutation by means of cross-pollination of knowledge (knowledge spillovers) leading to innovation by means of geographically proximate inter-cluster 'collisions' of ideas. From Schumpeter, we get the mechanism for these mutations for, as Andersen (forthcoming) shows, against many unreflective conflations of 'innovator' and 'entrepreneur' they are, for Schumpeter, rigidly distinctive categories. The former 'recombines' knowledge, while the latter acts upon and 'commercialises' it. These are conceptually distinct skillsets, even though they may occasionally be combined empirically in a single actor. Accordingly, imitative 'swarming' (or clustering) is principally an 'entrepreneurial event'. By these combined process mechanisms, regional evolution, including 'branching' to new path creation, occurs. In this respect this contribution transcends the problem of path creation stated by Garud & Karnøe (2001) in their review, which assigns virtual omniscience to 'entrepreneurship' and no role for the separate capability of the Schumpeterian 'innovator' in innovation and change.

In what follows the family of concepts, like 'path dependence', 'windows of opportunity' and 'chance effects' associated with the orthodoxy will be reviewed and

critiqued and the newer, evolutionary elements like 'related variety', 'mutation' and 'innovation transversality' (on the latter, see Cooke, forthcoming; Harmaakorpi et al., forthcoming) critically reviewed. This will be a prelude to an extended exemplification of key elements of the Jacobs-Schumpeter framework by comparison with a handful of illustrative regional and small-nation cases. Importantly, these mix process mechanisms emanating primarily from market transactions, on the one hand, and innovation policy governance interventions, on the other. Finally a concluding section brings the argument of the paper to fruition.

2. Concepts of Consequence: a Review

It is clear from the foregoing that this perspective on 'new path creation' presumes that this occurs in reality. There can be no doubt that it does, although the nature, extent and key mechanisms of change, on the one hand, but possibly more interesting in such a context, 'arrested development' and (regional) economic stasis or decline, on the other, require far more embellishment than are currently on display (see also, Martin, forthcoming). To introduce an exemplar to which the paper later returns, consider for a moment the recent history of Iceland, a national economy that seldom features in the more celebrated economic geography research literature. Yet very many economic geography Ph.D. candidates are, or soon will be, turning their attention to the fascinating and tragic case of how Iceland's entrepreneurs, a tiny minority of a total national population comparable to that of Coventry, transitioned in less than a generation from earning most of their income from fish, aluminium and tourism to becoming a financial services hot-house. For not only did the 'carry trade' (currency arbitraging), as well as 'sliced & diced' mortgage derivatives, as elsewhere, enable Iceland's banks to attract huge pension-fund investments from Germany, the Nordic countries, the Netherlands and UK *inter alia*, but the profits allowed them acquisition of, in the UK alone, not only such national jewels as House of Fraser, Hamley's, Karen Millen, Oasis, Whistles, Moss Bros and the XL package tourism firm, but also the Premier League football club that XL sponsored, namely West Ham United.

We shall return in section 3 to offer possible answers to the central question raised in the foregoing, namely how did an economy create such a radical new path for itself in a very short time, with little diversity of resources and minimal market scale? But for

the rest of this section we will attend to some strengths and weaknesses of key concepts around the discussion so far. And the first of these concerns the 'explanation' of the onset of agency (i.e. change) in respect of social phenomena as represented in the notion of 'window(s) of locational opportunity'. Let us first briefly deconstruct that phrase so that meanings are clear. First 'window': without being overly literal, recognising that the word has a metaphorical as well as a literal meaning in the concept and practice of fenestration, is usually deployed to convey 'a viewing place', on the one hand, and 'where external light (e.g. 'enlightenment') enters', on the other. Thus St Petersburg was constructed as Peter the Great's 'window to Europe' from Russia. What does this mean? In Marshall Berman's classic account:

> 'The building of St. Petersburg is probably the most dramatic instance in world history of modernization conceived and imposed draconically from above……in physical terms – for Europe was now accessible as it had never been – but equally important, in symbolic language…. (meaning)….scrapping Moscow, with all its centuries of tradition and its religious aura….new beginning…..clean slate (Berman, 1982, 176-177).'

The window here is indeed intended as an 'observatory' but much more. On the one hand, it is *intentionally* a means by which to learn 'modernity' from seeing Europe, but on the other, it is a means of intentionally stepping radically outside path dependence on everything Russian, symbolised by Moscow's tradition and religiosity. However and crucially, the city had already been envisioned, and resources, including architects and engineers from Britain, France, the Netherlands and Italy recruited with the order given that every stonemason in the Russian Empire must relocate. One amazed official could thus observe that 'geometry has appeared'. Analytically therefore, first came the vision of eighteenth and nineteenth century Russia's comparative economic regression, second came the geometric vision of Europe's modernity, enlightenment and advance, but third, in realisation, the one did not commit the other to oblivion, rather they co-existed , the cosmopolitan and the insular. Even the location was constrained to the shallows of the Neva ('Mud') river in the Gulf of Finland since that was Russia's only feasible port outlet. So, concept, constraint and change were necessitated to construct this particular 'window of locational opportunity' but agency, absolute power and limitless resources were the means of opening the window. Curiously therefore, in this narrative, the window is the consequence not the cause of new path creation. It can

be argued that equivalent 'windows of locational opportunity' are more dependent than independent variables. In Cooke (2005) it was demonstrated that certain writing about Silicon Valley constructs a narrative starting with distantly related technologies to the silicon chip (wireless valves and early TV experiments in San Francisco, for example) to give it a spurious path dependence and, with it an invented history, a symbolic status. This is, interestingly, the inverse of St Petersburg because – Silicon Valley *is* modernity, where did it come from, how to damp down its image of 'unreal urbanity'? Narrators thus seek to overcome its perceived insubstantiality and predicted transitoriness from having been literally built on sand, as seen from the other side of the window. But it is hard to see any window in this or any other narrative as having anything significant to do with origins. As with St. Petersburg any window effect is a post-rationalisation.

So, the window perspective lacks agency, except *ex post* and assumes that which must be explained and the principals responsible for change[1]. In reality, it is important to inquire about institutions and other social organizations in seeking satisfactory explanations for such phenomena. It is equally plausible to explain Silicon Valley as a result of the organizational innovation of *venture capital*, which was far more pervasive than merely bump-starting microelectronics there and has continued to be so through successive waves, including the growth of software, biotechnology and clean technology clusters (Cooke 2010a). Incidentally, as Martin (forthcoming) notes, *ex post* is usually the only type of explanation for complex social phenomena available to social science, whether it be 'bubbles' in stock markets, clusters in economic space, or path dependence in electronic keyboard design. However, it is then incumbent on those contriving *ex post* explanations to take great

[1] It can be objected that Storper and Walker allow for agency: explicitly that human agency will make the difference in some regional contexts while not in others (acknowledgement to Ron Boschma for pointing this out). But this is rather ambiguous. Does it mean the same agency works in location A but not location B? Or that success in location A requires little or no agency? There clearly has to be a vision, agency & resources to move through the WLO. The 'winners' thus gain their fortune from Pasteur's 'prepared mind'. The 'losers' didn't prepare or do it well enough. The WLO thus seems a post-rationalisation and is, in itself, just a 'medium' rather than an active social agent. Maybe it is simply a metaphor, but not necessarily a helpful one that also invites 'chance' 'explanation'. Incidentally, Sydow et al (2009) show efforts at chance explanations are in effect lazy since these authors utilise painstaking historical inquiry to reveal social agency explaining all cases cited. This criticism can also be extended to 'dartboard' theory as promulgated by the likes of Ellison & Glaeser (1997)

pains, assisted by multi-level analysis and guided by the rigorous testing of theory, rather than seizing on the essential determinism of monocausal explanations whether of a technological, cultural or spatial kind.

