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Government and Policy paper revision

"Designing learning networks in peripheral regions: comparison of two models"

Abstract. In spite of a growth of interest in implications of networks for regional development, those studies which closely examine applications of learning networks to peripheral regions are still few. The paper reviews how peripheral regions are less favoured in technological adaptation and innovation, and identifies key tasks network programmes need to perform. The paper considers two typical models of networks targeting an industry, one calling for participation to all relevant sectors in the industry, and the other focusing on a particular firm and its suppliers. Two cases of network programmes in Wales are closely examined. The paper suggests that the "supply chain" model is a more reliable choice for peripheral regions in producing tangible benefits to a wider population of its members in the relatively short term.

Introduction

There is a growing literature on implications of networks for regional development. Some point to interactive learning taking place through networks in economically successful regions. They argue for its application to less favoured, peripheral regions as a means to regenerate their economies (Morgan, 1997; Maskell et al., 1998).

In supporting local firms in peripheral regions, two approaches were dominant in the past. While one places an emphasis on a state-led improvement of R&D infrastructure, the other stresses privatisation of enterprise support services (Morgan, 1996). The latter, neo-liberal approach is based on the premise that there is enough supply of technical knowledge in developed economies like the UK. According to this view, what prevents firms from using external sources is the lack of a capacity to absorb and utilise knowledge on the part of firms (Rothwell and Dodgson, 1991).

The "networking paradigm" has emerged as a third way. The paradigm contends that firms learn best from firms, and attempts to create an environment conducive to such interactive learning (Cooke and Morgan, 1993; Commission of the European Communities, 1994; OECD, 1996). The argument for the networking paradigm has also met some criticism from those who question the impact of such policies and their basis as a socially inclusive development model (Lovering, 1997; Hudson, 1999).

However, those studies which closely examine applications of learning network to peripheral regions are still few (see Huggins, 1998a, 1998b for a general review of TECs' networking

activity in the UK). This is a particular cause for concern as a variety of bodies in peripheral regions have begun such applications with much expectation and little knowledge.

Against the backdrop, this paper attempts to examine the suitability of two typical network models to peripheral regions. It starts with a review of the conditions firms in peripheral regions are situated in adopting and developing new technologies. This aims to identify tasks network programmes face in peripheral regions and set key measures with which such programmes should be evaluated.

Then the paper considers two typical models of networks targeting an industry. One is what is called here the "industry wide model" that calls for participation to all relevant sectors within a targeted industry. The other is the "supply chain based, customer centred model" that focuses on a particular firm and its suppliers. The paper looks into the two models' organisational characteristics.

This is followed by an examination of the two models through two case studies. The two network programmes to be examined are the Welsh Medical Technology Forum (WMTF) and the Supplier Association Programme (SAP), both run by the Welsh Development Agency (WDA). The paper draws findings from two research projects that were undertaken in the period 1996-98 with a total of over 40 semi-structured interviews with key participants.

Following the case studies, the paper then discusses the suitability of the two models to peripheral regions and draws out some policy implications. Finally the paper concludes with a short summary of the findings.

Learning and innovation in peripheral regions: how are they less favoured?

In assessing networking programmes in peripheral regions, it is necessary to see how firms in peripheral regions are less favoured in terms of learning and innovation. This will clarify those areas which network programmes aim at and measures with which the programmes should be assessed. This section briefly reviews the situations of peripheral regions in terms of (1) type of firms located, (2) scale of R&D and nature of innovation, (3) producer service as an external source of knowledge, and (4) networking with other firms

Type of firms located

Peripheral regions are more often than not characterised by their branch plant economies: the dominance of branch plants operated by multi-locational firms whose headquarters are located elsewhere. The situation, which originally developed through the postwar regional development policy in the UK's case, remains largely unchanged today. A majority of peripheral regions have suffered a decline of their traditional manufacturing industries and, to overcome the

employment loss, they have often relied on inward investment by domestic and overseas capital. Linkages of branch plants with local firms tend to be weak. Phelps (1993) suggests a continued lack of embeddedness of branch plants into their regional economies and argues that it reflects the further integration of peripheral regions' industry into an increasingly international division of labour. Reflecting the spatial divisions of labour (Massey, 1984), peripheral regions are under-represented by high-tech firms. In the UK, there is a marked historic concentration of high-tech employment in southern England both absolutely and relatively (Keeble, 1989, 1995).

