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Emerald Article: Management of service supply chains with a service-oriented reference model: the case of management consulting

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Research paper

Management of service supply chains with a service-oriented reference model: the case of management consulting

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Abstract
Purpose – This paper aims to explore the utility of the manufacturing biased supply chain operations reference (SCOR) tool in services and develops a reference model for use in service organisations.
Design/methodology/approach – Services are considered as supply chain processes that are balanced around the capacity of the firm through the upstream sourcing processes. Empirical research is undertaken to model the design, creation and delivery processes of a management consultancy as a supply chain and to identify the potential application and benefits of the tool in a service context.
Findings – The developed model conceptualises the capacity of service firms as a resource inventory to build a service offering. This inventory-capacity duality that describes a service firm's capabilities is applicable across a wide spectrum of the service sector. Six major processes for the design and management of service supply chains are identified: plan, source, develop, adapt, operate, and recover.
Research limitations/implications – The reference framework that is developed is a proposition of how management in service supply chains could be standardised. Recommendations for future work are outlined so that an expansive reference tool can be developed to bridge the gap in service supply chain benchmarking and optimisation.
Practical implications – The developed process reference model can improve the overall performance of service provision systems through synchronised and well-coordinated integration of the different supporting services into supply chains.
Originality/value – The paper develops an original reference architecture for business services processes, which can be used to improve the overall performance of services design and delivery.

Keywords Supply chain management, Service operations

Paper type Research paper

Introduction

The service economy has always been the driving force of economic growth of every developed nation[1]. Despite the importance of services and the increasing "servitisation" of world economies, services lag behind in process excellence and performance when compared to manufacturing (van Ark *et al.*, 2008; Office of National Statistics, 2009). One of the reasons is that successful manufacturing organisations tend to integrate the supply, production and delivery processes of their core products with the use of effective information systems (Narasimhan and Jayaram, 1998; Bosworth and Triplett, 2004).

The rapid growth of the service sector over the last 50 years has generated the need for innovations and improved service productivity to fuel economic growth. While services marketing and services operations management have become established fields of research, very few studies have investigated how service providers can create value through the integration of the processes that extend their organisational boundaries (Ellram *et al.*, 2007; Voss and Hsuan, 2009). The inherent difficulties in developing standard models for services, as well as the complexity of their design and delivery processes, has contributed to the dearth of research in the area (Sampson and Froehle, 2006).

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Services are difficult to visualize and manage, they are diverse in nature and highly contextual and service procurement is not done in a centralized fashion (Ellram *et al.*, 2004).

An illustrative example is in the creation of value across service supply chains. In manufacturing supply chains this is easy to conceive, as it is primarily related with the transformation of raw materials into final products. Each company in the supply chain consecutively adds value to the product by processing the materials and information that "flow" from the upstream companies and then delivers the incomplete product to the next "link" of the chain. In the context of business services however, this is not relevant because they cannot be transformed, transported or inventoried in the same way as industrial goods.

This context has prevented established management practices transiting from the physical world of manufacturing to the world of services. There is however a pressing requirement for toolkits that will allow service operations managers to model and manage their supply chain processes in order to improve performance. The emerging field of service science, management and engineering (SSME) has provided a new platform for research in the design and delivery of services, by emphasizing the co-creation of value through the collaboration of various actors of a service system (Spohrer *et al.*, 2007), but until today has focused primarily on the multidisciplinary nature of the design of services. In a world in which customers' perception of service performance has become critical for the success of a company and the ability to manage service level agreements has become notoriously difficult, the development of a robust reference framework for SCM in services may be of paramount importance. This emanates from the promised benefits that effective SCM can create for all the collaborating parties: reduced costs and increased revenues, improvements in delivery, dependability and service quality.

Since 1997, the supply chain operations reference (SCOR) framework, produced by the supply chain council (SCC), has evolved into a very popular supply chain referencing tool. It has allowed an extensive base of users to model their supply chains, but it has not been applied yet in services. In this paper the utility of a service-based SCM framework is explored, by modelling the supply chain of a management consulting service and gauging the validity of SCOR in the context of "business services". These are services needed by many businesses (manufacturing, or service organisations) for the creation of their core products and services. The aim is to develop the foundations for a diagnostic reference tool that can be successfully applied to a broad range of service firms.

The remainder of the paper is organized in five sections. First, the usefulness and necessity of viewing services as part of supply chains is discussed, the SCOR model is presented and the peculiarity of service performance is analysed. The research design and analytical approach that is adopted to develop the framework and its features are presented in detail in the second section. The third section presents the developed framework and its application to a different context and the fourth section discusses the way that performance metrics for services supply chains can be adapted to assist its utilisation. The paper concludes with a discussion of the theoretical and managerial implications of the framework, its limitations and extension of the research.

Literature review

Why viewing services as part of supply chains can be useful

Despite the perceived barriers to the study of services' supply chains there are a number of existing and emerging factors that provide the impetus to pursue the development of services' supply chain models.

Coordination of processes

For the design and delivery of services a large number of independent stakeholders may be involved, whose processes need to be coordinated. Many business services (IT services for example) need to serve a large number of users from different departments of an organisation. This makes the delivery processes more complicated than industrial goods.

Improved performance through process integration

Considering services as part of supply chains it offers a holistic perspective of the processes involved for their creation and provision and the weaknesses that need to be addressed (Narasimhan and Jayaram, 1998).

Improvement of the customer interface

The high level of customer contact in services stresses the importance for an organisation to react swiftly to customer feedback. By adopting a supply chain perspective, managers can have a greater visibility of quality assurance processes.

Attempts to apply supply chain tools to services

Very few researchers have been interested in the management of supply chains of services, through the adaptation of existing SCM models (Ellram *et al.*, 2007; Sengupta *et al.*, 2006; Baltacioglu *et al.*, 2007). Studies so far focused on how traditional supply chain functions can be defined in services (Kathawala and Abdou, 2003; Ellram *et al.*, 2004), and investigated the dyadic relationship between the service provider and the end consumer of a service (Sampson, 2000). In an attempt to develop a service SCM framework, Ellram *et al.* (2004) assessed the utility existing SCM models and have adapted six processes of the global supply chain forum framework (Cooper *et al.*, 1997) for application to a service supply chain: information flow, capacity and skills management, demand management, customer relationship management, supplier relationship management, service delivery management, and cash flow. In their approach, they view capacity management as key to understanding the service, by considering the process of providing a service as the transfer of capacity for the purposes of providing value to the customer.

The efforts to develop conceptual models to articulate service supply chains and provide an understanding of the differences that exist between the manufacturing and service sectors have provided useful insights to the study of service supply chains. These works however provide only higher level constructs and tenets. They do not integrate them into a reference model that can be used to guide services' supply chain processes.

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The SCOR framework

The SCOR model is a diagnostic tool that assists managers to design and manage supply chain processes of an organisation at the strategic as well as the operational level. It can be used as a reference tool to benchmark disparate supply chains across several industries. To achieve this, SCOR standardises the activities of a supply chain into the following high-level five processes:

1 *Plan*. Processes that balance aggregate demand and supply to develop a course of action which best meets sourcing, production and delivery.
2 *Source*. Processes that procure goods to meet demand.
3 *Make*. Processes that transform products to a finished state.
4 *Deliver*. Processes that provide finished goods to meet demand.
5 *Return*. Processes that return products from the downstream to the upstream stages of the supply chain.

Each of the high level processes is split into three levels that describe analytically the strategic, tactical and operational activities that take place to support the supply chain operations. The model also considers and integrates the processes of a company's suppliers and customers, thereby providing a holistic supply chain perspective. Once a particular supply chain is mapped with the SCOR terminology, the standardized processes can be assessed with the use of specific metrics. For any improvement initiative, the toolkit points to recommended cross-industry best practices that can lead to enhanced performance in the standardized processes.

Despite its wide applicability, the SCOR model has been criticised for the limited and unvaried nature of the processes it models. Huan *et al.* (2004) argue for example that the model is not inclusive of all SCM processes (particularly the requirement to manage change) and Burgess and Singh (2006) suggest that it is not comprehensive when it comes to relational issues. Whilst the quality of the SCOR construct can be debated, it is its utilisation across manufacturing industries that has amplified its value (Huan *et al.* 2004).

