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Critical Competencies in Virtual Service Webs

JULIAN JONES, *University of Manchester*
B. BOWONDER, *Administrative Staff College of India, Hyderabad*
DOUGLAS WOOD, *Manchester Business School*

The paper reviews Williamson's transaction cost framework [*Markets and Hierarchies* (1975)] in light of new, and often location-independent influences to argue that conventional concepts including clustering, scale and scope economies and comparative advantage are becoming less clearly defined, and hence less useful in predicting industry structures in service transactions. Using a sample of service-based innovations, we describe how Williamson's account omits the key role that underwriting plays in mobilising new web-based options. The resulting 'service web model' provides a more complete account of the fragmentation of service chains arising from virtualisation and adds another dimension to discussion of comparative advantage conventionally focused primarily on goods exchanges.

Keywords: Firm boundaries, Comparative advantage, Outsourcing, Global value chains, Virtualisation, Transaction costs, Services, Governance

Introduction

This paper investigates the growing phenomenon of remote, increasingly transnational service provision. New technology provides an opportunity for remote provision of activities that hitherto have been geographically constrained by the need to integrate them within service and commodity value chains. Increasingly services and service elements in manufacturing value chains are being freed from the logistic constraints applying to remote suppliers. Indeed remoteness, to the extent that it provides much lower cost locations and time zone differences may be positively desirable. Services, due to their predominant characteristic of customisation are generally more labour intensive, information sensitive and time sensitive than either manufacturing or commodity production. To the extent that improved communications give fast, low cost access to exploit major international differences, remote service delivery has the potential for more fundamental changes in the international division of economic activity than globalisation of manufacturing activity.

Taking a transaction cost framework, the contribution of key technologies to redefining the boundaries of firms competing in the production and delivery of services differs considerably from the issues that affect commodities and manufactures. In commodity and manufacturing activities, the logistics involved in handling and transforming raw and value added materials and delivering them to final consumers commonly create structural and organisational constraints. Indeed these constraints tend to be the main determinants of industries and in identifying who competes in them. Services though tend to be almost weightless, so that logistic elements such as the paper used in the consultants report, the polish used by the shoe cleaner or the sutures used by the surgeon are minor elements in the value created by the customised, real time delivery of the service.

Service industries do however though tend to be informationally intensive, based on the cumulative history of a number of previous service encounters. The falling cost of information storage, retrieval and processing means that many of these service encounters are now computer supported, with a service provider's inputs, transformations and outputs based on digital rather than analogue formats. Such digital records can be transferred instantaneously and with no loss of information, so the same image can be made available to a security guard in India and one sitting in the gatehouse of a US plant.

As 'fly by wire' technology replaces analogue transactions, a growing proportion of both service and commodity value chains become internationally footloose, and delivered independently of the transaction cost limitations applying to physical processes. This leads to a dramatic increase in the range of market based alternatives to internal supply. With dramatic

declines in communication costs and large factor cost differences, cross border arrangements become not just feasible but increasingly competitive, introducing a new dimension to measurements of international comparative advantage, based primarily on goods exchanges.

This paper suggests that this new phenomenon of remote service provision raises some challenges to the robustness of widely used concepts such as clustering, competence analysis, industrial structure and competitiveness. As virtualisation brings near costless information exchange, the most competitive providers for given activities in the value chain may no longer be within a particular industry. Rather, they may be enjoying scale and scope economies based across many industries. Capabilities relative to within industry competitors are irrelevant if potential external suppliers are, or could become, even more competitive. Nor do clusters, enjoying externalities created by the physical proximity of many firms in the same line of business provide robust solutions once virtualisation allows access to remote suppliers who may be large enough to have internalised the advantages, have access to a broader range of externalities in different value chains or access to lower factor costs.

Examining a number of case studies through the lens of transaction cost theory, this paper shows that a new set of remote service delivery options are emerging because of the high co-ordination costs in responding to rapidly evolving customer needs, the availability of key competencies outside conventionally accessible boundaries, and the rapid diffusion of web-based innovations that lower the transaction costs of locating, managing and monitoring remote service delivery. These indicate the unlocking of a new scenario that challenges conventional notions of competitiveness and governance of value chain relationships.

Revolution in the Virtualisation of Services

Historically, international transactions consisted predominately of manufactured goods and commodities such as oil, and issues of economic structure and competitiveness concentrated on a relatively narrow category of so-called 'merchandise goods'. For a considerable period this focus seemed entirely appropriate as successive reductions in tariff and non-tariff barriers that impacted raw materials and manufactured goods resulted in a rapid growth in cross border trade transactions as a proportion of world GDP.

Taking the traditional definition of services as products that could only be created by the combination of their components at the point of delivery, most services were embodied in commodity or goods transactions rather than sold in their own right. So competitiveness of services in their own right was not explicit, with underperformance in service quality or competitiveness balanced against high competitiveness in raw materials or manufactured processes. Regulatory, financial, legal and accounting infrastructures, to the extent that they contribute to the overall competitiveness of nations also obscured service competitiveness.

Recent improvement in technology together with the emergence of key standards for electronic interchange have resulted in major changes in the cost and capability of communication systems and contributed to the growing economic importance of services. Between 1980 and 1997, the share of GDP accounted for by service value added increased from 56 - 61 per cent overall, with the fastest growth experienced by middle income countries (Table 1). This is reflected in the growth in value of world trade post-digitisation. The value of services exports in particular grew much higher ($392bn to $1371bn) than the growth in merchandise exports ($1733bn to $5241bn), emanating primarily from middle- and high-income countries.

New technologies such as video conferencing, digitisation of images and electronic data exchange protocols have provided mechanisms for instantaneous and near costless data exchange, whether between two departments in the same organisations or between departments in two separate organisations.