Scale of R&D, nature of innovation

Overall, R&D made within peripheral regions is relatively poor (Howells, 1984). The figures of R&D performed within business as percent of regional GDP in 1994 are 0.5 in Wales, 0.4 in Scotland, 0.7 in North as compared with 2.0 in South East. Peripheral regions also have a weak presence of government R&D institutions. The same figures for R&D performed within government institutions are 0.1 in Wales and North and 0.3 in Scotland as compared with 0.4 in South East (Office of National Statistics, 1996). The figures suggest a relatively weak R&D infrastructure in peripheral regions.

Further, given the spatial divisions of labour between core and peripheral regions, innovation taking place at firms or units in peripheral regions tends to be more production process-related than product-related (Oakey et al., 1980).

Producer services as an external source of knowledge

There is a lack of a pool of quality producer service firms in peripheral regions. Hitchens et al. (1996) find that service providers in peripheral regions lack competitiveness in a number of measures such as value added per head, sales per head, and propensity to export. They suggest that higher performance outputs shown by service providers in core regions are underpinned by a higher level of training and experience of fee-earning staff, and indicate a higher level of quality of the products they offer. In contrast, firms outside South East are more likely to serve a local market, fail to develop specialist market niches and lack competitiveness. In seeking for quality service providers, firms in peripheral regions need to make extra effort to overcome the disadvantage and look for sources outside their regions. Further, Mackun and MacPherson (1997) demonstrate that a poor presence of quality service providers in proximity leads to a lower level of innovation.

Networking with other firms

Firms in peripheral regions are less active in networking with other firms. This is particularly true with small and medium-

sized enterprises (SMEs) who do not tend to engage in interactive learning with external sources (Rothwell and Dodgson, 1991; Storey, 1994). Through a large-scale survey of SMEs in the UK, Keeble (1997) demonstrates that SMEs in peripheral regions record a significantly lower level of collaborative activity than ones in other regions. Phelps (1995) reaches a similar conclusion, comparing electronics firms in South Wales and Hampshire-Berkshire. The regional difference in collaborative activity is attributed to inadequacies with supplier capabilities (Phelps, 1995, p.355), lower levels of specialisation by firms in peripheral regions, and more restricted opportunities for collaboration within smaller regional economies (Keeble, 1997, p.290).

There is little doubt that firms in peripheral regions have less experience in networking. This leads to a vicious cycle in which a lack of experience further discourages an attempt of collaboration, producing organisational weaknesses in interactive learning.

In short, compared with core regions, firms in peripheral regions on average spend less in R&D and focus more on production process innovation. The supporting infrastructure for their R&D is weaker in terms of producer service providers as well as government R&D institutions in the UK's case. This signifies a potential for inter-firm learning as a source of knowledge. However, linkages to inward investors, who often have superior technologies, remain weak. Also the proportion of those firms active in inter-firm collaboration is smaller. These suggest a larger pool of firms, particularly SMEs, who are inexperienced in interactive learning in peripheral regions.

Tasks for network programmes and measures for their assessment

There are two distinct tasks network programmes have to address. First, network programmes need to acquaint firms with knowledge of networks and help them participate in a network in the first instance. Following this, they need to assist firms in learning and developing rules in the network so that they can avoid any troubles and benefit from their participation (Pratt, 1997).

Second, it is necessary to integrate knowledge acquisition with implementation. Forming a network and sharing knowledge and experience itself is of little use unless it is followed by the use of such knowledge in technical adaptation and innovation (Glasmeyer *et al.*, 1998). If network programmes leave the integration to individual firms, knowledge gained through networks may remain unused and create little value. Networks programme need to bring about behavioural change throughout the stage of putting knowledge into practice.

In light of the conditions firms in peripheral regions are situated, what aspects should be looked at in assessing network programmes? It is argued here that the following should be considered.

