

# Towards Model-Based Strategic Sourcing

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**Abstract.** Strategic sourcing recognizes that procurement is not just a cost function, but supports the firm's effort to achieve its long-term objectives. Strategic sourcing has become a critical area of strategic management that is centered on decision-making regarding an organization's procurement activities such as spend analysis, capability sourcing, supplier selection and evaluation, contract management and relationship management. Many companies face challenges in obtaining the benefits associated with effective strategic sourcing. From an organizational perspective, procurement data management is a core organizational challenge for chief procurement officers (CPOs) for fact-based strategic sourcing decision-making. To address this challenge, we define research objectives to design a holistic view on strategic sourcing orientations and to develop a conceptual basis for enabling centralization of procurement data and enabling the systemic exploration of sourcing alternatives. From a service ecosystem perspective as a holistic view on strategic sourcing, we define a model driven approach to explore sourcing alternatives based on a common language (C.A.R.S) that enables companies to achieve procurement data management and analytics competencies for fact-based decision-making.

**Keywords:** Model based strategic sourcing · Strategic sourcing and procurement · Service-dominant conceptual modeling · Procurement data management · Procurement analytics · Strategic sourcing decision-making · Fact-based decision-making

## 1 Introduction

Procurement has gained importance in supply chain management due to factors such as globalization, increased added value in the supply chain, and accelerated technological change. Vice versa, the growing importance of supply chain management has led to an increasing recognition of the strategic role of procurement [1]. Procurement has evolved from mere buying into strategic sourcing [2, 3] and has recently been recognized as a critical driving force in the strategic management of supply chains [4–6]. Strategic sourcing recognizes that procurement is not just a cost function, but supports the firm's effort to achieve its long-term objectives [7]. Strategic sourcing has become a critical area of strategic management that is centered on decision-making regarding an organization's procurement activities such as spend analysis, capability sourcing, supplier selection and evaluation, contract management and relationship management.

Because of the increasing significance of procurement, strategic sourcing decisions become more important. Sourcing decisions are strategic decisions at the management level about finding opportunities for and delivering sustainable savings; choosing the right sourcing alternatives like outsourcing, insourcing and co-sourcing (i.e., the typical make-versus-buy decisions) to achieve (sustained) competitive advantage; selecting the right suppliers and evaluate their strategic and performance dimension for long-term and short-term partnerships; identifying solutions for mitigating supplier risk, improving supplier governance and enforcing supplier compliance. These decisions are critical for various procurement decision-makers such as chief procurement officers (CPOs), chief strategic officers (CSOs), strategic sourcing managers, category managers, product managers, purchasing managers, contract managers and supplier/customer relationship managers.

This chapter demonstrates how a model-based approach that we characterize as “service-dominant conceptual modeling” can support companies to achieve two key competencies, procurement data management and analytics, which allow moving the company toward fact-based strategic sourcing decision-making. The chapter is organized as follows: Sect. 2 describes the results of our literature review on fact-based decision-making in strategic sourcing and subsequently elaborates on our research objectives; Sect. 3 introduces the proposed approach to achieve these research objectives; Sect. 4 discusses the research methodology, which is Design Science Research; Sect. 5 introduces the theoretical foundation of the research as “the way of thinking”; Sect. 6 defines a strategic sourcing conceptualization and viewpoints as “the way of modeling”; Sect. 7 presents a model-based approach for exploring strategic sourcing alternatives as “the way of working”; and Sect. 8 outlines “the way of supporting” the proposed model-based strategic sourcing approach; Finally, Sect. 9 concludes the chapter.

## 2 Procurement Data Management and Analytics

To drive fact-based decision-making, organizations require two critical competencies, data management and data analytics. The data management competency is the ability to address issues of data architecture, extraction, transformation, movement, storage, integration, and governance. The data analytics competency is the ability to analyze data for answering key business questions through applying advanced techniques such as modeling (e.g. statistical, contextual, quantitative, predictive, cognitive, other emerging models), deep computing, simulation, data mining, and optimization. Procurement analytics uses procurement data systematically through techniques from applied analytical disciplines to drive strategic sourcing decision-making for planning, management, measurement and learning. Advanced procurement analytics provides the fuel for an organization to make better sourcing decisions faster [8, 9].

Many companies face challenges in obtaining the benefits associated with effective strategic sourcing. From an organizational perspective, procurement data management is a core organizational challenge for CPOs and CSOs [10, 11]. A number of businesses have insufficient accurate and timely information about their spending patterns and suppliers. Most businesses are challenged with spend analysis and need to manage vast

volumes of internal and external supplier data due to the disparate nature of systems and data sources [10, 11]. With a large and increasingly global supply base and scattered data, most companies are overwhelmed with supplier information management and challenged to apply that information for procurement analytics to drive fact-based decision-making [12, 13].

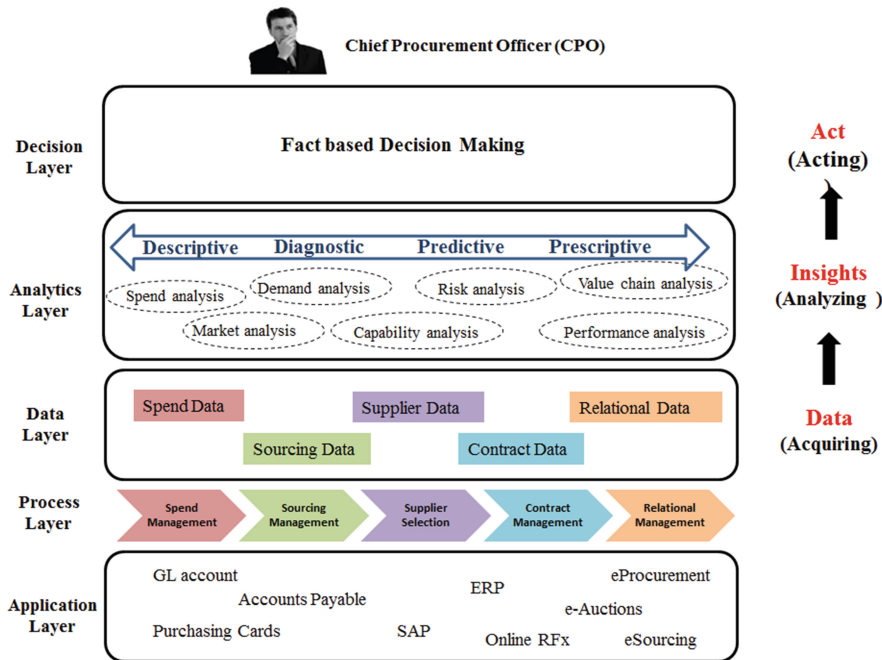
Based on our literature review, we have analyzed the observed challenge in obtaining procurement data management and analytics competencies by identifying problems at different organizational layers of procurement and strategic sourcing (Fig. 1). The first organizational layer is the application layer that consists of various software applications and information systems such as Accounts Payable, ERP and SAP applications; corporate purchasing cards; e-Procurement and e-Auctions systems; and online RFx (i.e. RFI, RFP and RFQ) applications to support operational procurement activities. Our review indicates that, due to the disparate nature of these applications, procurement data is often scattered across disconnected and diverse systems and data sources. The second layer is the process layer that consists of key procurement activities for strategic sourcing such as spend management, sourcing management, supplier selection and evaluation, contract management and relational management. Here our review learns that not all procurement processes are adequately supported by applications resulting in data that is not available in electronic form for analysis. Further, as decision-making within these processes could be better supported, there is an opportunity to integrate analytics into procurement processes to enable accurate and quick action. The third organizational layer is the data layer, which should be the core layer in the architecture for managing procurement data such as spends data, sourcing data, supplier data, contract data and relational data. Our review indicates that there is a lack of platform to consolidate all sources of data from the application layer and the process layer to enable creative discovery and a lack of shared operational data store to accelerate the ability to ingest and analyze procurement data. The fourth, analytics layer of procurement includes techniques for spend analysis, cost-benefit analysis, market analysis, demand analysis, capability analysis and performance analysis, risk analysis and value chain analysis. This layer thus focuses on analyzing the procurement data and identifying the insights most likely to create a positive business impact. Here, due to the lack of advanced analytical techniques (e.g. descriptive, diagnose, predictive and prescriptive), tools and skills, procurement data cannot be translated into insights that can inform decision-making. Finally, the last layer is the decision layer that uses the insights derived from procurement data to create value for the organization. Here the need is felt to use visualization techniques to quickly understand and act on data for fact-based decision-making [8–10, 14].