These have in turn transformed many of the transaction cost penalties associated with remote service delivery to the point where assembly and delivery of an increasing array of activities have no spatial requirement and their location is immaterial to service buyers. Exploiting any cost differentials between internal and external supply is also easier with services than manufacture. A knowledge and protocol base of the type used in financial and travel services can be straightforwardly transferred to an external, remote supplier, whereas manufacturing outsourcing often involves the relocation of capital assets and specialist skills. Initially global companies exploited cost differences to transfer services to low cost locations via internal, subsidiary governance relationships, but increasingly the range of insourcing and external outsourcing options have created an increasingly globalised market for service provision.

In evidence, international transport services handling physical shipments have experienced a declining share of service activities while knowledge based services including travel, communications and financial services have gained increasing shares (Table 2).

Table 1 Value of Services by Region

	GDP ($bn)		Services value added as % of GDP		Services exports ($bn)	
	1980	1997	1980	1997	1980	1997
East Asia & Pacific	444	1528	29	37	8774	82,484
Europe & Central Asia		1139		54		74,951
Latin America	782	2088	50	60	16,777	47,034
Middle East & North Africa	391	495	37	48	14,875	34,369
South Asia	222	512	38	46	4177	13,805
Sub Saharan Africa	269	326	43	48	9152	15,159
Europe EMU		6283		58	152,970	409,507
Low income	529	752	39	43	9757	25,593
Middle income	2530	5408	41	52	54,746	242,215
High income	7990	22,848	59	63	327,151	1104,142
World	10,925	28,978	56	61	391,654	1,371,950

Source: OECD (1998). The influence of emerging market economies on OECD countries international effectiveness

Table 2 Shares of Physical Transport Shipments and Knowledge-based Service Activities in Total Services

	Transport (share)		Travel (share)		Communication computers (share)		Insurance & financial services (share)	
	1980	1997	1980	1997	1980	1997	1980	1997
East Asia & Pacific	23.9	11.3	38.0	41.9	37.7	46.4	0.6	0.4
Europe & Central Asia	46.0	26.5	24.7	38.9	25.5	31.3	3.9	3.5
Latin America	27.4	25.7	40.9	43.2	25.2	26.3	6.7	5.0
Middle East & North Africa	25.1	19.8	33.0	39.3	41.4	40.0	—	1.2
South Asia	19.6	25.0	44.4	27.8	35.1	44.8	1.4	2.5
Sub Saharan Africa	45.0	25.3	27.6	46.9	22.1	24.0	5.6	5.4
Europe EMU	27.4	23.8	28.8	33.9	41.1	37.7	2.8	4.6
Low income	35.4	24.6	29.9	28.1	32.1	45.3	2.9	2.3
Middle income	29.6	20.3	36.4	41.4	30.3	36.0	4.9	2.6
High income	34.1	23.9	24.7	29.6	29.0	41.7	2.6	5.6
World	33.6	23.2	26.2	31.7	37.8	40.7	2.9	5.0

Source: OECD (1998). The influence of emerging market economies on OECD countries international competitiveness

Transaction Cost Analysis of Boundary Decisions

These developments can be broadly related to the internalisation/externalisation concepts initiated by Coase (1937) and subsequently developed amongst others by Williamson (1975, 1979, 1981). Coase (1937) proposed a powerful yet simplistic assumption that there may be decreasing returns from organising additional activities inside the firm; with the result that firms may fail to capitalise their scarce factors of production. Accordingly, equilibrium firm size occurs at a point where the operational synergies a company can secure from bundling internally managed activities exceed the associated costs of organising them externally. Firm size is thus determined by in-house servicing costs relative to the default position of market transactions (Williamson, 1975; Jones and Hill, 1988).

Transaction cost theory originally rested on a comparative account of organisational design (Klein and Shelanski, 1994). In conditions of competitive equilibrium and without constraints, organisations are driven by competition to continually evaluate their organisation against structures adopted by competitors and other potential alternatives. The original consensus was that the appearance of unrealised efficiency opportunities in this 'strong form' account always offered incentives to reorganise (Williamson, 1975, 1979, 1981).

Imperfect markets inevitably alter firm choices and critics suggested that in anything other than perfect competition, the kind of optimal solutions suggested by Coase (1937) and Williamson (1975, 1979, 1981) need not always prevail. Decision makers often operate under cognitive constraints (March and Simon, 1958), and in these conditions, strict optimising theories become untenable (Demsetz, 1988). Rather than setting out to displace transaction cost economics, March & Simon (1958), Robins (1987) and Demsetz (1988) repositioned it as providing the

viability conditions of internal versus external outsourcing opportunities in imperfect markets, rather than being the motive force of change 'When transaction costs are dislodged from their position as the motive force of organisational change, the conditions that mandate more or less costly forms of governance become an integral part of the analysis.' (Robins, 1987, p. 82)

This leads to a conclusion that companies internalise activities, provided the direct servicing and transfer costs involved are lower than what would follow from external, market transactions. These transfer costs are in turn influenced by four factors:

- The competitiveness of the external market,
- Information asymmetries between a firm and its external contractors,
- The costs involved in locating contracting and monitoring an external source, and
- The specificity of the assets involved in transactions.

The concept of market failure and Williamson's (1975, 1979, 1981) discussion of the way that numbers of service providers and information asymmetry between parties challenges the perfect market assumption seem directly applicable to contemporary issues in the virtualisation of services. If there are few suppliers in any market influencing the price of the service, clients become exceptionally dependent on the provider. With little public information on fair or market prices as a guide, information asymmetries give rise to potentially opportunistic behaviour and uncertainty. Further, structuring costs in re-routing work to external service providers create 'switching costs', making it difficult for clients to step over from one supplier to another. These are exacerbated where a history of in-house provision creates legacy problems relative to industry standards, and where there will be an absence of service benchmarks or contract development skills.

Supply market competition, contract development costs, switching and monitoring costs are therefore features of both traditional supply contracts and of supply within a virtual network. Services and in particular information based services, to the extent that they are not constrained by the need for exchange of physical material and product are inherently more sensitive to changes in transaction costs than goods based transactions. Provided the outsource market offers workable levels of competition, Williamson's (1975, 1979, 1981) concerns with market failure in supply markets are, therefore relevant to outsource supply. However when transaction costs decline, the number of competitors in the outsource market increases. Since insourcing and outsourcing opportunities will no longer be constrained by organisation's customary industrial and geographical domiciles, the impact on firm boundaries is unclear.

