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A TYPOLOGY OF SERVICE SUPPLY CHAIN STRATEGIES – PATHWAYS BETWEEN AGILITY AND EFFICIENCY

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ABSTRACT

Various service supply chain strategies may provide firms with competitive advantage, providing appropriate pathways between different configurations are identified. Using a case study and a theory building process, we illustrate a configuration and movement in a typology of service supply chains. We explain how the framework aids analysis of current and future positions and the strategic implications for service supply chains. A key principle of the framework is the distinction between novelty, or frequency, of mismatches between information-as-input and service requirements, and the analysability of the challenge, or the level of difficulty in identifying and acquiring appropriate input information.

Keywords: service supply chains, service supply chain strategy, pathways, strategic management of services, information management

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INTRODUCTION

The role of services continues to grow as a key economic driving force in most western economies and developing countries [1]. In supply chains, the provision of services constitutes a crucial component of the overall value proposition to customers, or it may even form the fundamental basis for exchange. However, the prevailing focus in supply chain research is on the coordination of the flow of physical items between supply chain entities, whereas the coordination of activities amongst service providing entities, 'service supply chains', remains largely unexplored. There is only "scarce empirical knowledge on service supply chains" [2, p. 93] and the domain struggles to establish a consistent foundation and language [3]. The coordination of operations across multiple organisations, named 'COMO' by Hayes [4], is also generally understudied, with many scholars noting that in traditional supply chain research there is an inadequate emphasis on relationships more complex than dyads. Thus, investigation of coordination over larger supply chain networks encompassing multiple organisations is still in its infancy.

Various scholars classify service-based supply chains as dissimilar to goods-based supply chains, due to the underlying exchange of intangible information rather than tangible goods [5], which has led to an extension of traditional supply chain research towards service-based supply chains [6] [7]. While there are different supply chain strategies for goods-based supply chains (such as pursuing either an agile or efficient configuration), it is not clear whether there are analogous service supply chain strategies. Based on these realisations, this research endeavours to answer the following question:

Research Question 1: What are the differences between service supply chain strategies?

Furthermore, supply chains are often investigated with the premise that the network is relatively static and unchanging. It remains unclear how service supply chains evolve through early stages, and particularly how these processes are coordinated in a strategic fashion. This presents a second question:

Research Question 2: What are possible scenarios or pathways to alter the strategy of service supply chains?

We attempt to answer these questions through the investigation of the early, evolutionary stages of a service supply chain. The coordination mechanisms employed are discussed, with emphasis on how these may change over time, as the service supply chain seeks to move from, for example, an agile configuration to one that is increasingly efficient. We expand on the literature of coordination in service supply chains, focusing on early-stage service supply chains, and how they develop and establish firm processes. Empirical findings on in the forming stages of a service supply chain are presented, based on insights from a globally-distributed service supply chain in the consulting industry. The findings demonstrate how the service network changed over time and intends to evolve in the future. The extent of this strategic repositioning is further explored and demonstrated on a matrix describing distinct service supply chain strategies which is grounded in established concepts from the supply chain literature. Finally, we outline a potential research agenda to confirm our propositions.

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LITERATURE REVIEW

Service and Service Supply Chains

Service supply chain management is generally perceived to be grounded on the differences between goods and services, rooted in the characteristics of intangibility, heterogeneity, inseparability, perishability [8] [9]. There is debate whether 'service supply chain management' is distinctly different to supply chain management. If "supply chain management is the management of information, processes, capacity, service performance and funds from the earliest supplier to the ultimate customer" [5, p. 25], then the discipline of supply chain management can safely encompass both goods and services. Indeed, a definition such as: "service supply chain management is the management of information, processes, and resources along the service supply chain to delivery services or servitised products to the customers effectively" [10, p. 1192] is similar to the definition outlined by Ellram et al. [5], although more specific to services.

However, service supply chains have also been described as being specific to "professional services such as outsourced engineering and technical services, consulting, financial services such as mortgage and insurance, commercial construction" [11, p. 262]. There may also be distinctive elements, such as the 'human element', which are especially crucial to service supply chains [12]. The fact that service supply chains cannot hold finished goods inventory" and are frequently constrained by the availability of skilled labour [11] support the view that a clear distinction exists. While many similarities exist, it has also been found that the objectives, tools, and levers used by managers are different in service supply chains [13].

Value in Service Supply Chains

The introduction of additional services can expand "manufacturing organizations' ability to compete beyond traditional measures" [14, p. 329] and therefore often form an important component in modern goods-based supply chains [15]. Providing services in addition to products is known as 'servitisation' [16] [17] [18], a process that helps to "create additional value adding capabilities for traditional manufacturers" [18, p. 547]. The focus of 'product-service-systems' [19] [20] carries servitisation through to a natural conclusion and expands the emphasis on value in the system and shifts the focus away from products.

Embracing the importance of services as the ultimate source of value, the service-dominant logic (SDL) perspective argues value is determined by the use of the final consumer [21] [22] [23]. In this way SDL may "serve as a framework for integrating [...] supply chain management practices" [24, p. 19], forcing a shift to a network or a constellation of firms focused on creating value [24]. A 'value network' is a "dynamic network of customer/supplier partnerships and information flows" [25, p. 22], interacting together so that they can "(1) co-produce service offerings, (2) exchange service offerings, and (3) co-create value" [24, p. 20].