As it stands, the SCOR model falls short in studying services' supply chains as the Make, Deliver and Return processes (in the way that they are defined) bear no relevance to business services. The inherent intangibility of many services makes their conceptualisation as product flows quite difficult. Services cannot be transported, or "made" in the same way as goods. The make and deliver processes also cannot be separated given their simultaneous nature, and the return process has limited significance. The lack of adapted performance metrics and best practices for services supply chains also make it an inadequate model for the management of service supply chains. The existing rich portfolio of performance metrics nevertheless may provide a useful source for the development of new adapted versions of SCOR for service supply chains.

Service performance measures

For the development of the services SCM reference model, the service performance characteristics need to be considered. Fitzgerald *et al.* (1991) propose six service performance dimensions, which are different from those for the manufacturing sector:

1 *Competitiveness*:
   - Ability to win new customers.
   - Customer loyalty.
2 *Financial performance*:
   - Asset turnover.
   - Control of labour and capital costs.
   - Profit per serve.
3 Flexibility:
   - Building volume, delivery speed and specification flexibility into service design in the long term.
   - Use of level design in the long term.
   - Employment of part time and floating staff.
   - Use of price and promotion strategies to smooth demand.
4 *Resource utilisation*:
   - Utilisation of facilities, equipment and staff.
5 *Innovation*:
   - Measurement of the success of the innovation process and the innovation itself.
6 *Quality of service*:
   - Relationship between customer and organisation.
   - Setting of clear customer expectations.
   - Measurement of customer satisfaction (Fitzgerald *et al.*, 1991).

Gaiardelli *et al.* (2006) also highlight the importance of after-sales service in supply chains. They develop a framework that associates long-term and short-term strategies with their related performance measures. At a strategic level they consider financial performance measures and at the operational level they focus on customer satisfaction, flexibility and productivity. They distinguish the service processes into back and front office and identify reliability and responsiveness as suggested measures for front office activities, while internal lead time, waste, costs and asset utilization are evaluated as being appropriate for back office activities.

By contrasting Fitzgerald *et al.*'s (1991) and Gaiardelli *et al.*'s (2006) service performance dimensions with the existing SCOR metrics, it is evident that current SCOR performance measurement is insufficient to assess service performance. Therefore, the current SCOR metrics call for further adaptation to measure service performance.

Research methodology and design

Due to the variety and complexity of business services, building a services' SCM reference model requires in-depth knowledge of their design, creation and delivery processes. The need to analyse how a service system operates and how the interaction between suppliers and buyers affects the performance management of its processes led to an inductive, constructivist methodology with the use of primarily qualitative data. The services' SCM reference model has been developed by analysing in detail the supply chain processes of a particular service.

The study has been undertaken in a large consulting organisation. It focused on the management consulting

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service of the organisation, which covers a wide scope of management areas (MAs), including strategy, customer relationship management, SCM, finance and performance management. Given the scale of the company's consulting services and the complexity of SCOR, the study it was framed within manageable bounds, involving the company's activities for the European region. It also included suppliers and one client that had direct contact with the selected company. The management consulting service is considered an appropriate context to explore the development of a reference framework for business services. It possesses at high level those characteristics that differentiate industrial goods from services (it is a highly intangible and heterogeneous service) and can generate pertinent insights for the modelling of disparate services supply chains. A flexible exploratory approach was adopted to identify areas that are important for the development of the model. The research process was designed with inherent confirmatory attributes that ensured that the findings derived from one source were confirmed with the findings of another.

Modelling approach

For the development of the reference model, the following sequential phases were conducted:

1 Conceptualisation of the supply chain processes that are involved in the creation and provision of consulting services.
2 Detailed conceptual mapping and migration of the supply chain processes of the consulting services to an adapted SCOR framework.
3 Identification of service performance metrics and adaptation of existing SCOR metrics in a service context.
4 Validation of the model with the help of the participant managers and through the development of a version of the model in a different service context.

The SCOR model has evolved over ten years into a detailed reference tool that allows a complex analysis of supply chains. For the purposes of this paper the development of the model has not explicitly addressed all three hierarchical levels of SCOR as the untested service application limits an exhaustive analysis.

Data collection process

Three research methods were utilised to collect data. This three-stage data collection process was applied to each of the five SCOR processes.

In-depth interviewing

This was the core phase of the research process. The interviewees were of high stature in the organisation. A total of 30 managers from the consultancy and its suppliers were interviewed in total. Of those, 70 per cent were senior executives, including the director of the company's European operations. A number of less senior managers were also interviewed to offer complementarities and comparison. Critical issues and assumptions derived from one interviewee were used as propositions to another, in order to confirm or deny the perceptions that had been developed. This approach also acted as a validating mechanism for the development of the model and ensured the construct validity of the study. The list of interviewees was not fixed at the outset. Initial interviews were conducted to develop an overview of the management consulting process and to identify further participants. This ensured flexibility in the research and allowed it to evolve in an exploratory fashion.

A codification system that traced patterns in the interviewees' responses was developed for the identification of services supply chain processes. The following analytical steps were followed to build the reference model:

1 The strategic planning processes (1-5 years) that shape the overall structure of the consultancy, as well as the operational planning processes of individual projects were analysed.
2 The processes for outsourcing (or in-sourcing) and procurement of IT solutions, including the supplier relationships that are formed were identified.
3 The processes for creating the consulting service were identified.
4 The client engagement activities throughout an entire project were identified.
5 Finally interviews with senior consultants were conducted to validate the developed supply chain model. These interviews were also used to analyse the terminating processes of a client engagement including the quality assurance processes.

Document review

This was a supporting method that was used to triangulate the interview data and to provide objectivity, as the documents had been previously ratified by the management team.

Observation

This was added later when permission was given to observe a consultancy engagement. This experience was sought to prove or disprove the propositions of how the company's resources were used.

Conceptualisation of a service supply chain

For the conceptualisation of a consulting service from a supply chain perspective, the consultancy can be perceived as "manufacturing" a service package that can be bought by a customer (and inventoried as the consultancy's latent professional capacity). This is influenced by Ellram *et al.* (2004) who view a service as the transfer of capacity from a vendor to a client. The consulting service supply chain was then conceptualised through a consideration of each of the SCOR processes:

- *Plan*. The planning activities set the strategic direction of the SCM and communicate the operational and strategic intents to the managers of the supply chain.
- *Source*. The sourcing processes involve the activities conducted at the interface between the consultancy and its suppliers. The core resources that are sourced for management consulting involve human capital, intellectual property (IP), software applications, and information. The major difference with SCOR is the consideration of employees as core resources. SCOR strictly separates people management and recruitment as enabling and not core processes.
- *Make*. The make processes involve the assembly of various resources to meet the client's requirements. This stems from the consideration that a consultancy's competence is

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its ability to draw on resources to provide a skilled client engagement team.

- *Deliver*. The deliver processes involve the actual client engagement.
- *Return*. The inherent intangibility of consultancy means that a "faulty" delivery of service cannot be physically returned. If the original service is inappropriate, remedial processes such as analysis of client feedback and quality assurance occur, which are more analogous to the product-based SCOR return process.

An illustration of the conceptualisation of the service supply chain (for a management consultancy) is shown Figure 1. This viewpoint is in line with Porter's value chain analysis, as it perceives the service design and delivery processes as adding value to the final service offering along various stages of its supply chain.

Conceptual models for each of the SCOR processes

Using the above conceptualisation, each of the high level SCOR processes was then conceptually modelled in greater detail before being consolidated into a holistic supply chain process model for the consultancy.

PLAN process

In SCOR, planning is the process that balances resources with requirements (Figure 2).

For the detailed conceptualisation of the PLAN process, the second level plan processes were split into operational and strategic levels. Two PLAN process maps have been constructed, shown Figures 3 and 4. In each process map the links to the other high level SCOR processes are highlighted. The strategic plan is developed by conducting an assessment of the external (demand) indicators and the internal (resource) capabilities. It sets out the market priorities and activity targets for the company, the client engagement methodology and the IP development plan. From the strategic plan, a contract/project plan is created that sets out the specific client engagement policies and the scheduling of the processes by taking into account short term external influences and the internal (organisational) capabilities.