In the remainder of this section, we review the major communication enablers that have simultaneously reduced transaction costs together with the drivers of a variety of remotely created services.

Transaction Cost Enablers

Digitisation

Digitisation captures information in electronic form and, unlike copying, preserves the structure of information allowing recipients to manipulate and add value. Digitisation provides a basis for low cost, error free intra- and inter-organisation information exchange, thus reducing any spatial disadvantages suffered by external or even offshore provision.

This expands the number of potential partners, hence reducing the small numbers problem in supplier search and contracting, and subsequent dependency. Global service provision is increasingly a reality and as a result, both hierarchical and market governance systems are giving way to virtual systems, operating through digitally delivered and globally co-ordinated shared information infrastructures.

The power of information technology to simultaneously allow decentralised delivery of digitised information through personal communication networks and at the same time allow centralised control through intelligent client servers supports a plethora of new business models which can be located without reference to the value chain they support. Remote medical transcription, telediagnostics, expert consultations, data mining, online entertainment, product service centres and transaction processing centres are such examples of spatially unrestricted businesses.

Communication Networks

In 1975, Gordon Moore, Intel co-founder predicted that the number of transactions on a semiconductor doubles roughly every 18 months, with a 50 per cent reduction in area, based on a log-linear relationship between device performance (higher circuit density at reduced cost) and time. The evolution of Intel chips through the 8086/88 in 1979, the 286 in 1982, the 386 in 1985, the 486 in 1989, the Pentium™ in 1993, and the Pentium Pro™ in 1996 has exemplified the technical progress anticipated by Moore's Law (Figure 1). The effects have been dramatic with the Joint Economic Committee of Congress concluding in July 2001 that 'At least a half of the recent increase in labour productivity… is attributable to IT.' US productivity had almost doubled between 1995 and 2000 (Fixmer, 2002).

The latest processors provide ample power to support the virtualisation and intense communication needed for remote service delivery. 1.5 GHz and 42M transistors already support applications such as

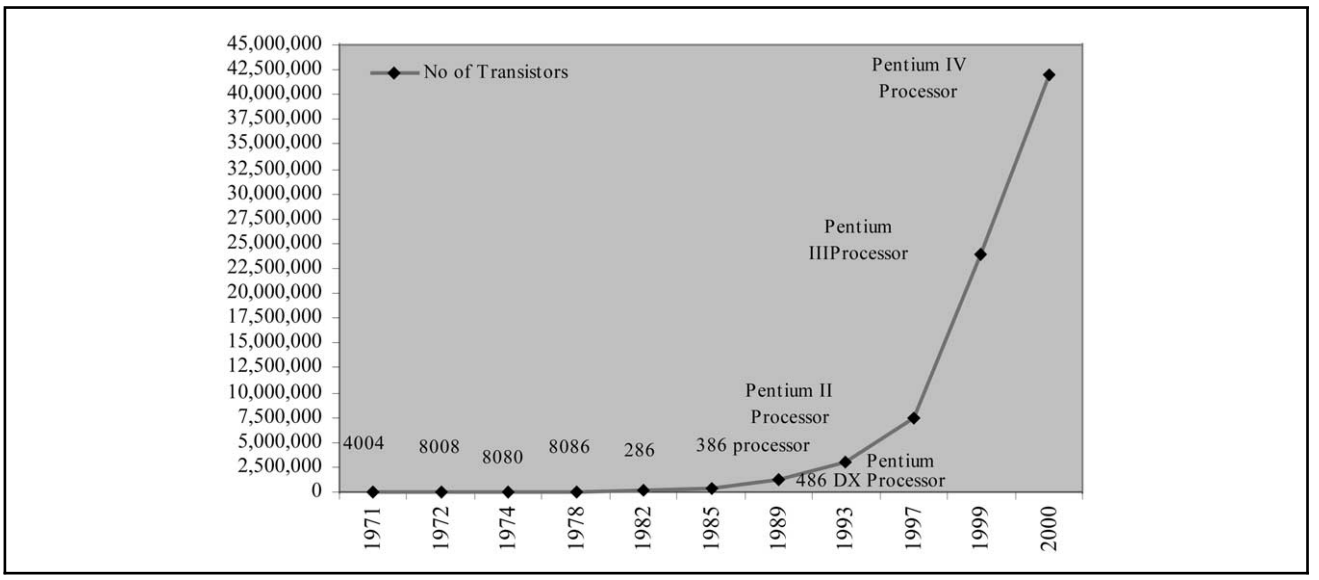

Figure 1 Power to Support Remote Service Delivery

streaming video on the web, real-time video encoding, 3D virtualisation, speech recognition and voice over image processing. Communication power has increased commensurately with Internet broadband capacity, for example starting at 1.5 Mbps (i.e. lasers switch 1.5m times/s) to fibre-optic systems carrying 80 channels providing Internet access at 10 Gbps. Already 40 Gbps capacity networks are being tested while 1/2 trillion bits of data per second are being proposed. Such systems could carry one month's traffic at current bandwidth in less than a second (Savage, 2001). Effectively Moores Law, alongside intense competition as bandwidth becomes commoditised and traded (Buckley, 2000), are driving processing and communications towards zero cost, in the process ensuring that almost all analogue business processes not involving physical manipulation become uneconomic.

Global Infrastructures

Developing countries share the World Bank's view that telecoms infrastructure is a prerequisite for development. While the developed world has a teledensity of just over five per 100 population compared to an average of 50-plus in the developed world, the virtualisation process is dependent on focused investment on high capacity business-to-business links, rather than mass investment on diffuse, low capacity business-to-consumer networks.

