Modular Services in Inter-Organizational Networks: Three Metaphors

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Abstract

The use of the principle of modularity in the management of product design and manufacture is briefly outlined, as well as its more general potential as a way to explain the organization of inter-organisational networks. It is noted that modularity in services is relatively neglected. Metaphor and analogy are identified as ways to help break from product-based thinking in analyzing service modularity, and three metaphors are suggested, drawn from the performance of jazz music, turn-taking in conversation, and the computer science concept of 'statefulness'. Novel aspects of service modularity are therefore identified, and their implications for research in inter-organisational network discussed.

Keywords

Modularity, Services, Interface, Metaphor, Analogy

Introduction

Modular design and modular production have been widely used and studied in the context of product design and manufacturing (Starr, 1965; Sanchez and Mahoney 1996). Taken narrowly, modularity can be seen as a principle of engineering or product design (Ulrich). But if treated more generally, modularity can be seen as a theory for the disposition

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of productive activity within and between organizations, and across time and space. Modularity has been studied mostly in the context of manufacturing, initially in an intra-firm setting. More recently, these approaches have been extended to inter-organisational settings (e.g. Sturgeon, 2002). Taken together, these discussions suggest that innovation and complexity can more effectively and efficiently be managed using modular approaches, and that modular product and process design allows the dispersion – structural and geographical - of productive activity across inter-organisational networks. Less prescriptively, perhaps, a 'modularity theory of the firm' (Langlois and Robertson 1995) can help explain patterns in the organization of industrial networks.

The IMP tradition of industrial network studies has been concerned with the ties between actors in networks, the consequences of combining their resources, and the way in which the activities carried out within organizations interact with those conducted between organizations. In some senses, modularity as a general principle of organization sets up interesting tensions with this, as it is concerned with the ways in which, and the extent to which, the activities and resources of one actor can be partitioned from those of another: it could be seen as a charter for *reducing* interaction and connectedness.

As already mentioned, modularity has been studied for the most part in a manufacturing context. This has been a powerful line of research. However, this paper will argue that the relative neglect of modularity in *services* has meant that some general aspects of modularity *per se* have been overlooked. Furthermore, it will be evident to the casual observer of contemporary business that modular principles are being used in a variety of Business-to-Business service contexts, notably where off-shoring and outsourcing of both low- and higher-skilled services are concerned. Although these approaches are, in some cases, being explicitly discussed as modular services, modularity as a more general principle for understanding the organization of service activity is much more pervasively relevant. This paper then, concentrates on modularity in services as an empirical context.

A few studies of modularity in services have been conducted, but these have been hampered in some ways by paying too much attention to the established body of work in modular production and trying to map it onto a service setting. This paper is an attempt to break free from that. The first way in which this is achieved is by making a number of relatively simple observations about the nature of service delivery processes. Following from this, the paper suggests that, while there are common features between modularity in products and modularity in services, there are distinctive aspects of services that need more explicit treatment. In order to provoke an innovative perspective on this issue, the paper takes three metaphors – or, more accurately, analogies – to stimulate a line of thought more clearly distinct from existing work on modular production. These three metaphors are drawn from (a) jazz music, (b) turn-taking in conversation, and (c) the notion of 'statefulness' in computing.

Modularity

Modularity was most elegantly discussed by Herbert Simon (1962), who emphasised modular design of products as a strategy for coping with complexity. Subsequently, modular production (Starr 1965) and the architecture of modular products have been explored (Ulrich 1995). An example of a modular product is a personal computer: there is a one-to-one correspondence between physical element (keyboard, monitor etc) and function. The elements can be connected and interchanged by virtue of the architecture of the product – how the functions are allocated to elements and how these relate to each other – and standardized interfaces such as USB connectors. This makes it possible to interchange various keyboards, monitors etc without affecting the rest of the computer system. Baldwin and Clark (1997) suggest that this involves partitioning information into

visible design rules (the standard interfaces and so on) and hidden design parameters (these define each particular element e.g. a graphics card in a pc).