What about the master concept, path dependence, itself? What is its purpose? Simplifying, it attempts to show that (technological) development is in often important, but sometimes trivial ways, history-bound. The most widely remembered case is the 'qwerty' keyboard, invented in Milwaukee by Scholes & Co. in the 1850s. Its layout is still used in the most advanced BlackBerries or iPhones. Why is that important or interesting? In fact, since the underlying technology that still utilises it has changed utterly over many technological eras, it is not interesting except to antiquarians or students of anachronism. In his celebrated paper on the subject, David (1985) goes into detail regarding the numerous alternative keyboard layouts that have been tried and failed as replacements, many with more user-friendly sequences of letters. The broader argument that claims attention is that all technological innovation has this 'conservative' or equilibriating character. Yet, somehow, the argument continues, 'punctuated equilibrium' comes along and radically disrupts this path dependence. How this happens is never satisfactorily explained. Arthur (1994) places a lot of emphasis on 'chance' dressed up as stochastic processes in his efforts to explicate, for example, why Silicon Valley is where and what it is. The inadequacy of a reliance on randomness is shown to be empirically as well as epistemologically dubious in Sydow, Schreyogg & Koch (2009) where they report painstaking research by historians of technology revealing intentionality behind some innovations claimed to be random.

So there are two obvious problems with these formulations as they stand, undermining our reasons for paying them much attention in evolutionary economic geography. The first problem is the conservatism of David's path dependence perspective while the second is the neglect of social or institutional agency in Arthur's recourse to randomness in accounting for economic geography. In the innovation systems approach, the first is dealt with by the concept of 'technological paradigm' in which socio-cultural meaning changes when radical innovation pushes a new regime and associated paradigm into the market. Examples would be the current, hesitant strategic niche experimentation with renewable fuels in the transportation and energy markets or, after Verganti (2006) the manner in which

design-driven innovation places radically different 'propositions' before customers, changing socio-cultural meanings, hence fashion-orientations in markets. Regarding the second problem, the role of 'chance' in socio-economic processes, the first thing to say is that it scarcely features in the reality of economic development except in probabilistic kinds of evolutionary modelling of innovation (e.g. Fagerberg & Verspagen, 1996). The problem of 'chance' explanations in relation to path dependence is identified by Martin & Sunley (2006) and its weaknesses summarised by Henn & Laureys (2010) as the following: undersocialisation, i.e. lack of agency; failure to differentiate outcomes from similar initial conditions; and uselessness for predictive or policy purposes. Having said that, even the latter critics conclude:

> 'The role of chance during the emergence of clusters, however, should not completely be ruled out here. Rather chance can be said to be of indirect importance as it is able to modify the scope of action of the local players…' (Henn & Laureys, 2010, 77)

This is known in the world of investment banking as 'hedging' of course, insurance against a possibly less than cautious generalisation on scientific matters. This is what Martin & Sunley (2010) show to have been Arthur's get-out clause, which they refer to as his 'chance-and-necessity' option. As they also point out, both David and Arthur also use probabilistic multi-equilibrium modelling in their analyses. It would be churlish to refuse such hedging, but even in mathematical terms its Monte Carlo modelling underpinnings, based on historic data, were shown to be spurious under highly disruptive, collapsing value, market conditions in the 2007-2009 credit crunch (Patterson, 2010).

So we come, finally for this section, to an approach that shows greater promise for utilising path dependence as a subsidiary conceptual element in a more satisfying overarching theoretical perspective consistent with evolutionary economic geography, which itself is uncomfortable with equilibrium assumptions except in the short term. It will also get us closer to an understanding of new path creation. This approach we will refer to generally as 'transversality', but in particular at this stage of the paper, 'relatedness' or 'related variety' (Boschma & Frenken, 2006). The language already denotes a certain ecosystem-like set of economic presences and possibilities in a given regional economy. For simplicity this assumes geographic proximity circumscribing relational proximity. Deeper analysis would imply at least some

relaxation of this constraint[2]. For the moment, three paths towards regional innovation can be conceptualised:

1) The *region* (i.e. administratively delineated, like Tuscany, N. Jutland or Skåne) has evolved in inter-related path dependent ways, industrially and institutionally. Innovation in the broad sense (e.g. cluster emergence) evolves through innovation in the narrow sense (e.g. commercialisation of new knowledge) conducted by innovators and imitated by entrepreneurs as new products or processes
2) The region's *industry* evolves path dependent characteristics, with an established inter-industry division of labour. Innovation in the broad sense (e.g. capability emergence) evolves through transversal (i.e. inter-industry) mutations from which innovation in the narrow sense emanates
3) The region and its industry are beneficiaries of innovation *imtermediaries* charged with inducing innovation either by stimulating cluster emergence (difficult) or transversality (less difficult) among existing (or inwardly investing) firms that may achieve innovation through induced knowledge recombination

All three cases are assisted, but are not equally dependent upon relatedness of industry as a means of escaping the negative aspects of 'lock-in' frequently associated with path dependence. Relatedness assists the first category to the extent market processes are supported by institutional means (e.g. strong trust, social capital, etc.) such that an industry may mutate and innovate mainly through its own internal dynamics. But it will also absorb neighbourhood knowledge spillovers, as appropriate, from related regional technology fields (Boschma & Lambooy, 1999). In the second case, transversality is stronger inasmuch as the innovation impulse, still largely rising from market interactions, here demands solutions that draw upon inter-industry knowledge spillovers. This further implies higher lateral inter-industry (platform innovation) absorptive capacity for knowledge recombination than vertical, cumulative (path dependent) intra-industry or firm knowledge

[2] However, on inspection, much relational proximity has its value in use within the geographical proximity of the home-base. This is because it may have been accessed digitally if in the form of exploitable information, absorbed or noted if acquired on a visit (temporary cluster, Maskell et al, 2006) or accessed relatedly from distant networks (e.g. a knowledge customer, supplier or provider), all then used in the region of residence. Accordingly, the quantum of non-geographic proximity that has to be allowed for constitutes, in practical terms, a statistically quite small tail.

recombination. Relatedness in the sense captured sociologically by notions of 'epistemic communities' or technologically by 'communities of practice' comes into play here, adding institutional embeddedness levels to pure industrial and technological relatedness (e.g. the common engineering knowledge discussed by Boschma & Lambooy, 1999 as underpinning diverse industrial districts and their lateral knowledge flows in Emilia-Romagna)

Finally, the third category of transversality involves the highest intensity of both revealed and 'induced' relatedness in the regional economy and its multi-level governance. Clearly, it is not impossible for the relatively low-key relatedness of the first two categories to produce highly unpredictable forms of inter-industry knowledge flows. But for the purposes of regional innovation and branching from path dependence such 'revealed related variety' probably does not predominate. Nevertheless, although related variety research methodology has itself evolved by leaps and bounds (e.g. survival analysis; Boschma & Ledder, 2010) it was, perhaps for purposes of modelling as much as anything, focused on the hypothesis that firms in different sub-sectors but within the same 2-digit NACE category were *a priori* more related than those located between such categories. Research subsequently showed the hypothesis that regions with firms in related NACE categories had superior economic performance indicators over time to those lacking them, gained consistent statistical support. However, such findings, interesting as they are, could be taken as vindication for the virtues of David-Arthur type unpunctuated equilibrium. It said nothing of particular interest about regional innovation and change, let alone the creation of new regional evolutionary pathways.

Of some theoretical interest, therefore have been the findings of research into the dynamics of territorial, sectoral and firm knowledge dynamics among more than twenty-eight European regions (see Crevoisier & Jeannerat, 2009). This shows remarkable variety in the inter-industry interactions occurring typically with respect to knowledge recombination for innovation. These are *ex ante* difficult if not impossible to predict but *ex post* simple to understand. Thus ten years ago it would be considered unlikely from an innovation perspective that farmers and car makers' associations would have much to talk about. But the rise of renewable fuels in automotives of many kinds means research interactions among them are pronounced nowadays. Moreover, adding a second dimension to relatedness, transversality is

increasingly practised by regional innovation agencies which, in distinctive ways, occasionally also focusing on 'green innovation' and associated transition strategy, induce knowledge cross-pollination among a variety of regional industries or sectors. In some cases, this is beginning to extend to inter-regional, inter-cluster cross-fertilization efforts.