A Decentralised and Responsive Focus

Service supply chains can differ with regard to their service focus but generally entail business relationships integrated in a network to service a customer [10] [26] [27] [28]. The

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customer-centric focus requires careful planning to ensure adequate capacity and inventory is available for service delivery [27]. A key method to ensure value for a customer is the personalisation or customisation of the delivery through a responsive supply chain [28] [29]. Service supply chains have a significant human labour constituent providing the required flexibility.

The focus in goods-based supply chains is traditionally on improving efficiency, aided by the homogeneity of processes and input materials as well as standardised controls. However, service supply chains require more flexible resources and inputs to work adequately within the decentralised processes, less standardised control, and greater uncertainty in outputs [12] [15] [30].

While there are examples of service supply chains that attempt to become more efficient, they remain significantly less efficient than manufacturing supply chains [31]. It is difficult to match the cost-effectiveness of manufacturing supply chains, while the service supply chains require greater responsiveness [29].

Bidirectional Information Flows

Sampson [32] argued that a service supply chain is “based not on the nature of the service production process, but on the inputs and outputs of services.” As a result, service supply chains are generally:

- Bidirectional
- Short, running from a customer that provides information to a service provider and back to the customer
- Inherently just-in-time (JIT)
- Service providers usually do not need to pay for their inputs as they come directly from their customer
- Embody expectations for value-creation

The human involvement in the service provision increases variation in outputs [30]. However, in a bi-directional service supply chain the input is provided by a customer, which may inject greater variation and uncertainty.

Coordination in Service Supply Chains

The nature of service supply chains mean that “uncertainty inherent in services [...] makes it more difficult to design and implement effective operational processes at the supplier-customer interfaces of the service supply chain” [33, p. 188]. The coordination in service supply chains becomes important.

Service Supply Chain Entities

The SDL perspective implies a decreased focus on a unidirectional ‘supply chain’ and greater emphasis on a multidirectional value network [24]. Within the value network there are multiple firms that are legally independent, yet strongly interdependent on each other to provide the service. There are multiple supply chain management tools that assist coordination between separate organisational entities, such as vendor managed inventory

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(VMI) systems that are designed to improve coordination of activities and processes in the retailer-supplier dyad. The retailer shares greater information, about ordering and sales, and the supplier is able to use this information in conjunction with detailed supply-base knowledge of lead times, to ensure that goods are available for the retailer when required [34]. While such supply chain frameworks are predominantly focused on the flow of goods, there is no reason why similar concepts should not be applied within services supply chains, particularly dealing with information sharing and information as a resource that flows between the parties within the service supply chain.

Service Supply Chain Activities

Most examination of new service development (NSD) follow phases similar to those in new product development (NPD), including: concept development, prototype development, testing and launch [35] [36]; similar NSD definitions and sequences are provided by Slack et al. [37] and Perks and Riihela [38]. For simplicity within the complexity of a value network, we break the functions into: planning activities, design activities, and the delivery or execution activities.

Planning requires accommodation of future provision requirements and the tasks required in the current iteration. Coordination may occur within an organisation as well as between organisations in the value network. A manufacturer ensures effective internal coordination between production and procurement departments, using tools such as Materials Requirements Planning (MRP) to translate the desired output into procurements requirements, allowing two functions to manage their interdependencies [39].

Drawing from product development research showing retention of architecture enables more rapid and effective introduction of new products [40], retaining the basic service design, or arrangement of components in a service, should enhance future service introductions. In this way, formalisation of the processes and team structures indirectly influence the focal firm's abilities to develop new services, and influence the service performance [41].

The realisation of a service is when the delivery, or execution, of the service occurs [36]. Effective inter-functional coordination between interdependent functions or groups can substantially influence execution and delivery of a profitable new service [42] [43] [44]. The presence of team structures, processes, and IT, all of which improve development of services, particularly the presence of cross-functional teams [41]. Some of these activities will be undertaken by a coordinating member of the service supply chain; other activities may involve cooperation between individuals or groups from different firms.

Coordination of Service Supply Chain Entities

Coordination is a critical element that supports smooth and effective supply chain operation [4]; a key area of concern in this research is therefore coordination in supply chains. Coordination is “the act of managing interdependencies between activities performed to achieve a goal” [45], and is understood to be a significant challenge in supply chains.

Early investigations into intra-firm coordination and control [46] built March and Simon's [47] earlier work. Coordination through planning involves the interaction by rules, tools, and

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equipment in the transformation process. Coordination through feedback involves the negotiation of alterations in tasks performed by multiple units [46].

Problems occur when products or designs do not match the processes presently used. Analysability of a problem refers to the difficulty in solving the problems. Adler [48] examines the design/manufacturing interface inter-firm. Where there is a mismatch between requirements and existing approaches there is an exception; many exceptions indicate a 'novel' situation where many problems occur. When these problems are solved, an easily found solution, requiring few and minor searches, shows that a problem is highly analysable; less analysable solutions are more challenging and require greater coordination between various departments within the firm.