To address the above organizational challenge and enable companies to obtain competencies with respect to procurement data management and procurement analytics, our research objectives have been defined as below:

**Objective 1:** Design a holistic view on strategic sourcing.

**Objective 2:** Develop a conceptual basis for enabling centralization of procurement data.

**Objective 3:** Develop a conceptual basis for enabling the systemic exploration and evaluation of strategic sourcing alternatives.



**Fig. 1.** Organizational layers of procurement and strategic sourcing

The first research objective is designing a holistic view on the multidimensional phenomenon of strategic sourcing. Eltantawy et al. (2014) [15] distinguish four strategic sourcing orientations: learning, performance, planning, and the relational orientation. The learning orientation focuses on exploiting opportunities for new capabilities and products through capability and resource analysis. This means learning about how a firm's internal capabilities and resources can be combined with external (supplier) capabilities and resources to create competitive advantage. The performance orientation focuses on exploiting opportunities for value creation and cost saving through cost-benefit analysis, spend analysis, value chain analysis, demand analysis, and market analysis in order to achieve bottom-line results (operational goals). The planning orientation focuses on defining sourcing objectives through strategic analysis in order to achieve long-term strategic goals. Finally, the relational orientation focuses on managing the supply base and structuring the supply network through strategic and performance analysis to maintain beneficial long-term and short-term relationships. A holistic view on strategic sourcing is needed to integrate these various strategic sourcing orientations, which is a prerequisite to develop solutions for the centralization of procurement data.

The second research objective is elaborating this holistic view into a conceptual basis for enabling the centralization of procurement data. Integration of procurement data from disparate sources and getting the data in the right form for analysis is a perennial challenge in organizations. A lot of time is wasted trying to collate data from

various systems and cleansing and organizing it. A common language and model of procurement data facilitates such centralization that is required for efficient and effective data architecture, storage, extraction, integration, governance, and hence enabling companies to obtain competency in procurement data management.

The third research objective is a further elaboration of our solution for enabling a systemic exploration and evaluation of strategic sourcing alternatives. A systemic exploration is a prerequisite for identifying multiple strategic sourcing alternatives and choosing the right sourcing alternative. We define strategic sourcing alternatives according to the four strategic sourcing orientations as performance alternatives, learning alternatives, relational alternatives and planning alternatives. Performance alternatives are multiple options about spend costs, captured value (profit) and perceived value for what and by whom. Learning alternatives are various options based on the actor's abilities, capacities and assets to achieve (sustainable) competitive advantage by participation in a value network. Planning alternatives are options about sourcing objectives for operational, strategic, short-term and long-term goals. Finally, relational alternatives are procurement options for choosing suppliers for long-term and short-term partnerships and finding new customers to seize the market. Such systemic exploration is required for effective use of procurement data to compare and choose the right sourcing alternatives and support companies to obtain competency in procurement analytics.

### 3 Service-Dominant Conceptual Modeling

We present in this chapter a model-based strategic sourcing approach, which we characterize as *service-dominant conceptual modeling*, as the proposed solution approach for achieving our research objectives. The main properties of our solution approach can be described as follows:

- **Service ecosystem perspective as a holistic view on strategic sourcing orientations:** As will be explained in Sect. 5, we propose a service ecosystem perspective as a holistic view on complex sourcing interactions such as resource integration, capability configuration, service exchange, value creation and capture, innovation, competitive advantage, profitability and sustainability. The proposed view integrates various strategic sourcing orientations, which is a prerequisite to develop solutions for centralization of procurement data and systemic exploration of sourcing alternatives.
- **Strategic sourcing conceptualization for procurement data modeling:** We propose the construction of a conceptualization of strategic sourcing that can be used as a language for modeling procurement data. We designed the strategic sourcing conceptualization by referring to Service-Dominant Logic as the foundation theory of our service ecosystem perspective as will be explained in Sect. 5. Different kinds of procurement data (e.g. spend cost data, sourcing data, supplier data, contract data and relational data) can be identified based on the core procurement concepts and their attributes and relations. We believe that such identification through the proposed conceptualization based on an holistic view of

strategic sourcing will help developing solutions for procurement data centralization, integration and standardization, thus enabling companies to achieve procurement data management competency.

- **Conceptual modeling as a way of exploring strategic sourcing alternatives:** We propose conceptual modeling as a technique for exploring strategic sourcing alternatives. We introduce conceptual models as schematic descriptions [16] of sourcing alternatives and apply the proposed conceptualization as a common language for describing these models. The exploration of the alternatives is systemic as the underlying conceptualization of the models offers a holistic view of strategic sourcing according to the various orientations (i.e. learning, planning, performance and relational). Through the proposed conceptual modeling of strategic sourcing alternatives, procurement data can be identified for evaluating the sourcing alternatives, which enables companies to achieve procurement analytic competency by applying model-based analytical techniques and tools.