(1) Manageability

'Manageability' refers to the ease which policy makers bring firms together to form a network and help them understand and develop rules for interactive learning and maintain progress towards shared goals. This is important as firms in peripheral regions tend to be more reluctant to engage in interactive learning due to their lack of experience. The ease of assessing progress falls here, too, as it enables a network to pursue its goals and keep its participants.

(2) Speed in producing tangible benefits

Network programmes have to produce results in a relatively short time. Firms in peripheral regions tend to be suspicious about merits of such programmes and reluctant to engage in it for a long time unless tangible benefits are gained. This is true with other political constituents whose support has to be gained in running network programmes. Programmes need to reach and carry out the second of the tasks identified above. Tangible benefits are felt only when knowledge gained through a network is applied in technological adaptation and innovation.

(3) Sharing of benefits by leaders and followers

Benefits of network programmes have to be felt by followers as well as leaders. Whether such policy is taken or not, leaders of technical and organisational innovation will anyhow undertake interactive learning. A measure of success is the degree of collective learning in which both leaders and laggards get involved and pursue the practice (Hassink, 1996). This is imperative since the proportion of such leading firms tends to be smaller in peripheral regions. Rather than strengthening a divide between leaders and laggards, programmes need to create a driving force for the whole.

Other areas that should be considered include: whether programmes are effective at embedding inward investors into the economies of peripheral regions (ie formation of stronger links between inward investors and local businesses), and whether they are suitable for process innovation or product innovation.

Two models of networks

The focus of this paper is an effective form of network that policy programmes should consider when they aim at facilitating interactive learning within an industry in peripheral regions. Two models to be examined here are two extremes in a continuum varying in the degree of focus within a targeted industry.

One is what is called here as the "industry wide model" (Figure to be inserted). This model takes an inclusive

approach that calls on all firms within a targeted industry to participate. In practice, firms make a decision depending on several factors such as interests and risks perceived. This usually ends in the situation where only part of firms within the industry join a programme. An exception to this is obligatory participation by law. Chambers of Commerce in Germany are a case in which all relevant firms participate in the groups.

The model implicitly aims at a few archetypes of industrial districts such as Silicon Valley. An increasingly strong contention, set out in Saxenian's (1994) work on Silicon Valley, is that a code of behaviour in favour of interactive learning exists within an industry in these successful districts. This facilitates information sharing and collaborative ventures among firms regardless of trade relations.

The other model to be examined is what is called as the "supply chain based, customer centred model" ("supply chain model" below) (Figure to be inserted). This model focuses on a particular firm and its suppliers in a targeted industry. The formation of a network starts with a call for participation to the customer, followed by a call to its suppliers. Although some suppliers may decline to participate, all participants have trade relations with the particular customer.

This model has its origin in the Japanese automotive industry (Sako, 1996). A similar model centred on a particular supplier (ie a group of a supplier and its customers) is possible in theory, but there are few cases in practice.

These two models are distinguished from each other by the following three organisational characteristics in the first instance.

(1) Size: The number of participating firms tends to be larger in the industry wide model than in the supply chain model.

(2) Nature of relationships: In the supply chain model, there are trade relationships between suppliers and a customer although suppliers are not linked to one another. In the industry wide model, trade relations do not necessarily constitute a major link among participating firms.

(3) Structure: In the supply chain model, a customer firm is in a central position as it is linked to the rest of the members (ie suppliers). In contrast, such a centre does not exist at the beginning in the industry wide model.

The primary distinctions can potentially produce differences between the two models in the following areas.

(a) Variety of participating firms: The larger size of the industry wide model is most likely to lead to a richness in the variety of participating firms. Combinations of participants with different backgrounds may produce unexpected outcomes.

(b) Reciprocity and shared goals: Supplier-customer relations encompassing the supply chain model provides a foundation for reciprocity and shared goals. Supplier-customer relationships form a core of any business and have direct bearing on business performance. This keeps firms aware of potential advantages of collaboration and interactive learning in the day-to-day operation. Viewed by suppliers, customers are the major source of income. They are more often than not keen to have close, long-term relations with their customers and develop information exchange (Dickson, 1996; Jones, 1998). Suppliers also often see customers as a source of knowledge in developing and refining their products (von Hippel, 1988). As for the customer side, there is a growing sign that customers see their suppliers as a source of competitive advantage. For example, to facilitate co-ordination in product design, production and logistics, major automotive assemblers have adopted the preferred supplier scheme in which they deal with a relatively small number of suppliers in a co-operative manner (Lamming, 1993). In short, there is reciprocity in which a growth at one side leads to one at the other ("you grow, we grow") in supplier-customer relations. This provides a foundation for interactive learning, which is also reciprocal in principle.