The paradigm case of the former occurs in the practices of *Bayern Innovativ* in Germany. This agency, set up in 1995, organises annually up to 1,000 regional industry meetings of various sizes aimed at inducing cross-cluster and cross-sector innovation contracts. Meetings range from conferences of up to 500 delegates to numerous much smaller partner meetings to facilitate commercialisation opportunities. A €1,000 fee is charged per member, explaining first how annual agency turnover runs at some €8 million and second, why its only form of evaluation is whether or not the board is satisfied that it has hit or exceeded its forecast return. Accordingly, in interview it was extremely difficult to get an assessment from CEO Nassauer of actual innovations reaching the market due to agency efforts, since they are not officially recorded. He finally admitted to an informed guess that 10% of meetings annually resulted in marketed product or process innovations. Where such innovations cluster to form a new regional competence area, they clearly constitute a visible, measurable branching process creating a new regional pathway.

Increasingly, inter-cluster cross-pollination also occurs inter-regionally although perhaps more rarely than some same-industry or cluster relational networks operate, notably in biotechnology (Cooke, 2007). Two worthy of brief mention exist in Sweden, one between the Geographical Information Systems industry cluster at Gävle and the mobile telecoms (*Mobile Heights*) cluster in Skåne region Sweden, with a view to innovating new mobile positioning services. Another connects Värmland region's *The Packaging Arena* (TPA; see section 4) cluster with Norrköping's (Ostragotland) *Printed Electronics* cluster for advanced 'organic electronics' to facilitate TPA's 'green packaging' initiative. An embryonic cluster might emerge from such interactions especially if innovations were licensed to a multinational packaging company like *TetraPak*. Precisely such a new path actually opened incrementally as a cluster of some twenty Flexography (printing accuracy on flexible surfaces) firms spun out of a Värmland regional college in the recent past. This is indicative of the potential of such apparently arcane innovations to facilitate

branching from regional path dependence (in this case, the pulp and paper industry), retaining close links to the mother industry, but partly re-tracking the regional economy in the process. Recall again that these are not purely market branching processes but significantly *intermediated* by regional innovation agencies, as explored further towards the end of section 4 below.

3. A Jacobian-Schumpeterian Matrix

We have thus seen how regional economic branching is more clearly capable of being rationally explained by virtue of the *transversality* perspective than the 'window of opportunity' or 'path dependence' and 'chance' approaches. As noted, they really have no theory of change, rather 'path dependence' is a thesis about continuity and the others leave it in the lap of the gods. Moreover, when put to work in the regional economic sphere, even path dependence loses much of the relevance it may once have had for accounting for curiosities, like the survival of 'qwerty' on the iPad. Perhaps what follows is a little harsh, but the fact that opera is still noticeably path dependent on the Italian language, or that the names for most Japanese industrial equipment remain essentially German because that was the language of the instructing engineers of the 1868 Meiji Restoration, are roughly as important to regional economic development.

The next step in this exegesis is to harness Jacobs and Schumpeter to sustain the discourse on relatedness and transversality. Recall, we are seeking more satisfactory, theoretically-informed accounts for regional economic change – including change-with-continuity as one of the variants – than is provided by orthodox, equilibrium and, for that matter, Marxist accounts of collisions between modes and relations of production. If we start with Jacobs (1969) we find what are subsequently termed 'Jacobs externalities' to be perhaps the most useful of concepts (e.g. Boschma & Wenting, 2007; Boschma & Ledder, 2010) but with variable and unsuspected constraints. In the latter chapter, Dutch banking spinoffs are shown to have less impact than they have in manufacturing, whether Klepper's (2002) pioneering study of spinoffs and clustering in Detroit car manufacturing or Boschma & Wenting's (2007) similar study in the UK. This is because Dutch banks had variable survival rates and spinoffs from existing banks only came later rather than at the cluster's

beginning[3]. It is concluded that in the end '….Amsterdam was just lucky to have many start-ups with pre-entry experience in the banking and related sectors' (Boschma & Ledder, 2010, 206). Why the above average share of start-ups (compared to early spinoffs)? It is cultural, and probably, though this is to surmise, due to the Netherlands' late industrialisation, because:

> '…..entry levels remained low until the 1890s. One of the reasons was that it was considered a sign of weakness to [borrow] money from a bank. In the 1890s, this resistance for credits from banks started to disappear….and…[became] normal among a growing number of entrepreneurs' (Boschma & Ledder, 2010, 198)

Accordingly, the nature of Jacobs externalities continues to warrant further and deeper research as a consequence of research that moves away from a manufacturing to a services template. Having said that, Wenting's (2009) study of the *haute couture* fashion clusters in Paris, London, New York and Milan finds spinoffs and labour mobility to be the principal causes of growth in each, but particularly in the largest and oldest, namely Paris. So some urbanisation economies (for that is what Jacobs externalities define) derive externality benefits from user-driven demand (banking) while others, notably cars and fashion, derive theirs more from design-driven demand. In the latter case, designers 'propose' products to the market using their expertise in symbolic knowledge manipulation, and users (consumers) take it or leave it. Famously, in the case of the Ford Edsel, they left it.

Jacobs externalities or knowledge spillovers can thus be user or design driven in their innovation demand. In Verganti's (2006; 2009) discussion of these, he holds that design-driven is more radical than user-driven innovation which, following Dosi (1982) he sees as always incremental, thus path dependent by nature. By contrast, Dosi (1982) sees 'technology push' innovation as capable of provoking regime and/or paradigm change in dominant technologies and innovation trajectories. Verganti's (2006) field of interest is the Lombardy regional innovation system, particularly its overlapping and interacting design-intensive furniture and kitchenware clusters, where his equivalent to a technological paradigm is a socio-cultural paradigm. Instead of technology, its discourse is *meaning* and by changing meanings designers, like technologists, are capable of changing paradigms and regimes through

[3] Ron Boschma comments that the study did not investigate the Amsterdam banking cluster from its very beginning (but only from 1850 due to data availability), so this citation does not tell the whole story of the paper.

innovations that entrepreneurs commercialise. This innovator-entrepreneur division is quite pronounced here, with 'circles' of external as well as internal designer-innovators iterating rounds of 'meaning analysis' to set the tone for new ranges of design-intensive products to be 'proposed' to consumer markets (Pisano & Verganti, 2008).

Accordingly, this intersects with Schumpeter who, as Andersen (forthcoming) shows, was rather rigid about the separate functions of *innovator* as recombiner of knowledge (old and new) and *entrepreneur* as commercialiser and imitator, responsible for cluster 'swarming' of the innovation. This is to be contrasted with

		Variety	
		Low	**High**
Regional Innovation	**High**	• *Creative Destruction* • *Low Path Dependence* • *Regime Shift* • *Innovation 'Push'* • *E. G. Iceland*	• *Mutation/Transversality* • *Early Path Dependence* • *Demand-driven Innovation* • *Co-evolutionary Transition* • *E.G. Jutland, DK*
	Low	• *Equilibrium* • *High Path Dependence* • *Branching* • *User-driven Innovation* • *Incremental Change* • *E.G. Värmland, SE*	• *Punctuated Equilibrium* • *Late Path Dependence* • *Renewal* • *Design-driven Innovation* • *Market Paradigm Shift* • *E.G. Lombardy*