Henderson and Clark (1990) suggest that innovation within modules (i.e. changes in hidden design parameters) is less traumatic for firms – and, by extension, for networks – than architectural innovation (i.e. changes in visible design rules), where change affects the relationships between functions and between elements, and can only be managed by pervasive organizational change. Langlois and Robertson (1995) develop a theory of dynamic transaction costs, suggesting that radical architectural innovation tends to favour vertical integration, whereas innovation within modules favours vertical dis-integration. They chart over a number of decades, for a number of sectors, alternating periods of integration and dis-integration as the two forms of innovation ebb and flow. Sanchez and Mahoney (1996) also make the link between the architecture of products and the architecture of firms, arguing above all that the modular architecture enables within-module innovation to proceed independently – in time and space - of innovation in other modules, rather than in the sequential fashion of 'traditional' product development processes, leading to more rapid product development. In his more rhetorically adventurous moments, Sanchez has been known to refer to 'plug-and-play' subcontractors, each supplying modules and, by implication, easily switched. Sturgeon's (2002) account of the relationship between modular architecture and global supply networks in the context of electronic product contract manufacturing is rather similar.

The Question of Services

Various approaches to the definition of services are currently being explored in operations management and marketing (Araujo and Spring, 2006; Vargo and Lusch, 2004). For the purposes of this paper, an important feature of service delivery is that services are necessarily delivered in a relationship between economic entities and that provision of services according to any of the three "service logics" of Gadrey (2000) is extended over a period of time. This is in contrast with the manufacturing situation where, typically, modules are combined before the transfer of ownership of the assembled good, with that transfer taking place to all intents and purposes instantaneously. This is something of a simplification, it is understood, but it serves to draw attention to the distinctive characteristics of some manifestly modular service delivery processes that are of interest here. For example, modular degree programmes can be designed *ex ante* in a modular fashion in that students can combine modules in different subjects to arrive at a particular degree award. But, in service *delivery*, the modularity has other implications e.g. that certain advanced modules may have to be taken later in the overall programme than elementary modules, that timetabling must allow a student to take appropriate combinations of modules without having to be in two places at the same time, and (usually) that there will be conditions for progression from one module to the next, such as satisfactory examination grades. To take a less explicitly modular example, a typical international journey will involve a sequence of taxi rides, train journeys, flights, and hotel stays. Different organizations will probably deliver these services. Self-evidently, an important aspect of the co-ordination of these 'modules' is that they are correctly temporally and spatially related to one another: in other words, the traveller wants the taxi to deliver her to the right flight at the right time and right place, and so on. Less obviously, the purchase of a flight ticket will involve the airline taking on some degree of liability for the safe transfer of a passenger's luggage, and the definition of the flight 'module' will sharply delineate when and where that liability starts and ends.

Existing studies of modularity in services have been hampered by being too closely wedded to production modes of thinking, neglecting the temporal, spatial and contractual. It is certainly the case that quite self-contained modules of service provision

can be identified and then combined in different ways for different customers, as is the case with modular products. But such treatments neglect the temporal nature of the delivery of services, and skirt around the precise ways in which the basic ideas of modularity such as architecture and interfaces are manifested in service settings. To break away from some of the fetters of product-dominant thinking, this paper utilises a metaphorical approach.

Metaphor in Organization Studies

There is no intention in this paper to present a thorough-going critique of the use of metaphor in organization studies. Just two notable contributions are presented here. Morgan suggests that "the use of metaphor implies a way of thinking and a way of seeing that pervade how we understand our world generally" (Morgan 1997: 4). And, later: "Thus metaphor proceeds through implicit or explicit assertions that A is (or is like) B". Interestingly, Morgan presents this graphically in the form of a Venn Diagram, showing a circle representing 'the man' overlapping a circle representing 'a lion', the diagram being annotated with the phrase 'but ignores the differences'. He also suggest that 'The most powerful use of metaphor arises in instances in which the difference between the two phenomena are perceived to be significant but not total' (Morgan 1980: 611-612). Along similar lines, Alvesson suggests that 'Too much or too little similarity means that the point may not be understood and no successful metaphor will have been created' (Alvesson 1993).

Tsoukas (1993) emphasises 'analogical' rather than 'metaphorical' reasoning. So, 'an analogy "operationalizes" a metaphor or a simile [by] transferring relationships between certain items in the source domain to the target domain'. Furthermore, 'the defining characteristic of successful analogical reasoning is the transfer of an explanatory structure for the source domain to the target domain. Although domain incongruence is necessary in metaphorical reasoning, this is not the case in analogical reasoning' (Tsoukas 1993: 337). Tsoukas summarises Gentner's 'structure-mapping theory of analogy':

- The attributes of objects belonging to two different domains are discarded.
- The relations between objects in the source domain are mapped onto the target domain.
- Of all those mapped relationships, only the higher-order relations (i.e. relations between relations) are retained at the expense of…mere isolated properties.