Resolution of problems requires a range of coordination mechanisms. Greater varieties are required "to tackle the complexities in managing the interdependencies like resource sharing, knowledge sharing, information sharing, joint working, joint decision making, joint design and development of product, joint promotions, implementing information systems, designing risk-sharing contracts" [49, p. 320]. Conflicts of different forms may exist, such as conflicting goals (goal conflict), differences in opinion on the domain of particular decisions (domain conflict), or differences in perceptions of reality of different supply chain members (perceptual conflict) [49].

Coordination is not just challenging in goods-based supply chains; effective service delivery requires coordination, particularly of information sharing. This is explored in the next section.

Coordination of Service Supply Chain Activities

Coordination mechanisms, or governance systems [50], are of great importance in both goods and services supply chains [51]. Carefully directed action is critical to overall performance; a lack of coordination results in the worsening off of the partners in the supply chain [52]; the "[k]nowledge of all value-added activities in the supply chain is critical" [53, p. 12] to effective holistic solutions.

Coordination involves "[t]he determination and design of interface points between stages of the supply chain" [53, p. 13] so there is effective alignment of processes and activities, to reduce costs, times, and improve customer service [54]. As networked relationships involve complex, non-dyadic, interdependencies [55, p. 134], management of coordination is of strategic importance in networks and supply chains.

Coordination mechanisms outlined in the supply chain literature, for use between separate firms, include incentive systems [56]; reputation, as it influences firms entering and exiting the network, and selection for the execution of tasks within the network [57]; channel alignment [6], information systems, sharing, and flow [6] [49]; contracts [34] [49] [54] as they remove the need for the mechanism of joint decision making [49] [58].

Strategies in Service Supply Chains

Information flows and adequate access to relevant information for all stakeholders are of crucial importance to the success of any service supply chain. The strategic orientation of a

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service supply chain is based on this premise. This section therefore explores the role of information as a key resource as well as different kinds of service supply chain strategies.

Strategic Importance of Information

Vargo and Lusch [21] differentiate between two types of resources. *Operand Resources* are resources that operations, processes, or acts are performed on to produce an effect. In a manufacturing supply chain these would be raw materials, such as sheets of steel entering a car manufacturer's factory to be shaped into car bodies, or half-finished motor vehicles (WIP inventory) in production. Contrastingly, *Operant Resources* are resources employed to act, operate, or engage in processes on Operand Resources or Operant Resources. Thus, operant resources within a car manufacturing plant would include robots, drills, and automotive engineers.

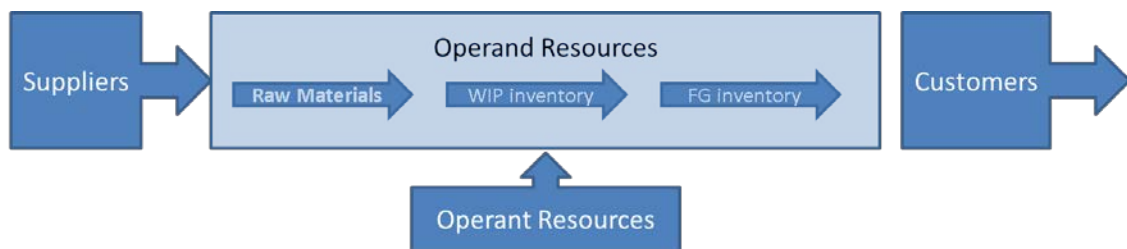


Figure 1 Operant and Operand Resources in a Manufacturing Supply Chain

While these differences may be relatively clear in a goods-based supply chain where there is a clear flow of operand resources from supply to customers (**Error! Reference source not found.**), in a service supply chain the distinctions are less clear-cut. Here, operant resources are often information- and knowledge-based (transformational information), while at the same time the operand resource, being processed, is also information from the customer (information-as-input, or IAI). In such an information-based bidirectional service supply chain, information can be either an operant or operand resource (

Figure 2).

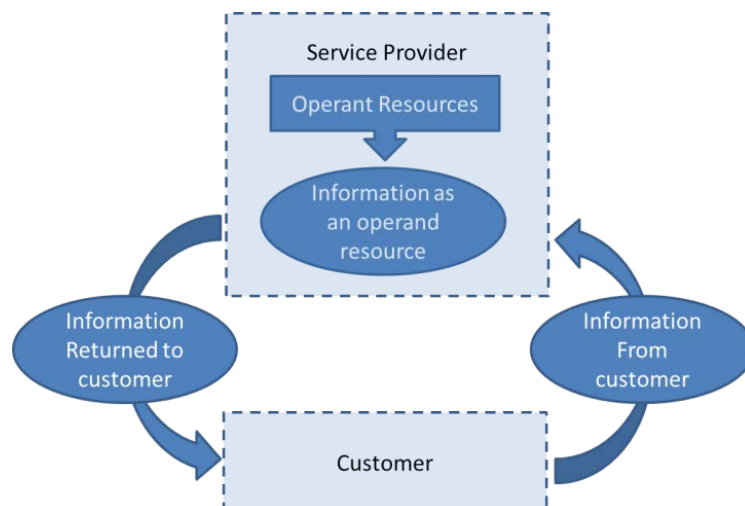


Figure 2 Information as an Operand Resource in a Service Supply Chain (based on the bi-directional service supply chain as described by [32]).