Fig. 1. Varieties of Path Dependent Economic Development

Garud & Karnøe's (2001) reification of entrepreneurship as the key change agent. From a Schumpeterian perspective the entrepreneur is the 'imitation' agent from the

viewpoint of novelty or innovation. At extremes, as Dosi (1982) sees it, certain innovations with radical qualities could be the handmaiden of those 'gales of creative destruction' by means of which old path dependences and their associated regimes could be terminated, or at least severely weakened, and new ones set in motion. Here, Jacobs makes a brief, but important re-entry based on variety, relatedness and the transversality that may arise in contexts of abundant knowledge spillovers and high lateral absorptive capacity. This is the point at which an innovation mutates through the interaction of these forces as entrepreneurs act upon the knowledge symbiosis effected by inter-cluster, inter-firm or inter-individual innovators. From this a new cluster or sector may emerge to prominence, as discussed above, there branching, or in a more Schumpeterian context of 'creative destruction' *breaking* with former regional path dependence. Much depends on the definition of 'radical' in innovation studies, a subject returned to in section 4 below. Returning to Schumpeter, for him according to Andersen (1994; 2007) the purest, most radical form of innovation was spatial and occurred with the opening up of new lands. The example he selected was the American Frontier that was subjected to 'railroadization' and where a *tabula rasa* waited to be inscribed with the signs and artifacts of modernity. In Fig. 1 we shall simply refer to this as 'regional innovation' since that term captures the two sides of the Schumpeterian innovation idea: on the one hand, 'railroadisation' or the opening up of new developmental pathways; on the other, 'creative destruction' or the undermining of old developmental pathways. This rather dramatic theoretical bifurcation is moderated usefully by interaction with Jacobs' concept of variety. Both of these dimensions are then given the designations 'high' or 'low' and from the resulting two-by-two matrix we draw out exemplars of distinctive forms and degrees of developmental path dependence, which are then explicated in the accounts that follow. In passing, while perceived as the 'purest' form of radical innovation, 'railroadisation' need not be understood as unproblematic, let alone perfect. The lawlessness, violence and genocide that characterised 'how the West was won' bear witness to the costs of massive social upheaval. As will be shown, Iceland's dash from fish to finance, which is the radically innovative path creation exemplar in Fig. 1, was also highly fraught, though fortuitously, less so than on the American Frontier.

4. Varieties of Regional Path Dependence

In what follows, accounts will be provided of key variables in the development of the exemplars, relating especially to varieties of path dependence proposed and the roles of related variety and distinctive innovation drivers in such contexts as the creation of new developmental pathways, incremental path dependent modernisation and relative regional economic equilibrium. In this paper, because of the interest in new path creation we do not consider cases of regional economic stasis or decline; however, it can be hypothesised that most would fall in the bottom left-hand corner of Fig. 1, i.e. low variety and low regional innovation.

Iceland: from fish to finance

Although not a region, Iceland with a national population of 317,900 being scarcely even scaled as one, its recent history shows a remarkable step-change in economic profile from staples (fish, energy) to producer services (investment banking) that demands analysis in a path dependence/path creation discourse. Accordingly, we begin with a stylised account of Iceland's radical regime shift, testing events against the broad template in Fig. 1. First, a brief summary of Icelandic economic history is essayed, drawing substantively upon testimony such as that of Boyes (2009). In April 1940 Iceland asserted its political independence consequent upon Germany's occupation of Denmark, the colonial power. One month later, in May 1940, Britain undertook a military occupation of the island on the strategic grounds that Iceland could align with Germany thus cutting off the North Atlantic route to US food and energy supplies. A year later, the US took over from the UK as Iceland's protector. Since 1380, when Denmark replaced Norway as the colonial power, the Danes had monopolised the Icelandic fish and wool trade. In this low variety economy, both Icelandic staples suffered harvest fluctuations; farmers and fishermen were thus familiar with the need for insurance and, later, 'futures' contracts to protect precarious livelihoods. This was their only connection with the modern derivatives trade.

US protection brought limited diversification of the Icelandic economy through the impact of the Keflavik air base, enlarged when Iceland joined NATO in 1949. By 1955 the US presence was contributing 18% of Iceland's foreign revenue while fishing

contributed 40%. So important was Keflavik to Iceland's economy that even in 2004 the second Bush administration was persuaded to keep four F-15 fighters stationed there long after the ending of the Cold War. From 1991 to 2009, the Independence Party, initially in coalition with Social Democrats, governed Iceland. Its programme had been to modernise, through privatisation, Iceland's sizeable state holdings, with its leadership, none more so than Prime Minister David Oddson, in thrall to neo-liberal ideology. Although the old economic regime, or traditional oligarchy, was to be assured that its power over transportation (especially shipping and the airline), and thus trade and even banking, were not going to be diluted by privatisation, a new and rising oligarchy was of a different opinion. Boyes (2009) describes Iceland's liberalisation concept as indebted to Milton Friedman, Reagan and Thatcher, but in practice more like the liberalisation of the post-Soviet Russian economy. Accordingly, while the former practised some degree of popular empowerment, Russian privatisation mainly enriched its oligarchs. Purchase of state assets like fish-processing factories, fertilizer plants, distilleries and transport companies at knock down prices created instant Icelandic billionaires. Tax rebates subsidised share purchases. The government's ambition was to move Iceland's economy from fish to finance.

Membership of the European Economic Area broadened Iceland's markets, fish quotas were introduced to conserve stocks but these were swiftly 'securitised' as loans against future catches and these and other financial innovations ('carry trade'; derivatives) fuelled the rise of a new oligarchy, which benefited especially from the post 1995 Independence Party-Progressive Party coalition policy to privatise Iceland's banks. A fishing oligarchy bought 26% of FBA (eventually Glitnir), the first bank to be privatised and then Jon Asgeir's network, a rival of both Oddsson and the old oligarchy, began focusing on Landsbanki and Kaupthing. Not so neoliberal supply-side deregulation prevented this for a time (minimum stakes of 25% and exclusion of foreign bidders ruled out all but a few indigenous acquirers) and the two bigger banks fell to interests supporting first the Progressive (Landsbanki) then the Independence (Kaupthing) Party. These intertwining institutional arrangements were of obvious importance to the Icelandic break-out from path dependence. However, instead of one, there were now three competing oligarchies: Baugur (Jon Asgeir; Sterling Airlines, Iceland Express airline and Glitnir bank); Bjoergolfur

(Pharmaco pharmaceuticals, Samson holdings, Landsbanki; West Ham United); and Gudmundsson (telecoms, frozen-food, Kaupthing). From these and the holdings of an outsider group ('S' group) (Samskip container-shipping, Bundarbanki and later, aligning with Baugur, Kaupthing - KB bank), grew the radical mergers and acquisitions empires that, assisted by neoliberal financial innovation 'pushed' Icelandic path dependence from fish to finance.

These new paths began, in the case of Baugur, with establishment, then acquisition of local supermarkets, internationalised into (UK) retail and by cross-group alliance (Baugur & 'S' Group) Glitnir and later Kaupthing banks. Bjoergolfur began in Russian bottling and alcohol markets with profits from which it acquired international generic pharmaceuticals firms, and subsequently Landsbanki and West Ham. Gudmundsson moved from air transport into Icelandic then international food retailing to merger with Bundarbanki and Kaupthing banks, later Baugur acquiring a large share. All banks engaged in high risk, high return loan activities that for the UK alone attracted, for example, investments of £40 million from Transit for London Authority, £30 million each from Oxford University and the Metropolitan Police, £11 million each from Cambridge University and the National Cat Protection Agency, and £858 million from 116 UK local governments. But by 2008 banking assets in Iceland had grown to 1,000% of GDP compared to 96% in 2000. The bubble, based on rapid credit growth, a steep current account deficit and escalating external debt led the rating agencies to move Iceland's economic assessment from 'stable' to 'negative' resulting in economic slowdown, asset price collapse, banking crisis and national bankruptcy.

Hence, where does this modern saga of creative destruction by 'jumping the rails' from fish to financial path dependence leave the Icelandic developmental trajectory? A new government of Social Democrats and Greens led by Johanna Sigurdardottir was elected in 2009. Women were also appointed heads of the re-nationalised and detoxified New Landsbanki and New Glitnir (now Islandsbanki) banks. Baugur was bankrupted by Landsbanki and Kaupthing calling in its loans. Unemployment, which rose above 10% in 2009 was 7.6% in June 2010 but economic growth had registered -6.5% for 2009 having been +6.0% two years earlier. The external balance of trade in services was -3.6 billion kronor 2009-2010 (Statistics Iceland, 2010). Inflation in 2009 was 12% but has since moderated to half that rate. Unemployment is lower

than previously because of return migration by, mostly, eastern European workers. The combination of negative equity and temporarily high interest rates wreaked havoc in the housing market. In 2009 the Icelandic financial system was under external management from the IMF, a consortium of Nordic banks and a Norwegian-Danish financial custodians committee. An application to the European Union was subsequently filed. That fish still count in Iceland was evident in their insistence on Icelandic not EU quota methodologies in the earliest negotiating gambit, but the likelihood of a return to such unreliable over-specialisation is extremely low, especially since the EU is unlikely to be swayed by a supplicant new member. So, the crisis meant Iceland effectively forsook its traditional path dependence as it suffered the negative effects of attempting another. Its future will most likely be a bit less 'Viking' with some attempt to embrace greater variety by slowly rebuilding its banking and finance, green energy, tourism and clean technology capabilities into a less risky, more balanced alternative developmental pathway.

