

briefing

How do supply networks shape industrial emergence?

New forms of supply network are emerging to support novel technologies coming to market and also to underpin alternative business models. As part of the IfM's Emerging Industries Programme, research at the Centre for International Manufacturing (CIM) is looking at how supply networks shape industrial emergence. It aims to examine whether the adoption of the correct supply network formation strategy could influence the chances of success of emergent industries and what the critical factors are that impact on this.

The emergent supply network

Industrial emergence, as a phase of dynamic industrial change, is a short-lived state of expansion characterised principally by the high degree of uncertainty present in all aspects of the business ecosystem. Key elements of uncertainty are:

- Market size and position
- Capacity requirements
- Product lifecycle
- Regulatory requirements
- Technological adoption
- Establishment of critical innovation partners
- Resource and knowledge location and availability

These areas can all be dealt with by considering the number and quality of the linkages made to suppliers (of both processes and ideas), in effect the formation of the supply network.

Emergent supply networks involve radical capability changes in the supply of a product or service. This often involves strategically rearranging the supply chain configuration in order to support the emergence of a new technology, new operations model or a new business model. Understanding the appropriate configuration, or in some cases

reconfiguration, of supply network elements is a critical part of this process. CIM is investigating how supply networks emerge from multiple points in the value chain, including upstream new technologies, novel downstream routes to market channels and emerging production systems.

The eventual goal of the research programme is the generation of a process, or processes, that describe models of supply network emergence and to ascertain to what extent the success of industrial emergence is influenced by the dynamics and processes of the creation of the associated supply networks?

Moving beyond the firm-centric model

Recent publications by CIM have demonstrated that the technique of analysing supply chain configuration as a sequence of maps provides a means for assessing the efficacy of the supply network of firms within a broad cross section of industrial sectors. Complementary research has focussed on intra-firm models, such as the growing importance of coalitions of companies (e.g. contract manufacturing service providers and supply chain downstream distributors) who join forces over a single commercial opportunity. These are defined as Global Manufacturing Virtual Networks (GMVN), and have been utilised to enhance market share or competitive advantage. This research builds upon this work and attempts to extend these analyses to the industrial level, through the generation of a series of cross-sector supply network formation analyses.

The challenge to industry – overcoming uncertainty

The work forms part of the IfM's emerging industries programme. The programme attempts to understand the barriers that inhibit the exploitation of new ideas and

technologies from the perspectives of science, technology, management and economics. These barriers are caused by a lack of awareness or understanding of several key industrial parameters, which inherently have a high degree of uncertainty. IfM case studies focused on the renewable energy, regenerative medicine and digital media sectors. Some of the key areas which have been observed are described below.

Resource

The ability to attract and retain key resource is a challenge for startups in many technical sectors. In general, UK start-ups involved in scientifically innovative product design tend to form around geographic clusters such as the Cambridge Technopole. Here, the barriers to access skilled scientific and engineering resource are relatively low. However, other key resource requirements, such as operational management, finance and strategic marketing, are less available and are often overlooked or viewed as being of secondary importance.

Start-ups were also seen to leave key areas of business strategy in the hands of non-specialists. This resulted in inappropriate solutions being selected for core activities such as the scouting of critical component suppliers, the targeting of downstream markets and innovation partners, which in turn leads to iterative rounds of product redesign to account for these shortcomings. Compounding this problem in an emerging industry is the lack of awareness amongst the non-technical community of the possible applications of the technology and the lack of business acumen of the firm itself.

End user requirements

The studies have shown that both successful and failed start-up companies commonly focused on too narrow a part of the value chain, to the extent the requirements of

the ultimate end user (as opposed to the immediate customer for the product or technology) were not well recognised. Indeed, the idea that they were in any way important was also not defined. Lack of engagement with, or exposure to, downstream actors was often cited as a reason for this.

Innovation partnerships

The formation of strategic alliances can accelerate, or otherwise promote technical innovation through a variety of means. These innovation partnerships can provide advantages such as access to key resources and markets. This approach however is an anathema to many companies attempting to penetrate an emerging industry, principally due to higher than usual concerns over IP leakage. As a result, relationships with suppliers are usually prescriptive, with little two-way information exchange. Such behaviour precludes genuine cluster activity and acts as a substantial barrier to innovation.

