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A Multi-view Framework For Defining The Services Supply Chain Using Object Oriented Methodology

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A MULTI-VIEW FRAMEWORK FOR DEFINING THE SERVICES SUPPLY CHAIN USING OBJECT ORIENTED METHODOLOGY

by

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ABSTRACT

Supply-chain management is the practice combining theory from logistics, operations management, production management and inventory control. Therefore, it is often associated exclusively with manufacturing or materials management industries. Application of supply-chain management to other industries often results in implementations that do not satisfy the needs of the involved enterprises. To improve the implementation of supply-chain solutions outside of the materials management and manufacturing industries there is a need for industry specific standards. One industry sector in need of a standard is the services industry.

The current problem facing the services sector is the inability to adapt current frameworks to the provisioning of a service. Provisioning a service translates into the supply-chain for the services industry since it influences the services supply and demand. A solution to the problem is development of a supply-chain standard specific to the provisioning of a service.

Objectives of the research are to define comprehensively, a new services supply-chain model that is applicable to the United States government classification of a service and to ensure the scalability and integration capability of the model.

To satisfy these objectives, it is necessary to understand the characteristics describing the services supply-chain process. The characteristics are the input into deriving the processes and terminology of the generalized

services supply-chain. Terminology and processes are then used to create a supply-chain framework using input from the Supply-Chain Council's Supply-Chain Operations Reference (SCOR) model. SCOR provides a foundation for describing the processes and defining the terminology in an already accepted format. A final verification of the model by industry experts insures conceptually that the framework is applicable to the current problem.

This research developed a three-level framework similar in structure to the SCOR framework. Presentation of the framework is a specification that defines and sequences the processes for implementation. A detailed case study applies the model using the framework and the definition of a comprehensive supply-chain.

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CHAPTER 1 INTRODUCTION

Supply-chain management describes the business practice that combines theories from logistics, production and inventory control and operations management. A common definition of supply-chain management is “the integration of key business processes from end-user through original suppliers that provides products, services, and information that adds value for customers and stakeholders” (Lambert 2006).

The key business processes of the supply-chain management definition comprise the supply-chain. Unlike supply-chain management, no generally accepted definition of a supply-chain exists. One common definition is the collection of several independent enterprises or business units that partner together to achieve specific goals by complementing each other (Figure 1).

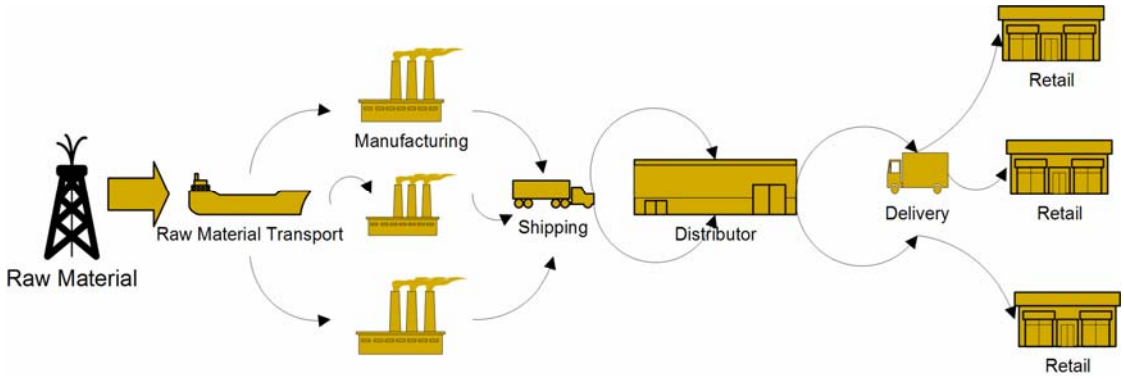


Figure 1: A simple multi-tier supply-chain.

A more formal definition of a supply-chain is “a network of facilities and distribution options that performs the functions of procurement of materials; transformation of these materials into intermediate and finished products; and distribution of these finished products to customers” (Ganeshan & Harrison 1995).

While the definitions may vary, the essence of what is taking place remains the same. All of the business entities communicate and coordinate for the mutual benefit of each business using agreed upon standardized information and processes. It has taken many years to evolve to this level of maturity. In its current form, supply-chain management has evolved to a leading edge business process used for competitive advantage. A supply-chain’s competitive advantage results from the coordinated interactions using evolving and mature frameworks and processes.

Some of the supply-chain frameworks have become de-facto industry standards, while others are publications waiting for an audience. The development of supply-chain frameworks and methodologies involves numerous groups. The most prominent groups are the Hewlett-Packard Business Process Group, the Supply-Chain Council and the Global Supply-Chain Forum. These groups maintain and enhance the more prominent frameworks. The most notable frameworks are Hewlett-Packard's model (H. a. C. B. Lee, 1995), the Supply-Chain Operations Reference (SCOR) model (Council, 2003), and the

Global Supply-Chain Forum Framework (Croxton, 2001), all of which apply a similar definition of supply-chain management.

Development of the supply-chain frameworks coincided with another radical business innovation, e-business. E-business played a critical role in making the concept of "supply-chain management" relevant to today's business. The advent of e-business allowed companies to handle more information and processes quicker than was previously possible. Further, e-business theoretically allowed buyers and suppliers to tightly couple operations, increasing efficiencies for a pull based manufacturing approach (Ming-Ling, 2005).

Review of the common frameworks reveals a central focus. This focus is on manufacturing and product supply-chain management. The result of the evolution of the frameworks led to this singular focus. The problem with the frameworks' manufacturing centricity is that the frameworks do not address other industry requirements, such as the service industry. As a result, service industries adopt frameworks not suitable for their business model. Further, the current frameworks do not reflect the characteristics unique to the service industry.

The importance of services to the United States economy is clear in the 2005 GDP. In 2005, services accounted for roughly 78% of the United States GDP (Agency, 2006). This figure in recent years stabilized as companies struggled to understand the impact services and service organizations have on their non-core competency processes. Even with the significant contribution to

the economy, the general understanding of services supply chains is not good. One reason is the variety of business sectors considered a service industry. Table 1 demonstrates the variety of businesses considered a part of the services sector.

Table 1: A list of business types considered services by the United States government.

Service Sector Industries (Goodman, 2002)
Certain Agricultural Services (i.e. landscaping, horticulture
Hotels and other Lodging
Personal Services (i.e. dry cleaning, hairstyling, tax preparation)
Business Services (i.e. temp agencies, software)
Automotive Services
Miscellaneous Repairs
Motion Pictures
Amusements and Recreation
Health care
Legal Services
Private Education
Social Services
Museums, Botanical Gardens and Zoos
Membership Organizations (i.e. Associations, Churches)
Engineering and Management Services (i.e. consulting)
Miscellaneous

The amalgamation of a variety of industry groups within the services sector adds significant complications in developing a generalized model. For instance, what is the similarity between computer services and insurance in Table 1? The lack of similarity results in the supply-chain community ignoring supply-chain model development specifically for services.

One reason why the current supply chains are not suitable is there inability to address the service industry's central complexity, the customer. The literature

reinforces this concept, indicating that the customer is a significant component of any services specific framework (Watson 2001).

Besides the lack of similarity and customer focus, there are many other concepts missing from current supply-chain frameworks. Some of the deficiencies include:

- Multiple industry views are not present,
- No enterprise level information and process integration specific to service industry operations,
- Focus is at the functional level of integration; service industry integration is at the customer level,
- Manufacturing industry specific semantics and processes, and;
- Adaptations of current frameworks require translation of manufacturing conceptualizations to service conceptualizations.

To address these deficiencies it is necessary to understand the following:

- What is the service?
- Who is the customer?
- How is the service delivered?
- When is the service delivered?

For the purposes of this research:

- The service is any material or non-material but definable asset requested by a customer,

- A customer is the initiator of a service request
- Delivery of service is in the form of a tangible or non-tangible asset for a defined purpose, and;
- Delivery of service occurs at any point in time a customer request concludes.

Another issue not addressed by current frameworks is the impact of government regulation on business processes. The services sector is comprised of the most heavily regulated (banking, health care, insurance, etc.) businesses in existence. In fact, many of the industries have regulations that are exclusive to their business processes. Examples of this include the interactions and management of the banking industry by the Federal Reserve, the last decade of mandates for the integration of health care business processes and the management of insurance funds and policies by government.

While these complexities may hinder development of potential frameworks, they can also drive the creation of a services supply chain. Benefits of a services supply chain may include standardized business processes and enhanced understanding of the customer. The first benefit can enhance regulatory compliance and the second may contribute to increased revenue and/or decreased administrative costs.

A simple case study will enable a better understanding of the complexities involved in service delivery. The simple case involves a typical visit to an auto repair shop. Figure 2 depicts the interactions discussed below. At the center of

the transactions is the customer's vehicle. The customer starts the process with a request at one of the entry points. The result of the request is many transactions originating on behalf of the customer. In the following case, the processes outline the operations of a simple repair shop. Following the case study is an analysis explaining the various complexities not captured by current models.