The solution approach is described in the rest of the chapter according to the four different perspectives proposed by Seligmann et al. (1989) [17]: as a way of thinking (i.e. principles for a systemic view of strategic sourcing) which addresses the first research objective, as a way of modeling (i.e. conceptualization of strategic sourcing) which addresses (partially) the second research objective, as a way of working (model-based exploration of strategic sourcing alternatives) which addresses the second and third research objectives, and as a way of supporting (model-based analytical techniques and tools) which we present as future research to further address the third research objective.

## 4 Research Methodology

The research methodology that was applied to develop our solution approach was the Design Science Research Method (DSRM), which is the standard research methodology used in the Information Systems discipline for designing new artifacts that solve unsolved problems or improve upon existing solutions. Design science research artifacts include constructs, models, methods and instantiations of these [18]. Referring to the DSRM process model we distinguish the following research phases [19]: (1) **Problem Analysis Phase:** we conducted a literature review of theoretical and conceptual studies in various procurement and strategic sourcing domains to explore the research problem, justify the value of a solution, and define the research objectives. (2) **Solution Analysis Phase:** state-of-the-art Service Science research contributions to Strategic Sourcing [15, 20] and Information Systems research contributions to Strategic Management [21] were investigated to shape a solution approach that has the potential to address the research problem. (3) **Design and Demonstration Phase:** we designed a model-based approach that can be characterized as *service-dominant conceptual modeling* to achieve the research objectives. We developed a proof-of-concept case based on a literature review in the healthcare domain to demonstrate the use of the proposed approach for exploring strategic sourcing alternatives in an outsourcing scenario; (4) **Evaluation Phase:** the goal of this phase is to observe and measure how

well the proposed approach supports companies to achieve procurement data management and analytics competencies for fact-based strategic sourcing decision-making. This evaluation will be performed through conducting case-study research. The evaluation phase is the next level of our research as we aim at translating our conceptual solution into a practical solution through the application of the envisioned tool support (part of our ongoing research). The current chapter is mainly focused on the first level of research (conceptual solution) through problem formulation, solution definition, design and demonstration, and a minimal scenario-based evaluation of the proposed conceptual solution.

In the remainder of this chapter, the emphasis is on the results of our Design Science Research study, which we present according to the four perspectives of Seligmann et al. (1989) [17] as discussed in the previous section.

## 5 Way of Thinking: Service Ecosystem

A systemic view on complex sourcing interactions (e.g. resourcing, capability configuration, service exchange and innovation, sustainability, value co-creation) is needed to integrate various strategic sourcing orientations (e.g. learning, planning, performance and relationship management orientations). Without such overview, it is difficult identifying the right procurement data and exploring various sourcing alternatives.

The interpretation of complex emerging phenomena is greatly facilitated by a systems view that synthesizes both a reductionist perspective (i.e. analyzing elements and their relations) and a holistic perspective (i.e. being capable of observing the whole) [22]. The Viable Systems Approach (vSa) is a Systems Theory that is linked to complexity theories and has been developed as a behavioral approach to interpret business and its interactions with the environment [23, 24]. A viable system is defined as a system that survives, that is both internally and externally balanced, and that has mechanisms and opportunities to develop and adapt, and hence to become more and more efficient within its environment [23, 24]. The vSa is also increasingly getting attention in service research due to their contribution to understanding complex phenomena of the service (eco)system such as resource integration, value co-creation, service exchange and win-win interactions [25, 26]. A service ecosystem is defined as a system of service systems connected (internally and externally) by mutual value creation interactions realized through service exchanges [27]. This ecosystem view is founded on Service-Dominant Logic (S-D Logic), which is an important theoretical framework for the study of service systems [28, 29]. The S-D Logic views (Fig. 2) a service system (SS) as a dynamic value co-creation configuration of resources, with at least one operant resource, that is connected internally and externally to other service systems by value propositions through service exchanges [30]. It highlights a paradigm shift away from the Goods-Dominant Logic (G-D Logic) in the service science. This paradigm shift from the G-D Logic to the S-D Logic implies a change in the service perspective from a static view to a dynamic view, which is formalized in the vSa as a structure-system approach [31, 32]. According to the vSa, the complex phenomena of a service system (e.g. resource integration, service exchange, value co-creation) can be observed from a dual perspective focusing on a structure-based view (StBV) or a



systems-based view (SyBV). The StBV is a static and objective perspective that is useful for describing and measuring a phenomenon by focusing on its components and relations. The SyBV is a dynamic and subjective perspective that is useful for interpreting the dynamic nature of a phenomenon by focusing on its interactions [33].

Consequently, we apply a *service ecosystem perspective (founded on S-D Logic)* as a system-structure view (*according to vSa*) on complex strategic sourcing interactions at micro levels (e.g. dyadic exchange encounter), meso levels (e.g. local), and macro levels (e.g. global) [34]. According to this perspective, vSa provides a structure-system view on strategic sourcing to describe and interpret its static and dynamic nature (e.g. sourcing components, relations and interactions). Moreover, S-D Logic provides a framework for thinking more clearly about the service system and its role in competition [15] and survivability [35]. The traditional view on (tactical) sourcing was a G-D Logic view that suppliers and customers were merely senders and receivers of goods. On the contrary, today's view on (strategic) sourcing derives from value co-creation as a central premise to the S-D Logic [15].

A service ecosystem perspective of strategic sourcing introduces a way of thinking about strategic sourcing in terms of S-D Logic. We observe a clear similarity between S-D Logic concepts (Fig. 2) and strategic sourcing concepts, as defined below in Table 1 [20, 36–40].