In Mexico, a $600m investment in a 'crystal triangle' project of fibre optic cables linking Mexico's three largest business centres — Monterey, Mexico City and Guadalajara with 30 other cities is nearing completion.[1] The result is an open access resource where scale and service advantages enjoyed in private networks disappear. Low entry costs provided by 'open' Internet systems and standard payment and delivery management have facilitated the emergence of small-scale international business units experimenting with new business architectures and service delivery/processing innovations. This goes a long way to making global service provision a reality; again mitigating problems associated with supplier search and negotiations.

Global Standards

Global communication and computing standards like TCP/IP protocols, packet switching standards, file transfer protocols, and 'impeg' standards provide another set of enablers since they eliminate the heavy set up and maintenance costs and restricted choice of partner inherent in proprietary value chains.

Effectively service providers and service owners can interconnect without formality anywhere around the globe. Standards in satellite broadcasting, image compression, and image file transmission have opened many new services to international competition and have been a positive and pervasive factor in growth.

Regulation/Competition

Harmonisation of legal and accounting frameworks and protocols such as 'Globally Accepted Accounting Protocols' (GAAP), progressive dismantling of monopolies in telecoms and increasing protection and enforceability of intellectual property rights such as patents, designs, copyrights and trademarks have lowered the barriers to remote service contracting. Countries are learning that harmonisation to international standards brings down investors' transaction costs, so facilitating global networking in services such as design, software development and drug research.

In any event remote service contracts, since they involve little in the way of tangible foreign investment are subject to relatively low regulatory risk. Once an adequate contracting market exists, both supplier and buyer can switch partners at low cost and inconvenience when an unwillingness or inability to honour a service agreement is manifest.

Effective regulation, as with the other enablers, is self-reinforcing. Falling costs lower transaction barriers and so widen the pool of potential contractors. In turn this increases competition, and by creating transparency and lowering risks, further lowers transaction costs and increases the potential volume of business. This in turn creates pressures to standardise communications infrastructures, business practices and regulatory environments, driving transaction costs down further. In the next section we move from considering enablers that remove barriers to remote service delivery, to consider drivers that create advantages for virtualisation.

Transferring professionals to the US involves matching US salaries, while remote contracts facilitated by virtualisation involve local costs

Virtualisation Drivers

Time to Market

The opportunity to shorten time to market has been a major driver in the virtualisation of many service value chains. Virtualisation supports parallel working and hence reduces cycle-time relative to value chains that are sequential with major benefits for products such as pharmaceuticals or aircraft that typically involve long development times and major expenditures. Boeing's 777 was developed through a virtual 'wired network' covering many components developed by independent suppliers in a number of countries. Virtual development allowed continual monitoring to ensure interconnectibility and compatibility of 'virtual prototypes' allowing Boeing to define contracts in terms of component performance rather than their physical characteristics. Digital representation of components allowed Boeing to develop a completely new generation of aircraft in four rather than seven years, with development of the Boeing 737-800 further reduced to 27 months.

Cost Differential

Another major driver has been cost differentials that can be realised offshore. Contracting research or processing activities to suppliers in low cost locations creates a new source of advantage. In medical transcription, Indian skilled labour costs are almost one tenth of the US equivalent. Virtualisation means Indian transcription services can provide a direct input into the production of medical services in US consulting rooms, effectively substituting for the time the physician would otherwise commit to updating and organising records. In film animation, virtualisation has ended reliance on skilled artists that could only be found in adequate numbers in Hollywood. Instead, virtualisation allows computer animators and animation software engineers to implement an entertainment concept from anywhere in the world. In business services and scientific research the cost gradient for qualified professionals may be even more advantageous since the training cost for a scientist, lawyer or accountant is much cheaper in India than in the US. Transferring professionals to the US involves matching US salaries, while remote contracts facilitated by virtualisation involve local costs.

Time Difference

Time zone differences provide a further driver. Development work on software or engineering prototypes can continue 24 hours a day through a relay of contractors working in different time zones. Microsoft maintains a Development Centre in India for precisely this reason. Remote service delivery plays a key role in shortening service delivery cycles in three ways:

- Service support outside normal business hours (medical transcription, credit card and insurance policy processing),
- New product design, and
- Software development.

Confidentiality

The low asset specificity of services means that most proprietary advantage comes from implicit knowledge. Competitors who headhunt key personnel can easily acquire such knowledge. Indeed the ease with which headhunting can be accomplished may be one of the key synergies leading to industry clustering. Virtualisation and remote service delivery provides some protection against such appropriation of competitive advantage since personnel with access to implicit knowledge will have no contact with customers or competitors. Furthermore, competitors are unlikely to have a facility that can provide local employment possibilities. Unlike outsourcing in product value chains where logistic advantages necessarily require co-located partners, service outsourcing allows remote location where proprietary information is less at risk. Remoteness is also an advantage for activities such as credit card processing and

airline ticketing since the difficulties in exploiting confidential information locally make fraud less likely.

Set-up Costs and Speed

The low marginal cost of set up is a driving force for the virtualisation of service value chains. For example, training is often a major element in service delivery set-up and without virtualisation, is almost of necessity provided through experience at onshore sites. However where training uses virtual materials, low labour cost locations become both feasible and cheap. Pilot training for example already relies heavily on the use of simulators and the same approach allows remote service personnel to be trained in the particular skills needed to serve remote markets. Indian call centre agents receive cultural training through video clips and television programmes that imbue them in the culture of the region they will be serving.

Virtualisation of training programmes also permits simultaneous training in multiple locations, speeding the rollout of a new operation or updated procedures for query handling. In the UK, piloting and then national coverage by NHS Direct, a computer aided telephone/Internet gateway into the health and emergency services was achieved in less than three years.

Capabilities

Leibenstein (1966) has long believed that there was more to output determination than clearly observable input resources. He argued that the exclusive focus on allocative efficiency (i.e. price and/or quantity distortions) was to the exclusion of other types of (initially undefined) efficiency, referred to as 'X-efficiency'. The implication from this simplistic, yet powerful notion was that firms and nations often fail to maximise the transformation of inputs into outputs. As such, they work at performance levels comfortably within feasible boundaries. The reasons advanced for this are that:

1. Labour contracts are incomplete,
2. The production function is not completely specified or known,
3. Not all factors of production are fully marketed, known or accessible, and
4. Interdependence and uncertainty leads competing firms to cooperate tactically with each other in some respects in imitating rather than maximising.