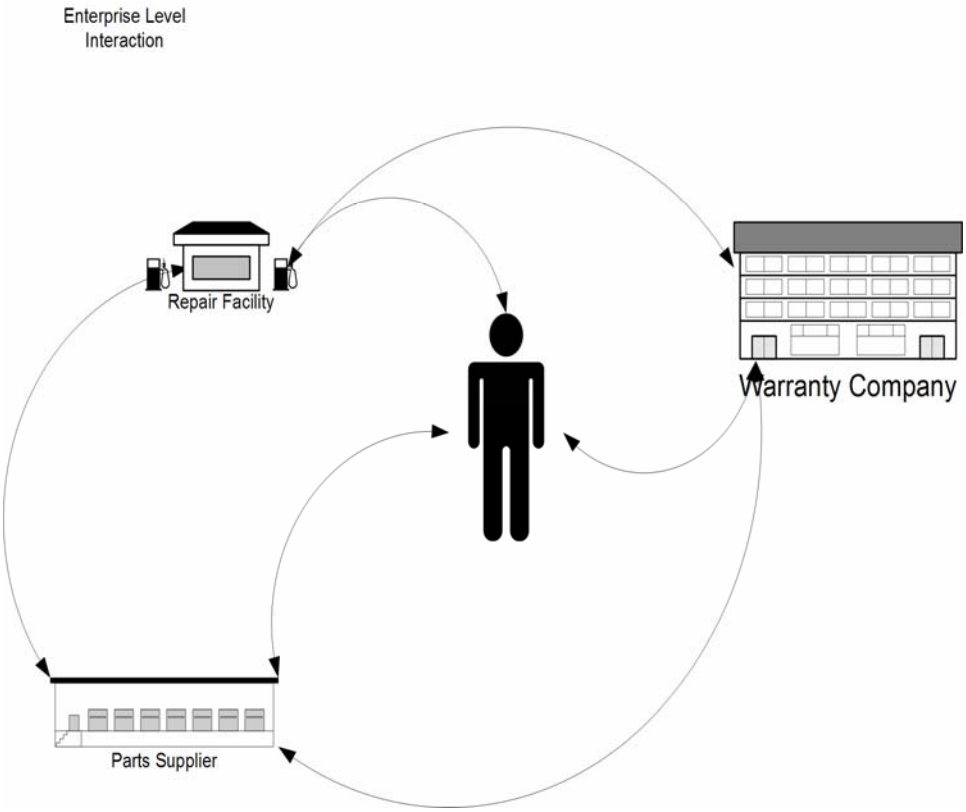


Figure 2: Enterprise interaction within the Services Supply-chain.

Sample Case

To start, a tow truck delivers the customer's vehicle to a repair facility for a non-specific problem. Let us assume that the customer has a warranty on the vehicle. Either the customer or the repair facility will confirm eligibility of the services suggested. The warranty company responds back indicating either an authorization or eligibility for the service. Technicians and other skilled professionals are then involved, depending on the service. In addition, the type of service may require perishable and non-perishable supplies. Once the vehicle repairs are complete, the repair facility determines the charges for the service. After the completion of repairs, the facility will contact the warranty company to obtain payment or receive payment directly from the customer.

While the service to the customer's vehicle is from a variety of contact points, all of the points of contact will have to provide information and knowledge input to the services provided. The complexities involved with supplying the services and knowledge also involve the interaction of each independent enterprise's supply chain for the procurement of goods to provide the services to the customers' vehicle.

Certain elements of this simple example can have parallels drawn to a materials management or manufacturing supply chain, however, the specific knowledge and information transfer is drastically different.

With this in mind and recognizing the need for the development of an enabling services supply-chain framework this research discusses a services based framework with focus being on a generalized model.

Statement of the Problem

The problem that this research will address is the existing need for the extension of current supply-chain models to define a comprehensive services supply-chain framework.

Research Objectives

Initial research objectives are to:

- Define the generic service supply-chain processes, and
- Develop a scalable integrated services supply-chain model

Contribution

Anticipated contributions to the common body of supply-chain knowledge are:

- A new supply-chain model specific to the services Industry
- An extension of existing supply-chain models enabling the services industries to adopt a scalable, enterprise integration based standard

- Use case components demonstrating the integration and usage of a services supply-chain framework.

Chapter Layout

The organization of this dissertation is as follows. Chapter 2 presents the relevant literature to date. Chapter 3 provides the methodology of the research while Chapter 4 discusses the implementation of the proposed model. Chapter 5 provides concluding remarks.

CHAPTER 2 LITERATURE REVIEW

Literature related to supply chain and supply-chain management provides a detailed history of the development and evolution of supply-chain frameworks. Therefore, this chapter presents the current state of supply-chain frameworks and the impact on the service industry. Brief synopses of recent literature and identification of the gap between service industry requirements and current supply-chain frameworks is the primary focus.

The technology of supply chain management is relatively new. It is a result of the realization that traditional Enterprise Resource Planning (ERP) systems do not facilitate external integration with customers and suppliers. As a result the technology niche of supply-chain management (SCM) software was born. The involvement of technology in SCM created a false sense of supply-chain integration. While technology is an important facet of SCM operationally and strategically, the fact of the matter is SCM is a business process (Sadler, 2005).

Unfortunately, a business process framework for SCM was not ready (Fayez, 2005; D. a. K. Lambert, A., 2004). Once the need for a business process (BP) based SCM framework was apparent, many options started appearing. As the development of a BP framework progressed, many hurdles also appeared. Among the hurdles was technology. Technology presented an unusual hurdle.

Early SCM adopters equated the successful implementation of SCM software with the success of a supply chain (Ming-Ling, 2005).

The reason is information technology was often viewed as the process solution in addition to the more obvious technology solution (Auramo, 2005). The realization this was not the case was often painful for the business and personnel involved. Post implementation, analysis determined that without structured BPs the supply chain added minimal value to the company. Research indicated that creation of physical customer-supplier networks is necessary to perform concurrently with the Information Technology (IT) implementation (Brown, 1996). Evolution of IT vs. BP is an ongoing debate and continuing subject of research in e-business processes and planning(Greiger, 2003; Ming-Ling, 2005; Nguyen, 2004).

The other focus of research is the strategies and operations associated with integrated supply chains (Sadler, 2005). The literature contains a variety of discussions on strategy and operations ranging from specific framework implementations to the importance of IT in the success of supply-chain solutions. One constant remains in the themes however, all relate successful implementations of SCM with a structured business process framework (Auramo, 2005; Gunasekaran, 2004; Lockamy, 2004; Mills, 2004).

Part of the BP frameworks effectiveness is not just the physical integration of suppliers, but also the inter-organizational aspects that create success. An important component of the inter-organizational BPs is an information system

adapted to the company's *way of doing business* (Williamson, 2004). The information system must go beyond the typical capabilities taking advantage of the semantic classification ability within XML, ebXML, XBRL, etc. By doing so, assuming a well-designed system, a tremendous amount of data and information is available for analysis.

Further, in order to fully optimize the value aspect of the supply chain, four practices are recommended that enhance the customer orientation: relationship building, interactivity, valuing customers over time and customization (Pitta, 2004). Unfortunately, accompanying optimization of processes are additional complexities.

Two issues with supply chains that add significant complexity are the uncertainty and risk involved. To address the complexity issue, quantitative methods are in use attempting to determine the complexity based on whether an organization generates, absorbs, exports or imports information (Srivadasan, 2002). Analysis of risks on the other hand involves the association with coordinated or disruptive activities within the supply chain (Kleindorfer, 2005). These issues, however do not seem to upset the SCM community as much as barriers to implementation or integration.

The perception in SCM is that upstream supplier barriers or downstream customer barriers are the primary barriers to success. In fact, these two foci receive much of the blame for SCM failures. As it turns out the primary barriers are internal (Frohlich, 2002; Storey, 2005). In order to counter the internal issues

it is critical that top management commit the success of the supply-chain and SCM (Ngai, 2004).

With the determination to improve SCM one thing remains clear, a supply chain must be cooperative, collaborative and have the commitment necessary for an extended enterprise integration to work. Lejeune characterizes the extension of the enterprise via supply chain management as built with the “4Cs”. The “4Cs” being communication, coordination, collaboration and cooperation (Lejeune, 2005). Simply put, the “4Cs” reinforce that intense collaboration and coordination with all partners is necessary for effective and efficient supply chains. The embodiment of the “4Cs” is a standardized SCM framework. The next section presents a discussion of the most common frameworks used in SCM and supply-chain implementation.

Supply Chain Frameworks

Recent development efforts focus on flexible frameworks and methodologies. The most notable frameworks are the Supply-Chain Operations Reference (SCOR) model, the Global Supply-Chain Forum (GSCF) framework, the Customer-Chain Operations Reference Model (CCOR) and the Design-Chain Operations Reference (DCOR) model (Douglas Lambert, 2005; L. Ellram, Tate, W., Billington, C., 2004; D. M. Lambert, 2006; H. Lee, Billington, C., 1995). Other frameworks include the original Hewlett-Packard (H-P) Supply-Chain model and

the Value-Chain Operations Reference (VCOR) model (L. Ellram, Tate, W., Billington, C., 2004; Heinzel, 2005). A comparison of the benefits and gaps related to a service industry implementation of each model is in Table 2.

Table 2: Comparison of current supply chain models.

	Relevancy	Process Suitability	Multi-Tier Relationships	Aggregation
SCOR	• Metrics are product manufacturing centric • Semantics are product manufacturing centric • Transactional	• Services cannot be returned • Services cannot be made	• Supports Multi-Tier Suppliers	• Does not capture dependencies • Interaction of Enterprises not modeled • Uni-directional
SCOR – Extended	• Metrics are product manufacturing and movement centric • Semantics are product manufacturing and movement centric	• Services cannot be returned • Services cannot be made	• Supports Multi-Tier Customers and Suppliers	• Captures dependencies • Describes interactions of Enterprises • Does not capture customer input
CCOR	• Metrics are "Return" and "CRM" process centric • Semantics are product support centric	• Services cannot be returned • Services cannot be made	• Much like SCOR in the linearity of the processes	• Not integrated with Enterprise • Captures product service and sales • Focus is on the "return" process within SCOR • Details "Supplier" interaction from a "Return" process only
DCOR	• Metrics are product design centric • Semantics are product design centric	• Services cannot be returned • Services cannot be made	• Multi-Tier capability not a stated parameter for development of the model	• Design aggregation only
VCOR	• Metrics are product centric • Semantics are product centric	• Services cannot be returned • Services cannot be made	• Not defined	• Not defined
GSCF	• Semantics are product manufacturing centric • Strategic	• Services cannot be returned • Services cannot be made • Breadth of model design highlights cross-functional dependency within the Enterprise	• Implementation is linear, multi-tier relationships are not ignored but are not well designed	• Relationship aggregation
HP – Model	• Metrics are product manufacturing and order fulfillment centric • Semantics are product centric	• Services cannot be returned • Services cannot be made	• Does not support Multi-Tier supplier or customer networks	• Aggregates the demand function of the supply chain

First, a brief discussion of the later frameworks is necessary. The H-P framework is the original framework that forms the foundation for SCOR. Figure 3 depicts the H-P framework.