(c) Indices for monitoring: The supply chain model has an advantage in monitoring its progress. Trade relationships provide a basis by which to measure benefits obtained from interactive learning. Parties in trade relations already use quantitative measures to assess their trade. When they enter into interactive learning, they can relate it to those trade-based measures and assess its pay-offs (Staber, 1996).

(d) Ease of co-ordination: The ready availability of a centre may provide the supply chain model with greater ease of co-ordination. A centre acts as a focal point where information from each of the members is gathered and analysed, strategic decisions are made, and information on the decisions is again disseminated. Direct relationship between a centre and each of the other members in the supply chain model also minimises distortion of information in communication.

(e) Greater responsibility of a centre: The performance of the supply chain model may to some degree hinge upon the resources invested by a centre. Given the position as a node of information flows, a centre is likely to be responsible for significant part of the setup and operation work in the supply chain model. When a centre does not invest enough resources to accomplish the tasks, the model may lose its advantages of having a centre and fail to function.

(f) Availability of power: The central location of a customer firm in the supply chain model tends to provide it with power. The concentration of linkages and information flows gives the centre advantages and, as a result, leverage over the other parties (Powell and Smith-Doerr, 1994, p.378). Further, trade relations the customer firm has with other firms in the supply chain model often give it power as the relations are often associated with asymmetries between two

parties. The imbalance is strong when it is difficult for one party to obtain resources from other parties than the counterpart (Marsden, 1983). This is particularly the case when the customer is a major business partner for the supplier. In contrast, more horizontal relationships associated with non-trade linkages tend to ensure that such asymmetries are less of an issue in the industry wide model. Although the existence of power is often discussed with negative implications, this may not necessarily be the case for interactive learning. Co-operation can take place between firms under subordinate relations as well as independent relations (Penn, 1992; Pyke, 1988). If employed with leadership and appropriate support for other members, power in the supply chain model may allow the centre to induce others to take on new initiatives that involve uncertainties and risks.

Two case studies

How do these differences between the two models result in their performance in the measures discussed above? To consider this, two cases are examined below.

WMTF

The WMTF, established in 1992, holds a series of seminars to improve linkages among organisations in various sectors of the health care industry in Wales. The WMTF drew directly on the experiences of a number of medical networks (eg Mass Medic in Boston and Medical Alley in Minnesota) established in the US. The members of the Forum include private firms (medical devices, pharmaceuticals), a majority of which are SMEs, as well as academics, NHS, Welsh Office and the WDA. The membership is flexible and some 600 people and organisations have participated in the Forum's activities and events (Henderson, 1998). In terms of linkages, what relates its members to each other outside the Forum varies to a great extent from social to trade based in nature, and from non-existent to strong in strength. Although the Forum has a Steering Group, no single member in the Forum has relationships with all other members.

The set-up of the WMTF went through a number of different stages in which the centre of gravity was gradually formed while participation remained voluntary. Its origins can be traced back to the interactions in the early 1990s among the WDA, the NHS and a number of academics. Further impetus came from several health care firms (pharmaceutical and devices) within the region. Clearly these organisations came together with differing motivations. What united this informal grouping, though, was the belief that the region's technological expertise was being under-exploited due to poor linkages between the various parts of the sector. The early

interactions led the WDA to organise a series of round-table discussions.

The outcome of this period of consultation was the appointment of a Steering Group. The Steering Group performs tasks as a pseudo centre in the WMTF's relatively decentralised structure. The Group meets approximately four times per year to review progress and determine a programme of activities. All the key positions of the Group are chosen from the private sector to ensure that the Forum is relevant to the needs of industry. Nonetheless, due to greater time pressures faced by private firms, the Group's membership has tended to be heavily weighted towards the academic and business support personnel, weakening its relevance to the private sector.