Initial case study findings and insights

Initial findings by the research team have indicated emergent industries are enabled by supply networks in a number of ways:

- Network reach providing access to resource and capability
- Clustering density e.g. supply/technical clusters enable rapid prototyping and rapid information exchange and awareness of complementary developments
- Supplier (innovation and asset-share) partnerships form a source of knowledge and resource
- Complementary developments occur across disparate industrial sectors
- Strong supply base and competitive pressure enhance innovation
- Outsourcing serves to reduce barriers to entry, and accelerates industrial development but may have unplanned implications on future innovation

The uncertainties inherent in emergent industries can be managed through the supply network by:

- Developing innovation partnerships which reduce uncertainty through sharing of risk
- Allowing access to high value or long lead time equipment, reducing investment and risk thus reducing barriers to entry
- Creating flexible/local supply networks to respond to fast product life-cycles
- Reconfiguring just-in-time manufacturing to match varying product and technological requirements

- Providing make-to-order and rapid mass customisation is associated with advanced Information and Communication Technology capabilities and modular design.

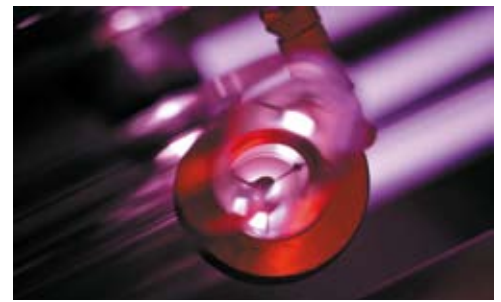
Typical characteristics of emergent supply networks

- Supply networks in emerging industries are either created organically or involve radical transformation of existing networks
- Supply network emergence involves a process of dissolution of redundant linkages and formation of new links, coupled with a restructuring of critical legacy links
- The ability of the upstream supply network to participate in this change is highly dependent on their understanding and use of intrinsic capabilities as historical network relationships may be of limited value
- Dissolution of firm networks is observed in many industrial sectors as a means of reducing cost and gaining access to external resource and capability
- Vertical integration models also observed to support particular industry emergence e.g. photovoltaic (PV) industry
- Vertical integration assures product quality standards are maintained along the value chain
- The returns associated along each part of an emerging industry supply chain are subject to uncertainty
- Early commoditisation may inhibit technical innovation and may not allow sufficient returns to finance high levels of R&D spend
- Vertical integration ensures control of scarce material and/or resource bottlenecks

Contribution to emerging industrial systems

Analysis

The analysis methodology employed is to map the supply network configuration along the value chain through case study interviews with key representative actors. The supply network configuration analysis elements are the structure (which can be conceptualised as archetypal shapes), the process of information and material exchange, the relationships between networked suppliers and the governance thereof; the product (or service) offering and its value structure. Analysis of these four elements yields a snapshot of the existing industrial state and allows assessment of potential for reconfiguration.



Categories of emergence

The type of industrial emergence may be categorised by the change evidenced in the supply network configuration. These classifications will be based on dynamic observations of a cross section of emergent industries. Each classification may be broken down into maturity-indexed evolutionary phases. From this it should be possible for a firm to select the optimum mode of entry into a new emergent industry based upon the type of emergence and their supply network configuration.

Programme outputs

The emergent supply networks study will encompass a range of industrial sectors of relevance to UK manufacturing companies operating at both a domestic and international level. The final report will be due for publication in late 2010.

The programme will:

- identify supply network emergence models from both a process-maturity and configuration perspective
- determine appropriate configurations and performance criteria
- develop supply chain transition maps for required reconfiguration
- develop tools to support firms, industry cluster organisations and regional/national/international development agencies

Project team

The principal investigators for this project are Dr Jagjit Srari and Dr Yongjiang Shi. The lead researchers are Dr David Kirkwood and Dr Tomás Harrington.

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