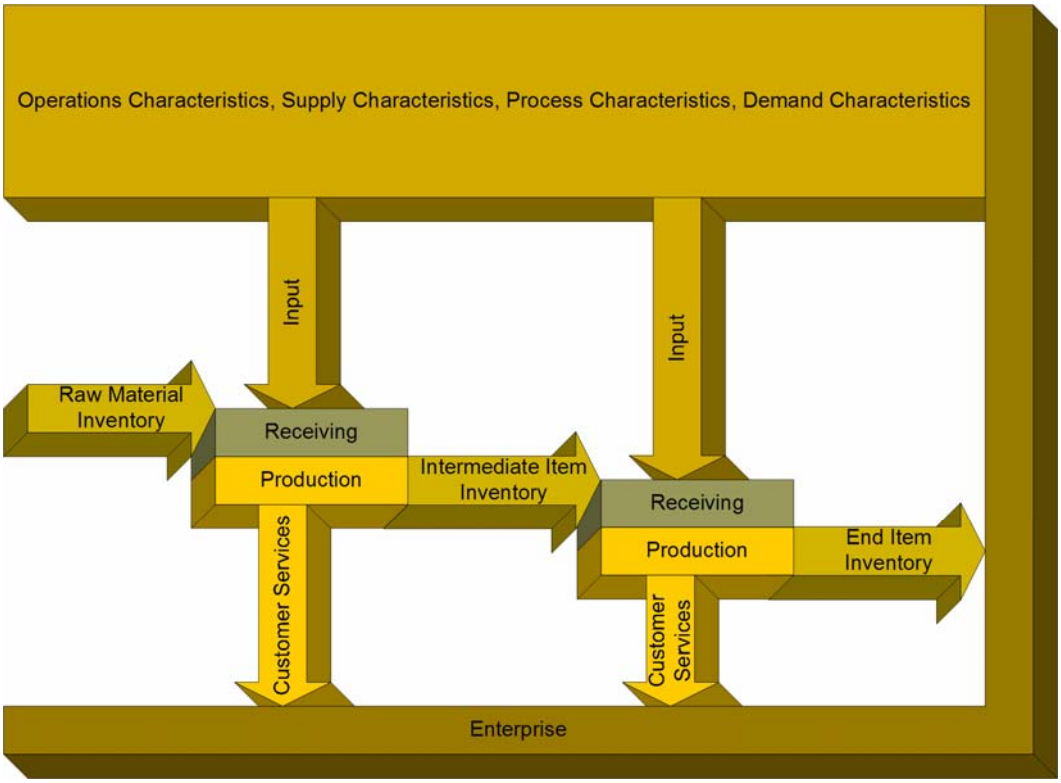


Figure 3: A depiction of the H-P model.

The processes that make up the framework are the primary contributions to SCOR as is the BP nature of the model. The BP influence stems from the originators of the model within H-P, the Business Process Management Group (BPMG). Currently, the enhancement of the model relies on input to SCOR.

Another framework that receives little attention is VCOR. VCOR is a new concept presented to the SC community. The basis for the framework is SCOR,

borrowing from the presentation and using a similar process hierarchy. Potential benefits of VCOR focus on the flow of information and the value of that information (Heinzel, 2005).

SCOR

Of the aforementioned frameworks, the one receiving the most attention is the SCOR model. As evidenced by the discussion of the secondary SC models, SCOR is a model that evolved from a company's effort to introduce efficiency into the SC. SCOR also serves as the basis for the evolution of many models developed for specific purposes.

The Supply Chain Council (SCC) promulgated SCOR in 1996. Since then, SCOR grew into what many consider the standard supply-chain framework (SCC 2005, Lee and Billington 1995). The SCC has promulgated many versions (currently the eighth version is the standard), each one containing enhancements that increase the effectiveness and efficiency over the prior version. Evolutionary enhancements include the addition of metrics, best practices and refinement of the processes. Other work outside of the SCC enhances the comprehensive nature of the model, providing a variety of operation views (Fayez, 2005).

As a model, SCOR presents an operational framework for the implementation of a SC. The foundation of the model is the H-P model (Figure 3) with significant enhancements, namely the addition of the metrics and best

practices. Data for the metrics and effectiveness of the best practices originates in the underlying processes of the model. The processes are the main elements of the model and describe the SC.

SCOR describes an SC as consisting of five primary processes; PLAN, SOURCE, MAKE, DELIVER and RETURN. These processes are Level 1 processes within the SCOR hierarchy. Level 2 processes describe using three process types; Planning, Execution and Enablement. At Level 3 are the standardized operations of the Level 2 processes. Level 4 enhances each of the Level 3 processes specific to the organizations needs. Figure 4 represents the SCOR Level 1 and Level 2 processes associated with the three process types. The model however does not define the interactions at each level.

One of the more recent works exploring the intricacies of SCOR is the research performed by Fayez. This work documented the weaknesses of the SCOR model and developed views of the framework to enhance the capability of the model (Fayez, 2005). Enhancements to the SCOR model include the ability to define interactions using a common ontology at the enterprise and functional unit level as well as clarifying the complexities involved within the supply chain. One of the conclusions drawn from this research is the need for a variety of views for other sectors outside of manufacturing.

(Fayez 2005)

Figure 4: SCOR Level 1 and Level 2 process types.

Fayez is not the only researcher recognizing this need. Others also recognized the need, with particular focus on the services sector (L. Ellram, Tate, W., Billington, C., 2004). However, their work equates the services supply chain to a services procurement process. This is a common theme, represented in any application of the current frameworks to the services industry. This theme is also present in the next framework, the GSCF framework.

Global Supply-Chain Forum

Another prevalently accepted framework, besides SCOR, is the framework developed by the Global Supply-Chain Forum. The composition of the forum includes representatives from academia and industry. This is in contrast to the SCC, which consists primarily of industry representatives. In presenting the GSCF framework, it is important to start with their definition of SCM. The forum defines supply-chain management as “the integration of key business processes from end user through original suppliers that provides products, services and information that adds value for customers and stakeholders” (D. M. Lambert, 2006). The definition is important because it connotes the integration of all business processes in contrast to the SCC model that focuses on the integration of the necessary processes only.

The definition of the supply-chain is both a strength and weakness of the GSCF. The definition is strong because the framework acknowledges the integrative role of multiple functional units within an organization, multiple tiered suppliers and multiple tiered customers. A weakness is that the framework is rigid when implemented, detracting from the flexibility sought by implementing a SC.

When implemented, the framework creates an integrated business unit. The framework essentially combines all of the functions necessary for a business to integrate into a single SC unit. The functions the GSCF includes in the

integration are “customer relationship management, customer service management, demand management, order fulfillment, manufacturing flow management, supplier relationship management, product development and commercialization, and returns management” (D. M. Lambert, 2006).

By integrating the business unit processes with the supply-chain processes, the GSCF promulgates a view that success requires integration of activities along the supply-chain process continuum, rather than managing at the individual function level (D. M. Lambert, 2006; Lamming, 2000).

One of the critical success factors of the GSCF is the continuous flow of information between suppliers, manufacturers and customers. In essence the embodiment of the linear supply chain depicted in Figure 1. The difference is that the GSCF defines the functional involvement of each business process with the business function. Figure 5 depicts this interaction and is adapted from information provided by (D. M. Lambert, 2006).

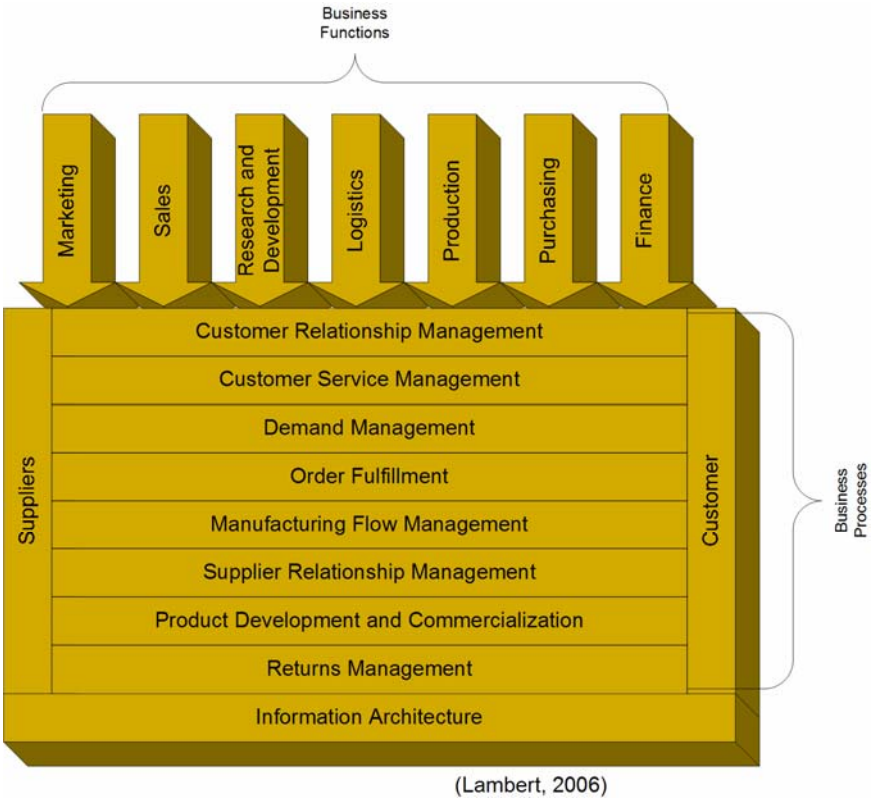


Figure 5: Depiction of the GSCF Framework.