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In **Error! Reference source not found.** the operand resources are the materials, which are acted on by the operant resources of the manufacturer. This represents a normal manufacturing supply chain. However, using Sampson's perception of a service supply chain being shorter and bidirectional [32], a very different picture emerges. The information provided by the customer is acted on by the operant resources of the service provider (

Figure 2). In these circumstances the information from the customer is itself an operand resource as it is acted on and transformed by the service provider. Yet, the information possessed by the Service Provider allows them to 'transform' this information input into valuable outputs for the customer. In this way we see that 'information' can be either an operand or an operant resource in service supply chains. We make this distinction by referring to these types of information as the IAI 'operand information' (information that is used as an input and processed) or transformational 'operant information' (information which is used to help transform an operand information).

Strategic Orientations in Service Supply Chains

Many traditional inter-organisational coordination mechanisms assist with the management of operand resources, such as materials, as these are the only forms of resources that had traditionally been considered. However, in modern goods-based supply chains and in service supply chains, there is a greater reliance on operant resources spread over multiple firms, and so there is greater need to visualise and understand the interdependencies of operant resources. There are, therefore, the following coordination issues:

- Between the service providers and the customer (information as an operand resource)
- Within a single service provider (operand resource coordination is primarily the most significant challenge)
- Between service providers (both operand and operant resource coordination can be challenging)

While inter-firm coordination of physical operand resources may be well-established (considering, for example, production control systems resulting in order release, such as through a materials requirements planning system), there are particular challenges in services. This is due to the nature of information as an operand resource – particularly in knowledge intensive services.

As a service becomes more knowledge intensive, and the service becomes increasingly co-created with a customer, the nature/specifications/parameters/characteristics of the 'information as operand resource' become less certain. As an example, an accountant may spend their day doing individuals' tax returns; they understand very precisely what IAI is required to complete the task and where information wasn't provided, they understand how to communicate this to the customer so that the appropriate IAI can be secured. Repeated work allows them to rapidly evaluate pieces of information from the customer, and identify the characteristics of each (necessity for inclusion, how it should be processed, etc.). However, if an accounting company is providing accounting consulting services, such as evaluating a system to allow rapid estimation of the benefits from an acquisition in a particular case, where there is a great deal of complexity, this means that the characteristics are not as firm or stable. Under these circumstances, co-creation of value with the customer is required; both

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parties work together to communication and understand the key characteristics and the correct 'information as operand' resources required to complete the project.

When a service provider works in a more stable environment, with an effective understanding of 'information as operand' resources required, they are able to operate efficiently. Through the rapid identification of the characteristics of information-as-operand-resources as required their emphasis will be on the flow of operand resources and controlling these, presenting an efficient configuration (Figure 3). Contrastingly, if there is greater emphasis on the coordination or use of operant resources, a service provider is acting as a more agile configuration, as they seek to have the correct 'transformations' applied on the input resources, to customise and deliver the highest value for the customer.

A service supply chain may be perceived to operate primarily on operand resources. Where coordination is of this type, the supply chain may develop procedures and routines that allow them to efficiently coordinate, enabling alignment towards goals. Contrastingly, where alternate sources of operant resources may be found and utilised as required, service supply chains may perform in an agile fashion, more able to respond to changes (Figure 3).

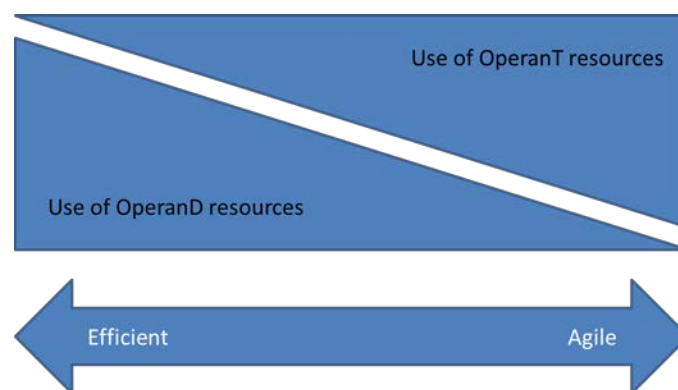


Figure 3 Efficiency of service supply chains and the related use of resources

Within the constellation of firms in a service providing network, there are multiple operant resources held over multiple members. In many cases the operand resources must be divided somehow, and transmitted to the relevant operant resource for processing, before being re-assembled for delivery to the customer as a finished service (Figure 4).