To the extent that service contracts are incomplete and knowledge accumulated through experience, the value and quality of service output is often difficult to determine with few commonly accepted standards to define productivity, cost, quality or timeliness. This coupled with significant transfer costs, hinders the efficient transfer of excess resources that should in principle, be generated as activities are routinised (Penrose, 1959).

The advent of cheaper and more effective communications allows firms to access a greater range of resource-based advantages in service based value chains. Effectively the universe in which the boundaries of the firm are defined has expanded and as Spender (1994, p. 829) notes 'The organisation is no longer a production function seeking internal efficiency. It is more of a node in a complex network of economic relationships, dependencies and mutual obligations'.

Global businesses including Microsoft, Texas Instruments, Warner Brothers, Walt Disney and Sony have recognised for some time that performance and/or cost advantages from specialist offshore service providers compensate for set-up transaction costs and additional risk. By establishing proprietary communication channels and specialist underwriting procedures (local contract management, performance guarantees) they initially used outsourcing to squeeze-out any residual economic benefit from commoditised activities (Leibenstein, 1966, p. 413), later moving into more innovative service outsourcing where their offshore service delivery platform served as a mechanism for superiority rather than parity (Leibfried & McNair, 1992, p. 36).

Case Studies

In this section, a number of case studies are presented, illustrating how technology has changed the delivery mechanism of a variety of services away from a location-dependent model to one seeking new sources of comparative advantage, irrespective of physical location or origination.

Beginning with the case of IT-enabled service centres and working up the services value chain to consider remote delivery of a more complex range of higher value services including telemedicine, finance and accounting services and research and development, the cases illustrate emerging skills in using virtual value webs to access remote sources of comparative advantage.

Case 1. IT-enabled Service Centres

Call Centres, or IT-enabled service centres have created a new service and distribution channel in all countries with an adequate infrastructure (teledensity, third party delivery and Internet penetration). However the call centres themselves have no infrastructure requirement other than broadband access, which is almost universally available.

Beyond this, the technology employed is non-specific, allowing switching between activities and clients almost instantaneously. Call centres are effective for many activities traditionally provided through in-house departments or line staff. While HR support, customer interaction services, accounting, banking, financial processing and data management services are commonly serviced through this means. Reservations, information and advice lines, inventory/purchasing control and emergency service call handling illustrate the much broader scope of call centres.

Currently international transactions account for a small part of call centre activity. However call centre location generally reflects the cost and availability of appropriate labour pools without reference to client or customer location. Services that are remotely located nationally can therefore be remotely located internationally and with wages accounting for 70–80 per cent of total costs, international labour cost differentials are particularly compelling. Additional transaction costs such as intercontinental operations may increase communication costs by 10–20 per cent but international wage differentials of up to 90 per cent result in net savings in the range of 50–60 per cent.

India and Ireland in particular have emerged as attractive call centre locations due to the availability of skilled labour and appropriate communications provision. Oracle has an $80m call centre in Dublin handling 100,000 calls per month in 20 languages supporting sales of its $40,000 database packages (Zwick, 1998). Citibank offers direct access banking facilities in 20 countries with the whole of continental Europe served by a single call centre in Germany (Survey, 1999).

In the last three years many international companies including GE, Bechtel, BA, SGS, and Thompson have established global service centres in India. British Airways dedicated call centre 'World Network Services' employs 700. GE in pursuit of its Customer Relations Management initiative employs 1400 people at its Delhi call centre, with another centre scheduled to open in Hyderabad. Although the virtualisation process is mainly centred on transaction processing activities, iDLX Technology partners have also established an Indian shared service centre to provide third party shared technology services to the financial sector.

Both Ireland and India have significant time differences from the US, which means that European and US companies can obtain 24-hour cover and for example overnight updating without paying premium rates.

The opportunity to decouple the value chain into discrete activities that can utilise remote service chains is created by the parallel working and shared information features of digitisation. Without digitisation, one person who would have to combine line operations with query handling necessarily controlled information. Now a remote operative has access to on-line data, so line operations and query handling can be separated providing productivity gains in both activities. With cost, time differences and security benefits favouring remote locations the transaction cost barriers are generally subjective, revolving round issues of control, confidence and trust.

Case 2. Film Animation

Pentafour Multimedia is an Indian company active in providing computer-aided animation and production services for the global entertainment industry. Film animation is a labour-intensive activity requiring experienced illustrators in sufficient numbers to animate a full-length film. Traditionally, these were only available in Hollywood. Pentafour though developed software allowing 'real time motion capture' so that actors' movements could be captured and used to animate virtual characters through a three-dimensional computer model. The movie 'Sinbad' was the world's first animated film featuring human characters using motion capture technology.

As well as motion in 3D form, Pentafour's software provides 2500 special effects, together with the support needed to offer animated story content, R&D, and pre-production and production services on a global basis to holders of entertainment contracts and their production teams.

The success of Pentafour effectively challenges the location imperative of the filmmaking cluster in California, which brought together film finance, distribution expertise and critical masses of specialists such as animation illustrators, film directors, stuntmen, special effects companies and skilled production specialists. Pentafour's software, combined with the ability to transfer work in progress instantaneously between India and cutting rooms in the US effectively turns a large part of a localised labour-intensive service activity into an internationally traded product. Pentafour's software and expertise in animation and in virtual client provision also provides significant time and cost advantages. A traditional animated film takes two years with animators in Hollywood costing US$250 p/hour. Pentafour charges around US$75 p/hour and guarantees delivery in six months. Effectively remote service provision lowers animation costs by 70 per cent.

Based on its software strength, Pentafour's digital imaging studio in Madras can produce:

- Four animation films per year,
- Four 52 episode television serials, and
- 100 minutes of special effects.