Implementation of the GSCF requires the analysis of each business function process in rigorous detail. The process is unlike SCOR in that SCOR allows the entity to detail their own processes, allowing for flexibility and nimbleness. GSCF provides a detailed framework laid out for implementation by end-users at the tactical level. SCOR on the other hand is a strategic deployment.

While the GSCF and SCOR are representatives of the two dominant frameworks available for SCM, other models exist for specific purposes. Two of

these models, CCOR and DCOR were developed and presented using the Supply Chain Council process.

Customer Chain Operations Reference Model

CCOR is a relatively new operations reference model, released by the Supply Chain Council in June 2004. The Hewlett-Packard Business Process Management Group developed the model. The model consists of 5 processes, Plan, Relate, Sell, Contract and Assist (SCC, 2004a). Table 3 defines each of the processes. Presentation of the model detail is much like SCOR, using similar notation, definitions and presentation.

Table 3: Definition of CCOR Processes (SCC 2004).

Process	**Definition**
Plan	"Planning processes prioritize sales activities and assigns sales targets to customer chain resources."
Relate	"The process of establishing and maintaining relationships with customer and intermediaries."
Sell	"The process of establishing an understanding of the customer's needs and presenting and/or developing a solution to meet those needs."
Contract	"The process of pricing a solution and gaining customer agreement."
Assist	"The process of providing post sales support for products and services provided to the customer."

The intent of the CCOR model is to provide a structure for the customer interaction in the sale and delivery of a product. Significant focus of the model is on the *relationship* processes. This is evident in the provisioning of a RELATE process, CONTRACT process and ASSIST process. Each process involves the relationship with the customer. Based on the aforementioned attribute it would seem that CCOR is a perfect fit for the services industry. The regrettable aspect of the model is that each process revolves around the service of a product.

It is significant to understand that Hewlett-Packard (H-P) recognized the need for a structured customer relationship process to enhance the supply chain. A structured customer relationship process is significant because of the recognition that the customer is intimately involved in any service delivery. Further, CCOR is not the only model H-P initially developed. H-P also provided the initial input for the DCOR model.

A review of literature, both academic and professional yielded no discussion on the application of CCOR.

Design Chain Operations Reference Model

Similar to CCOR, the DCOR model has it origins in the H-P Business Process Management group. The groups' goal for DCOR is to define the business activities associated with satisfying the demand of a product by a customer. The model consists of five primary processes: Plan, Research,

Design, Integrate and Amend. Table 4 details the definition of each process. The model specifically does not address sales and marketing, and elements of customer support. As with CCOR, the model borrows heavily from SCOR in terms of language, presentation and layout. Like SCOR and CCOR, DCOR includes performance attributes, best practices and metrics (SCC, 2004b).

Table 4: Definition of the DCOR Processes.

Process	Definition
Plan	Development and establishment of courses of action to fulfill the needs of the design.
Research	The process elements that comprise the company's research function.
Design	The process elements that comprise the design function including refresh, new design and new technology.
Integrate	Processes necessary for integration of the current design, a new design or new technology.
Amend	The process elements required to amend the design process.

Similar to CCOR, the academic literature does not have any available information on the Design Chain Operations Reference Model (DCOR). This is reasonable in that version 1 was released to the Supply Chain Council, Inc. in June of 2004. Hypothetical studies applying design chain and supply-chain operations reference models to value chains are however in the trade literature. There are indications a consortium to enable the further implementations of SCOR adopted DCOR (Michel, 2005).

Summary

The models presented detail the processes involved with the design, maintenance and delivery of manufactured products. While allusion to the deployment of these models in a service industry exists in the literature, the implemented definition of service relates to a product. Research indicates that no model exists specific to the service industries (L. Ellram, Tate, W., Billington, C., 2004). Because of this, the next section discusses service industry operations and their relation to the service industry supply chain.

The Service Industry

Discussion about the pervasiveness of the SCM's manufacturing centric view is extensive within the literature (Reiner, 2005). The manufacturing bias from an operations, management and marketing perspective is the primary focus in the research (L. Ellram, Tate, W. and Billington, C., 2004). This centricity is driven in part by the fact that supply chain management emerged from the manufacturing sector and has evolved into a manufacturing/materials management philosophy (Anderson, 2002; Brown, 1996; Gunasekaran, 2004).

It is generally recognized that services are a distinct industry with unique issues relating to the supply chain (L. Ellram, Tate, W., Billington, C., 2004). Even with the recognition that service industry operations are unique, their research suggests that a manufacturing model, in this case SCOR, is a good fit

for the service supply-chain. A shortcoming to their research is that they take the view that a central purchasing agent is involved with the purchase of the service. This is contrary to the service industry operations management literature in terms of defining the purchaser.

In service operation management the customer is central to the entire service process and essentially plays a dual role, that of customer and supplier (Fitzsimmons, 2006). This is why when one describes the characteristics of service operations, the most important aspect is the participation of the customer in the process. The dual role of the customer is not the only unique characteristic. Other characteristics include simultaneity of creation and consumption of the service; perishability of the service, whether the service is used or not; intangibility of the service; and heterogeneity of the service delivery (Fitzsimmons, 2006). These characteristics are critical to understanding service delivery. In using these descriptions service operations management describes services strategically.

Using the above characteristics, the literature provides a concept that combines each one into a singular concept. The concept is customer duality.

Customer Duality

Conceptually, customer duality is when the customer serves two roles in the supply-chain (Sampson, 2000). One role is that of the customer. The

second role is as a supplier. The role creates the bi-directional nature of a service supply chain (Fitzsimmons, 2006; Sampson, 2000).

While understanding the customer role is easy, the supplier role may be a bit perplexing. Putting the customer's supplier role in context, " customers are suppliers of significant inputs to the service production process" (Sampson, 2000). The definition is significant to understanding the role customer duality plays in the service supply chain. While some suggest customer duality is the service supply chain, no framework exists for implementation. Lambert, in his comparison of frameworks ruled out secondary frameworks that did not have a model (D. Lambert, Garcia-Dastugue, S., Croxton, K., 2005). Therefore, customer duality is a characteristic of a service supply chain. Regrettably, identification of other characteristics relating to a services supply chain has not taken place.

While services operation management presents service industry characteristics in the literature, few efforts attempt to define a supply chain. Those that do attempt to create a services supply-chain approach the challenge from a materials management perspective (Mckone-Sweet, 2005). To understand why service industry supply chains have this manufacturing bias, the identification of the root influence is necessary.

The root influence originates in the presentation of the value-chain. Porter, in Competitive Advantage, describes the value chain in terms of a traditional manufacturing and product delivery cycle (Porter 1985). The chain

consists of the following elements,; Inbound logistics, Operations, Outbound logistics, Marketing and Sales, and Service (M. E. Porter, 1985). It is quite evident the relation of supply-chain to the value chain by comparing the processes. Similar to current SC models, the value-chain model relates service to replacement management, fix and repair and spare parts. Porter's initial value-chain research leads him down the path of analyzing specific industries and the application of the value chain. One of the industries he focuses on is health care. His goal in analyzing the health care industry is to understand the dilemmas posed by this complex industry (M. Porter, Teisberg, E., 2006). The analyses eventually lead to understanding that the health care supply chain does not exist. Generalized, a supply-chain does not exist for the entire service industry sector. Support for this conclusion follows.

Porter's later research presented in a 2004 Harvard Business Review article opined on why health care competition failed and explored the nuances and influences of the value chain. This article interestingly "resulted in many comments and requests on how to operationalize their recommendations" (M. Porter, Teisberg, E., 2006).

The result from the feedback is the idea advocating value based competition within health care; however, no strategic or operational framework existed at the time. One of the key recommendations in the research, besides the need for a framework, included the development of a model for coordination of services.

The value chain work of Porter and Teisberg resulted in further research by others. One of the researchers, Burns, presents his views by defining the health care value chain. The definition parallels those of supply-chain management quite closely. A service value chain is defined “as a cooperation and coordination effort to drive efficiencies between supplier and provider through the use of best practices and strategic alliances” (Burns, 2002). Like Porter, Burns builds upon the strategic idea that the health care value chain and the supply chain are good ideas(Burns, 2002).

However, neither addresses the need to operationalize their ideas, nor does either consider the customer an integral part of the process. As an example Burns’ value chain for health care is; Payer, Fiscal Intermediary, Provider, Purchaser and Producer (Burns, 2002). This process completely ignores the patient involvement. Both researchers, however, demonstrate the splintered health care delivery system and correspondingly that of the services industry (Burns, 2002; M. Porter, Teisberg, E., 2006). Fortunately, others have taken a different approach to determining the supply chain.

In research funded by ASU/CHMR (Arizona State University/Center for Health Management Research), the influence of the customer on the supply-chain cycle is evident. In this research, the supply-chain definition is “the information, supplies and finances involved with the acquisition and movement of goods and services from the supplier to the end user in order to enhance clinical outcomes while controlling costs” (Schneller, 2006).

The concept behind this definition is the balance of cost-efficiency vs. customer care. In essence, the definition suggests deploying a nimble and responsive supply-chain system to provide services to customers. As with most definitions applied to the service industry one of the issues is the focus on the link between product suppliers and providers. It is promising however that the patient is a part of the service.

European researchers have taken a more holistic approach. Beech and Vissers take the view that a framework constructed from the bottom up using processes to drive tactical decisions and in turn drive strategic decisions is the way to proceed. The three layers recommended are:

Strategic – infrastructure and planning policies

Tactical – Demand Chain – Care Chain

Operations – Clinical (Vissers, 2005).