North Jutland, Denmark: a local green platform in global energy markets

After the roller-coaster ride of Iceland's difficult break from path dependence Nordic neighbour Denmark's (Fig.1) high related variety axis intersecting a moderate regional innovation axis offers a much calmer portrayal of regional economic modernisation. Nevertheless, it still reveals change of a potentially *transitional* magnitude (re climate change) occurring within certain inherited, path dependent industrial parameters. Some explication of key terms is warranted here. It will be recalled from Section 2 that 'transversality' is the condition whereby a region contains a number of industries or clusters that display relatedness and from which innovations that cross-pollinate between such distributed knowledge bases may be created. In a context where such innovations are both produced and consumed, the region in question may be engaged in an innovative *transition* involving at least some degree of technological regime change (Freeman & Perez, 1988; Cooke, 2010b). A particularly precise form of such transition occurs in relation to eco-innovation which has been proposed as 'co-evolutionary transition' by leading 'system innovation' authors (Kemp, 2002; Geels, 2004; 2006) focusing on innovative responses to anthropogenic climate change. Since this is empirically shown to occur in a spatially uneven manner, the designation 'transition regions' is proposed for

those meso-units breaking out of path dependence upon fossil fuels in production and consumption. In the account that follows, it can be seen that 'transversality' is a crucial feature of 'co-evolutionary transition' to decarbonisation[4] because many technologies and institutions must combine systemically through 'strategic niche management' to achieve it. The complexity of this tends to mean that eco-innovations are incremental though their overall effect, when combined, will be regime-changing because technology push may ultimately induce a paradigm-transcending, post-hydrocarbon production/consumption 'landscape'. The latter is a long-term expectation in 'co-evolutionary transition' theory, capable of being glimpsed in 'transition regions' which, nevertheless must co-exist with the broader, global, hydrocarbon path dependence and its prevailing regulatory regime.

The present discourse is important not least because it draws attention to the role of *discourse articulation* in stimulating change from path dependent development[5]. Just as in the Icelandic case neoliberal discourse formed the basis for a thoroughgoing critique of the path dependent model of state ownership of assets, so in Denmark and elsewhere, two critical discourses were articulated to undermine prevailing path dependence circa the 1960s. The first of these was an anti-nuclear energy discourse; the second was its obverse, a pro-renewable energy discourse. In combination and through protest-based social movements this discourse brought about a reversal of government policy, the suspension of nuclear energy policy and the redirection of Denmark's nuclear research (the Risø laboratory at Roskilde) towards renewable energy research (Jørgensen & Karnøe, 1995; Karnøe & Jørgensen, 1996). Thus knowledge from research conducted into modern wind turbine prototypes was transferred to regions where industrial expertise and weather conditions were perceived as supportive of creating early path dependence on renewable fuels.

A further important point is that in such demand-driven innovation settings, subsidies are a necessary element of 'strategic niche management' and are found

[4] The concept of co-evolution however is not limited to this field. Compare for example: Nelson, R. (1994); Nelson, R. (2008); Cantwell, J. et al, (2010). However, these authors are not concerned with related variety or specific industries. Rather they concentrate principally upon the co-evolution of technology markets and regulatory regimes. I am grateful to Martin Heidenreich for these reminders.

[5] Originating in Laclau & Mouffe's (1985) theorisation of regime evolution and hegemony, it is illuminatingly deployed in Davenport & Leitch's (2009) account of pro- and anti-GMO discourse strategies in agricultural politics.

being made to consumption rather than only to production. The Danish case involved what *ex post* is revealed as a successful consumer subsidy policy regime that more than paid for itself in tax returns from wind-turbine production. From the early 1970s, government subsidies were made available to users of first generation wind turbines. This sustained the industry, initially based largely upon domestic demand, and enabled the north and mid-Jutland-based cluster to out-compete its main rivals in California and others in Europe. The user subsidy stimulated experimentation, knowledge spillovers, and niche market evolution in regionally 'path-dependent' trajectories in both Jutland and California. But the Reagan administration jettisoned wind energy subsidies while in Denmark they continued until a right-wing coalition entered government in 2000. By which time the Danish design had evolved considerably from its path dependent roots in agricultural and marine engineering where the plough and the ship's propeller were the inspiration. Meanwhile the Californian design atrophied around its inspiration, propeller driven aircraft. Already something of an anachronism, the two-blade, pointed upwind turbine design proved inferior to the three-blade, point it downwind Danish solution. *Vestas*, Denmark's national champion now has 40% of the world wind-turbine market and has been joined in its Aarhus-Aalborg cluster by the likes of Germany's *Siemens*, who acquired the other main Danish companies, S*uzlon* from India and *Gamesa* from Spain. Including home market production of turbines in Germany and Spain, these European producers, along with Denmark have 70% of world turbine production capacity with employment of 133,000 and global demand far from saturated.

However, this was only the beginning of the exploitation of path dependent relatedness in new ways. Markets had opened up for renewably fuelled Combined Heat and Power stations for District Heating. Demanding customers are the municipalities, most of whom run local energy supply companies and some 60% of Denmark's citizens rely upon it. Municipalities seek a balanced supply and order customised mixes of a variety of related energies (hedging again) involving biomass, biogas, wind, solar and marine energy depending on location and the type of solution required. Enormous export markets for District Heating have opened up in mature and emerging markets faced with climate change and 'peak oil' constraints, notably India and China. Within north Jutland (Fig. 2.) is a community of some 100-150 specialist renewable energy firms that combine to meet this demand. Incremental

innovation such as that of pipework firm *Logstor*, now a North Jutland District Heating company having branched from marine to power station technology and innovated a pre-insulated dual pipe system to minimise heat loss by fitting the cold water input pipe inside the hot water pipe. Together, the District Heating firms, municipalities, university laboratories and technology transfer agencies created an association entitled *Innovative Region: Flexible District Heating* with characteristics described in Fig.2.

This echoes the 2007 regionalisation of Denmark's administration into five, one of which is North Jutland. It constitutes both a regional innovation system and a

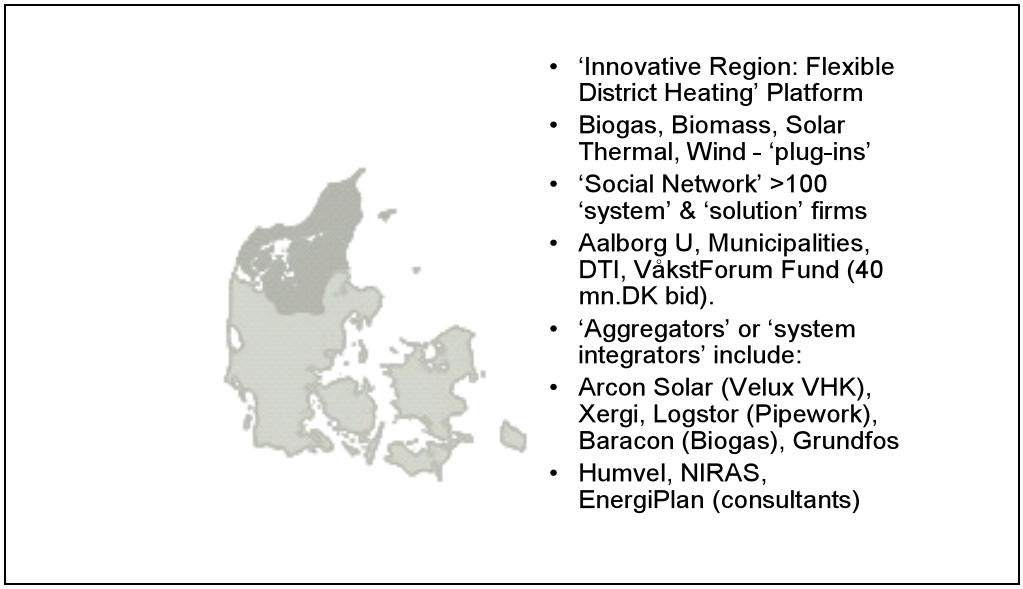

Fig. 2 North Jutland's Green Regional Innovation System

Source: Centre for Advanced Studies

'transition region' designation because, on the one hand, of its interactive commercialisation and knowledge generation sub-systems, and on the other, its regional production/consumption of renewable energy. The former consists of networks of firms in supply chains focused around the District Heating engineering platform while belonging to distinctive renewable energy business segments. These are, nevertheless, capable of being system-integrated by lead 'aggregator' firms such as solar thermal specialist *Arcon*, biogas contractor *Xergi*, green engineering firm *Grundfos* or consultants *NIRAS* into consortia for plant assembly. Supporting this sub-system is a knowledge enterprise support sub-system consisting of public laboratories, regional development agency, municipalities and technical agencies

