Path Dependence & Innovation in Cities

Professor James Simmie
Department of Planning, Oxford Brookes University

OISD – SoBE Breakfast Research Seminars 21 October 2008
Path Dependence and the Evolution of City Regional Economies

Edited by James Simmie and Juliet Carpenter
With papers by Ron Boschma, Juliet Carpenter, Andrew Chadwick, Harry Garretsen, Robert Hassink, Ron Martin, James Simmie, & Peter Sunley
History Matters
Path dependence and innovation in British city-regions

James Simmie, Juliet Carpenter,
Andrew Chadwick and Ron Martin
Presentation structure

• Theoretical explanation
• Research methods
• New path creation
• Path dependence
• Local innovation systems
• Lessons for policy
Theory: Path dependence

• Economies inherit the legacy of their past developments and this shapes the possibilities for the future.

• “A probabilistic and contingent process (in which) at each moment in historical time the suite of possible future evolutionary trajectories (paths) of a technology, institution, firm or industry is conditioned by (is contingent on) both the past and the current states of the system in question”. Martin and Sunley (2006, p. 402)
Theory: Path Dependence and the Development of a New Industrial-Technological Sector in a City-region Economy
Product life cycle and US locational effects

**Figure 4.14** The product life cycle and its suggested locational effects on United States production and trade. Source: L. T. Wells Jr (ed) (1972) The Product Life Cycle and International Trade, Boston: Division of Research, Harvard Business School, 1972, Figure 1, p. 15. Reprinted by permission.
Research methodology:
Travel-to-Work-Areas with core populations > 125,000 in 2001
## City-Region Selection

<table>
<thead>
<tr>
<th>CIS4 Outcome</th>
<th>Strongest</th>
<th>Weakest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novel products</td>
<td>Cambridge (35%)</td>
<td>Swansea (6%)</td>
</tr>
<tr>
<td>Novel processes</td>
<td>Northampton (11%)</td>
<td>Newport (2%)</td>
</tr>
<tr>
<td>New products</td>
<td>Aldershot (38%)</td>
<td>Norwich (20%)</td>
</tr>
<tr>
<td>New processes</td>
<td>Oxford (32%)</td>
<td>Leeds (13%)</td>
</tr>
<tr>
<td>Organisational change</td>
<td>Reading (34%)</td>
<td>Wakefield (13%)</td>
</tr>
<tr>
<td>Marketing change</td>
<td>Warrington (32%)</td>
<td>Middlesbrough (15%)</td>
</tr>
</tbody>
</table>
New path creation

- Indigenous creation.
- Heterogeneity and diversity.
- Diversification into technologically related industries.
- Upgrading of existing industries.
- Transplantation from elsewhere (Martin and Sunley 2006)
Indigenous creation: Cambridge & Swansea

• ‘Star individuals’ played significant roles in the instigation of radical new institutions that generated new technological/industrial pathways.
• Cambridge Consultants was formed in 1960 by a small group of chemical engineering graduates from the University.
• Swansea: the Vice Chancellor of the University inspired the Technium Programme launched in 2001.
Indigenous creation: Cambridge & Swansea

• No strong and dynamic relationship between universities and the local economy/innovation system. Universities do not function as major players in generating spin-outs or direct transfers of technology and knowledge.

• Role (as in Cambridge) more as a source of skilled scientific labour (once the local innovation system begins to develop), or as a happenstance source of enterprising individuals (as in the origin of Cambridge’s high-tech development or Swansea’s Technium Programme).
Heterogeneity & diversity: 12 cities

Inverse Herfindahl-Hirschman index of diversity selected cities
1981-2005

GREAT BRITAIN
Aldershot
Leeds
Warrington
Northampton
Norwich
Reading
Oxford
Wakefield
Middlesbrough
Cambridge
Newport
Swansea
Heterogeneity & diversity

- Specialised diversity (or clustered diversity) is probably more likely to generate radical innovations than simple Jacobs' diversity.
Diversification into technologically related industries: Cambridge
“Clustered diversity” in Cambridge High-Tech Economy

Upgrading of existing industries

• It has been easier to start new industries in new locations rather than to upgrade older industries in situ.
• Possible explanation for this is that product life-cycles follow a path of start-up, growth, maturity and decline and that there is a limit to how long an industry can continue without the need to introduce entirely new products.
• Even in the case of Cambridge it is already possible to see the first wave of high-tech developments in IT, electronic equipment and instruments moving in to a phase of relative loss of dynamism.
Transplantation from elsewhere: Swansea

- Development of the electronics industry in Swansea.
- Triggered by the Sony investment east of Swansea in Bridgend in 1973.
- At the height of production, 50 percent of televisions and 75 percent of video cassette recorders (VCRs) produced in Europe were made in Wales.
- Both these markets have now disappeared due to decisions made by the overseas headquarters of the Welsh branch plants not to re-invest in places like Swansea in order to keep pace with technological change.
Sources of path dependence

• Dependence on initial external chance events.
• Technological lock-in (Paul David).
• Increasing returns (Brian Arthur).
• Institutional hysteresis (Douglas North, Mark Setterfield).
• Social embeddedness.
Dependence on initial external chance events

• Despite frequent recourse to the notion of serendipity in the path dependence literature we think that this may have more relevance in explanations of how new pathways are created than how their long-term developments are determined.

• We do not have evidence from our empirical analyses of sectoral development being determined significantly by chance.
Technological lock-in: Swansea

• Local economy was based on extractive industries. At its peak, Swansea was producing 60% of the world’s copper requirements. Failure to break out of and diversify its longstanding mining technologies lead to the closure of these industries by the 1960s and 70s.

