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Macro regional economic development from micro-level partnerships between the higher education and business sectors

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A major thrust in UK government policy to achieve sustainable economic development concentrates on innovation and strengthening the competitiveness of small and medium-size (SME) firms in regional contexts. A core mechanism for promoting such development lies in encouraging partnerships between the higher education and private business sectors, particularly to enhance knowledge-based skills. University managed schemes with government funding that aim to generate improved business performance are also a highly effective way of creating new job opportunities.

The south-west region of the UK is characterised as a peripheral region where employment turnover and skill levels are typically below national averages. Previous research has developed system models showing how slow staff turnover can paradoxically harm aggregate skill levels in an organisation in times of rapid business change. The consequent need for rapid importation of expertise can be met by academic-industry partnerships based on short-term (½ to 2 year) applied research and development projects mainly in SME firms. Such firms often otherwise lack the resources for substantial investments in staff training. Causal diagrams prove their utility as an effective communication tool for preliminary discussions about the main feedback relationships and possible business development policies. Improved linkages between the academia and industry sub-systems, which tend otherwise to be ineffectively connected, set off mutually reinforcing long-term feedbacks.

Business competitiveness in peripheral regions

The rapidly changing global industrial environment is forcing companies to improve their competitiveness through the acquisition of new technical skills and through investment in advanced technologies. However, there are many factors inhibiting the adoption of new technologies - particularly Small and Medium size Enterprises (SMEs). According to Bennett et al (1998) these include:

- lack of capital investment funds
- lack of staff to investigate new technology
- lack of access to expert assistance
- lack of time to investigate new systems
- lack of knowledge of available systems

In addition, these difficulties can be further exacerbated by businesses being located in peripheral regions – one such being the south-west of England. Lower wage and fewer advanced technology businesses lead to a greater than average difficulty of attracting and retaining highly skilled staff. As a consequence, graduates educated in the region tend to

migrate to regions where opportunities are greater. A result is that SMEs can often suffer from lower aggregate skill levels in peripheral regions.

The qualitative conceptual model of Winch and McDonald (1999) shows a skills inventory (level) where the gains and losses of skills in the firm are depicted as inflow/outflow rate variables. Gains arise from recruitment and/or training; losses arise from staff attrition and from the natural obsolescence of skills. A certain turnover of staff can be beneficial, when a firm is undergoing fundamental change, because of the opportunity to import new skills to address different business circumstances. As Winch and McDonald argue, this is paradoxical since the conventional view in human resource management is to retain staff as a way of retaining expertise in-house. Peripheral regions, however, can suffer from both lower available skill levels in the general labour market and lower staff turnover rates.

There are several ways of overcoming such difficulties by importing specialist skills from outside bodies (eg. consultants) and other 'knowledge partners' (universities/colleges of further education). One particular way is through technology transfer partnerships between businesses and higher education institutions ('knowledge partners'). One such government-sponsored scheme, called the Teaching Company Scheme (TCS), has been operating in the UK since 1975. This entails the recruitment of a high-calibre graduate to work on a specific project (usually of 2 years' duration) on location at the firm, with the knowledge partner supplying academic expertise.

A Government review of TCS (Quinquennial Review, 1996) has concluded that the economic impact of the scheme is "substantial" and it calculates that, in terms of net cumulative additional activity, each £1 million of TCS support generates:

- 58 jobs
- £3.6 million value added
- £3.0 million exports
- £13.3 million turnover
- £1.5 million capital expenditure
- £0.2 million R&D expenditure

Furthermore, although TCS does not have an explicit job-creation objective, the review noted that the TCS actually creates jobs for less expenditure (£13,900 per job) than many other schemes with more explicit job-creation objectives. The scheme encourages partnerships to be set up because of the government grants that part fund the employment and supervision costs and also by managing the risks and difficulties associated with recruiting and employing a graduate for a limited duration project.

Business - university synergy

It is clear that technology transfer partnerships work by exploring the synergy of the two very different sets of skills brought by each side. Businesses possess practical skills in commercial and technology development and market knowledge, but may not have the time or inclination to undertake theoretical studies or research and development where paybacks are unclear. The problem is likely to be particularly acute in peripheral-region SMEs, as argued above. Knowledge partners possess skills in researching and understanding new thinking and technology, perhaps not immediately related to the collaborating firm's main business sector.

Their weakness is lack of exposure to practical business imperatives, unless local businesses invest in R&D programmes. Again, this is less likely in regions where there is a higher proportion of SMEs.