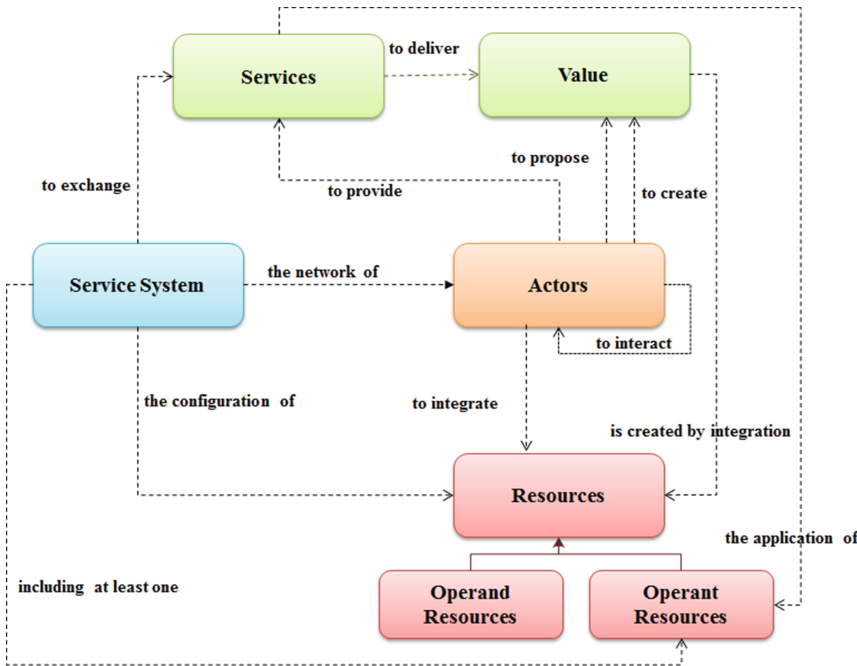


Fig. 2. S-D logic concepts and relations



**Table 1.** S-D logic and strategic sourcing mapping of concepts

S-D logic concepts	Strategic sourcing concepts
<b>Operand Resources</b> as usually tangible, static and passive resources that must be acted on to be beneficial, e.g., natural resources, goods, and money [30, 41].	<b>Resources</b> as the firm's assets that require action to make them valuable and beneficial for the firm to sustain competitive advantage. Strategic resources enable organizations to sustain competitive advantage, if the resources are Valuable, Rare, Inimitable, and Non-substitutable (VRIN) [42, 43].
<b>Operant Resources</b> as usually intangible, dynamic and active resources that act upon other resources to create benefits, e.g., knowledge, skills [30, 41]. They are the essential component of differentiation and the fundamental source of competitive advantage [20].	<b>Competencies</b> are the firm's specific strengths that allow a company to gain competitive advantage. <i>Threshold competencies</i> are needed to meet the necessary requirements to compete in a given market and achieve parity competitive advantage, whereas <i>distinctive competencies</i> allow the firm to achieve sustainable competitive advantage [44].
<b>Service System</b> as a configuration of resources (at least one operant resource) that is capable of providing benefit to other service systems and itself [30]. The ability to configure best in class operant resources from different organizations increases the ability to gain competitive advantage or increase viability.	<b>Capability</b> is a configuration of the firm's resources and competencies that makes the firm able to achieve and sustain competitive advantage. <i>Dynamic capabilities</i> are the firm's capacities and abilities to reconfigure its resource base internally and externally to achieve the sustainable competitive advantage [45]. Dynamic capability act on operational capabilities [46]. <i>Operational capabilities</i> can be broken into technical, administrative, and governance capabilities for producing and selling a defined (and static) set of products and services [47].
<b>Service</b> is the application of operant resources for the benefit of another party [30]; Service is the fundamental basis of value creation through economic exchange. <i>Competitive advantage</i> is a function of how one firm exchanges its services to meet the needs of the customer relative to how another firm exchanges its services" [20]. <i>Surviving</i> is a function of how the firm exchanges its services to be able to survive and thrive in its surrounding environment" [35]. Service is the primary source of competitive advantage and survivability. However,	<b>Service</b> is the application of competencies to achieve competitive advantage or survivability. <i>Competitive advantage</i> is the ability to create more economic value than competitors. It is a firm's profitability that is greater than the average profitability for all firms in its industry. Furthermore, <i>sustained competitive advantage</i> is a firm maintaining above average and superior profitability for a number of years [44]. The primary objective of strategic sourcing is to achieve a sustained competitive advantage (in a commercial domain) or survivability (in a noncommercial domain)

(Continued)

**Table 1.** (Continued)

S-D logic concepts	Strategic sourcing concepts
“the only true source of sustainable competitive advantage and survivability is the operant resources that make the service possible” [20].	which in turn results in superior profit or long-term viability.
<b>Actors</b> are engaged in the services exchange as value co-creators through <i>actor-to-actor (A2A) relations</i> [48] at the micro, meso, micro level [34, 49]. They are essentially doing the same thing: creating value for themselves and others through resource integration [50]. An actor can only offer a value proposition concerning some services and cannot solely create value for the beneficiary actor [41, 51].	<b>Supply chain members</b> as the focal firm, buyers, suppliers, internal customers and external customers are able to create value in the supply network through sourcing relations like supplier-buyer relationship and customer- provider relationship [15].
<b>Value</b> is an increase in the viability (survivability, well-being) of the system. Value comes from the ability to act in a manner that is beneficial to a party [52]. A <i>value proposition</i> establishes connections and relationships among actors [41, 51]. The process of co-creating value is driven by <i>value-in-use</i> (actualization), but mediated and monitored by <i>value-in-exchange</i> (capturing) [35].	<b>Perceived value</b> is defined by customers, based on their perceptions of the usefulness of the product on offer. <b>Exchange value</b> is realized when the product is sold. It is the amount paid by the buyer to the producer for the perceived value [53]. Strategic sourcing derives from value co-creation, which in the provider role serves as value proposition to customers, in the supplier role serves as value facilitation to customers, and in the customer role serves as value actualization [15].

As a result, to create a systemic procurement and strategic sourcing view, we consider the firm’s organization as a system of interconnections and interdependencies (e.g. service exchange, capability configuration, resource integration and value creation), both internally (sub-systems) and externally (supra-systems) balanced, that has mechanisms (e.g. outsourcing, global sourcing and co-sourcing) and opportunities (e.g. learning, reconfiguration, seizing and sensing) to achieve (sustainable) competitive advantage and survivability. Therefore, we define sourcing as a strategic process for organizing and fine-tuning the focal firm’s capabilities and resources internally and externally through A2A interactions (e.g. resource integration, capability configuration and service exchange) with suppliers, buyers, internal and external customers, at the different sourcing levels (e.g. local, international and global) to achieve (sustainable) competitive advantage or survivability, which in turn results in value as superior profit or long-term viability.

## 6 Way of Modeling: The C.A.R.S Conceptualization

Conceptual modeling is our proposed approach for exploring strategic sourcing alternatives in the four strategic sourcing orientations or decision areas of learning, performance, planning and relational management. Conceptual modeling [54] is a technique used in several research and application fields in Information Systems such as requirements engineering, database and information system design, knowledge management and enterprise modeling. Conceptual modeling has also been introduced in the Strategic Management and Business Model Innovation literature as a technique to generate business models [55]. To create conceptual models that describe sourcing alternatives, a domain-specific modeling language [16] for strategic sourcing is needed. Such language is defined by a conceptualization of the strategic sourcing domain and associated viewpoints that specify conventions for constructing and using different sourcing views. A view is a representation (i.e. conceptual model) of a system from the perspective of one or more decision makers to address specific concerns [56].