This is very similar to the SCOR model. SCOR is a process driven model that delineates each of these focal areas. Relating these concepts to SCOR equates the strategic layer to SCOR's planning layer, tactical to execution and operations to enablement. Interestingly, no reference to SCOR exists in their research.

In their research, the description of service consists of two parts, business processes and operational processes. Unfortunately, the decoupling of the business processes and operational processes is all too evident. This view has been supported elsewhere by Vissers and others(Vissers, 2005).

In applying the three-layer concept described above some have approached the services supply chain by creating supply chains specific to an operation (Beech and Bell 2005). In this particular research, the development of a supply chain specific to a health condition is explained. This specificity to a process does not account for the nuances that are enterprise wide within the supply chain.

Again, the creation of a generalized service framework results in a point solution. One benefit from the research is the suggestion that a framework should address: planning questions, analysis and sources of data, and what information should be analyzed and mined (Beech and Bell 2005). As evidenced above, the supply-chain research presented is very fractured and dislocated at times. The foundation of a value chain understanding the centrality of the customer in the service industry is also non-existent. What is beneficial is the traction of process based supply-chain management. The important aspect of all of this is the point Burns, Everard and Porter all allude to: a service supply-chain does not exist and is necessary.

A common thread among all of the frameworks is they describe the characteristics of the service supply chain. They do not describe a framework that exists. Therefore, this research will use the SCOR framework as a basis for the design of a general service supply chain.

There are two compelling reasons for this. First, SCOR is generally accepted within the supply-chain community. While the GSCF model provides

close competition, it is not as prevalent in the literature reviewed. Second, SCOR provides for extensibility since it is process based. Being process based allows for generalization of the framework and implementation at the specific level necessary for the organization. Contrasted with GSCF using organizational functions, where a significant effort intra-organizationally is required to implement within the parent organization, let alone coordinate with other organizations.

With the basis for a framework proposed, understanding the service industry in detail is necessary. This is a daunting task for any research. Therefore, brevity will influence the analysis. In selecting an industry within the services sector, one that is representative of multiple service types is preferred. One such industry is health care. Regulatory forces, financial transactions, financial services, product and materials management as well as inherent customer involvement influence health care significantly. This combination makes health care an ideal case. The next chapter presents the implementation followed by a detailed case study.

Summary

A characterization of recent supply chain literature highlights the focus on integration and optimization of supply chains (Ferdows, 2004; Slone, 2004). The goal is to gain efficiencies and simplify business processes. This is a prudent

goal for all industries. Despite the prudent nature of the goal, not all industries are fortunate enough to participate in the supply-chain benefits.

Employment of supply-chain management concepts to accomplish this goal is prevalent throughout the manufacturing and product management industry. This is not the case within the services industry. The literature review presents many reasons for this, chief of them being the manufacturing centricity of current frameworks. A lack of understanding service industry operations and the complexity of the service industry are root causes of the manufacturing centricity in current frameworks.

The proposed remedy is the development of a comprehensive supply-chain framework for the services industry using SCOR as an example. Input for the development process includes case-study analysis, determination of shared service industry characteristics and expert opinion. The following chapter presents the development and implementation of a services supply chain.

CHAPTER 3 METHODOLOGY

The goal of SCM is to “meet customer service objectives, while at the same time minimizing inventory and related costs“(Jones and Riley, 1985; Houlihan, 1985). Global competition highlights why companies should implement a SC. Besides increasing pressure to boost profits, competition within all markets is becoming tougher. As a result, the relevancy of the goal continues today, just as it was when the SCM discussion began in the 1980s.

Similar to the constancy of the goal, the focus of the SC models remains constant as well. The manufacturing focus was the theme in all of the literature reviewed thus far; highlighting the need for a SCM, framework and SC model for services.

Therefore, the identified research opportunity is the development of a primary view of a services supply chain model (SSCM) along with pertinent secondary views. These views will describe the SSCM using a generally accepted modeling methodology.

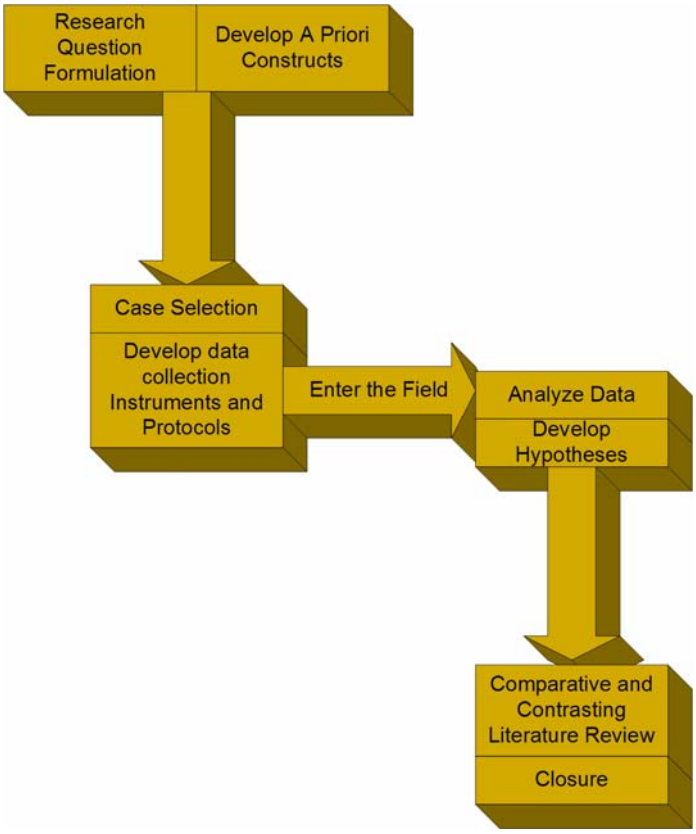
For this research, there will be two phases of analysis. The first involves the analysis of idealized cases. This analysis provides the input characteristics to use in the development of the SSCM processes. The second phase uses the characteristics to develop and implement a new SSCM standard. Verification of the model is in the next chapter.

Phase I

Theory development using case analysis originates in the study of social sciences and organization management. Application to business and engineering is recent. The literature does however suggest case analysis is becoming an accepted method of studying engineering processes (Bonoma, 1989; Kulonda, 2001).

There are many analysis processes available. To understand the breadth of case research method, select any book discussing quantitative and qualitative case based research (Kirk, 1986). The process selected for this research is the one suggested by Eisenhardt. In the process are the necessary details and methods used to build empirically valid theory from case studies (Eisenhardt, 1989). One downside to case based analysis is the predisposition to create overly complex theory or the development of narrowly focused theory (Eisenhardt, 1989). An illustration of the entire case based theory process is in Figure 6.

The goal of the case analysis is to create a SC model independent of the constraints of current models. A first step in accomplishing this goal is to understand the characteristics of the service industry operations that contribute to the supply-chain. To do this the research starts by clarifying the research question.



(Eisenhardt, 1989)

Figure 6: Depiction of the case analysis process.

Research Question

The primary research problem is the absence of a service industry specific supply-chain model. This is a broad goal intended as the primary contribution to the supply-chain body of knowledge. A macro analysis of this goal would prove elusive. Therefore, it is necessary to develop a set of fundamental questions to refine the analysis.

The primary research goal is suitable as an initial frame of reference. As such, the research starts with current supply-chain models. The literature review reveals that multiple supply-chain models exist; some are general while others are for specific purposes. This begs the question about adaptability. Therefore the first question is;

"Can the current supply chain models be extended or altered to fit the service industry supply chain?"

It follows that if altering the models to fit the needs of the service industry is not feasible, can they contribute ideas, processes or formulations? Therefore a second query is;

"What are the characteristics of the service industry supply-chain that should be reflected in the SSCM?"

In answering the first question, the literature suggests that current models may be able to adapt to service industry needs (L. Ellram, Tate, W., Billington, C., 2004; Fitzsimmons, 2006). In fact many cases have been developed where the SCOR model was adapted to a "Services" requirement (Alvarado, 2004; L. Ellram, Tate, W., Billington, C., 2004; D. M. Lambert, 2006). Reviewing the type of "service" showed that the service implied was an extension of the product or manufacturing supply chain. Specifically, the service is part of the return management life cycle.

However, when alignment of the definition of service with the United States Government definition takes place, issues arise with generalization. The

issue with generalization of services is that grouping of the industries is not easily accomplished. In order to preserve the integrity of the sector the groups should exhibit similar characteristics. This then becomes the second goal of the proceeding analysis.

Case Selection

The research question identifies the service industry as the primary focus of the research. A secondary goal of the case analysis is to determine characteristics of service industry companies that describe service operations. The next step in the process is case selection.

In case analysis, selection of cases is typically a theoretical sampling (not random) of descriptive cases within the selected area of work (Eisenhardt, 1989). When possible the case selection should demonstrate polarity within the research subject area. Further, to ensure an appropriate level of detail, it is imperative to select a significant number of cases to build consensus and the validity of the research. Typically, the selection of 4-10 case studies is sufficient (Eisenhardt 1989). The case studies in this research will aid in determining the common characteristics of supply operations within the service industry.

To determine the common characteristics, the research must analyze the service industry as generally as possible. Generalization allows for assessment of multiple scenarios occurring cross-industry, insuring the characteristics apply

to the general operations shared by the industry and not a specific industry function. The broadest generalization is the government definition of industries that are service oriented presented in Table 1. The government identifies service industries as non-agriculture and non-manufacturing. The industries that fall within this classification create a diverse list. Further, the list in Table 1 does not describe attributes of service delivery and types of service.

The literature indicates that analysis of this entire list is time intensive and may yield only marginal improvements of the data (Fitzsimmons, 2006; Sampson, 2000). Sampson and Lovelock suggest the use of taxonomies to facilitate the decomposition of the service industry into manageable groups (Lovelock, 1996; Sampson, 2000).