Source process

SCOR utilises a seven stage sourcing process (identification of supply resources, selection of supplier, scheduling of delivery, receipt of products, verification of order, transfer of product, authorization and payment). Some of these processes however (e.g. delivery planning and transfer of product) are only relevant in products and adaptation needs to be made for services. For the SOURCE process, the sourcing or IT solutions, consultants and external IP and information resources are mapped:

- *Sourcing of IT solutions*. The outsourced IT solutions cannot be considered as assets that are procured and owned by the consultancy. They remain the property of the software vendors, who actually get the payment from the client. The value of the consultancy lies in the "consulting time" spent to adapt the software to match the customer's requirements. In this sense the sourcing of IT solutions can be perceived as involving the development of relationships between the company and software vendors to satisfy customer demands. The process map of Figure 5, illustrates the IT sourcing processes that facilitate the development of the service. First the requirements for IT solutions for a specific project are analysed. In case there is a capability deficiency, a decision is made on whether the IT solution will be outsourced, or jointly developed with a partner. Quality assurance processes are conducted to make sure that the developed (or outsourced) solution meets the company's plan. If the company has the capability to develop the IT solution then processes to adapt an in-house solution are conducted, which is then delivered to the client.

Figure 1 Conceptualisation of SCOR processes in management consulting service context

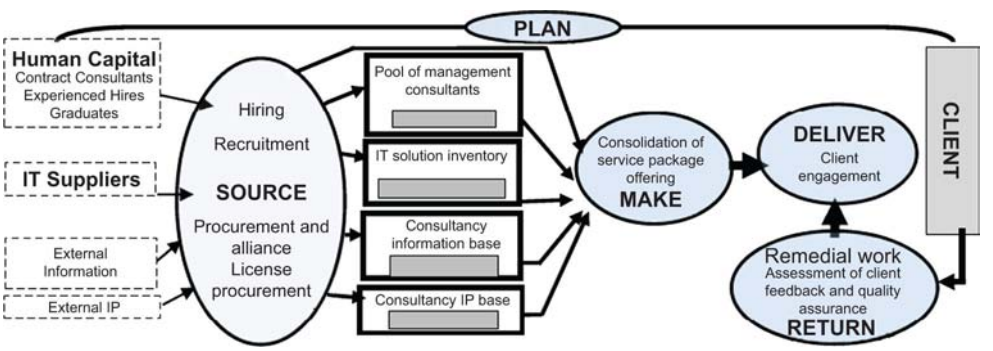


Figure 2 The SCOR view of how planning processes balance requirements and resources

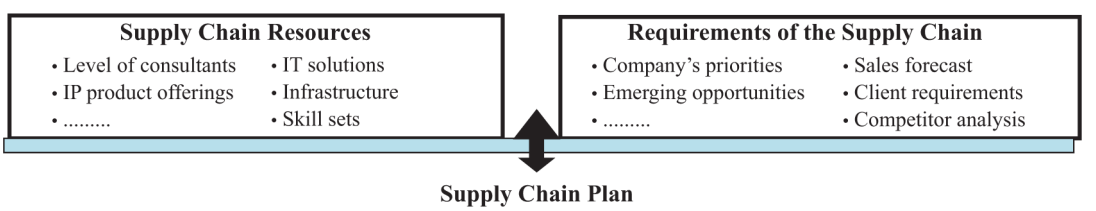


Figure 3 The SCM planning processes (strategic level)

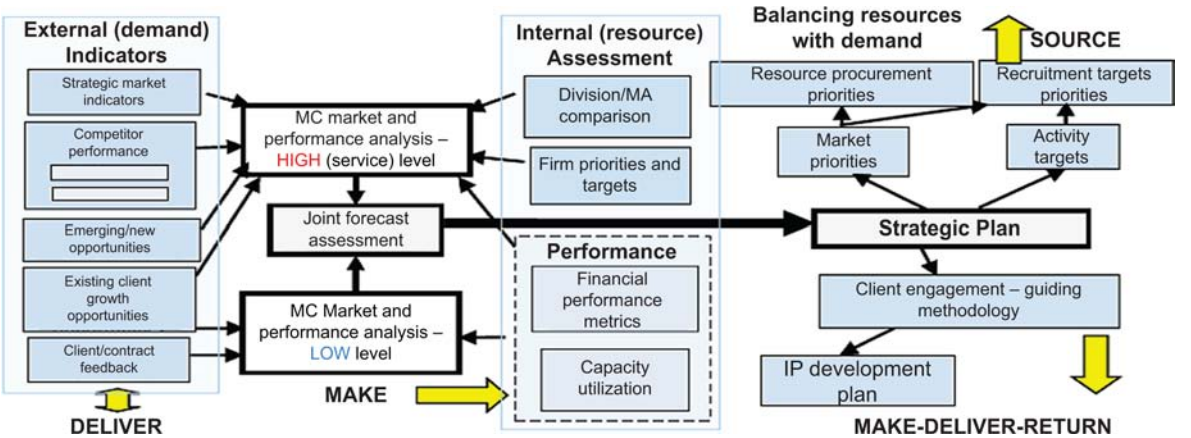


Figure 4 The SCM planning processes (operational level)

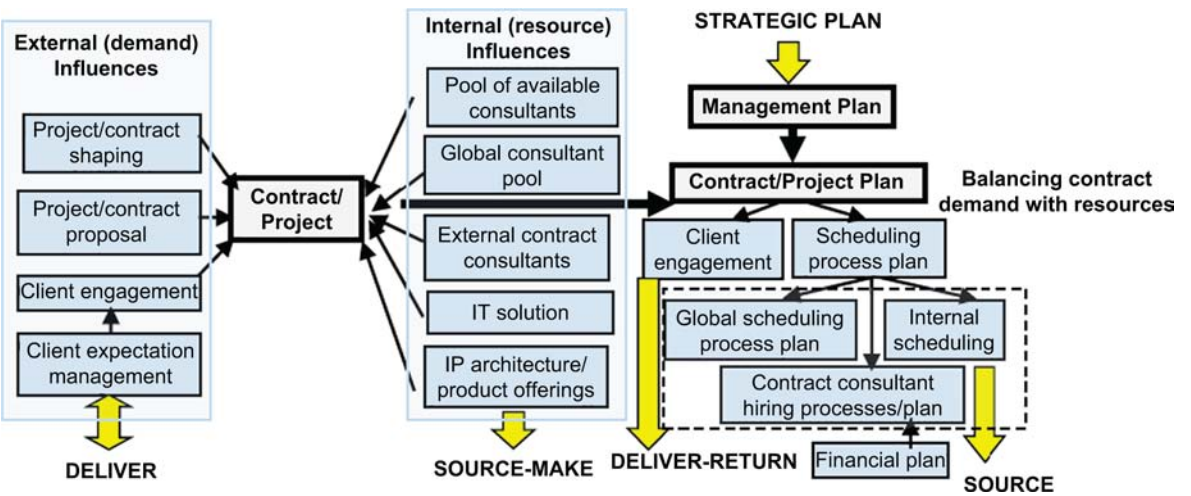
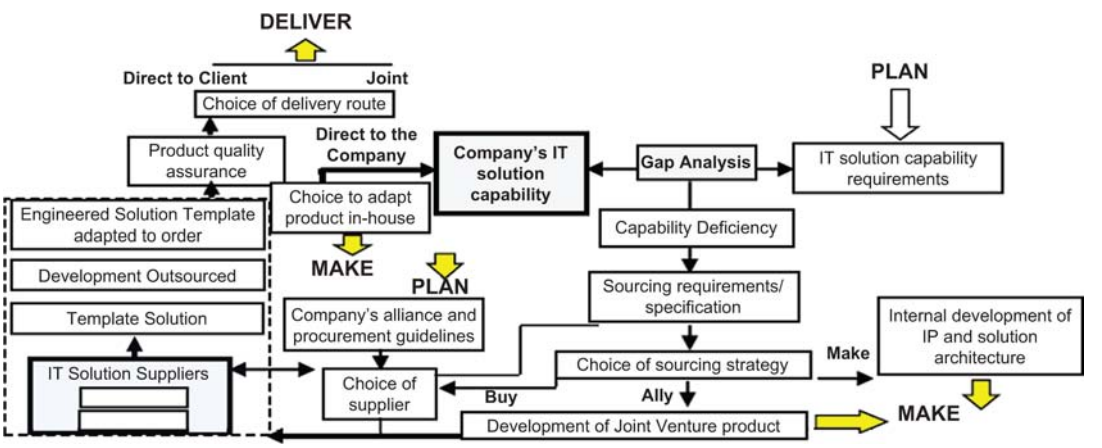