Reflecting the weak leverage of the Steering Group over the Forum's members, setting up the WMTF was a delicate task. In marketing the Forum, the WDA undertook field visits and a questionnaire survey to gain support and identify prospective participants. This revealed not only support but also some concerns about the issue of confidentiality. To overcome the fears, the WDA and the Steering Group went to a great length to ensure that nobody would be forcing its participants to divulge commercially sensitive information.

The WMTF has shown a number of significant weaknesses in its operation. One is its difficulty in obtaining feedback from its participants. In deciding its future programmes, the Group relies on a feedback questionnaire included in the delegate pack for each seminar. However, it has rarely succeeded in obtaining a high level of returns from this exercise. A further source of monitoring data was informal feedback received during the meetings and other contacts. Evidence obtained from such occasions is largely anecdotal.

The Forum's weakness is more pronounced in assessing the benefits of its activity. This is because a great majority of knowledge generated in the Forum is know-who ('who knows what and what they can do'), benefits from which remain largely unquantifiable. They are unable to produce other quantitative performance measures than the number of meetings and attendants. The Forum's strategic direction has tended to be guided by the intuition of the Steering Group and anecdotal 'success stories'.

The WMTF faces an attendance problem as well. In the early period, the Steering Group decided to concentrate on generic issues with a broad appeal (eg industry and academic links, funding for innovation, quality and regulatory affairs). More recently, the programme has begun to focus on more specialised areas (eg biotechnology and sensors, lasers and medicine). Here the Steering Group aimed at providing an opportunity for the Forum's members to gain knowledge from outside their immediate sector of interest. This view, however, is only shared by a small number of what might be called 'innovative participants', who are willing and able to experiment with networks outside their immediate focus. In contrast, a majority of the Forum's members, and small firms

in particular, began to participate on a selective basis. The attendance figures declined from almost 100 at some of the early generic meetings to around 30 to 40 (Henderson, 1999). The Forum's participants end up meeting and networking more and more with those who are focused in the same direction. This has reduced the merit of the Forum's large number of members and variety of their background.

The Forum also has a serious weakness in transforming knowledge gained through networking into practice. As noted above, a major form of knowledge generated in the WMTF is know-who. In addition to presentations and discussions, the seminars also set aside refreshment periods for more informal interaction. These periods are viewed as a vital component of the Forum's activities, providing an opportunity to make contacts and exchange experiences. Such initial interactions can lead to more in-depth interactive learning. The most high-profile output of such know-who acquisition has been a new electron beam sterilisation plant to be established by a member of the Steering Group in partnership with a Canadian firm that gave a lecture on the potential of electron beams (Henderson, 1999). However, such cases of innovative collaboration are very small in number and scale (usually involving two or three members) and dependent on chance. In the majority of cases, contacts made at meetings have not led to any further interactions or collaborative ventures.

What is crucial here is the lack of mechanisms that induce and help its members to learn to transform new contacts into collaborative relationships. In the Forum's operation, such learning remains as responsibility of individual members. As a result, a great majority of its participating firms have, as yet, gained very little in terms of quantitative output. In this respect the spread of changes in learning behaviour to the majority of its members is likely to be a long term process.

SAP

The SAP, initiated in 1992, help firms to form a supplier association, a group consisting of a sponsoring customer and its key suppliers (Hines, 1994). The programme is a deliberate attempt to copy supplier associations in the Japanese automotive industry. A supplier association holds seminars, workshops and strategy sharing meetings on a regular basis to share knowledge and experience. As of March 1999, 30 associations have been founded under the SAP. They are different in size, from a small group with five members to a large one with over 30 members. Sponsoring customers also vary in their industrial sector (eg automotive, electronics, office equipment) and size (ranging from medium-sized local firms with about 200 employees to large-scale multinationals). Yet the associations share the structure in which all member suppliers have trade relations with a sponsoring customer who acts as a centre. Further, in many cases, member suppliers are SMEs and smaller in scale than a sponsoring customer.