While the comparative advantage of Walt Disney, Warner Brothers and Sony are still in origination, financing and distribution of films, virtualisation makes remote service provision instead of local service provision a contender for a large portion of the value chain.

The nature of filmmaking whereby almost all the costs are spent before any revenues arise, means there is little chance of recovering from production errors so the risks of using remote service provision may be a deterrent. In the case of Pentafour this was overcome by setting up a front office studio in Hollywood to handle the interface with clients. This limited onshore presence proved sufficient to translate creative instructions into production requirements, which could then be implemented remotely. At the same time, offshore work-in-progress in India can be monitored in the US via high-speed web links, ensuring seamless liaison between onshore clients and remote providers.

Case 3. Remote Military Operations

The effectiveness of military equipment is increasingly limited by the physical frailty and functional specificity of the service personnel in local control. A carefully selected and trained military pilot can survive a maximum of 8*g* while aircraft technology can handle forces up to 18*g*. In addition to protecting and assisting the limited information processing and retention abilities of a single pilot, enormous investment has to be made in advanced avionics equipment, highly specific pilot training, on board life-support systems and communications. All these systems need to be maintained by skilled engineers who will be located close to the combat zone to maximise operational availability. In turn, the space and weight required for pilot support imposes design constraints on the aeroplane and limits the range of armament options available.

Unsurprisingly, the alternatives enabled by digital technology have become increasingly important. UAVs, (unmanned air vehicles), remotely controlled and supplying information to remote command centres (the Afghan campaign was run from Central Command in Florida) are increasingly displacing conventional manned weapon systems.

The Predator, developed by General Atomics and costing $4m, is a low-level reconnaissance vehicle, equipped with streaming colour video cameras and radar that penetrates smoke or haze. It can also carry missiles for combat use. The plane can remain on station at an altitude of between 15,000 and 20,000 ft, for 16 hours and is navigated from a ground control station up to distances of 600 km from the target. The Global Hawk, developed by Teledyne, is a high altitude long-range reconnaissance UAV capable of remaining at 65,000 ft for 24 hours. It transmits information from radar and electro-optical and infrared sensors through a satellite connection and because it is under the command of an expert system pre-programmed with flight and navigation details, it can operate autonomously thousands of kilometres from base. In development is Boeing's X45A, an unmanned combat vehicle designed to knockout enemy air defence and control systems.

The same digitisation and communications developments that are reshaping non-military value chains are having a similar effect on warfare. They enable a specific, previously non-substitutable and expensive service (combat zone piloting) to be replaced by a remote service that can divide the task into components handled by units specialised in particular areas such as engineering, navigation, intelligence and target acquisition. Unmanned vehicles are estimated to cost a third as much as manned vehicles to build, offer several times as much operational time and involve much lower operating costs.[2]

Unlike civilian outsourcing where remote service may be regarded as risky, in military applications, distance from combat is risk reducing; hence military applications will be at the forefront of digitisation and communications technology. Advanced compression technology, high frequency transmission and laser communication via satellites are all areas under current development.

Case 4. Telemedicine & Remote Diagnosis

The role of technology in redefining the boundaries of service firms is also evident in medical services.

A large (and due to legal concerns an increasing) proportion of doctors' time is spent recording, updating and reviewing patient records. This area of activity is suitable for remote delivery. Doctor interactions with patients and other health professionals can be captured by audio recorders and subsequently transcribed into digital records by a medical transcription service. The types of information handled include examination reports, consultation reports, operative reports, discharge summaries, medical imaging reports, pathological reports, radiology reports, electrocardiograms, autopsy reports, death summaries, and emergency room notes.

Currently, approximately 250,000 medical transcriptions per annum are conducted in this form in the US alone, with an industry turnover in the order of $17bn per annum, growing at approximately 25 per cent per annum. According to American Association for Medical Transcription, two factors are responsible for this growth:

1. Demand for greater transparency in patient records has grown along with the volume of such records, and

2. As litigation costs rise, medics have been forced to reengineer and tele-source medical services to focus doctors' time on knowledge-orientated activities and systematic, defensible treatment.

While medicine has always been a highly customised client-specific service, necessitating face-to-face contact with patients, the fact that elements of a value chain with high risk of failure are being virtualised is further support of the disaggregation phenomena affecting service delivery. In this case, diagnosis and treatment remain as core features of service provision, with insurance companies and health management organisations setting up telemedicine services in remote locations such as India that offer low training and employment costs and time differences to provide next day service.

Reliable infrastructures and an increasing flow of digitised information alter medical services in other ways too. Remote medicine, where mobile medical examinations conducted by paramedics can be transmitted back to doctors for diagnosis brings high quality treatment to remote locations and is spearheaded by military applications where doctors, particularly in the US, are generally unwilling to be in the front line. In 1995, US troops, deployed to Bosnia-Herzegovina, as part of the UN's stabilisation force (IFOR) could be x-rayed from an army base in Hungary.[3] British defence medical services opted for a simpler, less expensive system of recording and transmitting diagnostic-quality digital radiographic images from ordinary radiographs in a tented and isolated British field hospital in Sipov, Bosnia, linked to the Navy's Royal Haslar Hospital, Portsmouth. Images of radiographs, electrocardiograms, wounds and skin rashes were digitally transferred from Bosnia via a high-resolution digital camera, a laptop computer and a satellite phone to consultant specialists (Ritchie, 1998).

Japan too has long since provided mass screening and full medical services in remote locations from mobile units, housing a CT scanner and telecommunications equipment for examinations and teleconferencing facilities to provide on-line, two-way transfer of image data to medical centres for specialist consultation. Pilot studies report that mass screening of 19,117 residents resulted in the identification of 75 early lung cancer cases (Takizawa *et al*., 2001).[4]

Further developments involve remote medical intervention. Micro- and nano-technologies use digital interfaces between surgeon and patient, making it possible for a remote surgeon to perform a specialist procedure while local staff undertake life support procedures. The prevalence of head injuries in battlefield casualties has stimulated the search for operating helmets that contain all the sensing and surgical equipment to enable a remote surgeon to intervene.