We introduce the C.A.R.S (Capability – Actor – Resource – Service) conceptualization as a language for strategic sourcing modeling. There is a clear mapping between the C.A.R.S concepts and core concepts of S-D Logic as we apply them in the way of thinking to strategic sourcing (Fig. 3). The C.A.R.S concepts capability, resource and competency are interpreted as their corresponding S-D Logic concepts, i.e. service system, operand resource and operant resource. We chose to retain the more specific strategic sourcing terminology instead of employing general S-D Logic terminology, though the meaning of the concepts is derived from S-D Logic. C.A.R.S further employs the service concept to interpret the primary objective of strategic sourcing that is competitive advantage or survivability. Furthermore, the actor notion is used to describe the role of the focal firm, suppliers, buyers and customers in a supply network for value co-creation. The C.A.R.S concepts are defined as follows:

- **Capability** is ‘*What the actor Can do*’ for competitiveness and survivability. The capability notion can illustrate the abilities of firm, buyer and supplier to achieve long-term objectives. The capability of an actor represents its potential long-term effects on the achievement of sourcing objectives.
- **Actor** is ‘*Who is the Resource Integrator*’ that provides service, proposes value, creates value and captures value.
- **Resource base** is ‘*What the actor Has*’ that is capable to create value. The resource base notion includes tangible and static resources (e.g. goods), as well as intangible and dynamic resources (e.g. competencies and skills), hence both **resources** (i.e. S-D Logic operand resources) and **competencies** (i.e. S-D Logic operant resources) are included in the resource base.
- **Service** is ‘*What the actor Does*’ that is exchanged with other actors for competitiveness and survivability. The service notion can illustrate the performance dimension of actors to achieve operational objectives (bottom-line results). Performance of an actor represents short-term effects on the achievement of sourcing objectives.

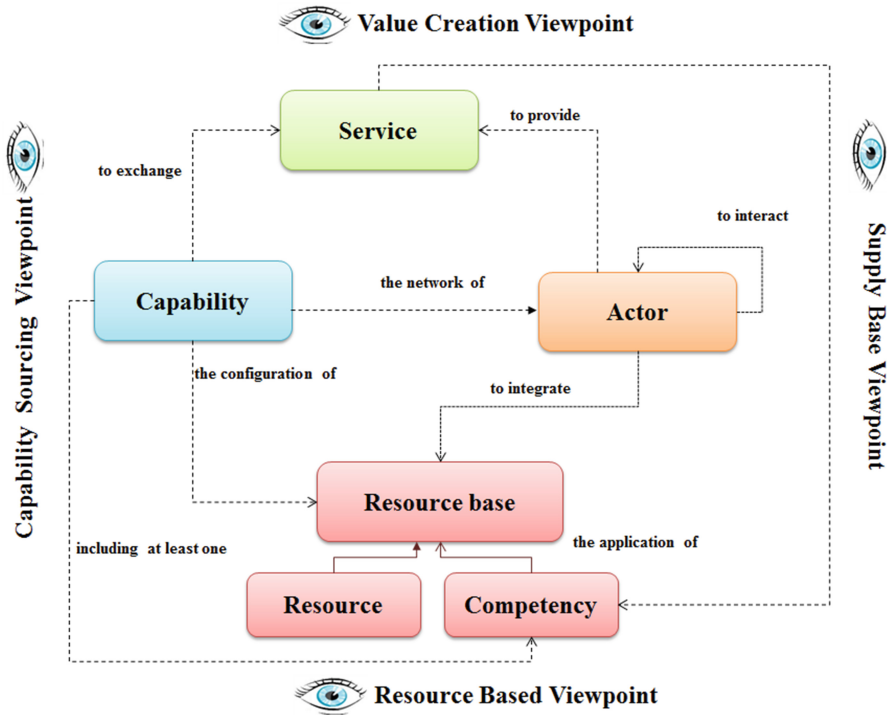


Fig. 3. C.A.R.S conceptualization and viewpoints

The C.A.R.S conceptualization is extended by considering viewpoints (Fig. 3) that relate to different strategic sourcing orientations and associated decision-making areas and decision-makers. The *value creation viewpoint* focuses on the firm's profitability that is derived by the participation of its network members to co-create value. The value creation viewpoint's concern is performance-oriented sourcing decisions about determining how much cost is being spent, with which suppliers, for what and by whom; how much value is perceived or captured, with whom, and for what. The *capability sourcing viewpoint* focuses on the firm's abilities (strategic dimension), its supplier's abilities and its customer's abilities to configure its resources and competencies internally and externally to achieve competitive advantage and to survive in a rapidly changing environment. The capability sourcing viewpoint's concerns are (a) learning-oriented sourcing decisions to choose the right sourcing alternatives like outsourcing, insourcing and co-sourcing (make-versus-buy decisions) to achieve (sustained) competitive advantage; (b) planning-oriented sourcing decisions about identifying sourcing objectives (e.g. cost saving, mitigating risk, ensuring delivery availability, enforcing compliance, driving innovation and making long-term partnership) and aligning these objectives with long-term organizational goals. The *resource based viewpoint* focuses on the firm-specific strengths (superior resources and core competencies) that are capable of creating value and allow a firm to gain competitive advantage. The resource based viewpoint's concern is learning-oriented sourcing

decisions about integrating superior resources and turning into a specific benefit. Finally, the **supply base viewpoint** focuses on the firm's interactions with suppliers and internal and external customers to achieve long-term or short-term partnerships. This viewpoint's concern is relational-oriented sourcing decisions (a) to select the right suppliers and evaluate their strategic and performance dimensions for long term and short-term partnerships; (b) to find new customer to create more value and innovation.

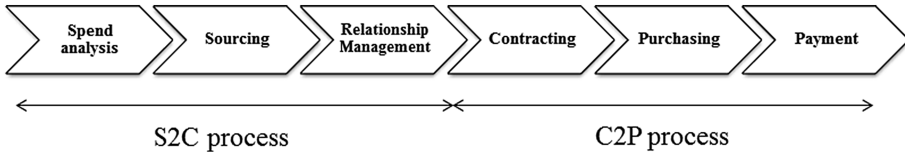
The purpose of the C.A.R.S conceptualization and its viewpoints is to support strategic-sourcing decision-makers by offering a common language to model procurement data such as *spend data*, *sourcing data*, *supplier data*, *contract data* and *relational data* that reside in disparate systems and data sources. The capability notion, its attributes and other supplementary concepts defined in the capability sourcing viewpoint can be used to model the (strategic) sourcing data about outsourced, insourced and co-sourced capabilities, operational, organizational and technical capabilities and also data about capacities to leverage the existing resource base, to reconfigure the existing resource base, to integrate the resources, to develop new products and capabilities, to absorb the external resource base and to take advantage of market opportunities (adapting). The service notion, its attributes and other supplementary concepts defined in the value creation viewpoint can be used: (a) to model the performance (operational) data about the spend cost, the total cost of ownership, the transaction cost, the captured value (profit) and the perceived value; (b) to model the contract (operational) data about the quality of service, the service level agreements and the service delivery time, the contract's clauses, RFx (e.g. RFI, RFQ, RFP) and KPIs for evaluating supplier performance. The actor notion, its attributes and other supplementary concepts of the supply base viewpoint can be used to model the relational data about the suppliers and their classification such as registered, approved, active, partner, strategic partner, undesirable and blocked and also data about the (strategic and non-strategic) customers. The resource notion, its attributes and other supplementary concepts defined in the resource-based viewpoint can be used to model sourcing data about the internal and external resource base, interconnected resources, composite resources, threshold and distinctive competencies and VRIN resources.