• Second wave based on FDI in electronics. The technologies used in the production of CRTs and VCRS were rendered obsolete by the new technologies of plasma and LCD screens and CD recorders.

• In both egs the local economy remained locked-in to technologies that were overtaken either by the discovery and exploitation of alternative sources of natural resources or by the invention of replacement technologies
Increasing returns: 12 cities

Change in proportions of employees in narrow KIBS selected cities 1981-2005

Years

% employees in narrow KIBS

Reading
Aldershot
Cambridge
Oxford
GREAT BRITAIN
Leeds
Northampton
Norwich
Middlesbrough
Swansea
Wakefield
Newport
Institutional hysteresis: Cambridge & Swansea

- Private sector respondents in both Cambridge and Swansea were critical of the slow pace of change in local institutions.
- Universities are too slow in starting or reacting to new economic opportunities.
- Public policy in a number of areas is well behind what is needed to exploit new markets, eg land use planning.
Institutional hysteresis: Swansea

• Old working practices, such as the expectation of a job for life in the same company, and grant dependent culture are unrealistic in the face of contemporary international competition.
Social embeddedness: 12 cities

Knowledge partners located nationally or internationally selected cities CIS 4 2002-2004

- Cambridge
- Oxford
- Warrington
- Reading
- Middlesborough
- Norwich
- Northampton
- Wakefield
- Aldershot
- Swansea
- Newport
- Leeds

% using national or international knowledge networks

- Government, public research
- Universities
- Consultants & private R&D
Local innovation systems and absorptive capacities underlie the processes of new path creation and path dependence.
Definition: Innovation

• “Carrying out of new combinations such as a new good, a new method of production, a new market, a new source of supply, a new industrial organisation” (Schumpeter 1961).
• “Creative destruction” (Schumpeter 1942).
• “Implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations” (The Oslo Manual Guidelines for Collecting and Interpreting Innovation Data, OECD 2005, p. 46).
Invention: 12 cities

Change in annual patent applications to EPO per 100,000 population 1990-2001

- Cambridge
- Oxford
- Aldershot
- Reading
- Middlesbrough
- ENGLAND
- Northampton
- Norwich
- Wakefield
- Leeds
- Newport
- Swansea
Novel product Innovation British City-Regions 2002-2004
Definition: Absorptive capacity

“The ability to utilize externally held knowledge through three sequential processes:

1. Recognizing and understanding potentially valuable new knowledge outside the firm through exploratory learning

2. Assimilating valuable new knowledge through transformative learning

Absorptive capacity: Private & public sectors 12 cities

Change in proportions of employees classified to R&D and higher education selected cities 1981-2005

- Cambridge
- Oxford
- Aldershot
- Reading
- Warrington
- Norwich
- Middlesborough
- GREAT BRITAIN
- Swansea
- Leeds
- Northampton
- Newport
- Wakefield
Stylised Process of Negative Path Dependent Innovative Development - Swansea

- Pre-formation phase
  - Legacy of old industrial structures, restrictive business cultures and limited skill base

- New path creation phase
  - Restricted scope and opportunities for emergence of new technological pathways

- Pathway development
  - Lack of momentum in development of new paths of industrial and technological paths.
  - Lack of any critical mass

- Absorptive capacity
  - Failure to attract or build high-skilled, scientific labour force.
  - Enterprise culture and supporting institutions fail to emerge

- Innovation capacity
  - Limited indigenous innovative capability and linkages to external knowledge environment very slow to develop

Restricts the scope for and scale of growth-enhancing effects
Stylised Process of Positive Path Dependent Innovative Development - Cambridge

- **Pre-formation phase**
  - No major industries, or entrenched business cultures.
  - Established scientific reputation of university. ‘Greenfield’ environment.

- **New path creation phase**
  - Considerable scope for, and activated openness to, new industrial and technological development.

- **Pathway development**
  - Emergence and self-reinforcing growth of new sectors.

- **Absorptive capacity**
  - Build-up of high-skilled, scientific labour force, enterprise culture and supporting institutions.

**Innovation capacity**
- Build-up of indigenous innovative capability and linkages to external knowledge environment.

**Reinforces growth of existing pathways**
- Stimulates further creation of new paths of industrial and technological development.
Lessons for policy

• Endogenous sources of economic growth.
• Path breaking non-equilibrium long-term change.
• The co-evolution of non-economic factors with economic change.
• Market opportunities.
• The emergence and adaptation of innovation ecologies through time.
Endogenous sources of economic growth

• Path dependent development is also place dependent
• Start with local historical development of particular sectoral structures.
• Re-invent or branch out of local specialisations.
Path breaking non-equilibrium long-term change

• Large scale policies at national level: fiscal, information, tech transfer, innovation schemes.

• Leading cities’ successes based on long-term development of 30 to 40 years.

• Adaptive and accommodate future uncertainty.
Warrington Master Plan 1972
Co-evolution of non-economic factors with economic change

- Institutional forms of collective capitalism have generated high rates of innovation.
- Create innovative set of institutional and cultural phenomena.
- Local authorities currently ill-equipped.
Toulouse Innopolis 2006
Labège Innopole South East Toulouse
Market opportunities

• Leading cities’ growth based on local identification of market opportunities.
• Identify windows of locational opportunity for existing or new specialisations.
• Avoid long-term lock-in to existing pathways of development.
Emergence and adaptation of innovation ecologies through time

• Systemic and interrelated nature of local innovation systems
• International knowledge networks.
• Positive international and local feedbacks.