Figure 5 The IT solutions sourcing process



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- *Sourcing of management consultants*. The consultant sourcing process map, is split between long term and short term sourcing. For these sub-processes the SCOR labels of source-to-stock and source-to-order are assigned (Figure 6). The source-to-stock consultant process corresponds to the long-term recruitment process, which endeavours to balance the available consultant pool with the future requirements of the company. A gap analysis is conducted to assess the need for sourcing consultants, by comparing the existing pool of consultants with the requirements of the company. A HR sourcing plan is created, consultants are identified and assessed in terms of their capabilities and if accepted they are trained and inserted in the existing consultants' pool. The source-to-order process occurs as a result of a resource deficiency for a specific project and is linked to the operational (project) planning process. It can be considered as a demand smoothing activity. Identified consultant deficiencies can be rectified by either contracting freelance consultants, or by the use of industrial secondments. Third party agencies (recruitment consultants, head-hunters) may be present to facilitate the recruitment process.
- *Sourcing of external IP and information resources*. As IP is a critical value adding resource for management consulting, it is mostly created and sourced internally. In contrast, outsourced information resources are needed more frequently. The process for acquiring information is relatively simple, being achieved through license acquisitions that allow access to external databases. Figure 7 shows the process map for the parallel processes for IP and information sourcing.

Make process

The "making" of a consulting service can be split between:

- the construction of intangible assets and capabilities (IP architecture, consultant skills); and
- the assembly of consultancy resources into the service package.

These processes are presented in Figure 8. The Make process is viewed as a combination of manufacturing swim-lanes for each of the previously described sourcing process, which are combined downstream when the service package is assembled for delivery to the client.

Deliver and return processes

The delivery process concerns the service provision activities at the client site. For management consulting this is a highly heterogeneous process, making it difficult to develop a generic process map. It is also difficult to distinguish it from the make processes. In order to do that the delivery can be considered as a temporary installation of the company's resources and capabilities in the client organisation. The return process also cannot be separated from delivery. The interviews and discussions with the company's clients revealed that the return process was instead more suited in situations where IP and business solutions are returned to the company's IP and solution inventories. The deliver and return process map that was developed is shown in Figure 9.

The consolidation of the process maps

The consolidated process map that has been developed from the migration of the individual processes, shown in Figure 10, presents the processes of sourcing and assembling of resources as separate swim-lanes before they are combined to make the service package that is delivered to the client. This approach represents the resources as product flows that undergo transformational activities as they progress along the supply chain, before being assembled and delivered to customers. The planning processes that are placed at the top of the diagram direct these activities. Whilst it is not viewed as a separate process in the original SCOR framework, the notional inventories for each of the resources are presented in the centre of the process map. The consolidated process map utilises the following notations of different activities.

The service supply chain reference model

In light of the findings and insights generated through the conceptualisation of the consultancy supply chain and the mapping of the SCOR processes, the SCOR processes have been adapted into a framework which is considered to be more relevant to supply chains of business services. The