By way of an illustrative example, Tsoukas discusses Stafford Beer's use of a human nervous system as an analogy for an organization, where the point is not how the heart or brain works (mere isolated properties) but how the brain relates to the nerves and how these control motor functions (relationships). These relationships are then used to explore aspects of organizational control systems.

The approach here is much the same. The target domain is inter-organizational networks. The source domains are: small groups performing jazz music; conversations between people, in particular the way in which turn-taking occurs; and the concept, used in computer science, of statefulness. Each is now discussed in turn.

Metaphor One: Jazz

The exploration has its genesis in my experience of watching Pete King, the British saxophonist, walking into a club in Manchester with a collection of single-sheet musical sketches of jazz 'standards' in a folder, shaking hands with the pianist, bassist and drummer, whom he had obviously never met before, and then, within a couple of minutes, beginning to play a series of numbers with them. (Hatch (1999) briefly mentions something similar.) This

was only possible because of their having a common understanding of how to work within the architecture of the songs they played, and of how to interface between ensemble passages and solos. I want to suggest that there are strong and fruitful parallels here between the architecture and modularity of the song and the ideas of architecture that inform discussion of product and organisational modularity (Sanchez and Mahoney 1996).

Hatch emphasises the improvisatory element in jazz, but the contention here is that this misses an opportunity to apply the metaphor in a more systematic way, along the lines suggested by Tsoukas (1993) and, furthermore, that this is particularly relevant to inter-organizational relationships. The metaphor – or analogy - most strongly suggested is that the architecture of a jazz standard is rather like the architecture of a modular product or service, in that it allows collaborators with no knowledge of one another effectively to work together very quickly. The performers are analogous to the firms who come together to develop and provide a modular service. In some respects the analogy holds for any situation – involving product or service - where, because of established 'standards' (the same word applies), each organization's role is defined at the outset. But because the structure of the music, and its performance, is necessarily about relationships in *time* e.g. a solo of 16 bars, or a form defined by a *sequence* of chords, some service-specific phenomena are invoked. And if the performers are analogous to the network actors, the performance as delivered on a particular occasion is analogous to the service delivered. (Of course, the metaphor is partial, and players *are* network actors – freelance musicians working with others to earn a living – and the performance *is* a service delivered. But it is useful nonetheless.) The analogy raises questions about the nature of the definition of the architecture, the nature of the interfaces between modules and, in a more general sense, what else makes it possible for the players so readily to perform together.

Another question that arises is the objective. For many of the players, and for the more demanding listener, an important objective was innovation and, for some at least, the architecture of the jazz standard constrained this too much. Modal jazz, of which the most famous example is the album 'Kind of Blue' by Miles Davis, dispensed in large part with the chord sequences of what had gone before. Bill Evans, the pianist on most of the Kind of Blue album and, arguably, its major inspiration, wrote the sleeve notes and in them described one tune as follows: ' "Flamenco Sketches" is a series of five scales, each to be played as long as the soloist wishes until he has completed the series'. So, modal jazz shifted the architecture away from predictable chord changes and, as we see from Evans' note, away from predetermined solo lengths. Free jazz of various forms and in various ways further dispensed with structural regularities. If innovation is our object, what are the organizational and inter-organizational equivalents of modal jazz and free jazz?

Metaphor 2: Turn-taking in Conversation

In earlier modern jazz we see an architecture defined by the conventions of the jazz standard and by blues chord progressions. In modal jazz and free jazz these externally-imposed architectural constraints are progressively relaxed. As a result of this, the musicians have to attend more closely to one another's contributions and make their own according to what they hear. Another setting where we see the interplay of several voices is in conversations, meetings, interviews, debates and so forth – more generally 'speech exchange systems' (Sacks et al 1974). Socio-linguistics scholars have analysed the ways in which the practices of speech provide mechanisms by which turn-taking can be effected. It is suggested here there is a useful analogy between the participation of individuals in conversation and the activities of various network members in the delivery of a service.

Sacks et al (1974) suggest that there are two components in the analysis of turn-taking. First, there is the turn-constructional component – analogous to the service module

or jazz solo – which might be a sentence, clause or phrase uttered by an individual in the conversation. Secondly there is the turn-allocation component, by which the next speaker is identified and the timing of his or her turn indicated. This is in some ways analogous to the interface between service modules.