A totally different medical service enabled by digitisation is data mining. Digital records of symptom presentation, diagnostic investigations, treatment and outcome together with lifestyle information support the development of expert systems which prompt doctors on best procedures at each stage of treatment and also help pinpoint risk factors that might otherwise be ignored. Effectively, skills in high-speed numerical analysis, supported by digital information are providing an alternative source for part of the traditional medical service chain.

Case 5. Finance & Accounting

Shell formed a joint venture 'Tasco' with accountancy firm Ernst & Young in an ambitious plan to provide outsource accounting services to multinational companies. Initially the company took over the accountancy function from many of the Shell group companies with the intention of extending the service to companies operating in Shell's supply chain and to third parties. Describing the outsourcing activities of Ernst and Young in Europe, Nick Land, a senior partner reported, 'The new business will start in Europe where the market for that sort of activity is worth around £600m a year'[5]. He expected turnover of the joint business to be worth £60 million within 5 years and said, 'other outsourcing companies take on the function completely, but by forming a joint venture, the client continues to have a stake in the work… Similarly each major client will have its own approach.'

Both companies complemented each other's expertise in creating the new venture. By virtualising accounting and finance operations, Shell is able to focus on its core energy and distribution businesses and secure scale benefits and profits as EY attract additional customers. EY in return secure credibility for 'Tasco' through Shell's endorsement, a critical mass of Shell business and the potential (by acquiring further contracts) to provide accounting services profitably, at below current internal cost to third parties of whatever size.

Effectively, through endorsement and provision of activity volume, Shell was underwriting the initiative. In turn, by accepting a service agreement, EY accepted responsibility for technical delivery. As a joint enterprise 'Tasco' avoided the significant monitoring and enforcement costs that would otherwise be involved in a stand-alone service agreement because Shell have access to, and benefit from 'Tasco's' operational success. In turn, 'Tasco's' mandate to pursue external work makes otherwise specific site, physical, human and dedicated assets non-specific, reducing the potential for, and rewards of a 'hit and run' strategy (Klein, 1980).

Case 6. Research & Development

The impact of digitisation on widening strategic sourcing options and reducing international co-ordination costs is illustrated by the global design centre established by Texas Instruments in Bangalore, India. Established in 1985 at a cost of $15m, the centre uses a dedicated satellite link between the Indian centre, TI Headquarters in the US and their R&D Centre at Houston, Texas, allowing Texas Instruments (India Limited) to utilise the time zone differences to work in parallel with the Houston facility.

The Bangalore centre designs against user requirements set by US-based Business Managers. Requirements are then converted into specific design concepts with prototype and final designs encrypted and directly transmitted to the Texas manufacturing facility. Changes to specifications in response to market developments are then transmitted back to India.

Three decisive factors led to Texas Instruments virtualising this part of its operations. First, it allowed Texas Instruments to restructure its global operations to focus on a leading edge market segment growing ten times faster than for basic general-purpose microprocessors. Secondly, virtualisation allowed development times for very large-scale integrated software circuits to be cut. Thirdly, a new pool of highly-skilled software developers could be accessed, creating new competencies in anticipation of technological developments.

“…core competencies will no longer be core if they can be acquired more cheaply from the external market”

The Bangalore centres’ track record speaks for itself. In 1988, it developed the first commercial digital signal processor, leading to a family of digital signal processing ICs. In the same year, the Federal Communication Commission released the US standards for digital HDTV, and the THS 8133 chip, fully designed in Bangalore was released in June 1989, ahead of Philips, Sony and Fairchild. The Bangalore centre also recently designed a new family of ICs that support a digital visual interface standard for desktop LCD monitors and a chip for Minolta that doubles the speed of colour printers. Texas Instruments further gained valuable lead-time against the switch to digital TV, using high-speed communications to allow designs to be tested in Texas as they were developed in Bangalore.

Research is a key source of competitive advantage in the software industry, and disaggregating research services in a way that allowed them to be outsourced to an Indian service centre was a bold, though risky step. The high level of strategic control possible through ownership and the high level of operational control possible through advanced communications mitigated the transaction costs. In turn, the reputational endorsement and front office support provided by TI meant that the Indian origins of the technology were not a factor in customer purchasing decisions. The potential gain in terms of cost, access to software and hardware competencies and lead time reduction through parallel (time zone enabled) working was sufficiently compelling for TI to move to remote provision.

Since the Indian research centre would be dealing with proprietary information and designs, a location remote from customers and competitors was desirable. However, for US-based business managers to control and integrate the facility, a failsafe business process model was required. This consisted of mandatory notice and approval of modifications through the engineering change notice system that strictly controls quality and performance parameters. Other elements enabling a remote service option for the design stage of the value chain included:

- Comprehensive system protocols based on gate (approval) and stage (of design),
- Continuous interaction through teleconferencing,
- Intensive human resource development to international standards, and
- Strict adherence to cycle times.

Through these elements Texas Instruments (India Limited) has achieved international competitiveness. With 120 US patents granted in its first 13 years, it has been recognised as the most productive research centre in India. The effectiveness of parallel working in Bangalore and Houston is reflected in the fact that by 2000, Texas Instruments had captured 60 per cent of the US$45bn, global market for digital signal processors.

Conclusion

Unlike commodity markets where logistics create structural, location and organisational constraints, the service economy comprises a wide range of activities that can be delivered from anywhere in the world. Many of these activities may also form part of manufacturing value chains. Effectively virtualisation makes it impossible in many cases to distinguish between internal and external supply, or local or remote delivery. The ability to specify, monitor and control an activity is little different. Given large international cost differences in hitherto non-traded service resources, the low-level remote delivery reflects inertia as much as equilibrium under traditional transaction cost theory.

Widespread unlinking of service and manufacturing

chains raises considerable uncertainty not just over the boundaries of the firm, but also over the value of traditional measures of organisational performance such as competitiveness, core competencies, core business and industry structure. The problem is that competitiveness and competencies are generally defined by within industry and within market comparisons. However, once weaker competitors outsource under-performing activities to world-class suppliers, their disadvantage turns to an advantage. Similarly core competencies will no longer be core if they can be acquired more cheaply from the external market.