Figure 6 The consultant sourcing process

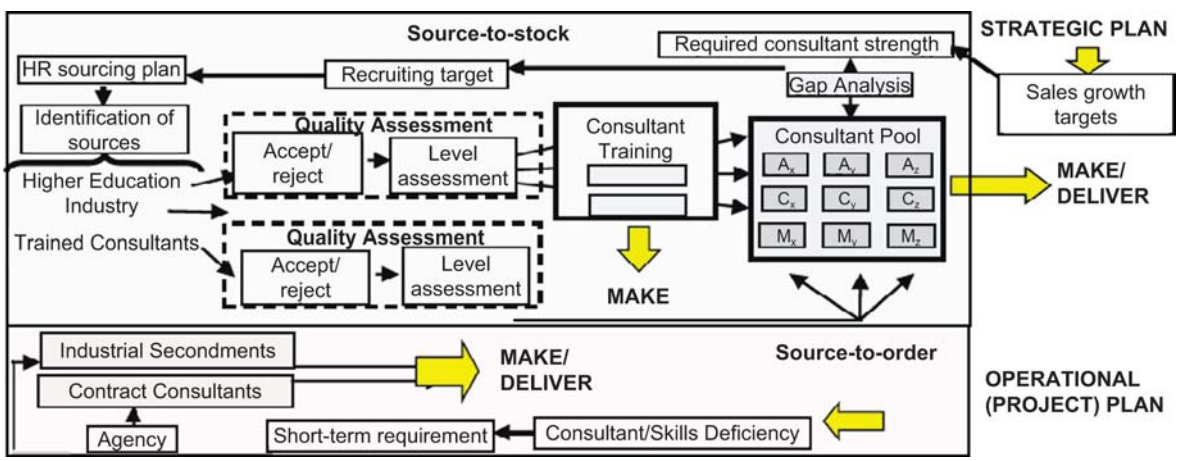


Figure 7 The IP and external information sourcing processes

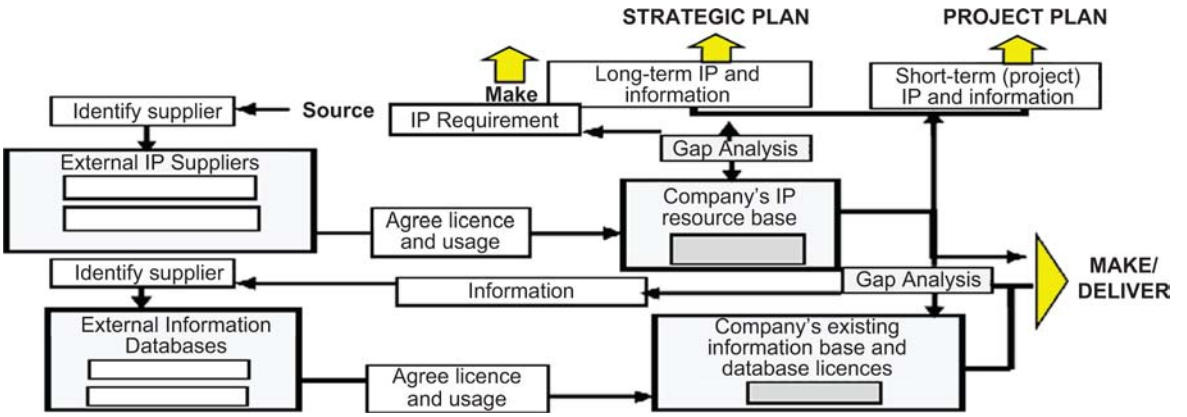


Figure 8 Process map for the make activities that occur before client engagement

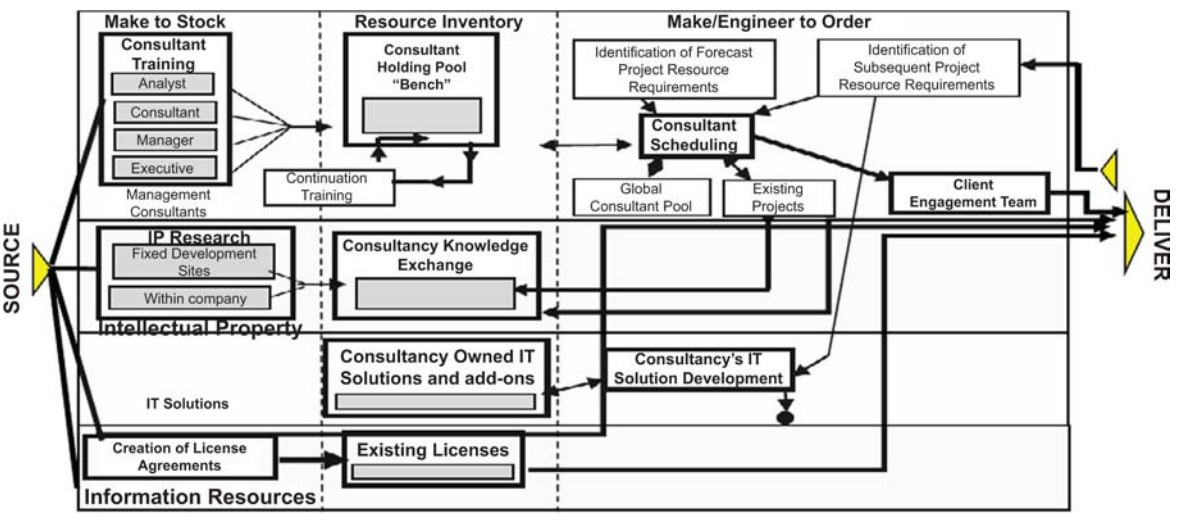


Figure 9 Deliver and return processes

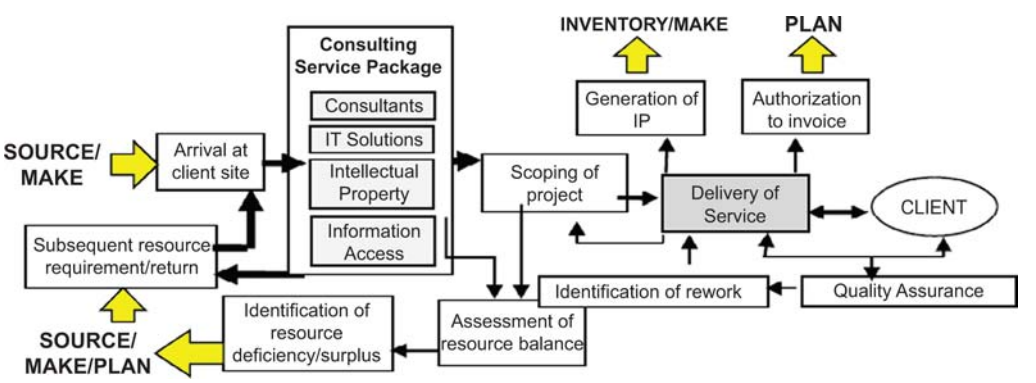
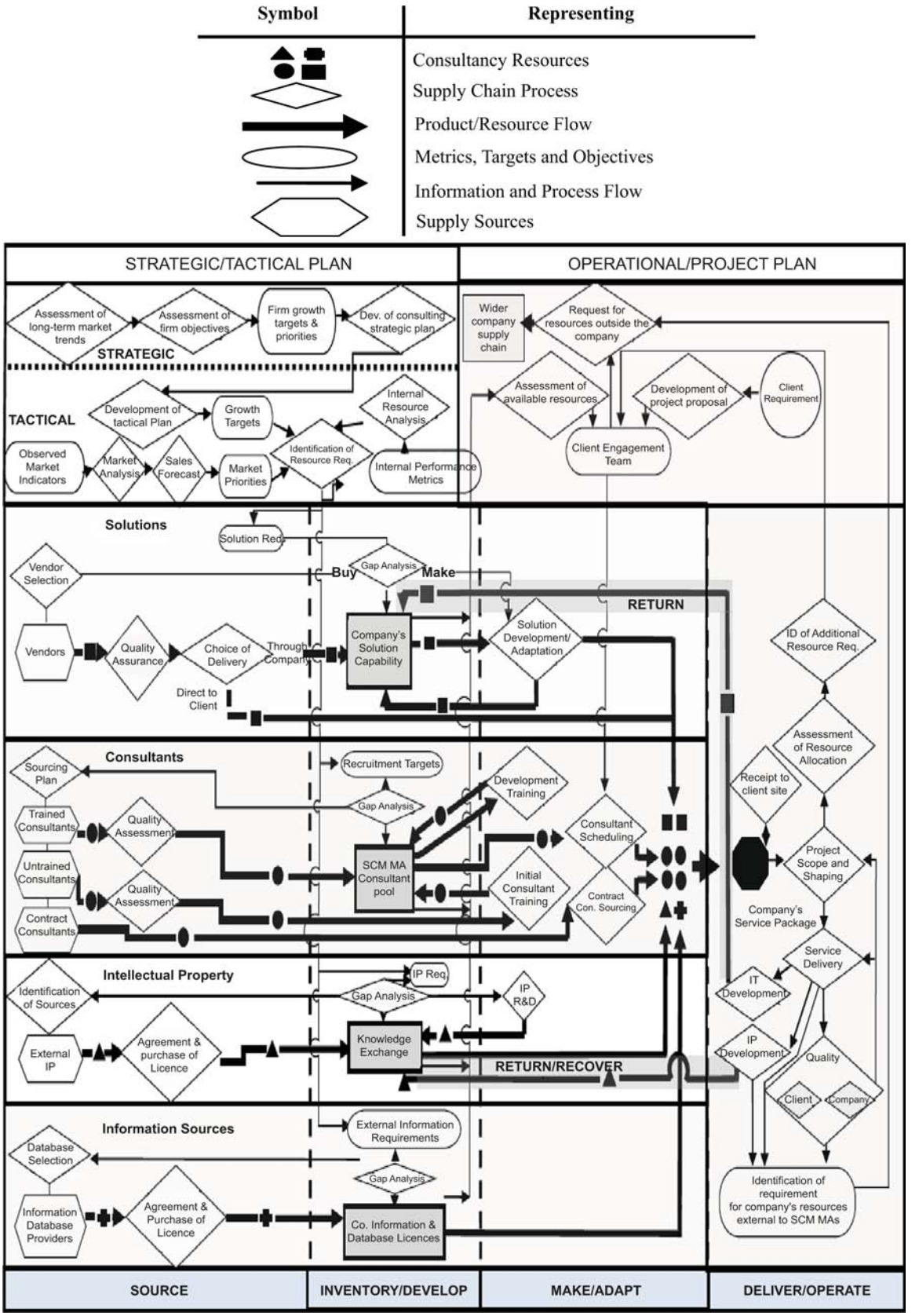


Figure 10 The consolidated process map for SCOR consultancy



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adaptation of the processes and the rationale for each process is discussed below:

- *Plan*. As all business exchanges (for services or goods) require planning, there has been no ambiguity in the SCOR terminology for the planning processes and the perception of planning as balancing demand with resources.
- *Source*. Two notable challenges emerged during the modelling of the source processes. Contrary to SCOR that views human resources issues as supporting activities, in services it is essential to view human capital as critical value adding resource. Secondly, the ownership of service resources that are sourced is often retained by the supplier. Delineation is therefore needed between the sourcing processes of these resources and those which merely facilitate service routes and relational processes.
- *Make*. These are cognitively difficult processes to perceive in a service supply chain. The capacity-inventory argument however facilitates an interpretation that is easier to apply. The original hypothesis of the service package being "assembled", only partially describes the creation of services. Service creation can be viewed from strategic and tactical viewpoints. The strategic process is the "development" of activities that generate the capacity and the tactical processes are those that "adapt" the resource inventory in response to client demand. In this sense the make process should split either side of the supply chain capacity-inventory to more accurately depict the service activities.
- *Deliver*. As "make" processes can also occur during the client engagement, the "make" and "deliver" processes cannot be easily separated. Furthermore, the view that the delivery is solely conducted during client engagement does not translate to some services in which the contact with the client is minimal. A more useful adaptation is to consider the delivery phase as the "operation" of the service package once it has adapted for client use.
- *Return*. As a service cannot be returned, it is more appropriate to consider the "recovery" of resources as the terminating return process. In the case where the service utilises physical infrastructure (e.g. transportation) the recovery is the return of the assets to the company. In the case of more intangible delivery means, the recovery can be seen as the activity that returns the intangible resources (IP, information, experience) to the company.

The developed model, shown in Figure 11, is balanced around the capacity of the consultancy supply chain and has a number of second level processes attributed to each of the main processes, an overview of each is provided below.

Plan

- *Plan supply chain*. Processes that set the priorities and targets for the entire service supply chain so that capacity is balanced with demand.
- *Plan sourcing*. Processes that dictate how the sourcing activities will be conducted.
- *Plan development*. Processes that set the priorities and targets for the development of service resources and capabilities.
- *Plan adaptation*. Processes that adapt the service resource inventories in order to meet client demand.
- *Plan operation*. Processes that direct the activities for the operation of the service and the interaction with the customer.

Source

- *Source to own*. Processes for sourcing resources or services that will be owned by the organisation.
- *Source service routes*. Processes that establish the contracts and relationships with third party service vendors so that the organisation has assured routes to services provided by external parties.
- *Source right to use*. Processes for establishing the contracts and relationships with suppliers.