The next section illustrates an instantiation of C.A.R.S based on an outsourcing scenario, employing a model driven approach as way of working.

## 7 Way of Working: Model Driven Approach

We propose a model driven approach to explore strategic sourcing alternatives in various orientations (e.g. learning, planning, performance and relational) for three distinct purposes: descriptive, predictive or prescriptive. In this paper, the proposed approach has been defined and limited by focusing on the upstream procurement activities (Fig. 4) from spend analysis to contracting- as the Source to Contract (S2C) process- that include spend analysis, sourcing management and relationship management.

According to the first step of S2C process, *category spend management* is a main sub-process of spend analysis to determine the category baseline spend costs and then identify potential cost saving opportunities. A category is a grouping of resources or



**Fig. 4.** Source to Contract (S2C) process Vs. Contract to Pay (C2P) process

services that have similar supply and usage characteristics to meet business objectives. In the second step, *capability sourcing* is a core sub-process of sourcing management to achieve sourcing goals and objectives. Capability sourcing is a course of action to execute strategic sourcing goals through gaining access to best-in-class capabilities in the value chain to achieve sourcing objectives such as increasing quality, capturing saving, mitigating risk, ensuring delivery availability, enforcing compliance, driving innovation and making long-term partnership [38–40, 57]. Finally, in the last step, *supplier lifecycle management* is a sub process of relationship management for supplier discovery, supplier engagement, supplier qualification, supplier performance management, and supplier classification and supplier risk assessment to achieve sourcing objectives such as supply base reduction, optimization and rationalization. Referring to the S2C process and its sub-processes, we define the model driven exploration based on the C.A.R.S conceptualization in three executive steps as below:

1. ***Spend exploration*** to determine how much cost is being spent, with whom, and for what.
2. ***Sourcing exploration*** to identify sourcing objectives and choose the right sourcing model alternatives (e.g. outsourcing, co-sourcing and insourcing) to achieve objectives through capability sourcing.
3. ***Supply base exploration*** to identify, evaluate and qualify of suppliers for long time or short time partnership.

We take a hypothetical case for illustrating our model-based exploration through a literature review [58–60] on strategic sourcing in the healthcare domain. Healthcare costs are increasing and hospitals are facing fierce competition to provide high quality services, continued lower operating margins, increased risks and potentially once-in-a-lifetime health care reform. With this backdrop, there is an increasing focus on supply chain management as a means to minimize risk, optimize operating costs, improve revenue, improve operating margins and hence enable the hospital to better serve the patient. Now more than ever, hospitals need strategic sourcing in order to survive within the sector. Strategic sourcing can play a key role in creating a more efficient hospital by decreasing the total cost of ownership of resources (e.g., capital equipment) through tracking the sales prices of equipment sold by suppliers; differentiating the hospital's services through hiring specialists and purchasing or renting equipment; improving supply chain management through decreasing negotiation times in the new vendors contracts by providing the necessary information to streamline the process; defining and reviewing the Preferred Supplier List; obtaining QDC objectives (Quality-Delivery-Cost) for all projects; managing strategic long-term relationships

with the global suppliers. We focus our example to find cost saving opportunities in “Healthcare Information Management”. The proposed model-driven approach should be able to support decision makers to answer the business questions as below through three executive exploration steps (e.g. spend exploration, sourcing exploration and supply base exploration) based on the C.A.R.S conceptualization.

- How much is being spent on “information system management” by the hospital?
- What could be the right sourcing model (e.g. outsourcing, co-sourcing and insourcing) of “information system management” for saving cost in the hospital?
- What should be the hospital’s resource base that enables the hospital to have a core “information system management” capability to achieve sustainable competitive advantage?
- Who is the preferred provider for “information system management” in the hospital?

**Step 1: Spend Exploration Based on the C.A.R.S Conceptualization.** In the first step, the value creation view (Fig. 5) as a descriptive representation illustrates (1) how much cost is being spent on “information system management” (as a category of healthcare information management) to improve the hospital operational efficiency; (2) how much value is being perceived by the end users of information systems; (3) what is the value proposition of the IT department (as the internal service provider) to improve the hospital operational efficiency; and (4) how much profit is being captured by the hospital through improving operational efficiency. Value as “*What the actor Perceives*” and profit as “*What the actor Captures*” are two supplementary concepts in the value creation viewpoint. Consequently, Total Cost of Ownership (TCO), Net Perceived Value (NPV) and Net Captured Value (NCV) are operational metrics to measure the cost, value and profit. The profit of improving operational efficiency as the captured value by hospital is determined after perceiving value by beneficiary actor (users) as “ $NCV = NPV - TCO$ ” [61]. Here, the cost of “information system management” is more than its profit that is being captured by hospital. Hence, there is the opportunity for saving cost in “information system management” through a right sourcing decision-making.

**Step 2: Sourcing Exploration Based on the C.A.R.S Conceptualization.** In the second step, the capability sourcing view (Fig. 6) as a predictive representation shows what could be the right sourcing model of “information system management” for saving cost in the hospital. Referring to the view, the right sourcing model of “information system management” could be an outsourcing model. Two metrics for choosing the right sourcing models are (1) the strategic metrics such as operational capabilities (e.g. technical, administrative, organizational) and dynamic capability (e.g. leveraging and reconfiguration); and (2) the operational metrics such as Production Costs (PC) and transaction costs (TC) of service. The hospital’s ability to leverage the existing resources and competencies for “information system management” is a non-core capability that results in a parity competition, not competitive advantage. Therefore, the “information system management” can be outsourced to a preferred supplier in the value network based on the low transaction costs. Dynamic capability as “*the actor’s capacity and ability to alter its resource base*” and operational capability as “*the actor’s capacity and ability to configure its resource base*” are two supplementary