Sacks et al also identify a number of 'grossly apparent facts' from their studies of how conversations take place. These are briefly listed, verbatim, from Sacks et al (1974):

1. "Speaker-change recurs, or at least occurs
2. Overwhelmingly, one party talks at a time
3. Occurrences of more than one speaker at a time are common, but brief
4. Transitions from one turn to a next with no gap and no overlap are common
5. Turn order is not fixed, but varies
6. Turn size is not fixed, but varies
7. Length of conversation is not specified in advance
8. What parties say is not specified in advance
9. Relative distribution of turns is not specified in advance
10. Number of parties can vary
11. Talk can be continuous or discontinuous
12. Turn-allocation techniques are used
13. Various turn-constructional techniques are employed for the production of the talk that occupies a turn
14. Repair mechanisms exist for dealing with errors and violations"

Many of these phenomena suggest a more flexible and unpredictable pattern of turn-taking than in a jazz standard, say, but also one which is governed very effectively. Overlaps and violations are brief and or rare: turn-allocation techniques work very effectively. Two broad types of turn-allocation techniques are identified: current speaker selects next speaker (e.g. by addressing a question to another party) and speaker self-selects.

In modularity terms, it seems that interfaces between modules (turns) are rather clear. Critically, conversations are more obviously sequential than jazz music performances where, although there is usually a turn-taking aspect, there is also an important ensemble aspect in the form of harmonics, counterpoint and so on. This sequentiality of conversation leads to another important insight – that what one person says often determines who speaks next and/or what is said in the next turn. Also note that the form of the 'turn-constructional technique' allows others to anticipate when the current turn will end e.g. when the current sentence will end. In broad terms, the analogical reasoning process asks: what would an inter-organisational service-delivery network that functioned like a group of friends having a conversation look like?

Metaphor 3 – Statefulness in Computing

This metaphor takes the sequentiality aspect in the foregoing discussion to a more formal level. In computing, a stateful computer or program keeps track of the state of the interaction with a user or another device. The information about state informs how it carries out subsequent functions. When a user requests a web page, the web pages are served without the web server remembering the request later. This is a *stateless* interaction. The addition of state data in the form of a cookie, however, renders subsequent interactions stateful. Hence, for example, the Amazon website 'knows' what types of music I like and can tailor its services accordingly. In service delivery, most medical procedures are stateful in that the procedure or treatment administered depends on a preceding service element such as a diagnosis or test. Some services are stateless: staying for a night in a hotel does

not usually depend on what has gone before, unless it is organised as part of, say, a package tour.

This analogy is less obviously concerned with the actor-equivalent than the previous two. The element equivalent to the actor is a series of lines of code in a piece of software. It does draw more specific attention, however, to the nature of the interface between the process stages or modules. A small example will show how this might relate to a non-data-processing service delivery setting. Paramedics, when they take a patient into Accident and Emergency (A&E or ER), do a lot more than drive the van. They administer various forms of treatment to stabilize the patient and, most importantly to this discussion, assess and summarise the patient's condition so that the doctor in the A&E can be briefed effectively and quickly. Recent research (Talbot and Bleetman, 2007) has examined the extent to which certain types of more standardized handover protocol – service interface in modularity terms – make the handover more effective in allowing the receiving doctor to begin the appropriate course of action straight away. This is a 'stateful' interface (thankfully) but, according to the research, only to a certain extent. Evidently receiving doctors are often distracted from listening to and absorbing the handover briefing by their own attempts to find out the information for themselves by examining the patient immediately. What might otherwise be a 'neat', stateful, thin interface is compromised by some combination of distrust, professional instinct, lack of clarity about the division of labour and defensiveness about professional demarcations. More generally it reminds us that such interfaces are contestable and institutionally constructed.

Synthesis and Conclusion

These three metaphors progressively draw attention to the sequential aspect of service delivery. This contrasts with the treatment of modular products in the literature, where modules are specified and assembled in advance and then sold instantaneously. Hence the interfaces between service modules are not simply pre-determined demarcations between what one service provider will do and what another will do, but may:

- Be more or less predetermined
- Be determined institutionally or by convention to a greater or lesser extent
- Be established by equivalents to the 'turn-allocation techniques' of conversation
- Be stateful or stateless

To draw these insights together, it is suggested that a theory of modular services in networks will need to take account of architecture between modules that is institutionally determined and of interfaces that are appropriately stateful in terms of time, space and other relevant aspects of state. It is hoped that insights derived from these explorations will inform empirical studies in B2B service settings so that these various aspects of service modularity may be characterized more generally and comprehensively and, perhaps, others be identified.

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