The Quinquennial Review does recognise the benefits of TCS programmes in both directions to each party. There may be 'reverse technology transfer' as academics work with firms using advanced commercial and manufacturing practices, leading to more case studies for teaching purposes, better direction for research, networking and enhanced departmental credibility.

However, the Quinquennial Review does not explicate the mechanism by which such synergy works or what the longer term implications are for the regional economy and participating institutions. Synergy relationships imply positive feedbacks, but what are the best levers to encourage long-term sustainable regional economic development? Such a question is of interest to the Department for Business Development within the University of Plymouth, which manages TCS projects and other government/European Union funded projects with business.

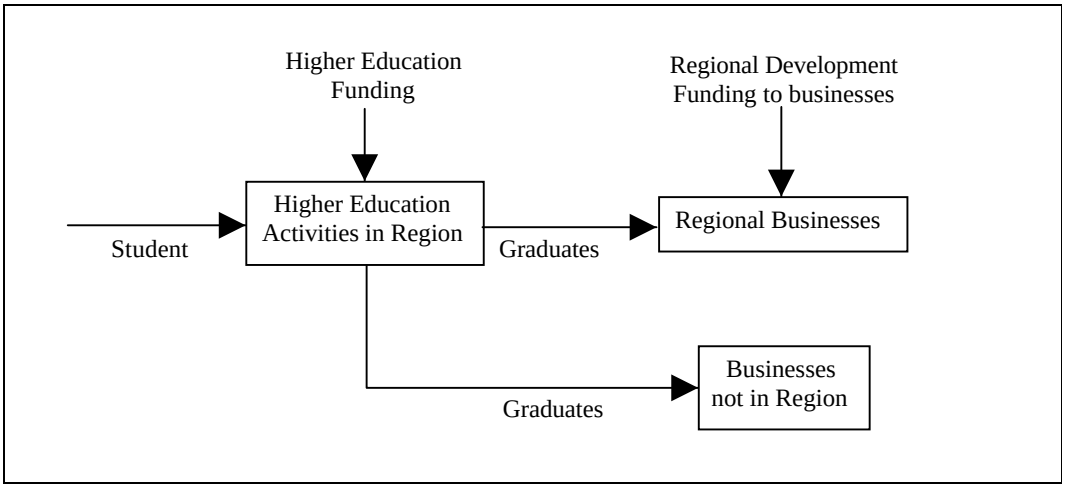

Fig 1. "Traditional" view of separate higher education and business sectors

A typical view of the regional economy in the past would have consisted of two subsectors: the higher education sector and the business sector (Fig 1). Each sector receives their own funding stream; businesses can be eligible for a range of expansion and development grants. The only link between the two is the flow of graduates into vacancies in business firms. The influx of graduates into local firms can be restricted in peripheral region SMEs as discussed above - remaining graduates are attracted out of the region.

Causal mapping of synergy

Moscardini et al. (1999) discussed the way in which causal loop diagrams can assist in the teaching and learning of applied economic theories. CLDs aid structural thinking about economic relationships and can be developed into simulations – and the benefits of the learning stimulus from them – even if CLDs themselves are only static representations. Thus, in Figure 2, we suggest some of the positive feedback relationships involved in the business-knowledge

partner relationship. Negative feedbacks are not shown for clarity, but include limits imposed by time, budgets, available expertise and availability of suitably qualified recruits. Figure 2 is a highly aggregated causal map, typical of those often drawn at the start of projects to generate ideas; it is not the type of causal map that can be constructed at the end of a quantified simulation study to summarise findings. However, both causal maps have their uses as communication devices.