Develop

- *Develop own resources*. Long term processes that develop the procured service resources.
- *Develop service routes*. Processes that adjust the contracts and relationships with external vendors so that the service routes can provide the resources to meet demand.

Adapt

- *Schedule own resources*. Processes that allocate and attribute service capabilities and resources to individual service packages in response to client requirements.
- *Identify service providers*. Processes that identify and schedule external services through developed routes in response to the requirement for an individual service offering.
- *Engage with client (adapt)*. Processes that govern the engagement with the client in order to identify the specifications for the service offering.

Operate

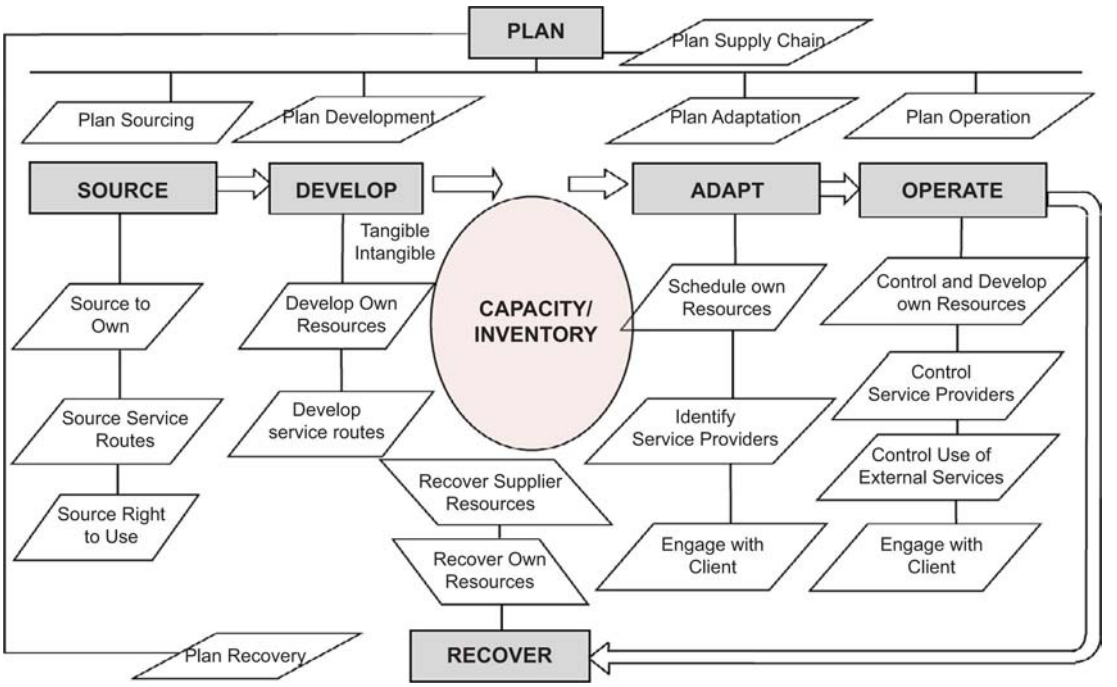
- *Control and develop own resources*. Processes that guide the application and development of service resources that are owned by the organisation.
- *Control service providers*. Processes that co-ordinate the service providers during the application of the service.
- *Control use of external services*. Processes that control the use of external services by the members of the service operation team.
- *Engage with client (operate)*. Processes that govern the engagement with the client in order to develop the service offering.

Recover

- *Recover supplier resources*. Processes that govern the return of assets and resources to third party service vendors upon the completion of the service package operation.
- *Recover own resources*. The return of service infrastructure and resources to the organisation.

The processes of the proposed model have been developed so that it can be applied to services that are characterised by tangible as well as intangible infrastructures. The model (and the terminology used) has been designed as a flexible tool to aid in the conceptualisation of multivariate service supply chains, but the performance metrics and best practices can only become apparent after multiple applications to several

Figure 11 The service supply chain reference framework



cases. Like SCOR it can be used more widely to describe a complete network as shown in Figure 12.

The application of the model to the rail transport service

A comprehensive validation of the model through the application of the framework to diverse service industries is an extensive and demanding process, given the complexity and heterogeneity of the service sector. In order to probe its applicability to different contexts, a validation exercise of the model has been conducted through its application to a service supply chain that is very different from management consulting. The rail transport service that needs a vast physical infrastructure has been chosen.

The supply chain of rail transport was modelled by considering the activities that could be attributed to each level 2 process of the framework. The model that was developed is shown in Figure 13. Under each process a box details examples of possible activities that could form the process and the central oval shape lists the elements that could be considered as the firm's inventory or capacity. Although the modelling did not result from a detailed analysis, it was found that the framework was relatively easy to interpret in this new context.

Migration of SCOR metrics

The final challenge for the development of the reference framework has been the adaptation of SCOR's physically biased metrics in a service context. Interview data as well as the company's official documents for performance measure were used to migrate the metrics. A total of 56 discrete metrics were identified and validated with the participants to the study. The metrics can be split between six generic groups that were identified during the analysis, as shown in the Appendix. The migration approach for each group is explained next.

Cost analysis

This is the largest group (20 metrics) that includes metrics which assess the cost of discrete activities within the supply chain. These metrics allow a business to identify how expensive each part of the supply chain is to operate, thereby assisting managers to allocate funds appropriately. They can be easily used in services and their interpretation is self-explanatory. For example, the cost to identify sources of supply is simply interpreted as the cost of the management time spent selecting preferred suppliers. Activity Based Costing methods can be used to identify these costs.

Figure 12 Application of the service supply chain reference model to a service system