The taxonomy types suggested describe the nature of the service. The taxonomy types are:

- mind,
- body,
- belonging; and
- information(Fitzsimmons, 2006).

Each of the taxonomies above describes how a service interacts with the customer. For example, a service performed for the mind is an intangible that benefits the mind, such as education, entertainment or therapy. Services that benefit the body include transportation or funeral services. Belongings on the

other hand include landscaping, pool service or auto repair. Finally, information includes investing, accounting advice and legal service.

Use of the taxonomies provides a cross-reference of service industries from the government's list related to the theoretical taxonomy decomposition of the service industry.

Table 5: Correlation of Service Sector to Service Type.

Service Sector Industries (Goodman, 2002)	Service Sector Type (Fitzsimmons, 2006)
Certain Agricultural Services (i.e. landscaping, horticulture	Belonging
Hotels and other Lodging	Body
Personal Services (i.e. dry cleaning, hairstyling, tax preparation)	Belonging
Business Services (i.e. temp agencies, software)	Information
Automotive Services	Belonging
Miscellaneous Repairs	Belonging
Motion Pictures	Mind
Amusements and Recreation	Mind
Health care	Body
Legal Services	Information
Private Education	Mind
Social Services	Mind
Museums, Botanical Gardens and Zoos	Mind
Membership Organizations (i.e. Associations, Churches)	Mind
Engineering and Management Services (i.e. consulting)	Information
Miscellaneous	Unknown

Using this theoretical breakdown narrows the required case types necessary to derive the common characteristics. Now, instead of focusing on the entire government list to determine a general model, only the four taxonomy groups identified for service industries are necessary for case study selection.

Selection of the case studies is from the Harvard Business Review Case Study database. The selection consists of four case studies based first on taxonomy and then by industry. Table 6 relates the case study selected with the taxonomy and industry.

Table 6: Selected case study related to taxonomy and industry represented.

	Case Study	Taxonomy	Industry
Case 1	How Business Schools Lost Their Way (Bennis, 2005)	Mind	Private Education
Case 2	Intermountain Health Care (R. Bohmer, Edmonson, A., 2002)	Body	Health care
Case 3	Commerce Bank (Frei, 2002)	Belonging	Personal Services
Case 4	Client Co-Production in Knowledge-Intensive Business Services (Bettencourt, 2002)	Information	Engineering and Management Services

Table 7 associates each case study with the taxonomy and representative industry. By using these case studies, a comprehensive analysis of service industries can take place.

Table 7: Generalized case study association.

Service Sector Industries (Goodman, 2002)	Service Sector Type (Fitzsimmons, 2006)	Associated Generalized Case Study
Certain Agricultural Services (i.e. landscaping, horticulture	Belonging	(Case 3)
Hotels and other Lodging	Body	(Case 2)
Personal Services (i.e. dry cleaning, hairstyling, tax preparation)	Belonging	(Case 3)
Business Services (i.e. temp agencies, software)	Information	(Case 4)
Automotive Services	Belonging	(Case 3)
Miscellaneous Repairs	Belonging	(Case 3)
Motion Pictures	Mind	(Case 1)

Service Sector Industries (Goodman, 2002)	Service Sector Type (Fitzsimmons, 2006)	Associated Generalized Case Study
Amusements and Recreation	Mind	(Case 1)
Healthcare	Body	(Case 2)
Legal Services	Information	(Case 4)
Private Education	Mind	(Case 1)
Social Services	Mind	(Case 1)
Museums, Botanical Gardens and Zoos	Mind	(Case 1)
Membership Organizations (i.e. Associations, Churches)	Mind	(Case 1)
Engineering and Management Services (i.e. consulting)	Information	(Case 4)
Miscellaneous	Unknown	Unknown

Data Collection

Once selection of the cases occurs, data collection and analysis can begin. Data collection derives the necessary data from the selected case studies. Analysis typically consists of case comparison, researcher notes and insights in the within-case analysis using the data collected. A key characteristic that should be prominent is the overlap of data analysis. Overlap reinforces the validity of data points derived from the research.

The data collection methods should be flexible to allow for indication of important insights into the cases. As many methods are suggested it is recommended to reference Yin for further detail if necessary (Yin, 1984).

Data collection requires a standardized collection process. The data collection processes for the analysis of the cases include:

- questionnaire based on characteristics of a supply-chain ,
- current supply-chain model gap analysis shown in Figure 7; and,
- cross case analysis.

The questionnaire derivation uses the characteristics of the service industry and supply-chains identified by the literature. The characteristics of service operations include, participation of the customer in the process; simultaneity of creation and consumption of the service; perishability of the service, whether the service is used or not; intangibility of the service; and heterogeneity of the service delivery (Fitzsimmons, 2006). A summary of the answers is in Table 8.

Analysis of the results focuses on the similarities between the case studies. A summary of the similarities provides input for the cross case analysis.

The next data collection instrument is a mapping of these case studies to the SCOR model. An example of the results of this process is in Figure 7. The analysis demonstrates the weakness of the SCOR model in adapting to the service industry. Insights from this process will confirm or negate the insights from the questionnaire.

The next data collection is cross case analysis using researcher insight into the applicability of CCOR and DCOR models. Specifications for these models suggest they provide a framework for customer interaction and may provide useful insight into high-level business processes accepted by the general supply-chain community. Further, the use multiple techniques for data analysis

enables overlapping the data collection process and the inclusion of insightful notes in a standardized manner.

Manufacturing Case Study:
Company Description – Large manufacturer providing widgets to end consumer as well as corporate customers
Product Description – Widgets are constructed of 5 raw materials using two separate manufacturing processes; Raw materials are provided by 3 Suppliers and are transformed by 2 Processors before being provided to Final Manufacturing
Transportation – Ground shipment between suppliers and between end-stage manufacturing and customer

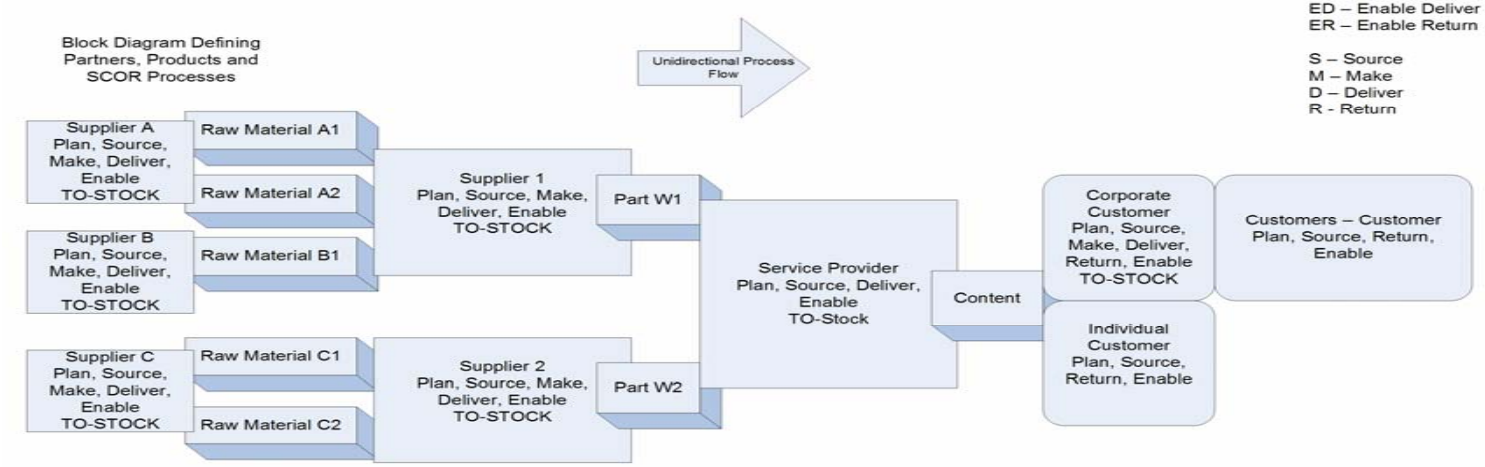
Use SCOR to define the Supply Chain

SCOR Model Processes

P1 – Plan Supply Chain
P2 – Plan Source
P3 – Plan Make
P4 – Plan Deliver
P5 – Plan Return

EP – Enable Plan
ES – Enable Source
EM – Enable Make
ED – Enable Deliver
ER – Enable Return

S – Source
M – Make
D – Deliver
R - Return



SCOR Level 2 Processes

Name	Role	Product	SCOR Level 2 Processes
Manufacturer	Focus	Widgets	P1, P2, P3, P4, EP, ES, EM, ED, S1, S2, M3, D3
Supplier A	Supplier's-Supplier	RM A1, RM A2	P1, P3, P4, EP, EM, ED
Supplier B	Supplier's - Supplier	RM B1	P1, P3, P4, EP, EM, ED
Supplier C	Supplier's - Supplier	RM C1, RM C2	P1, P3, P4, EP, EM, ED
Supplier 1	Supplier	Part W1	P1, P2, P3, P4, EP, ES, EM, ED, S1, M1, D1
Supplier 2	Supplier	Part W2	P1, P2, P3, P4, EP, ES, EM, ED, S2, M2, D2
Corp. Customer	Customer	Widgets	P1, P2, P4, P5, EP, ES, ED, ER, S3, M3, D3
Individual Customer	Customer		P1, P2, EP
End- Customer	Customer's - Customer		P1, P2, EP, ES, S3

Figure 7: Sample of process used in comparing cases with current SC models.