The set-up work of supplier associations under the SAP starts with initial contacts by the WDA with a sponsoring customer firm and centres on the customer throughout the following stages (Izushi, 1999). When a customer firm agrees to set up an association, it then selects member suppliers in consultation with the WDA. This is followed by an invitation to the selected suppliers and a start-up meeting which all concerned parties attend. Either before or after the start-up meeting, the sponsoring customer visits the site of each member supplier and conducts benchmarking of their performance level. Then the customer sets targets and starts its regular programmes (ie seminars, workshops). After this stage, the operation is usually led by the sponsoring customer and the involvement of the WDA diminishes progressively in a majority of associations.

In setup and operation, a sponsoring customer often makes use of the leverage it has over member suppliers. In addition to its central position as the sole member who has relations with the rest of the group, a sponsoring customer firm is in many cases larger than member suppliers and viewed as a source of business they cannot neglect. This gives a sponsoring customer some leverage. A good number of suppliers felt that they were tested on their loyalty to the customer at an invitation to join in a supplier association. A customer firm also uses the leverage in shaping rules within the group. For instance, a programme is often drawn in such a way that if a member gives a presentation or hosts a factory tour on its site, every member takes it in turns. This makes it clear that a member has to offer as much benefit to others as it receives.

Trade relations between a sponsoring customer and member suppliers help supplier associations alleviate the assessment problem the WMTF experiences. Under trade relations, suppliers are subject to some quantitative measures (particularly price). The SAP goes one step further and facilitates exchange of information that was thought to be previously internal. As noted above, supplier associations conduct a benchmarking exercise at an early stage and repeat it regularly to check progress. This helps to identify major problems or weaknesses members have in common, raise their awareness and work on the weaknesses. Measures used in benchmarking cover various aspects including quality (eg defect ratio), production efficiency (eg changeover time), safety (eg time lost for accidents), delivery (eg delivery on time as percent of the total) and moral of employees (eg days of absence). The use of such measures is possible partly because they are closely attached to goods (or services) traded and partly because a sponsoring customer has the leverage to request member suppliers to disclose relevant information. The assessment by quantitative measures is a driving force to move supplier associations forward.

As in the WMTF, one of the major types of knowledge generated in supplier associations is know-who. This takes place in terms of (1) furthering knowledge of each other

between a sponsoring customer and member suppliers, and (2) gaining knowledge of other member suppliers.

Of greater importance is know-how acquisition in the SAP. When a sponsoring customer takes the lead in putting techniques into practice and discloses information on their implementation, the acquisition of know-how becomes a collective process in which benefits are shared by all members. For example, when the sponsoring customer of supplier association A announced a plan of adopting the *kanban* system, its member suppliers expressed strong opposition for the fear that they would end up holding a larger stock. Having had no experience in the system, the customer first implemented it in-house and invited the member suppliers to see it. Then the customer organised a team of five people who visited each supplier's site and made all arrangements for the system's set-up. Once the member suppliers saw the system's benefits (eg elimination of waste, early warning of quality problems), they became enthusiastic about the system, enjoying performance improvements (Izushi and Morgan, 1998). What makes it possible for the sponsoring customer to take the lead is the basis of reciprocity it has with all the member suppliers in trade. The sponsoring customer knew that all the investment in helping the suppliers would be returned directly by lower price and higher quality of goods supplied by them.

Sponsoring customers, however, do not always make use of their position. Some supplier associations are not as successful as others because of the lack of leadership (Izushi and Morgan, 1998). They attracted from many member suppliers strong criticism that the groups just talked about techniques and did not act on their implementation. In those associations, sponsoring customers use the groups solely to inform member suppliers of general principles of techniques. However, generalised knowledge of a technique often poses difficulties in its implementation because each member has many idiosyncrasies and unique problems. Unless general presentations at meetings are followed by transfer of more detailed knowledge on a one-to-one basis from someone who uses the technique, it most likely leaves out some of the members, hampering the cohesion of the group. The integrated process of learning and implementation largely depends on an early commitment of a sponsoring customer.

Where the cycle of learning and implementation started, the process became multi-lateral rather than unilateral from a customer to suppliers. Suppliers became more willing to make their know-how available to other members as well as to a sponsoring customer. Further, some firms that had participated in the SAP as member suppliers have founded their own associations with their suppliers, spreading interactive learning down the supply chain.