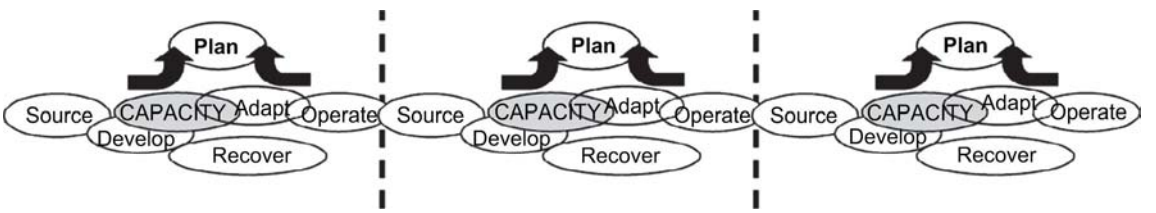


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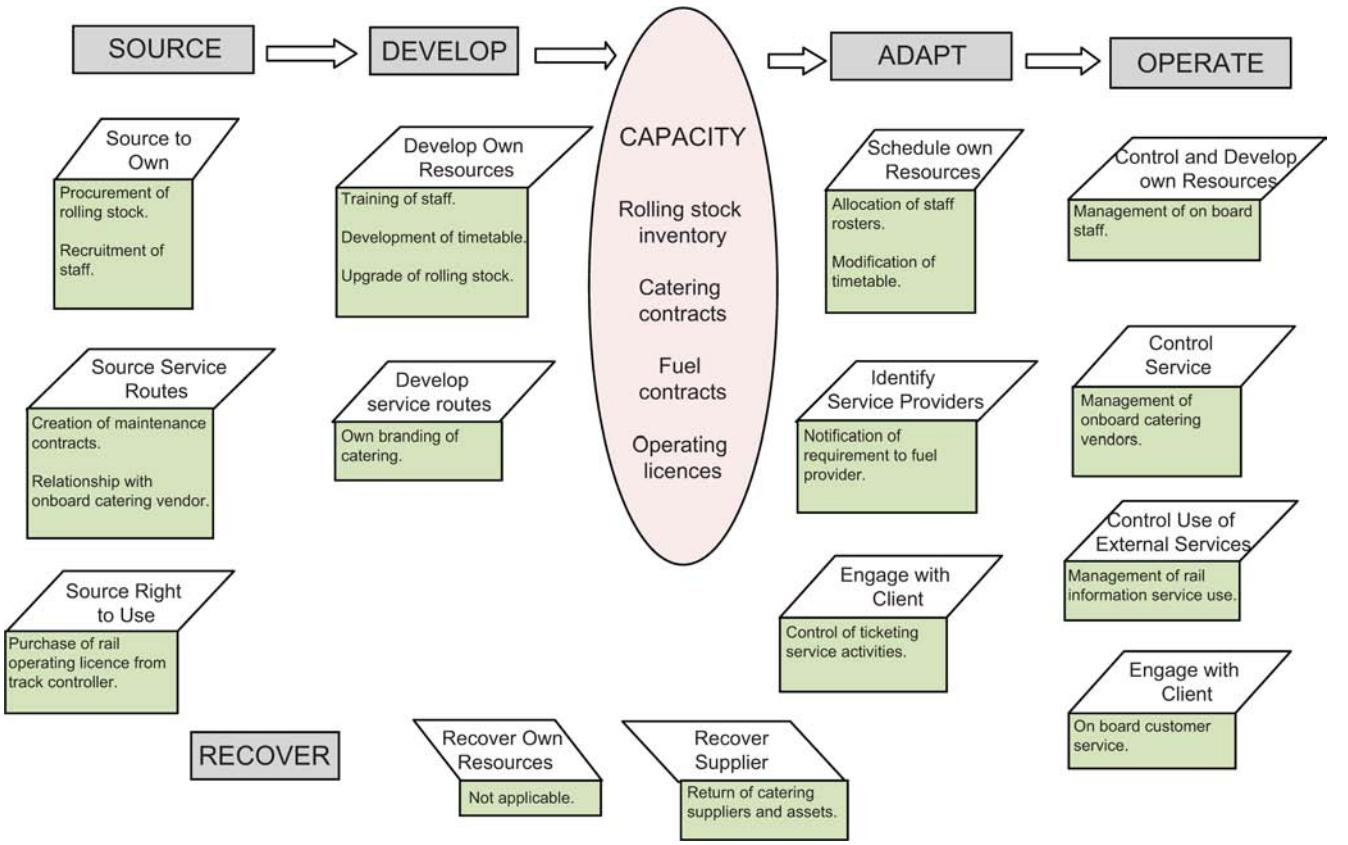
Figure 13 The model in passenger rail services



Time analysis

These metrics refer to time measurements attributed to supply chain activities and phases. The migration of the metrics was made possible by adopting Svensson's (2004) approach, who describes a service exchange as a connection of sequential service encounters. With this perspective, the migration of a time metric from the physical SCOR approach to the intangible service context is conceptually easy. For instance, the time it takes a consultant to derive their findings is just as important to a management consultancy as a machine set-up time is to a manufacturing firm.

Inventory analysis

The SCOR metrics make the key assumption that the making and sourcing processes feed into inventories. The inherent perishability of services however makes the adaptation of SCOR model metrics for service activities very difficult. In order to avert a cognitive impasse, a parallelism of what service inventories are has been developed using the proposition of Akkermans and Vos (2003), who argue that the upstream amplification of service activity, as a result of the bullwhip effect, is analogous to the amplification of upstream inventories in manufacturing companies. In services the amplification results in an over-utilisation of the service capacity, as it is not possible to store services in buffer inventories. This view of service capacity being used as a proxy for inventory is also taken by Lee *et al.* (1999) who believe that inventory strategies should be applied to service capacity planning in an environment of uncertain future demand. When applying this view to the management consulting supply chain, the key value-adding resources and capabilities (consultants, IT etc.) are seen as exhibiting a capacity-inventory duality. With this parallelism of resource capacity as inventory, the SCOR metrics have been migrated. For example, the SCOR metric that measures inventory days of supply was transformed as an assessment of available consultants who can be sold instantaneously to meet a customer demand.

Forecast analysis

For forecast metrics the work of Armistead and Clark (1994) who proposed five propositions to be used in the management of service capacity has been utilised. The forecasting metrics were tied to the capacity-inventory resources, but, unlike the inventory metrics, which merely measured the levels, these metrics assessed how well the capacity plan was at meeting demand by gauging the capacity utilisation over a time period as opposed to a spot measure. For example the consultant demand forecast analysis is equated to an assessment of the consultant utilisation and the number of short term contracted consultants that need to be hired to meet the company's deficiencies.

Quality assurance

The migration of the quality metrics was hampered by SCOR's focus on product inspection and defect identification. The quality of services can be better assessed through a gap

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analysis between the company and customer's perceptions and expectations of cost, quality and delivery (Deshmukh *et al.*, 2006). This view allows a successful translation of the SCOR quality metrics, as an example the number of "faultless product installations" was viewed as the number of Q&A engagements that did not raise any abject criticism from the client.

Financial analysis
SCOR uses financial metrics to assess the contribution of individual processes and products to the overall profit (or loss) of the company. It has been found however that SCOR's financial interpretation is crude when compared to financial performance tools which currently exist within the consultancy. As such the migration of the small number of financial metrics was not subject to a detailed analysis. These metrics were found to be those that offered least value in the assessment of the company's performance.

Discussion and conclusion

The proposed services' supply chain framework offers a new perspective of how service processes could be standardised. Its greatest value is that it can assist service operations managers to view and assess the design and management of service processes in a different way as opposed to the traditional management of service level agreements. The process of modelling the management consulting service as supply chain using SCOR, led to the exposition of many imperfections of the original SCOR framework when applied to services and of numerous challenges in the migration of its processes to service contexts.

The service package
A key challenge has been to perceive the service offering as a tangible product in order to translate SCOR's product bias. In order to achieve this, a conceptualisation of service supply chain processes was created that views the offering of the company as a consolidated service package, which is leased to the client for a finite period of time. This has brought together the disparate activities of the consultancy process into a single entity that is analogous to a manufactured product, thereby facilitating the interpretation of the SCOR processes and the migration of SCOR make metrics to support the measurement of the processes that produced the service package. This concept is central to the developed model as it considered the culmination of the sourcing processes that generate and developed the discrete resources that are assembled according to the client's order. Another difficulty has been reflected in the translation of the SCOR processes that involve the movement of products, most notably the delivery and return phases. As such it was decided to consider the service package merely as the concept that facilitated an understanding of the model and not something that required detailed analysis in its own right.

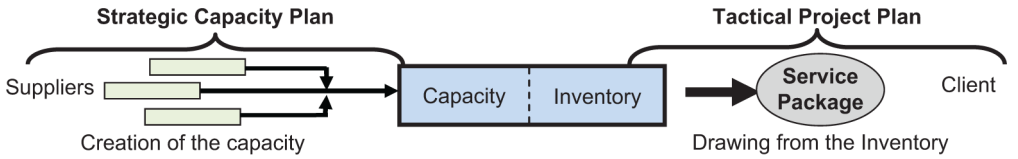
Capacity-inventory duality
SCOR views inventory as distinct from capacity. A critical issue for the development of the model is that in services (especially in highly intangible services) there is not a divide between inventory and capacity. The conceptualisation of services supply chain processes proposed that resources are held as inventory prior to being consumed during the assembly of the service package. For example, the company's knowledge, in which IP is maintained, was considered as the intellectual inventory that could be drawn upon to develop client solutions. This conception was useful in that a number of SCOR inventory maintenance practices could be applied to optimise the management of this knowledge. However, further analysis demonstrated that these resources were actually more congruent to the capacity of the service. This alternate view stemmed from the fact that the resources are not consumed when they are utilised, for instance IP resources can be used indefinitely. It has been revealed that the company's resources exhibited a duality which allowed both inventory and capacity practices to be applied.

The strategic and operational split
The developed model splits the strategic generation of capacity and the tactical utilisation of resource inventories. This stems from the capacity-inventory duality attribute of many services, through which the sourcing processes develop the resources as capacity, but the making of the service package is drawn from the resource inventory. By considering the supply chain process map that was developed for the management consulting supply chain (Figure 10) it can be argued that the activities on the left side of the inventories are strategic capacity building processes, whilst those on the right are tactical service assembly processes. The lead times for consultant and IT sourcing were too lengthy to generate capacity for individual projects and as such the strategic built of capacity had to assume a forecast for future demand. This theoretical proposition is illustrated in Figure 14.