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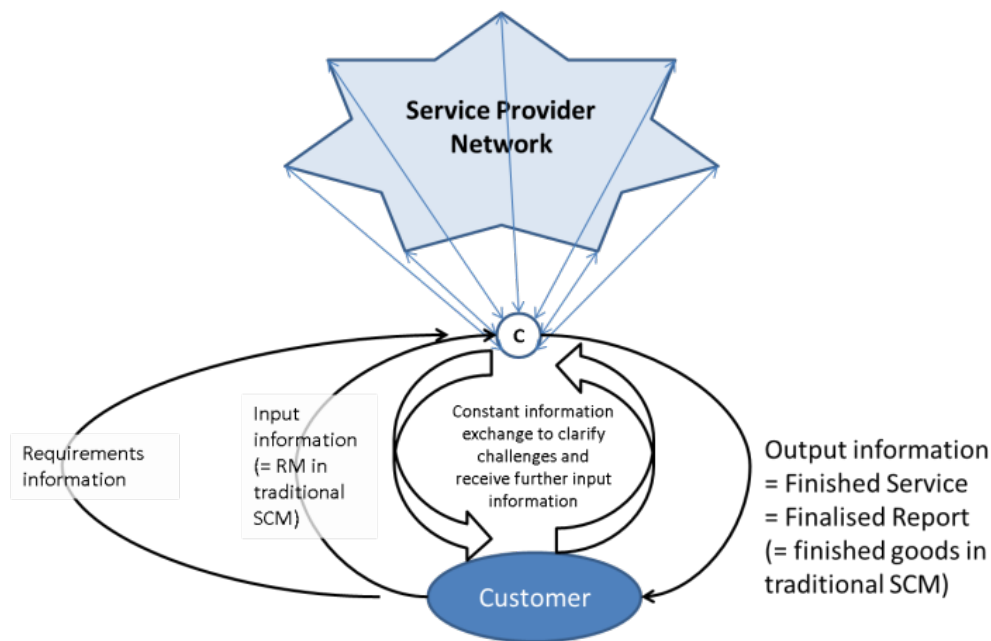


Figure 4 Service networks with multiple types of information and requirements information

Drawing on the frameworks provided by Perrow [46] and Adler [48] and returning to the concepts of novelty and analysability provides further insights. The arrangements of activities within the service provider and mechanisms, processes, or routines that are used to work through various problems provide the service provider with either an efficient or an agile service supply chain. Problems occur when there are differences between the resources available and the resource required to complete the service. This represents a mismatch between service 'product' and the service 'process' for delivery. If the wrong IAI has been provided to the service supply chain, or customer requirements are not clear in relation to the IAI provided, iterative engagement must occur between the service supply chain and the customer to resolve the mismatch. Where there are many of these problems or exception between what is provided as IAI and what is required for the service completion, novelty is high.

Where the mismatch is easily overcome, analysability of the problem is high. Where it is difficult to ascertain what IAI is required in light of customer requirements and the capabilities of the service supply chain, analysability may be lower, and the mismatch may take longer, or more extensive collaborative work, to overcome.

RESEARCH METHODOLOGY

Understanding the nature of service supply chains and their strategic orientations is an important, yet under-investigated, research area that is relevant for industry and academia alike. Due to the underdeveloped nature of this research area, we opted for the use of an industry-focused exploratory case, an appropriate strategy when "little is known about a phenomenon" [59, p. 548]. The increasing importance and role of qualitative research methods (including case studies) within the discipline of operations and supply chain management [60] can provide new empirical insights. This research follows the suggestion of Eisenhardt [59, p. 539], that "investigators should formulate a research problem [. . .] with some reference to extant literature" at the commencement of an investigation.

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Case Selection

Effective case studies are often underpinned by careful case selection. This research was supported through the use of a case protocol [61], consisting of a method to identify and define what the case was, field procedures for the researcher, and schedules for data collection. A case forms the unit of analysis [62]; as the service system is the fundamental unit of analysis in service research [63], this study uses a case defined by an emerging service supply chain, forming a service system, consulting of several consulting companies, as the unit of analysis.

A two-stage criterion-based theoretical sampling approach was determined to be appropriate. Selection criteria were applied to select appropriate cases for further investigation, ensuring appropriate representation of the key phenomena under investigation [62]. First, we selected an industry and chose the consulting industry as the professional services industry is one area where service supply chains are likely to exist [11] and there must be effective sharing of information between consultants and customers [64] [65]. The sharing of information is critical as service supply chains exhibit a flow of information, rather than goods [5]. Second, specific consulting firms needed to be identified using industry associations, publications, the internet, and institutional networks. 27 potential firms were identified and emailed. Of these, 16 agreed to an initial screening interview and 11 declined to participate or did not respond. Running through additional criteria with those willing to participate, four firms remained; one was selected as it appeared to be a case that would provide rich information and interesting relationships.

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Data Collection

Retrospective investigations are appropriate for studies relying on interviews [66], and so we selected a service supply chain that had completed the first value co-creation iteration (VCCI). Service supply chains co-create value and each iteration of this process, with a new or existing customer, strengthens the perception of the existence of a supply chain. In addition to semi-structured interviews, field-notes, observations, and additional documentation proved valuable sources of additional data.

Working with concepts and theories in the literature as a guide, interview questions were formed to be open-ended and thematic [67] to guide and structure interviews without unduly constraining their course [68] [69]. All interviews were conducted by the same researcher, were recorded for subsequent analysis, and lasted around one hour. The interviewees included employees and managers of the consulting firms and the customer organisation. Interviews were conducted on-site in New Zealand and Canada and by video-conference, or telephone where this was not possible [70] [71].