Table 8: Summary of answer correlation between case studies

Service Case Analysis Questions	Case 1	Case 2	Case 3	Case 4
How is demand managed?	✓	✓	✓	✓
What is demand dependent upon?	✓	✓		
How is inventory linked to demand?	✓	✓		
Is inventory a tangible?				
Is inventory an intangible?	✓	✓	✓	✓
Are there concurrent processes?		✓		
How are concurrent processes managed?				
How is status of a process determined?				
How is a process initiated?	✓	✓	✓	✓
Who/What is the initiator of the supply-chain process?	✓	✓	✓	✓
Are there outside links to other supply-chains evident?	✓	✓	✓	✓
How are the external links managed?				
Are external links to other services?	✓	✓	✓	✓
Are external links for product to fulfill the service?		✓	✓	
Are external links for customer service?				
What aspects of the SCOR model are evident?	✓	✓	✓	✓
What aspects of the CCOR model are evident?	✓	✓		✓
What aspects of the DCOR model are evident?				
What aspects of the GSCF model are evident?	✓	✓	✓	✓
What aspects of customer-duality are evident?	✓	✓	✓	✓
What other characteristics are evident?				
What performance measures are evident?				
How is performance measured?				
Can best practices be employed to improve efficiency?				

Service Case Analysis Questions	Case 1	Case 2	Case 3	Case 4
How is demand managed?	✓	✓	✓	✓
What is demand dependent upon?	✓	✓		
How is inventory linked to demand?	✓	✓		
Is inventory a tangible?				
Is inventory an intangible?	✓	✓	✓	✓
Are there concurrent processes?		✓		
How are concurrent processes managed?				
How is status of a process determined?				
How is a process initiated?	✓	✓	✓	✓
Who/What is the initiator of the supply-chain process?	✓	✓	✓	✓
Are there outside links to other supply-chains evident?	✓	✓	✓	✓
How are the external links managed?				
Are external links to other services?	✓	✓	✓	✓
Are external links for product to fulfill the service?		✓	✓	
Are external links for customer service?				
What aspects of the SCOR model are evident?	✓	✓	✓	✓
What aspects of the CCOR model are evident?	✓	✓		✓
What aspects of the DCOR model are evident?				
What aspects of the GSCF model are evident?	✓	✓	✓	✓
What aspects of customer-duality are evident?	✓	✓	✓	✓
What other characteristics are evident?				
What performance measures are evident?				
How is performance measured?				
Can best practices be employed to improve efficiency?				

Service Case Analysis Questions	Case 1	Case 2	Case 3	Case 4
Is the customer and supplier independent at each tier?	✓	✓	✓	✓
Does each independent supplier interact with the customer at each level?	✓	✓	✓	✓
Does each independent customer interact with the supplier at each level?	✓	✓	✓	✓
If there are multiple supply chains, how is the customer defined?	✓	✓	✓	
How are the characteristics of each supply chain changed when interacting with a service?	✓	✓		
Is a service fulfillment dependent upon external supply-chains for completion of the service?	✓	✓	✓	

Analysis

Within-case analysis is the primary method of analyzing the data. For the cases, information provided by the questionnaire and the insight into the ability of the current operations reference models to handle the case scenarios provides useful information to determine characteristics of the service supply chain. The gaps for each case analysis and the questionnaire provide the data necessary for case comparison.

Current models have many limitations when applied to the services industry. Two of the most significant limitations of the SCOR model are the semantics and process types. The limiting factor of the semantics and process types is the connotation of the embedded definitions.

An example is the definition and use of the “MAKE” process. Semantically the “MAKE” definition in SCOR is the process of manufacturing that adds value to a product (SCC, 2006). The conversion of the SCOR “MAKE” process to service semantics creates a situation that is lost in translation. In fact, “MAKE” in the service industries does not have a direct translation. Another process that is not in any services setting is the “RETURN” process. One reason is that the physical return of a service is highly improbable. This is because once a service is rendered the service is consumed, thus invalidating the semantic and process descriptions in relation to services (Fitzsimmons, 2006).

Besides semantics and processes creating limitations, the complexity of the models is another limiting factor. Manufacturing models are simple compared to providing a service to a customer. Using the “PLANNING” process of the SCOR model as an example highlights the differences in the levels of complexity.

Take for instance the planning of supply and demand. Manufacturers plan and schedule based on certain known quantities that they are to deliver. Conversely, in services, the planning is input controlled rather than output influenced. Therefore, the planning focus is on making inventory available for events that may or may not happen.

Another observation is that within a service supply chain the clear delineation of the focus organization tasks is essential. This suggests that the service supply-chain model have the ability to integrate with product delivery models described within the SCOR model, the CCOR model and the DCOR model. The data presented leads to the conclusion that the models taken singularly do not provide the flexibility required to enable a service supply chain.

Evident from the model comparison are the following elements:

- Customer input is not documented within the supply chain
- Semantics create difficulty in adaptation of the supply chains
- The operations reference model for design and customer are not integral to the supply-chain operations reference model.

- Performance metrics are specific to the manufacturing and product delivery process.

The questionnaire data confirms the insights from the model comparison. For example, multi-tier customer interaction between supply chains is not evident in any of the cases. This confirms the notion that customers are not an integral part of operations methodologies today. However, the literature suggests that the customer is an operational cycle within the business. Insight such as this from the questionnaire summary provides the input, in conjunction with the model comparisons, to develop the service industry characteristics.

Using the information above provides the foundation for the generalization of service industry characteristics for the supply-chain. The results from the generalized case analysis detail seven characteristics exhibited by service industry supply-chains. The characteristics are:

- Non-government
- Perishable
- Finite inventory
- Variable demand
- Customer requested
- Single event
- Micro- process level; at the Macro level this process may fall through.

The first of these characteristics is that all service companies are non-governmental entities. While the government provides services, it does so in a

non-capitalist environment. This provides for control of the service and does not adequately allow for variations of services. The services provided are also not typically dependent upon external sources to complete, as often is the case with government.

The second characteristic is that all services are customer requested. The fact that the service is customer requested differs significantly from the manufacturing based supply chains. Common to the SCOR, SCOR Extended, CCOR and the GSCF models is that all of the processes exist thru a prearranged agreement with customers. Within the services industry there is typically not a pre-arranged agreement involving preparation for rendering of services. The expectation exists that the rendering of a service occurs when requested, given that inventory exists.

A third characteristic is the finiteness of the inventory models. Within all of these case studies, the inventory is limited in terms of expansion capacity. An example is the Intermountain Health Facility. While demand may be extraordinary, the physical limit of time available is limited and cannot expand. While the point that the workday can extend to a 12-hour day or even a 24-hour day is valid, the amount of time is still limited to the maximum of 24 hours.

The next characteristic is the variability of demand. In all of these cases, the demand plans for consumption of available inventory. However, the demand is not always present. In the case of service-based companies, short-term reduction of inventory is not practical. This is in contrast to a product-

manufacturing environment, where if following good manufacturing practices, demand should be close to available inventory. While in both cases the demand may decrease, the adjustments for the increase in the short-term are feasible within the product-manufacturing environment. Typically, in the short-term the demand variability within the services is still restricted to the availability of the finite inventory.

Another characteristic of the services supply chain cases is the fact that the management of customer requests is a single event. Using an accounting office as an example, a single event is the request by the customer to perform tax services for a specific timeframe. This is characteristic for all of the events within the service industry; there is a specific terminating time. Contrast this with the product-manufacturing environment where there may be steady state processes and terminating processes.

The final characteristic observed from the idealized cases is the fact that the examples are restricted to the micro process level. This indicates that the processes from the case studies function specifically within a local environment, or in terms of economics at a microeconomic level. As such, one can make the general assumption service industries are independent from other environmental factors that may influence the inventory-demand cycle. Contrasted with the macro level, the global inventory or demand fluctuations exert influence on the processes.

A final observation in the formation of the characteristics is that the service supply chain cannot function without interaction with the product supply chain and the customer supply-chain.

Based on the characteristics derived from the idealized cases, we can assert that a planning function, a request function, a service rendering or fulfillment function and a deliver function exists. At this point however, there is the need for flexibility to ensure that as comprehensive a model as possible is developed. To accomplish this, the next iteration of case analysis is required using these characteristics to create an initial model. Table 9 maps the processes to the characteristics identified from the research. Figure 8 presents the model pictorially.

Table 9: Supply-Chain process mapped to identified characteristics.

Service Sector Characteristics	Supply-Chain Process
Non-government	Planning, Fulfillment
Perishable	Deliver
Finite inventory	Planning, Fulfillment
Variable demand	Request
Customer requested	Request, Fulfillment, Deliver
Single event	Fulfillment, Deliver
Micro- process level	Planning

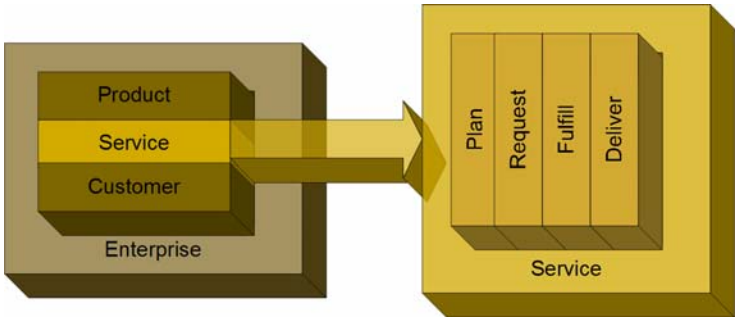


Figure 8: Depiction of the proposed services supply chain model.

Using the case studies to develop multiple scenarios, the analysis of each process occurs. The scenarios help determine the order of process execution. A sample scenario would describe the how, why, when and where of an event. For example, an individual arrives at a hospital for an outpatient procedure. Before arrival, the individual has requested an appointment. The planning for the appointment occurs before the initial request; therefore, planning must be the initial step in the service. The second step, request, is a result of the customer creating the demand that has been scheduled for within the planning process. Since it creates the demand, it follows that request is the second step in the service process.