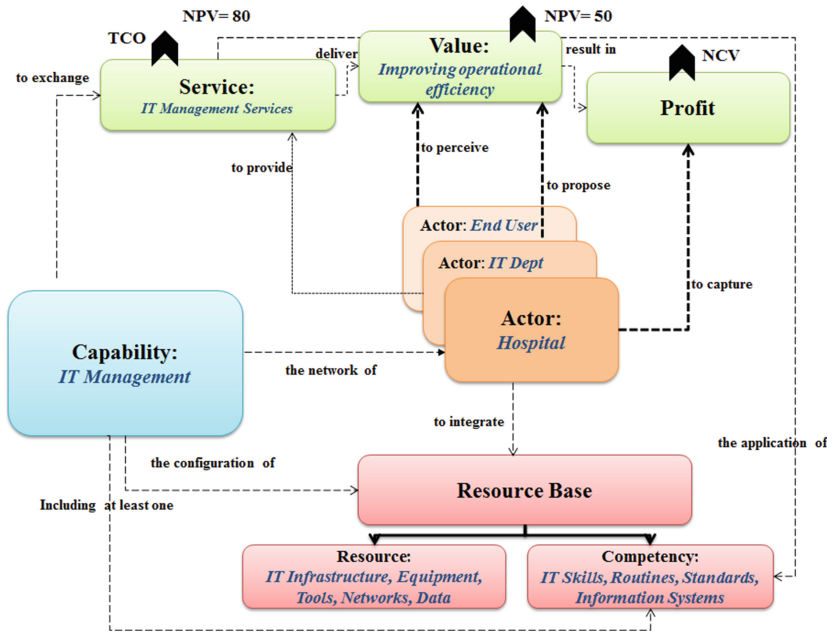


Fig. 5. A value creation view

concepts in the capability sourcing view. Operational capabilities constituted by valuable resources and distinctive competencies are critically underpinning competitive advantage that others cannot imitate and obtain. These core operational capabilities are deeply embedded in the firm and therefore difficult to transfer and likely to be performed internally. Capabilities involved by non-valuable resources and threshold competencies are non-core operational capabilities, which can be outsourced without any serious compromise to the firm competitive position.

Furthermore, in this step, the resource based view (Fig. 7) as a prescriptive representation illustrates what should be the hospital's resource base to have a core capability in "healthcare information management" to achieve sustainable competitive advantage as a long-term goal. Referring to the view, the hospital needs a knowledge creation and integration capability to manage its information. This capability as an interconnected operant resource is the hospital's ability to create, absorb, acquire and integrate information through internal and external networks. This interconnected operant resource is constituted by technological competence (e.g. technological expertise), network competence (e.g. the ability of network management execution) and quality management competence (e.g. the ability of quality management execution) that are Composite Operant Resources (CORs). These resources are a composition of IT infrastructure and systems, individual skills (e.g. IT security, CRM) and quality audit routines and policies as the Basic Operant Resources (BORs). By integration of composite operant resources (CORs), the hospital is able to achieve a temporary competitive advantage and by integration of basic operant resources (BORs), the

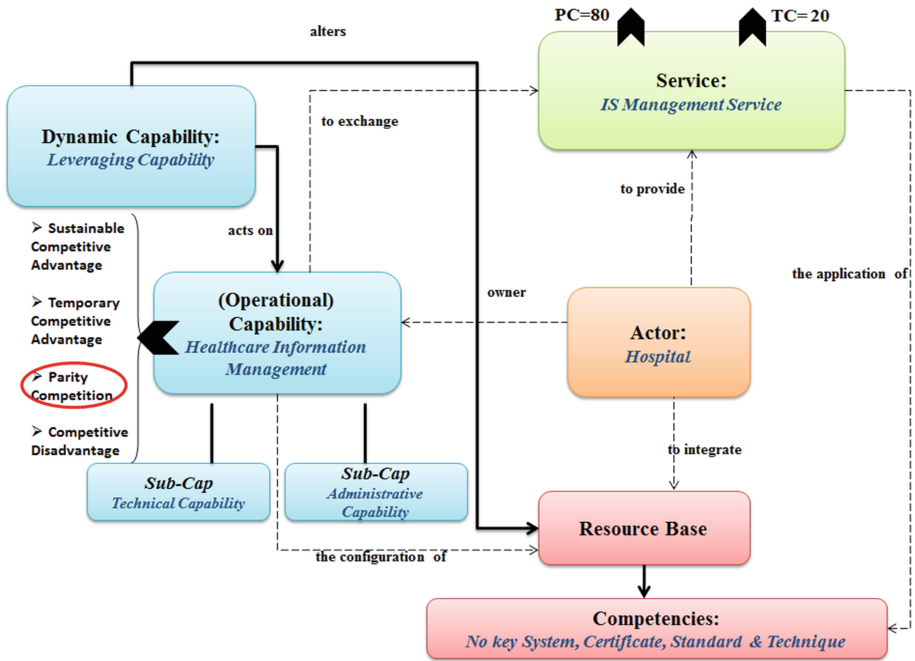


Fig. 6. A capability sourcing view

hospital is able to achieve parity competitive but no advantage. The hospital is able to achieve a sustainable competitive advantage through integrating interconnected operant resources (IORs) as a combination of BORs. Valuable, Rare, Inimitable, and Non-substitutable (VRIN) attributes are metrics to evaluate the actor's resource base to achieve (sustainable) competitive advantage. Valuable common resources can lead to competitive parity but no advantage such as basic operant resources. Non-value-adding resources lead to competitive disadvantage. Rare resources are those possessed uniquely by one organization or by a few others only. Valuable rare resources can provide, at best, temporary competitive advantage such as composite operant resources. Inimitable resources are those that competitors find difficult to imitate or obtain. Non-substitutable resources are resources that do not have a strategic equivalent. Only valuable, rare, hard-to-imitate and non-substitutable resources can provide sustained competitive advantage such as interconnected operant resources [62].

**Step 3: Supply Base Exploration Based on the C.A.R.S Conceptualization.** In this step, the supply base view (Fig. 8) as a descriptive-predictive representation illustrates (1) what are the service providers operations and capabilities in "information system management"; and (2) who can be a preferred provider for long-term partnership in an outsourcing contract. Referring to the view, the service provider B with the high-level capabilities (e.g. information quality management, documentation and cost reduction) and the high-level performance (e.g. the cost of service, the delivery time of service and the quality of service) can be a candidate for long-term relationship. Two measurements are defined for supplier selection and evaluation as operational and strategic