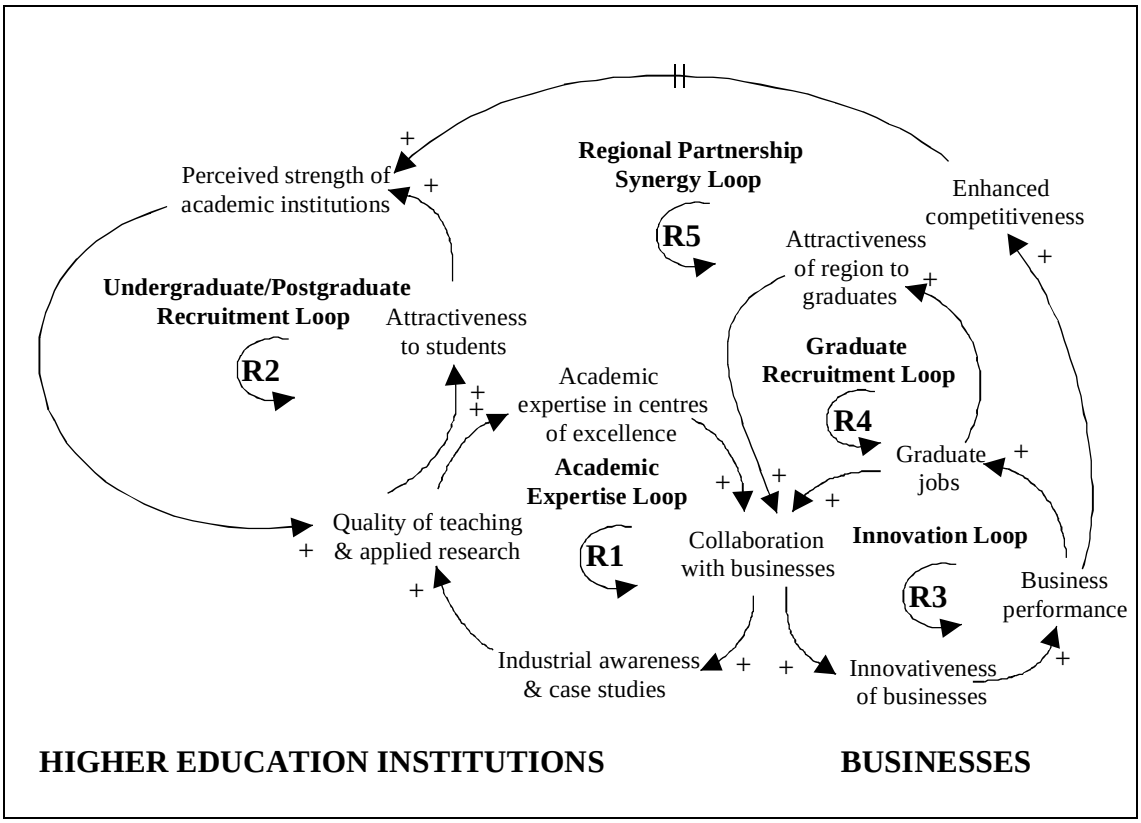

Fig. 2 Positive feedbacks involved in academia-business synergy

An interesting benefit of sketching out the positive feedbacks is to identify where the high-leverage policies lie which can unlock further growth in the number and quality of technology transfer partnerships. Positive loop R1 in Figure 1 seems intuitively the key short-term response loop linking the business-academia sectors. The longer-term loop R5 is a much less direct and implies a general impression in the population that academic institutions become stronger because of proximity to and other involvement from local businesses.

Current initiatives in the University of Plymouth involve setting up and promotion of existing academic areas of strength in the form of "Centres of Expertise". This initiative seems to make sense in the light of the central position of loop R1. The Quinquennial Review reports that the way that TCS partnerships come together is often serendipitous. Such centres would mitigate this by helping to develop and focus existing contacts with business, build reputation and create longer-term relationships. Without a quantitative simulation model, the robustness of claiming superior leverage through such a policy is not established solely from a causal map. But building a quantitative model would be a formidable project. Discussions with academic

regional economists indicated that the following list of economic variables and issues (though not exhaustive) could be included in an econometric model of regional development:

- productivity of employees (valued added per head)
- % of R&D undertaken with university
- liquidity, profitability, efficiency indices, return to shareholders
- data from input-output models/ multiple regression models
- capital stock theories
- GDP per head as economic proxies for attractiveness of the region
- availability of land, labour and the price of labour
- game theoretic approaches to collaboration
- similarity to foreign direct investment decisions (decision making quantifying the mutuality of such proposals)

A simulation model was suggested as one of the few ways of constructing a coherent model to represent all these factors, given the endogenous growth nature of this system. But there are many factors for which data are not easily available or for which judgmental data would be highly speculative. Coyle (1999) continued the debate on qualitative versus quantitative models. He compares the utility of a carefully constructed causal map (or influence diagram) with the danger of erroneous conclusions from a quantitative model containing unreliable assumptions. Correspondingly, in the practical world of management decision making (in this case regional business development initiatives in universities), policy initiatives may not be able to wait for the detail required for a quantitative model. Management instead proceeds on a "controlled experiment" or emergent strategy approach. However, such policy making will be facilitated by the structural thinking engendered by causal mapping.

Summary

Causal loop diagrams provide a route to understanding how synergies operate in business-academia partnerships. A simulation model could be developed from the basis of such structural diagrams. For the purposes of preliminary disussion and brainstorming, causal maps act as communication devices that seem more powerful at summarising dynamic growth ideas than other more conventional ways of describing economic relationships.

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