such as the Danish Technological Institute. In 2008 the consortium made a bid to the regionally administered Danish Growth Fund (*Väkstfonden*) for 'user-driven design and innovation' (Ministry of Foreign Affairs of Denmark, 2008). A €5 million award was forthcoming to the consortium, now known as *Flexenergi* that currently has five innovative District Heating pilot projects underway in the region.

Briefly to reprise, this is an illustrative case of high variety cluster mutation involving embedded marine and agricultural engineering firms branching into the energy industry exploiting key design transversalities among wind turbine blade technology, pipework, gearing, energy damping and so on that evolved into design, prototyping and production for a new industry. Accordingly, the region was a beneficiary of early path dependence (discussed by Martin, 2010 after Page, 2006) and, following the vicissitudes of knowledge transfer, foreign competition and consumer subsidy now operates in a world of global demand-driven, mostly incremental, innovation for its renewable energy products and services. As stressed in the account the importance of co-evolution among industry, institutions and innovation discourses and practices was crucial to this achievement.

Shifting meanings and markets by design-driven innovation

It was noted in discussion of co-evolutionary transition theory that Dosi's (1982) concept of 'technological paradigm' shift is central to its key theoretical dynamic. This is that path dependence upon hydrocarbons shifts with innovation and regulation that comprise 'strategic niche management' of the former by the latter. At scale, these shift the energy technological paradigm towards predominance of renewable, post-hydrocarbon technologies, which ultimately evolves into an overarching socio-economic regime or landscape of 'green' (i.e. no greenhouse gases) production and consumption. The idea of 'technological paradigm' has also migrated to research on design-driven innovation (Verganti, 2006; 2009) that also casts useful light on relationships between path dependence and creation of new paths within specific market segments. A claim is made for the discovered design methodology to be considered radical innovation, which provokes the question: just how radical must innovation be for it to be considered 'radical innovation'? Briefly, it tends to be seen as broadly competence-destroying and business-cycle shifting in the neo-Schumpeterian world-view (Dosi, 1982; Freeman & Perez, 1988) and cognate with

major ‘creative destruction’. The complete replacement of fossil by renewable fuels would be ‘radical’ in these terms. However such a shift would be epochal and extremely rare; accordingly it is necessary to differentiate ‘epochal’ from more ‘episodic’ radical innovation. Verganti’s use of ‘technological regime’ change adapted as ‘socio-cultural regime’ shift (in fashion markets) is of the ‘episodic’ kind. It nevertheless points usefully to mechanisms for ‘creation of new paths’ from path dependence.

‘Design driven innovation’ aims radically to change the emotional and symbolic content of products i.e. their meanings and languages, through a deep understanding of broader changes in society, culture and technology. This is design not as a process of individual abduction (Roger Martin, 2009) but a collective process involving knowing what knowledgeable others think about society as well as being creative regarding series rather than one-off innovations. Accordingly, a manufacturer’s ability to understand, anticipate and influence the emergence of new product meanings is built by engaging external interpreters (designers, firms in other industries, suppliers, schools, artists, the media etc.) who share the same problem; to understand the evolution of new socio-cultural models, and propose new visions and meanings. In this way management of the innovation process regarding socio-cultural meaning mirrors that in technological innovation. Designers and technologists are thus in principle – and collectively – capable of learning from each other’s key processes in, on the one hand, design driven innovation in meanings and, on the other, technological innovation.

Design driven differs from user driven innovation (Von Hippel, 2005), which implies that product development begins from a deep analysis of user needs. Such analysts observe customers as they use existing products and track their behaviour in consumption processes. However, firms that Verganti (2009) takes as exemplars, notably Lombardy domestic goods and appliances firms such as Alessi, Artemide and Kartell (also non-Italian design-intensive firms like Apple & B&O) practise ‘design driven innovation’. These ‘propose’ innovations that radically re-define what a product means to the consumer. An example is the Alessi kitchenware product line which was transformed from simple tools to ‘transition objects’ that embodied transgressive forms thought likely to appeal to child-like affections dormant in

adults. The innovation model of a firm such as this means it *pushes* innovative designs onto the market, so there is little overlap with user driven innovation (Shane & Ulrich, 2004). The discourse is one of making *proposals* to the potential consumer or user of the innovation.

Verganti (2006) then conducts a regional systems of innovation analysis of Lombardy, demonstrating it is a key centre of furniture manufacturing, comprising 25% of the Italian furniture industry with 45% of its output exported. Regional furniture growth rates exceeded both the Italian and European Union levels from 1994-2003. The regional design cluster study reported in Verganti (2006) focused on the lighting, kitchen furnishing, furniture and kitchenware clusters. It reported findings from expert interviews that the region was distinctive for the number and strength of links between diverse actors in the regional innovation system. The skills portfolio of leading entrepreneurs and their territorial identities are cosmopolitan. Thus the founders of Alessi and Cassina are lawyers, Artemide's owner is an aerospace engineer, while others are from such disciplinary backgrounds as business economics. Leading designers include Israeli Ron Arad, American Michael Graves, Philippe Starck from France, Richard Sapper (German) and Ettore Sottsass (Austrian). Accordingly, knowledge of regional and global transversality are keys to the Lombardy design platform. Verganti (2006) emphasises the importance of variety by citing UK designer Jonathan Ive, designer of iPhone, iPad and most subsequent Apple innovations as a case in point. He previously designed bathrooms.

Hence, this episodically radical innovation analysis conceives of creation of new design market paths as forms of what evolutionists would consider 'punctuated equilibrium' with each equilibrium episode characterised by relatively late path dependence (i.e. the preceding fashion paradigm, regime or dominant discourse). However, to the extent that design-intensive innovation may draw expressly on historically quite distant motifs to inform design and product novelty, its capacity for change with renewal demands attention. In other words, preceding paths may re-appear in the guise of new paths. This is not confined to this kind of innovation, which often displays a 'recycling' capacity, as revealed in the 're-discovery' of windmills as modern energy providers. Thus design driven innovation rests on relatedness, transversality but also strongly upon knowledge recombination episodically to seek to change 'socio-cultural regimes' to develop market advantage.

Slow, incremental innovation from limited, but evolved relatedness

The final exemplar derived from the varieties of regional path dependence analysis and taxonomy presented in Fig. 1 is the peripheral Swedish region of Värmland, historically path dependent on forest products, notably the pulp and paper industry. However the interest for this study lies in the relatively constrained but undoubtedly impressive 'branching' that has been induced by transversality policy in an otherwise fairly unprepossessing regional setting. Värmland has a notably user-driven (intermediate and final) innovation model with elements of design-driven transversality. As noted in section 2 it is home to the Packaging Arena – a complex of clusters of packaging, paper and graphics firms that are indispensable for regional evolution. University science and technology have been bent to the needs of business clusters in packaging, paper, food, steel and ICT while advanced college expertise in flexography and packaging media are institutional and commercial spinoffs. Firms use the services of The Packaging Arena to 'rehearse' customer-response to new flexographic designs to its packaging. This entails market research from the TPA-based Karlstad University Services Research Centre, customer eye-tracking equipment in TPA's Packaging Media Laboratory and design input from SMEs spun out of the flexographics training centre at Broby Cross-Media College, an industry sponsored professional training centre.