Organisations that own world-class activities pose inverse questions, since their best use of resources will be to expand those activities with outside contracts and reduce under-performing activities elsewhere in the organisation. In activity terms, the organisational boundaries shrink, but at the same time they expand as geographical and application scope increases. The billing expertise of United Utilities for example was exploited by forming Vertex which now sells customer relationship management without reference to the geographical and industry boundaries of its parents' operations.

The break-up of service value chains and their reassembly in the form of value webs across industry and geographical boundaries seems a likely next stage in organising service-based resources and the next stage in the development of market-based governance models. As early as 1937, transaction cost theorists moved from addressing the basic question of why firms exist to concerns about the viability conditions for market exchanges. Subsequently, business process models such as Porter's (1985) concentrated on profitability drivers and the role of proprietary knowledge and time competition in creating hard to imitate advantages. But proprietary business models often involve non-standard interfaces that exclude or complicate access to world-class suppliers. Increasingly, networks are offered as the engine providing access to proprietary resources for growth and eliminating competitive weaknesses in resources (Thorelli, 1986, p. 46). Such networks will be loosely governed by transactional relationships and social control mechanisms, rather than by logistics or ownership.

The case studies have shown that once the possibility of external suppliers, drawn from outside traditional industry and geographical boundaries exist, business process models and comparative advantages become less precise. Comparative advantage is no longer defined relative to competitors' internal provision, but by competencies available within the global value web. World-class outsource providers are, by definition, institutional benchmarkers, vacuuming up best practice and revising their service offering in order to protect and nurture their own competence and few, if any, companies could match this through internal provision. In the value web model, firms no longer rely on competitive intelligence in the conventional sense but on their ability to separate and move service elements that have long operated as 'defective monopolies' (Drucker, 1954) with little incentive to improve outside conventional boundaries.

Comparative advantage in the value web model is further defined as the ability to manage continuously changing knowledge requirements rather than by reference to functional competence. Transnational players such as GE, Texas Instruments, Walt Disney, Warner Brothers and Sony have accessed remote service providers outperforming any pre-existing provision. What they have retained is knowledge of customer requirements, cognitive knowledge and an ultimate hold on the customer by controlling distribution channels.

The cases also demonstrate the importance of underwriting skills in mitigating 'psychic' transaction costs, such as distance, unfamiliarity; low trust levels and a difficulty in assessing competencies available in different markets. Underwriting, by reputational endorsement, participation and local physical liaison play an important role in reducing these problems. While this is at odds with both competence and transaction cost principles, it does validate Scarbrough's (1995) account that transaction cost economics is a rather under-socialised account of governance relationships, and that not all exchanges reflect the ruthless pursuit of transaction efficiency.

While Williamson (1975, 1979, 1981) and indeed Coase (1937) would not have had in mind the kind of technological advances that have influenced the fragmentation of service value chains, this paper has shown that modern governance choices for services are also influenced by:

1. Underwriting skills that allow for outsourced transactions in markets subject to a degree of failure,
2. Effectiveness in organising boundaries to exploit economic benefits available out of industry and in intermediate positions within value chains.

Only if these are considered in conjunction with market failure principles does transaction cost economics provide an encompassing explanation of governance choices in the modern value web. Distinct sources of competencies in this value web model as opposed to those originally outlined by competence theorists (Prahalad and Hamel, 1990) include locating or creating a supply market, structuring a mutually beneficial i.e. non-opportunistic governance structure, and maintaining information advantages that sustain relationships with present and future customers.

Notes

1. BT/MCI Global Communications Report (1996/97)
2. Source: *The Economist* (2002), Transformed? A Survey of the Defence Industry.

3. Source: Georgetown University Medical Centre (1998)
4. Since X-ray film requires storage of new unexposed films, storage and use of chemicals and water for processing, all of which previously had to be collected and shipped out of the area, this drastically improved the operational efficiency of military medicine.
5. Source: Petroleum Economist (1997).

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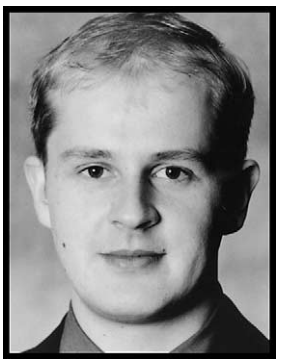
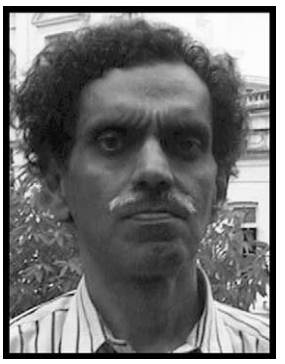


JULIAN JONES, *School of Accounting and Finance, University of Manchester, Crawford House, Booth Street East, Manchester M13 9PL, UK. E-mail: julian.jones@man.ac.uk*

Dr Julian Jones is Lecturer in Management Accounting at the University of Manchester. His research interests centre on global outsourcing strategies, re-engineering and competitiveness of business services.

DOUGLAS WOOD, *Manchester Business School, University of Manchester, Manchester M15 9PL, UK. E-mail: douglas.wood@man.ac.uk*

Douglas Wood is Director, International Business Centre, and Professor of Banking and Corporate Finance, Manchester Business School. His main interests are in international finance, editing Blackwell's New Encyclopedic Dictionary of Finance.



B. BOWONDER, *Administrative Staff College of India, Bella Vista, Hyderabad, 500 082, India. E-mail: bowonder@asci.org.in bowonder@hotmail.com*

B. Bowonder is ITC Chaired Professor of Strategic Management of Technology, Dean of Research and Chairman, Centre for Energy Environment and Technology at the Administrative Staff College of India. In addition to his teaching and research, he is Editor of the International Journal of Information Technology Management *and the* International Journal of Biotechnology.