Table 1

ORGANISATION	PARTICIPANT	
Consulting Firm A	Project Manager	Auckland, NZ
Consulting Firm A	Senior Manager	Wellington, NZ
Consulting Firm A	Consultant	Brisbane, AUS
Consulting Firm B	Senior Manager	Hamilton, CA
Consulting Firm A	Consultant	Fredericton, CA
Consulting Firm A	Consultant	Fredericton, CA
Consulting Firm C	Project Manager	Mississauga, CA
Consulting Firm B	Consultant	Toronto, CA
Consulting Firm B	Project Manager	Toronto, CA
Customer	Employee	Toronto, CA
Customer	Employee	Toronto, CA
Customer	Project Manager	Toronto, CA

Data Analysis

Interviews were transcribed into textual data which was then compiled, cleaned, verified and organised in *nVivo 7*. The data was coded in an iterative process, i.e. category labels would change as more codes were added, and codes would be split or combined where appropriate, reflecting the evolving nature of the coding as the data were analysed [62]. This process relied on descriptive, interpretive, and pattern codes, in order to identify constructs of emerging theory and their relationships [59] [72]. These analysis and coding steps were conducted separately by two members of the research team, before the results were compared and discussed, to produce a single scheme agreeable to the researchers that reduced individual researcher bias. The process was continued until the researchers were satisfied by the generalisations in light of the specifics of the case and the emerging theory developed.

CASE ANALYSIS

The service supply chain was creating an infrastructure asset management framework with associated guidelines. It represented the first VCCI, working with a Canadian government

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institution. The main responsibility of the customer was the planning and maintenance of local infrastructure, whether relating to transport, healthcare, or education, and the delivery of specific projects such as this infrastructure asset management framework.

As shown in Table 1, the consulting companies were located in Canada, Australia, and New Zealand. Each had a particular area of expertise, ranging from strategic consulting, to infrastructure or transport management advice. The largest company is one of the “Big Four” global professional consulting companies, and they approached the two smaller consulting firms in order to gain access to more specialised knowledge. One is a North American firm with expertise in condition assessment and evaluation of buildings. The second specialises in asset management, infrastructure development, and environmental planning. The final outcome of the exercise was to be a 400-page infrastructure asset management framework, which may be followed by various training opportunities. During the data collection and analysis it was found that similar cultural expectations and management experiences govern the investigated companies. Hence, despite the fact they come from different countries, there appeared to be few cultural differences between them.

A crucial first step was the establishment of face-to-face meetings between key staff in the service provider companies. A work schedule and breakdown of responsibilities was established, with individuals or groups within the firms being allocated work appropriate to their specialties. Weekly meetings were agreed on, and the establishment of a project management position and a ‘conductor’ position. While the project manager orchestrated the overall project, the conductor was responsible for liaison with clients and the individuals or groups within the service supply chain. In this manner the conductor reduced complexity, assumed the role of a gate-keeper, and ensured that appropriate resources were present in the supply chain, as well as ensuring that the information received from the customers was adequate for processing.

Over the life of the VCCI, the organisations worked to standardise processes and methods for operating. They became increasingly effective at solving problems and coordinating the flow of information and requirements amongst themselves. The entire exercise was perceived as being the first of multiple operations or iterations. They intended to offer a similar service to other clients, drawing on positive experiences and lessons from the first VCCI to create more effective processes in subsequent VCCIs, allowing a more efficient service delivery.

DISCUSSION

The underlying operations and processes of services provided by a network of companies should be managed in a way that supports the supply chain’s strategic objectives. For example, tasks designed for unwarranted agility or flexibility are unlikely to support a strategy aimed at offering low-cost services. Company internal activities may be easier to control in order to ensure congruency with strategic objectives, whereas the management of activities across a service supply chain is likely to be more challenging due to the fact that each supply chain member has only limited control over the combined resources. Thus, careful coordination of operant resources, activity design, and the actual activities associated with specific business processes, may offer a powerful opportunity for a service supply chain to manage operations congruently and improve their overall level of competitiveness.

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Based on the presented case study we can see that the firm realised that there are operant resources in other organisations that they needed to have, which were otherwise uneconomical to retain in-house. When they were tackling the problems there were challenges in identifying the correct type of information that needed to be processed, indicating a clear mismatch between information requirements (for operant resource processing) and information received (IAI). Analysability is a measure of simplicity in finding a solution. Novelty is the match between the input (operand resource) and the process required (using an operant resource).

Many service supply chains may first develop based on an 'agile' configuration, characterised by an ability to solve diverse problems. They can themselves apply innovative solutions to significant challenges and furthermore locate and utilise additional operant resources to achieve set objectives. Over time, the configuration for a given service supply chain will evolve into something different, as the chain attempts to create new competitive advantages. The four quadrants, based on different levels of novelty and analysability, represent the different configurations for service supply chains (Figure 5).