The Packaging Arena supplies services to its 45 members ranging from Guidance & Process support, to Consumer Testing, to Innovation Support. It supports Consumer, Paper and Graphics research at Karlstad University and Broby College. The Packaging Arena is one of many clusters operating in the Värmland regional innovation system, which displays considerable relatedness enabling knowledge spillovers and joint working to occur. This aspect of joint working is evident in the Packaging Arena's strategic plan document. The process management team is well-qualified and team members have distinct competence areas that result in the whole group being able to manage sometimes complex work-related tasks. Perhaps uniquely, the Packaging Arena displays a number of related facilities, notably the Packaging Media Lab, the Packaging Greenhouse, DoTank Design Studio, Swedish Flexography Institute and the Graphics Institute at Broby College. Resources are

allocated for creating an incubator at the downtown Karlstad head office. The Japan desk is important because of close knowledge transfer links established with the Japanese packaging industry. Representatives of the latter are regular visitors to several of the facilities of the Packaging Arena as they are to major trade exhibitions such as TokyoPac. Future platform policies aim to promote user-driven innovation based on companies knowing better what consumer markets require of products and services (research projects by the Service Research Centre include studies on user-driven innovation). 'Sustainable Packaging' involves technical research on – amongst other subjects – fibre, (potato) starch, paper surfaces, green packaging, and renewable energy.

Hence this is a model based on low variety and relatively low and mainly incremental innovation. However the institutional set-up that has arisen from modest policy action and initiatives facilitates evolution of new pathways albeit relying ultimately on the regional core capabilities in pulp and paper production. In other words the regional economy is relatively equilibriated, strongly path dependent on forestry and its associated support industries, demonstrating modest branching (e.g. towards cross-media professions like scriptwriting in the regional college, founded to supply flexography skills). The regional innovation support system is highly-focused on user-driven innovation, which according to Dosi (1982) is fundamentally incremental compared to the more radical 'technology push' or 'design push' kind. Accordingly, what may appear to be new paths can relatively easily be traced back to initial path dependence in Värmland.

Conclusions

The main message of this analysis is that possessing or building variety in regional economies is generally a better regional development strategy than seeking to specialise, especially anew, in unrelated activity. In this respect Jacobs is a superior regional policy guide to Porter. Even the low early variety, low innovation Värmland region rose to seventeenth among Swedish regions as it evolved its moderately diversified platform. There are three further conclusions arising from the conceptual and empirical accounts in the foregoing. First, the paper demonstrates the importance of the concept of 'innovation' to any discussion of path dependence and the emergence or creation of new paths. In order to do that, however, the thrust of

the paper involved re-considering certain shibboleths of innovation systems studies. Among these was the 'new orthodoxy' (circa Lundvall, 1988; Von Hippel, 1988) that users and producers combined for innovation in ways overlooked entirely by an earlier generation of production-focused innovation analysts. However, that assumption has remained relatively unexplored in the intervening decades until recently. Accordingly, it is clear that attention must be devoted to time, industry and region in thinking about predominating but also changing forms of innovation impulse. In this, four forms were identified from the literature. The least developed, though fundamental to understanding the negative effects of recent financial services innovation is what was referred to as supply-side innovation involving liberal markets and low regulation. A distinction was then drawn between the frequently conflated user-driven and demand-driven innovation modes, the former being more based in consumer markets in which market research techniques prevail, the latter being much more societal and associated with multi-level governance from supranational to municipal levels dependent upon the desired entry-point of state intervention. Finally, attention was drawn to design-driven innovation, which is claimed to be paradigm-transcending although it was necessary to distinguish 'epochal' from 'episodic' kinds of innovation radicalism to clarify the adaptive use of core innovation concepts, such as technological and socio-cultural regimes and paradigms.

Second, these were related to a discussion of key concepts in thinking about path dependence and the creation of new paths. These included purported mechanisms by which change in regional economic trajectories was said to occur – largely by chance from 'windows of locational opportunity'. It was argued that this approach offers very little by way of explanation for important processes like, for example, cluster emergence (Fornahl, Henn & Menzel, 2010). Path dependence was argued to be clearly a dependent variable, the importance of which to regional change may be, on the one hand, over-estimated and yet, as the empirical sections of the paper showed, more or less useful on occasions when harnessed to a key change mechanism, notably innovation and its varieties. Evolutionary economic geography's key concept of relatedness was assessed and found the most important independent variable in regional economic evolution. This was because, again allied to an analytic and measurable variable like innovation (allied with entrepreneurship), it could furnish

explanation for 'branching' or indeed 'jumping the rails' from path dependence. Relatedness and its cognate transversality, which embraces regional variety and conscious policy action to exploit it, were shown to be important elements in any explanation of regional change.

Third, and linked to the insights of Jacobs on variety and Schumpeter on regional innovation, a taxonomy was drawn up representing different degrees of path dependent change. These ranged from the radical shift away from historic trajectories implied by high innovation and low variety, to the early but mutating co-evolutionary and transversal model in which demand-driven innovation contributed to co-evolutionary transition, to the punctuated evolution/late path dependence of the design driven innovation model with episodically radical change implications for market collectivities, and the equilibriated, incremental, highly path dependent model in which user driven innovation predominates. This taxonomy was then stress-tested against empirical reality by adducing exemplars from Iceland, Denmark, Italy and Sweden. A high level of isomorphism was shown to connect the taxonomy to each test case. This transforms the taxonomy into a typology which can be tested by future research. The results support the insights of evolutionary economic geography rather against the over-equilibriated assumptions of classic path dependence formulations. Clearly path dependence is not always and everywhere the dominant historical force it is often presumed to be, as change agents as diverse as Peter the Great and the Icelandic oligarchs have demonstrated throughout history.

References

Andersen, E. (1994) *Evolutionary Economics: Post-Schumpeterian Contributions*, London, Pinter

Andersen, E. (2002): Railroadization as Schumpeter's standard example of capitalist evolution: an evolutionary-ecological account, *Industry and Innovation*, **9**: 41–78

Andersen, E. (2007) *Schumpeter's Evolution*, Aalborg, Aalborg University Press

Andersen, E. (2009): *Schumpeter's Evolutionary Economics: A Theoretical, Historical and Statistical Analysis of the Engine of Capitalism*, London, Anthem

Andersen, E. (forthcoming) Schumpeter and regional innovation, in Cooke, P, Asheim, B, Boschma, R, Martin, R, Schwartz, D. & Tödtling, F. (eds.) *The Handbook of Regional Innovation & Growth*, Cheltenham, Edward Elgar

Arthur, B. (1994) Industry Location Patterns and the Importance of History, *Increasing Returns and Path Dependence in the Economy*, Michigan: Michigan University Press

Belussi, F. and Sedita, S. (2009) Life Cycle vs. Multiple Path Dependency in Industrial Districts, *European Planning Studies*, 17, 505-528

Berman, M. (1982) *All That is Solid Melts Into Air*, London, Verso

Boschma, R. (2005), Proximity and innovation. A critical assessment, *Regional Studies* 39, 61-74

Boschma, R. & Wenting, R. (2007) The spatial evolution of the British automobile industry, *Industrial and Corporate Change*, 16 (2): 213-238.