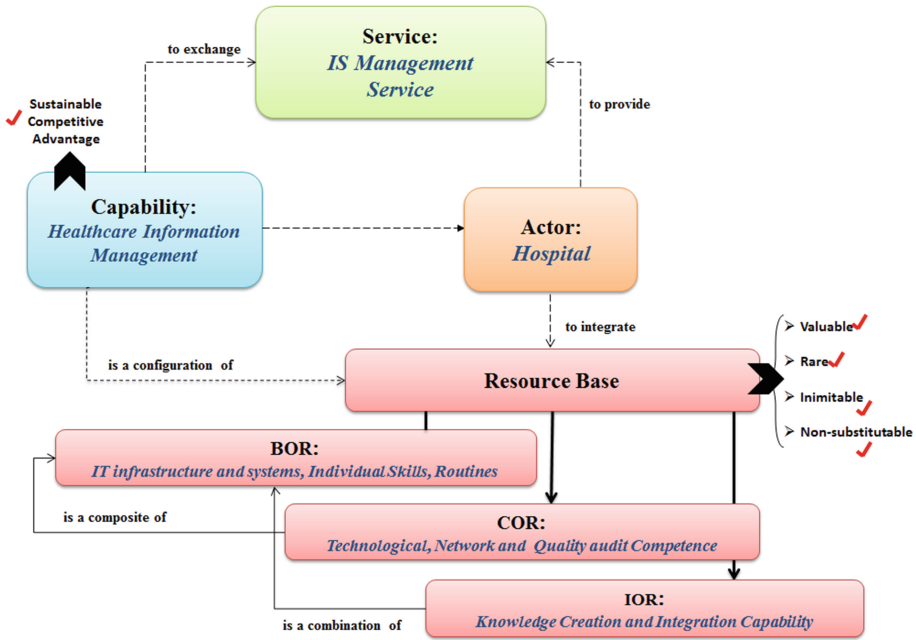


Fig. 7. A resource based view

metrics [63]. Operational metrics are indicators related to the performance dimension of a supplier (i.e. quality, cost and delivery time). Strategic metrics are indicators related to the capability dimension of suppliers such as technical, managerial, and operational capabilities. Consequently, service providers characterized by high-level performance and high-level capability are strategic providers, which the firm needs to develop a long-term relationship with. Service providers with a high-level performance and a low-level capability are candidates for further development to improve their capabilities. Service providers with a low-level performance and a high-level capability are unable to use their capability efficiently. Service providers with low-level performance and capability are candidates for “pruning”.

The purpose of model driven exploration based on the C.A.R.S conceptualization is a systemic representation (descriptive, predictive and prescriptive) of the procurement data to explore sourcing alternatives and enabling companies to achieve procurement analytic competency by applying model-based analytical techniques as way of supporting.

## 8 Way of Supporting: Model Based Analytical Tools

Procurement analytics is the process of using advanced techniques such as modeling, deep computing, simulation, data mining, and optimization to derive actionable insights and outcomes from procurement data. Analytical techniques for procurement

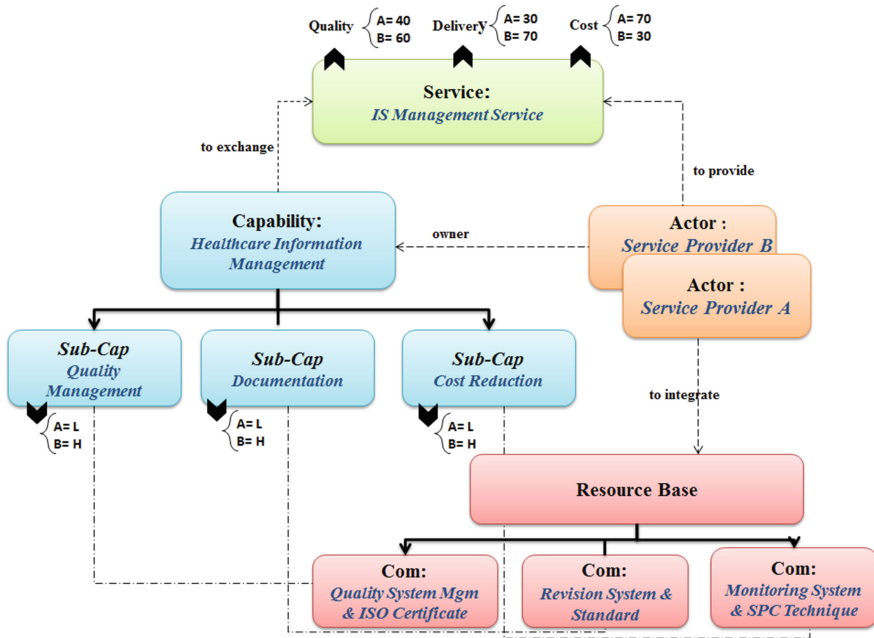


Fig. 8. A supply based view

and strategic sourcing have ranged from simple weighted scoring models to complex mathematical programming approaches. These approaches may include (1) mathematical techniques such as AHP, TCO, and linear programming; (2) artificial intelligence techniques such as neural networks, software agent and fuzzy set theory; and (3) complex techniques based on a single analysis method like cluster analysis and principal component analysis or involve combined methods like AHP with linear programming [64]. The analytical techniques used are usually performance outcome based techniques for evaluating “point-in-time” procurement data [65]. Although, these approaches have their own relative advantages, the procurement analytics needs to involve more than the consideration of current operational characteristics. Strategic sourcing decision-making needs to incorporate tangible, intangible, strategic, and operational factors into any analysis [66]. Furthermore, the lack of reliable data, intelligent tools and analytics skills to interpret data are other important issues in the procurement analytics.

A model based analytical technique can be integrated into our approach to support the way of modeling (C.A.R.S conceptual modeling) and the way of working (model driven approach) for enabling fact-based decision-making. Such analytical technique based on C.A.R.S conceptualization would be capable of (1) extracting the most data from applications and operations (i.e. application and process layers in Fig. 1) to deliver outcomes that matter; (2) integration the procurement analytics into procurement processes; (3) considering tangible, intangible, strategic, and operational metrics into any (descriptive, predictive and prescriptive) analysis based on the historical

procurement data; and finally (4) visualizing insights and results derived from procurement data.

## 9 Conclusion

Companies are acting in an increasingly volatile, uncertain, complex and ambiguous world. Hence, more and more they expect from the chief procurement officers (CPOs) to develop long-term and short-term plans in supply chain management. Generating and measuring savings, safeguarding quality, ensuring delivery availability and enhancing value creation, making partnership and innovation will be remained the top priorities of CPOs in the supply chain management until 2017 [11]. Leading companies need to transform their supply network from static, isolated and internally focused to externally collaborative to achieve the today's procurement objectives and priorities. To create a new business model of supply network, organizations should adopt a strategic sourcing approach that includes initiatives designed to drive above priorities. By applying a systemic view (service ecosystem) on the supply network, we consider the strategic sourcing as a strategic process for fine-tuning the organization's capabilities and resources internally and externally through interactions with suppliers, buyers, internal and external customers to achieve procurement and sourcing objectives. According to this systemic view, a model driven approach has been defined to explore sourcing alternatives based on a common language (C.A.R.S) that enables fact-based decision-making through procurement data management and analytics competencies. As future work, we will evaluate the proposed model-based strategic sourcing around important sourcing trends such as shared service centers, business process outsourcing and global sourcing.

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