Discussions

In spite of the common use of seminars as a basic format of activity, the performances of the WMTF and SAP were in striking contrast. The WMTF set up the Steering Group as a pseudo centre but had difficulty in measuring the outcome of learning in its operation. Although the Forum produced a few cases of collaboration, a great majority of its participating firms were only able to make new contacts and gain basic knowledge of some topics. For most of the members, benefits from such contacts, if any, have yet to appear. In contrast, some supplier associations in the SAP managed to produce substantial improvements in production techniques. The improvements were shared by each member of the group with quantitative indicators easy to understand.

The differences between the two networking programmes derived from their distinct organisational characteristics. The WMTF's relatively decentralised structure, in which trade relationships are not a major link among its participating firms, produced a few cases of highly innovative collaboration between parties. In contrast, trade relationships between a sponsoring customer and suppliers in the SAP provide a solid foundation on which they share interests, work together and measure outcomes. The central position occupied by the sponsoring customer, coupled with leverage it has over suppliers, allows it to exercise leadership in the activities ranging from agenda setting to implementation of what is learned.

The industry wide model and the supply chain model are complementary in the sense that the former creates collaborative relationships beyond a supply chain. The industry wide model's inclusive nature has fewer restrictions in membership and can produce surprising collaboration in the long term. However, when their applications to peripheral regions are considered, the supply chain model has some advantages over the industry wide model.

In terms of manageability, the two models involve different potential difficulties. The industry wide model finds it difficult to adopt quantifiable outputs which move the network forward. Having trade related figures at hand, the supply chain model has little trouble in this regard. However, it entails difficulty in finding a customer firm that bears responsibility for acting as a centre. As success of the supply chain model to great extent hinges upon an early commitment of the centre, careful assessment of prospective centres and good consultation with them is necessary in its preparatory stage.

What gives a clear edge to the supply chain model is in its speed in producing tangible benefits shared by technology leaders and followers. The model tends to produce outcomes in the relatively short term. It also strongly induces members to work together as a group and provides benefits as well as confidence in interactive learning for both technology leaders and followers. In contrast, the industry wide model is, though inclusive, more individualistic. It sets an environment for contact making but, lacking the locus of

control, leaves each of the participating firms responsible for interactive learning and implementation of knowledge. It most likely takes long for followers in peripheral regions to learn to make best use of such an environment. The model's long-term nature, as well as the lack of quantifiable outputs, may put them into a position where they find it difficult to justify continued participation.

In addition to the above, the supply chain model has a couple of secondary advantages. First, the supply chain model is more easily applied as a tool of embedding inward investors in the economies of peripheral regions. The model can be tailored to meet the needs of inward investors and strengthen their links to local suppliers. This has been demonstrated by the fact that many customers operating supplier associations under the SAP are inward investors.

Another advantage of the supply chain model is its potential applicability to both process innovation and product innovation. While the programmes of supplier associations under the SAP have concentrated on production, logistics and managerial technologies, the WMTF's case suggests that outcomes of networking tend to be collaborative ventures of product development because of the lack of trade relations between many members. It might be argued that the latter's orientation towards product development can change the relative dominance of process innovation in peripheral regions under the current spatial division of labour. However, this is most likely to be a long term process. If the aim of network programmes is to help local firms in the short term, the supply chain model is a better choice. Further, the cases of supplier associations in the Japanese automotive industry show that they are useful to co-ordination in product development as well (Nishiguchi, 1994).

Conclusion

The paper focuses on two models of networks, the industry wide model and the supply chain model, and considers their application to peripheral regions through policy programmes. The two case studies, the WMTF and the SAP, suggest that the two models may have respective problems in manageability. However, when leadership is taken by a customer at the centre, the supply chain model has advantages in producing tangible benefits to a wider population of its members, both technology leaders and followers, in the relatively short term. The industry wide model faces more difficulty and takes long to take off as it starts with building relations among members from scratch (Malecki and Tootle, 1996, p.48). Given a weaker presence of a networking culture in peripheral regions, the supply chain model offers a better and more reliable choice.

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