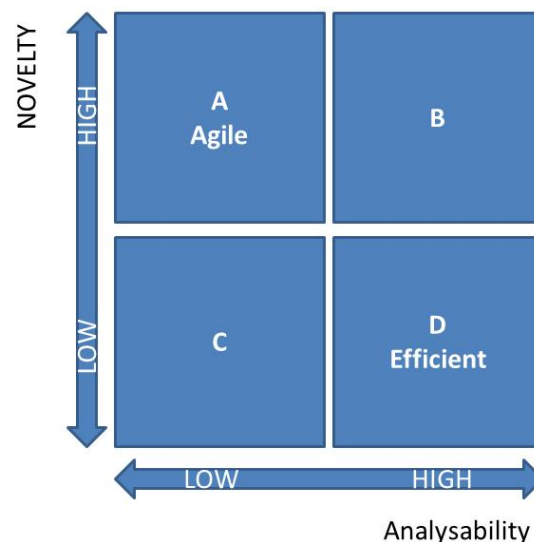


Figure 5 Analysability and novelty together indicate four possible service supply chain configurations

Agile Configuration (A)

Most information-based consulting services commence as an 'agile' configuration, working on a 'project' basis, which is the word that you will most commonly hear used by the consultants in these cases for each VCCI. There is usually a significant problem which will frequently be broken up into smaller sub-problems. In many cases, these will be different to other problems the service provider has worked with before, requiring new and innovative solutions in these customised situations to solve the problems. In some cases, this will require specialists to be brought on board to complement the range of operant resources available in the consulting company. Novelty is high; there are low levels of stability, particularly between VCCIs. At the same time, analysability of problems is low. Finding solutions within a specific VCCI can be challenging and time-consuming, requiring significant investment of operant resources.

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In these cases, the match between IAI and the requirements of processing is not always clear. The service supply chain frequently fails to clearly understand what IAI is required - such a service has not been created before and there are no experiences or past instances to work from as a model. This makes the matching of input to requirements more challenging. Furthermore, when inputs are received, it is not always apparent whether they meet the requirements. That is to say, that the definitions of requirements are unclear and imprecise, particularly at the commencement of a VCCI.

They can draw on other, external, specialists. This is necessary as they tackle a range of assignments and the exact operant resources required are not known ahead of time. Thus, it would be uneconomical to retain such operant resources as a fixed resource in the organisation. Instead, operant resources located in other firms are sourced and brought into a particular VCCI when required, in order to resolve low levels of analysability.

Analysability refers to the match of operant resources within the service provider and their ability to use these to solve the problems. If there is a high level of analysability, the operant resources required are available. If operant resources are not available it will hinder the search for solutions and indicate low analysability. This challenge is offset through the acquisition of requisite operant resources from another service provider, forming a service supply chain.

Service Outsourcing (B)

Within the Service Outsourcing configuration there are still a large number of challenges, but the analysability is higher. That is, it is easier to identify the correct types of information required to conduct the service. This means that a central coordinator in the service provider is able to analyse requirements, collect IAI, and then outsource the work to other service firms for completion. The focus is on reliability and control of the processes.

Examples of this include routine activities such as accounting. Firms outsource accounting activities, these are externalised processes which are well-understood and require little supervision. The work can be 'farmed out' easily. While there are a large number of problems that occur, the analysability is high, allow a speedy searches for solutions and easy transmission of clear requirements. Many exceptions may be routinized to allow rapid resolution of problems.

The primary focus is on efficient operand resource flow. The use of operant resources is heavily reduced within a single firm; operant resources may be located in other firms but tend to be relatively fixed, or 'stuck' in a particular configuration. This is in contrast to an agile configuration, where operant resources may be more fluid and may be tied to the knowledge or skills of particular individuals that are capable of shifting organisations.

Small and Specialist Configuration (C)

Some services may be much more limited in scope and can be adequately delivered by a smaller company or group of specialists that work together. There are fewer exceptions between IAI and requirements, allowing for some routinized situations which occur smoothly until an exception occurs. There are few established operant resources, but each time there are significant challenges to overcome while they search of a solution, as the analysability is

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low. They may not have firm processes in place and routines, or they may not repeat the specific type of work frequently enough to gain the experience that would allow rapid resolution of future exceptions, and analysability remains low. There may be adequate operant resources in a firm, or spread over several firms, where they can be accessed or 'borrowed' on an as-need basis.

Efficient Configuration (D)

Here there are few exceptions and relatively stable understanding of information-as-input and operant resources. Service supply chains opt for a configuration that enables effective routinized operations, in an efficient configuration. Many operations will be brought in-house to enable maximum control over the operations to ensure efficiency. Where an exception is identified, it is relatively easy to understand the information-as-input as a requirement and match it to an appropriate operant resource, or identify the operant resource type required. The focus becomes the smooth use of operand resources, screening and identifying processes to enable the correct identification of information-as-input.

This configuration may lead to an in-house focus or highly-integrated service supply chain, acting as a single firm, or a service network that is well-established and stable.

Pathways between Quadrants

There are multiple configurations of activities and operant resources between partner firms that are available for service networks and it is important to note, as demonstrated even within a single VCCI, that such service networks are not static entities. They may change their configuration within, and clearly between, different VCCIs.