Boschma, R. & Lambooy, J. (1999), Evolutionary economics and economic geography, *Journal of Evolutionary Economics*, 9, 411-29

Boschma, R. & Frenken, K. (2006) Why is economic geography not an evolutionary science? Towards an evolutionary economic geography, *Journal of Economic Geography* 6:273–302

Boschma, R. & Ledder, F. (2010) The evolution of the banking cluster in Amsterdam, 1850-1993, in Fornahl, D, Henn, S. & Menzel, M. (eds.) (2010) *Emerging Clusters*, Cheltenham, Edward Elgar

Boyes, R. (2009) *Meltdown Iceland*, London, Bloomsbury

Cantwell, J, Dunning, J. & Lundan, S. (2010) An evolutionary approach to understanding international business activity: The co-evolution of MNEs and the institutional environment, *Journal of International Business Studies*, 41, 567-586

Cooke, P. (2005) Regional transformation and regional disequilibrium: new knowledge economies and their discontents, in Fuchs, G. & Shapira, P. (eds.) *Rethinking Regional Innovation & Change: Path Dependency or Regional breakthrough?* Berlin, Springer

Cooke, P. (2009) Transition regions: green innovation and economic development, presentation to DRUID Conference, Copenhagen, June 17-19

Cooke, P. (2010a) Jacobian cluster emergence: wider insights from 'green innovation' convergence on a Schumpeterian 'failure', in Fornahl, D, Henn, S. & Menzel, M. (eds.) *Emerging Clusters*, Cheltenham, Edward Elgar

Cooke, P. (2010b) Matrix policy: rationales and good examples, in A. Eriksson (ed.) *The Matrix: Post-cluster Innovation Policy*, Stockholm, Vinnova

Cooke, P. (forthcoming) Transversality and regional innovation platforms, in Cooke, P, Asheim, B, Boschma, R, Martin, R, Schwartz, D. & Tödtling, F. (eds.) *The Handbook of Regional Innovation & Growth*, Cheltenham, Edward Elgar

Cooke. P. and Morgan, K. (1998) *The Associational Economy*, Oxford, Oxford University Press

Crevoisier, O. & Jeannerat, H. (2009) Territorial knowledge dynamics: from the proximity paradigm to multi-location milieu, *European Planning Studies*, 17, 1223-1242

Davenport, S. & Leitch, S. (2009) Creating space for the successor: the discourse strategies of pro- and anti-GM factions regarding the future of agriculture in New Zealand, *European Planning Studies*, 17, 943-962

David, P. (1985) Clio and the economics of QWERTY, *American Economic Review,* 75, 332-337

Dosi, G. (1982) Technological paradigms and technological trajectories: a suggested interpretation of the determinants and directions of technical change, *Research Policy*, 11, 147-162

Ellison G. & Glaeser E. (1997) Geographic concentration in U.S. manufacturing industries: a dartboard approach. *Journal of Political Economy* 105:889–927

Fagerberg, J. & Verspagen, B. (1996) Heading for divergence? Regional growth in Europe reconsidered, *Journal of Common Market Studies*, 34: 431-448

Fornahl, D, Henn, S. & Menzel, M. (eds.) (2010) *Emerging Clusters*, Cheltenham, Edward Elgar

Freeman, C. & Perez, C. (1988) Structural crisis of adjustment, business cycles and investment behaviour, in G. Dosi et al., (eds.) *Technical Change & Economic Theory*, London, Pinter

Garud, R. and Karnøe, P. (2001) Path Creation as a Process of Mindful Deviation, in Garud, R. and Karnøe, P. (eds.) *Path Dependence and Creation*, London: Lawrence Erlbaum, 1-38

Geels, F. (2004) From sectoral systems of innovation to socio-technical systems: insights about dynamics and change from sociology and institutional theory, *Research Policy*, 33, 897-920

Geels, F. (2006) Co-evolutionary and multi-level dynamics in transitions: the transformation of aviation systems and the shift from propeller to turbojet (1930-1970), *Technovation*, 26, 999-1016

Harmaakorpi, V, Tura, T & Melkas ,H. (forthcoming) Regional innovation platforms, in Cooke, P, Asheim, B, Boschma, R, Martin, R, Schwartz, D. & Tödtling, F. (eds.) *The Handbook of Regional Innovation & Growth*, Cheltenham, Edward Elgar

Henn, S. & Laureys, E. (2010) Bridging ruptures: the re-emergence of the Antwerp diamond district after World War II, in Fornahl, D, Henn, S. & Menzel, M. (eds.) (2010) *Emerging Clusters*, Cheltenham, Edward Elgar

Jacobs, J. (1969) *The Economy of Cities*, New York, Vintage

Jørgensen, U. & Karnøe, P. (1995) The Danish wind turbine story: technical solutions to political visions, in A. Rip, T. Misa & J. Schot (eds.) *Managing Technology in Society: the Approach of Constructive Technology Management*, London, Pinter

Karnøe, P. & Jorgensen, U. (1996) *The International Position & Development of the Danish Wind Turbine Industry*, Copenhagen, AKF

Kemp, R. (2002) Environmental protection through technological regime shifts, in A. Jamison & H. Rohracher (eds.): *Technology Studies and Sustainable Development*, Munich, Profil Verlag

Klepper, S. (2002) Capabilities of new firms and the evolution of the US automobile industry, *Industrial & Corporate Change*, 11, 645-666

Laclau, E. & Mouffe, C. (1985) *Hegemony & Socialist Strategy: Towards a Radical Democratic Politics*, London, Verso

Lundvall, B. (1988) Innovation as an interactive process: from user-producer interaction to the national system of innovation, in Dosi, G, Freeman, C, Nelson, R, Silverberg, G. & Soete, L. (eds.) *Technical Change & Economic* Theory, London, Pinter

Martin, R.L (2010) The Roepke Lecture in Economic Geography – Rethinking Regional Path Dependence: Beyond Lock-in to Evolution, *Economic Geography,* 86, pp. 1-27.

Martin, R.L. and Sunley, P. (2006) Path Dependence and Regional Economic Evolution, *Journal of Economic Geography*, *6*, pp. 395-438.

Martin, R.L. and Sunley. P. (2010) The place of path dependence in an evolutionary perspective on the economic landscape, in Boschma, R. and Martin, R.L. (Eds.) *Handbook of Evolutionary Economic Geography*, Cheltenham: Edward Elgar, pp. 62-92

Martin, R.L. (forthcoming) Regional economies as path dependent systems: some issues and implications, in Cooke, P., Asheim, B, Boschma, R, Martin, R, Schwartz, D. & Tödtling, F. (eds.) *The Handbook of Regional Innovation & Growth*, Cheltenham, Edward Elgar

Martin, Roger L. (2009) *The Design of Business,* Boston, Harvard Business Books

Maskell, P, Bathelt, H. & Malmberg, A. (2006) Building global knowledge pipelines: the role of temporary clusters, *European Planning Studies,* 14, 997-1014

Ministry of Foreign Affairs of Denmark (2008) *Invest in Denmark*, Copenhagen, Government of Denmark

Nelson, R. (1994) The co-evolution of technology, industrial structure, and supporting institutions, *Industrial and Corporate Change* 1994; 3: 47-63

Nelson, R. (2008) What enables rapid economic progress: what are the needed institutions? *Research Policy*, 37, 1-11

Page, S. (2006) Path dependence, *Quarterly Journal of Political Science,* 1, 87-115

Patterson, S. (2010) *The Quants*, New York, Crown Business

Pisano, G. & Verganti, R. (2008) Which kind of collaboration is right for you? *Harvard Business Review*, 86, 78-86

Schumpeter, J. (1975) *Capitalism, Socialism & Democracy*, New York, Harper Torchbooks

Shane, S and Ulrich K. (2004) Technological innovation, product development and entrepreneurship in management science*, Management Science*, 50, 133-144

Statistics Iceland (2010) *External trade in services, 2009-2010*, Rejkjavik, Statistics Iceland

Storper, M. & Walker, R. (1989) *The Capitalist Imperative: Territory, Technology & Industrial Growth*, Oxford, Blackwell

Sydow, J, Schreyogg, G. & Koch, J. (2009) Organizational path dependence: opening the black box, *Academy of Management Review*, 34, 689-709

Verganti, R. (2006) Innovating through design, *Harvard Business Review*, December, Reprint R0612G, 1-9

Verganti, R. (2009) *Design Driven Innovation*, Boston, Harvard Business Press

Von Hippel, E. (1988) *The Sources of Innovation*, Oxford, Oxford University Press

Von Hippel, E. (2005) *Democratizing Innovation*, Cambridge, MIT Press

Wenting, R. (2009) *The Evolution of a Creative Industry*, Utrecht, University of Utrecht Press