Current research is conducted to expand the pool of appropriate performance metrics and best practices that can be attributed to each of the processes within the framework. It involves the application to numerous disparate service organisations (spanning from highly intangible professional services, service shops and mass services). Best practices are developed with the use of service science concepts that bridge computer science, engineering and management concepts. These practices are consolidated through exposition to numerous interventions across industry and identification of appropriate best practices and metrics from individual organisations (Chae, 2009).

The proposed service supply chain reference tool needs to be in a form that can be understood by service practitioners. Given that the development of service best practices and metrics is an evolutionary activity, it is appropriate that the first iteration of the service model lacks prescriptive practices as they confuse the users. In this sense the proposed framework should be seen as a supporting framework that enables managers to construct their own supply chain models and then identify for themselves the pertinent metrics and practices that could be consolidated for subsequent, and more applicable, versions of the model. It is hoped that a wide utilisation will ultimately result in the acceptance of the framework as a useful reference tool for service supply chains in the same way that SCOR has established its presence in the world of manufacturing.

Figure 14 The strategic and tactical split



Note

1 The service economy refers to the service sector, in addition to service activities performed in the extractive and manufacturing sectors. In the UK, the service economy accounts for 75 per cent of the GDP, around 55 per cent of the total employment (World Bank, 2009).

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Appendix

Table AI Performance metrics and groupings for service supply chains

SCOR process	Company's process	Metric group
Time and cost to identify requirements	Management time spent developing the company's growth targets	Cost analysis
Time and cost to identify recourse level	Assessment of HR and management processes involved with measuring consultant pool level	Cost analysis
Cost to identify available product resources	Costs of monitoring available consultant pool level within GSL	Cost analysis
Cost of identifying sources	Management time spent on analysing available vendors as a ratio to the number of solutions sources	Cost analysis
Costs of selecting vendor and negotiating contract	Costs of management time and contracts used to generate IT solution route from vendor	Cost analysis
Costs associated with verifying product	Staff time spent assessing quality of solution prior to being available for client implementation	Cost analysis
Costs to identify products requirements	Management time spent assessing requirements for solutions	Cost analysis
Cost to transfer product	Cost of hiring process as a ratio to the revenue derived from the hired consultant	Cost analysis
Cost and time to identify sources of supply	Management time spent committed to identifying external IP	Cost analysis
Cost and time to negotiate agreements	Cost of management time devoted to finalising IP contracts and the time taken from identifying sources of IP until it is ready for use in client engagement	Cost analysis
Cost and time to identify sources of supply	Management time spent committed to identifying external information sources	Cost analysis
Cost and time to negotiate agreements	Cost of management time devoted to finalise licences for information databases	Cost analysis
Cost and time to produce and test	Average time per consultant spent on initial training and the total costs allocated to training (trainee salaries, cost of courses, etc.)	Cost analysis
Costs to package	Average costs associated with the scheduling process per project type (management time spent, etc.)	Cost analysis
Cost to make	Average cost of IP offering. Consultant hours spent developing generic product	Cost analysis
Cost to process and quote	Cost of proposal phase including tendering costs and consultant time spent structuring bid and contract pricing	Cost analysis
Installation cost	Cost of engagement consultants' time as a proportion of total contract price	Cost analysis
Cost to assess delivery performance	Total cost of Q&A process as a proportion of the contract revenue	Cost analysis
Cost to assess product requirements	Additional cost to project as a result of any upscale in consultant allocation as a proportion of initial contract cost	Cost analysis
Costs to return and receive excess product	Costs associated with return of IP and solutions developed at client site (includes consultant time spent administering return process and overhead of KX)	Cost analysis
Cash-to-cash time	Time between making the investment in the solution until the payment is received from the client in whose site the solution has been implemented	Financial analysis
Cost of goods sold	Total costs of the solution including development and procurement of external licences. Can be assessed through the consultant time that has been spent creating the adaptation	Financial analysis
Warranty costs	Costs associated with testing the assimilation of training material (testing, remedial rework etc.) as a ratio to total course costs	Financial analysis
Cash-to-cash cycle time	The time taken from the completion of IP offering until payment has been received from client implementation	Financial analysis
Product yield	Revenue attributable to IP offering as a ratio of development and production costs (consultant time etc.)	Financial analysis
Forecast accuracy	The ability of GSL consultant pool to meet demand	Forecast analysis
Forecast accuracy	Proportion of client engagement teams that are manned by consultants from outside the consultant pool	Forecast analysis
Forecast accuracy of planned requirements	Ratio of solutions procured and developed in response to individual project requirements compared with solutions through strategic vendor relationships	Forecast analysis
Forecast accuracy of planning requirements	Assessment of capacity utilization and the excess requirements (contract and global consultants) required to meet SCM GSL project requirement	Forecast analysis
Forecast accuracy of planning requirements	Assessment of the utilisation of internally developed IP that is being used and the ratio of externally procured IP offerings compared with internally developed IP	Forecast analysis
Forecast accuracy of planning requirements	Assessment of the utilisation of existing information databases and the instances of individual project-driven information-sourcing activity	Forecast analysis
Forecast accuracy	Proportion of engagements that require a revision to the initial resource allocation	Forecast analysis
Asset utilisation	The total yearly training expenses as a proportion of revenue created by the consultant	Inventory analysis

(continued)

Table AI

SCOR process	Company's process	Metric group
Inventory days of supply	Develop metrics to assess mean consultant allocation to template projects and equate to consultant pool	Inventory analysis
Inventory days of supply	SCM GSL consultant pool available for generic project types. Translates as the amount of project capacity held in pool	Inventory analysis
Inventory days of supply	Total value of solutions that are being developed as working capital, i.e. the value of the unfinished solutions	Inventory analysis
Capacity utilisation	Amount of time spent by consultants developing solutions as ratio of the total available consultant hours dedicated to the development of solutions	Inventory analysis
Percentage of orders that are received defect-free	Ratio of number of defect reports received from client to the number of times a solution has been implemented	Quality assurance
Percentage of supplies that are defect-free	The percentage of potential consultants that meet the quality level and are successfully hired	Quality assurance
Percentage of products that are received in perfect condition	Percentage of client engagement that require amendments to the engagement team make up, i.e. request for additional consultants mid-project	Quality assurance
Delivery to customer commitment date	Percentage of projects that commenced at the time stipulated in the original schedule	Quality assurance
Percentage of faultless installations	Proportion of engagements that run to schedule and are resourced correctly from the outset	Quality assurance
Perfect condition	Proportion of client engagements that are deemed successful by the client during the Q&A process	Quality assurance
Make cycle time	Time allocated to the development of an average IP offering	Time analysis
Cycle time to identify available resource stock	Time between identification of project resource requirement and identifying available resources (local and global)	Time analysis
Cycle time to identify product requirements	Time taken between project being agreed and the resource requirement being identified	Time analysis
Cycle time for identifying resource requirements	Cost of management time and length of time taken to assess requirements for consultants	Time analysis
Schedule cycle time	The amount of time taken between identifying the requirement for the arrival of hired consultants	Time analysis
Cycle time for identifying resource requirements	Time taken from the identification of IP source to the offering becoming available for client engagement	Time analysis
Cycle time for identifying resource requirements	Time taken from the identification of information sources to the databases being available for use	Time analysis
Make cycle time	The average amount of time spent developing a solution from identification of requirement to when it is ready to be implemented at the client site	Time analysis
Package cycle time	Time taken from the identification of the project requirement from consultants until the client engagement team is available to begin project delivery	Time analysis
Order fulfilment dwell time	Time in which no consulting or delivery activity occurs after the contract has been won and the client is ready to receive the client engagement team	Time analysis
Cycle time to produce quote after inquiry	Time between initial client contract and proposal and pricing being developed	Time analysis
Make cycle time	The average amount of time spent developing a solution from identification of requirement to when it is ready to be implemented at the client site	Time analysis
Cycle time from identification of excess product to receipt in upstream supply chain	Average time taken for new solutions and IP to be returned from client engagement teams into KX ready for application to other projects	Time analysis

About the author

Mihalis Giannakis is a specialist in Supply Chain Management and teaches MBA and undergraduate modules in Operations and SCM. He has published extensively in international academic journals (*Journal of Supply Chain Management, Supply Chain Management: An International Journal, International Journal of Purchasing and Supply Management, International Journal of Operations and Production Management*) and serves on the editorial board of these journals. He is currently is involved in many research projects with international academic and corporate partners in the field of *SCM*.

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