They are constantly caught in the tension between providing a customised and highly-valued service, and being able to provide a rapid and efficient service (opposite ends of the continuum). Within a specific VCCI we can see that the firms organise themselves in such a way that the service supply chain drifts towards a more efficient configuration over the duration of the VCCI. An example is provided in our case, where the firms use a conductor. This role rapidly gains understanding and trust of the customers, enabling effective communication about IAI requirements. They can also begin to arrange the operant resources over the service network to enable rapid facilitation of problems when identified.

While this was a single such instance of a VCCI of this nature, the firms involved have identified that this is a 'test' of this service network configuration and that they were keen to work together in the future to improve their business opportunities. By working in this manner over repeated VCCIs there is the hope that specific 'ways of getting things done' can become more formalised and become embedded processes within the network.

Over time, the experience of specific individuals as operant resources builds up, coupled with established processes, enabling them to rapidly spot exceptions between IAI and requirements for processing, and avoid these where possible, indicating lower novelty. Furthermore, when the exception has been identified, they are more able to communicate requirements to the customer organisation and gather appropriate IAI, enabling a more rapid facilitation of the problem, indicating a significantly lower level of analysability. Thus, a service network will work in a single VCCI towards a more efficient configuration, and over multiple VCCIs towards a significantly more efficient solution.

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The management of activities across the members of a service supply chain can significantly impact the overall competitiveness of the network. Sensible strategic positioning within a range of possible configurations, and continuously ensuring congruence of goals and activities over partner firms, may provide an opportunity for the formation and successful management of a service supply chain. However, competitive priorities may change over time, forcing service supply chains to reconsider their strategy and evaluate the potential opportunities arising from a transition to another configuration. Depending on the type of organisation, and the type of service that they aim to deliver, the movements will be different. Each of the configurations provide different advantages, between the ability to overcome new and innovative challenges (agile), providing cost-effective services (efficient), solving specialist challenges in a limited delivery (specialist), or solving numerous problems in an efficient manner (outsource).

CONCLUSIONS

Examining the types of information required by a network of service providers that are co-creating value with a customer, we determine that there are two types of information (operand and operant information) and that problems occur when matching the IAI to the requirements to complete an operation in the service provision. These matching problems may occur frequently (if the service provision is more novel) and they may vary in terms of the time and effort required to solve the problem (highly analysable problems are easier to solve). Building on this framework we present a matrix that examines potential positioning of service supply chains and examines the possibility for evolutionary shifts in service supply chain structures and coordination mechanisms that present the opportunity for a service supply chain to present either an agile or an efficient network configuration.

Through examining some core challenges in service supply chains, building on empirical data, we expand our understanding of service supply chain characteristics, coordination requirements, and possible evolutionary trajectories for strategic improvement. Insights from a case study provided empirical evidence for the kinds of information flows in service supply chains and associated coordination mechanisms. Based on these results the case can clearly be described as an archetypical 'Agile' configuration. Hence, the case strengthens our understanding of service supply chains and supports the framework presented.

Theory building has resulted in a framework customised to map and characterise service supply chains. Practitioners can use the framework to understand how they may change their service supply chains and understand how to become more competitive. Researchers will be able to examine the relationships in greater detail and validate the framework, e.g. provide examples of service supply chains that fit the characteristics described for archetypes.

Theoretical Contributions

This analysis, based on a single case, makes a contribution to the literature by identifying a range of different service network configurations. By identifying and classifying two important dimensions, outlined based on the case, and presenting a new consideration of the bi-directional service supply chain and the dual role of information, we present the 2x2 matrix (Figure 5). This matrix identifies a range of theoretically possible configurations which can be tested. Furthermore, we have also identified the rationale and reasons that

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service networks may select to move through the matrix. These propositions can be empirically tested.

Managerial Implications

A key implication from this framework is that there are different types of information, which are quite unequal. The ability for managers to be aware of these 'forms' of information and challenges in dealing with each has significant implications to their work within service supply chains. Understanding that there are multiple configurations possible and that plans can be made to shift the current configuration to an alternate configuration that may provide greater opportunities in the future, through different 'value' offered to the customer, whether customised solutions, or more efficient solutions.

Limitations and Future Research

This research is built on a single service network case study which makes it difficult to generalise beyond the specifics of this industry, which is strongly focused on customisation and agility. This can be overcome with further empirical research, particularly statistical studies, seeking to gain a statistically valid sample, providing validation for these concepts and the matrix over a range of service industries.

A longitudinal case-study which may be required to understand the RQs further, particularly from the perspective of several service firms or service networks that are changing their strategic positioning, to understand what the motivation was for the change, and whether the pathways for change identified are valid.

We also suggest that the matrix presented in this paper should be empirically verified. For example, researchers could deliberately sample cases that fulfil the characteristics outlined in each quadrant. Such a multiple case-study could provide rich descriptions and further insights into the area of enquiry. Similarly, scholarly research should investigate the performance issues related to each service supply chain configuration. Ultimately, the goal should be to provide managerial insights that go beyond the mere description of this unit of analysis, and unfold suggestion on how these individual archetypes can ideally be initiated, managed or improved.

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