Once the patient has arrived at the hospital, the hospital will fulfill a service. This service is independent of the type of service or individual clinical process; instead, the fulfillment is a result of multiple steps occurring to provide a final service to the individual patient. Conclusion of the fulfill process is the delivery of the service. Multiple processes are required during delivery to finalize

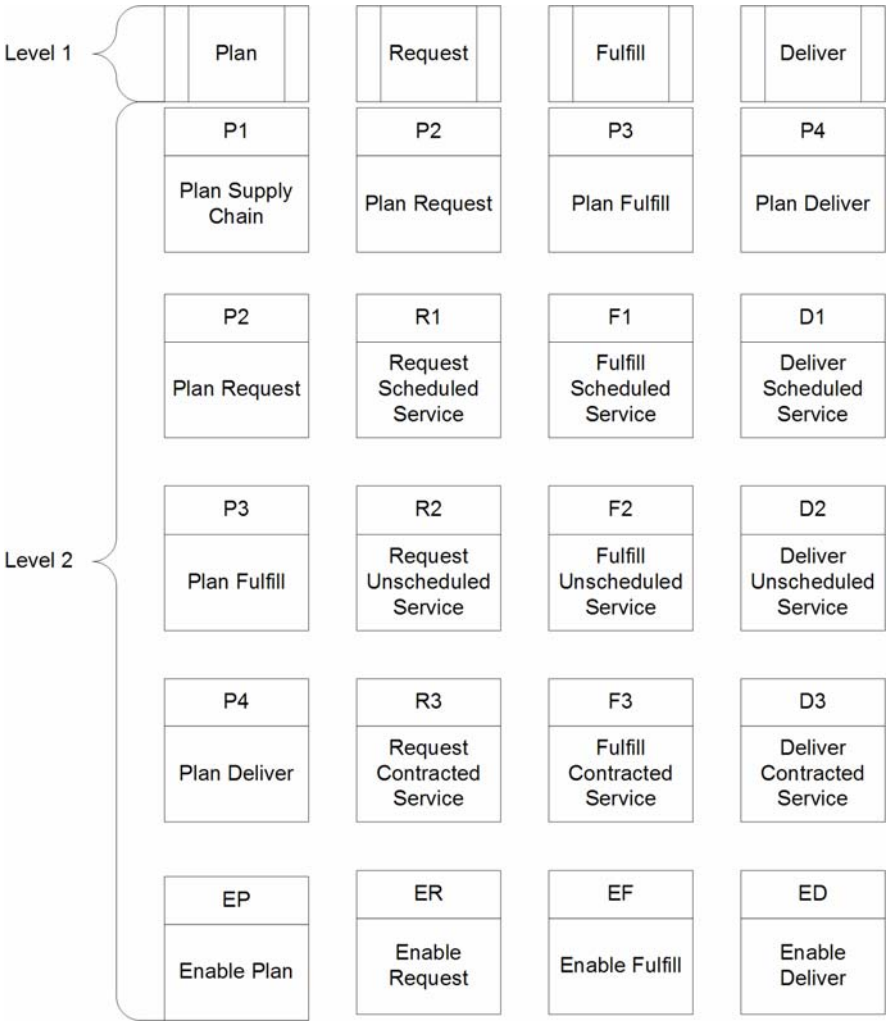
the service chain. This creates the settlement process. As settlement is the definition of deliver in the proposed model, Deliver is the final process.

Multiple analyses similar to this vetted the execution process and the names of the processes. The scenarios were also discussed a number of times with experts in the supply-chain field to verify the chain. Results of the scenario analysis indicate the order of execution is planning, request, fulfill, and deliver is appropriate.

After establishing the execution order of the processes, the links between the processes create the “chain.” The linked processes are Level 1 processes, using the Supply Chain Council (SCC) parlance. Before continuing, an introduction of the concept of Levels within the SCC is necessary.

The SCC uses the term Level to describe the hierarchical association of processes. For example, Level 1 is the top level describing the types of processes. Level 2 describes the configuration level and categorizes the processes, while Level 3 is the decomposition of the processes at the element level. Level 4 is the next level and describes the implementation. Level 4 is what impacts the end-user directly as it is the decomposition of the elements into the detailed processes. For this research Level 4, is the final Level analyzed. Therefore, based on the above description, the processes in Figure 8 are Level 1 processes for the new services supply-chain model. Execution of a similar scenario analysis identifies the Level 2 processes. Figure 9 summarizes the

resulting characteristics describing Level 1 and 2 using the same presentation format as the Supply Chain Council.



(SCC, 2006)

Figure 9: Representation of the services supply-chain Level 1 and Level 2 processes using the presentation format of the SCC.

Creation of Level 3 processes use the same methodology as for Level 2. The difference is instead of using Level 1 as the primary driver, the Level 2 processes determine the elements that compose the Level 3 processes. A

summary of the Level 3 processes are in the appendix. At Level 3, the processes are described further using a schematic.

The resulting model defines the service supply chain. The name of the model is S^2COR, Services Supply Chain Operations Reference. To capture the model, the document in the appendix presents the proposed standard. What follows is a summary of the document and a sample implementation. The implementation describes the PLANNING process through Level 3.

Phase II

S^2COR

The Services Supply Chain Operations Reference (S^2COR) Model addresses the issues specific to the Service industry. The interactions between entities occur at the enterprise level. This model can serve as the starting point for future efforts related to the development of common business processes for the provisioning of services and input to the development of a robust Service Supply Chain Operations Reference model.

The model's structure and descriptive tools are adapted from the Supply Chain Operations Reference (SCOR) framework version 8.0 (Supply Chain Council 2006). While similar in presentation and detail, the new framework is the result of an original development effort. Adaptations from SCOR include the:

- Naming conventions and nomenclature,

- Specification outline,
- Process diagram organization,
- Multi-level approach to hierarchical model development,
- Use of “PLAN” as an initial Level 1 process; and
- The Plan/Enable/Execute terminology (SCC, 2006).

All other information is original.

This document introduces the S^2COR model. The introduction includes guidance and technical details for the implementation of the model.

Development of the model focuses on the description of business activity associated with the fulfilling of a customer service request. Organization of the model is around four processes; PLAN – REQUEST – FULFILL – DELIVER. Similar to the original SCOR model, the goal is describing the continuum of service supply chains using a common definition. The intended result is that multiple enterprises can communicate and integrate the supply and delivery of information, services and goods.

It is important to understand that the model intent is not to capture all business processes or activities related to the services supply chain. Rather, the intent is to provide a broad enough framework to facilitate the adaptation of processes and activities.

Like SCOR, S^2COR has three primary levels of detail described in the specification. Secondary levels, such as Level 4, are for description of processes specific to the implementing organization.

The Supply Chain Council (SCC) uses the term level to describe the hierarchical association of processes. For example, Level 1 is the top level describing the types of processes. Level 2 is the configuration level and categorizes the processes, while Level 3 is the decomposition of the processes at the element level. While an organization can use the Level 3 processes as-is further decomposition into Level 4 enhances the frameworks usefulness. Level 4 describes the implementation of performance measures specific to the implementing organization. From a process point of view, Level 4 also describes the workflow of the organization using standard flowcharting techniques. The final level, Level 5, details the transactions of the processes described in Level 4. The transactions are either human or technology managed.

As described above, implementation of the model requires extension to Level 4 and Level 5 to account for organizational processes, systems, practices and transactional detail. With respect to end users, Levels 4 and 5 impacts them directly as it is the decomposition of the elements into the detailed processes. Development of the S^2COR framework, Level 4 and Level 5 are not included.

S^2COR is also a BP reference model that links process elements, metrics, best practices and execution features associated with a business activity.

Supporting the organizational structure of PLAN, REQUEST, FULFILL, and DELIVER are three process types: planning, execute and enable. Borrowing from the SCC terminology, the following definitions apply:

Planning – generally occurs at regular intervals and can contribute to response time of the supply-chain.

Execute – triggered or planned activities based on planned or actual demand

Enable – prepare, maintain and manage information or relationships that the Planning and Execute processes rely on.

Description of the model uses a standard set of notation throughout the model. P relates to PLAN elements, R to REQUEST elements, F to FULFILL elements and D to DELIVER elements. An E preceding indicates an enabling process. For example, EP is Enable Planning. Since the model is hierarchical, notation of Level 3 uses a decimal association with the process element. For example P1.1 indicates a planning process at Level 1 associated with supply-chain planning at Level 2 and specifying the identification, prioritization and aggregation of requirements at Level 3.

Sections describing Plan, Request, Fulfill and Deliver use a standard structure. At the beginning of each section, a graphic depicts the relation of each process, input and output. Following the graphic is a text table identifying: 1) a standard name for the process element, 2) notation for the process element, 3) definition of the process element, 4) any performance attributes, 5) metrics and 6) best practices.

Within the each Level 1 process, a common internal structure germane to the performance of services is in use. The structure consists of three types of

service requests; scheduled, unscheduled and contracted. Therefore, each process element will have a Plan Scheduled Service, Request Scheduled Service and so on for each type of service.

Each enable process uses the same format, graphic and description process.

Metrics for this initial model apply at Level 1 only. This should allow for the development of Level 2 diagnostic metrics in future evolutions. Each metric corresponds to a performance attribute. The SCC defines performance attributes as characteristics that allow for comparison and effectiveness evaluation of supply-chains. Performance attributes associated with the S^2COR model are attributable to customer associated activities and internal activities. Customer activities measure reliability, response and flexibility. Internal activities measure costs and asset utilization. The following definitions correspond to the attributes:

- "Reliability – accurate delivery of the requested service
- Response – speed with which service is completed
- Flexibility – ability to respond to market, supply and demand changes
- Costs – operation costs, both indirect and direct
- Assets – management of assets used in the fulfillment and delivery of a service" (SCC, 2006).

A description of the corresponding attribute and metrics are described below using nomenclature and presentation format of the SCC (

Table **10**).

Table 10: Performance attribute and metric association table (SCC, 2006).

	Performance Attributes				
Level 1 Metrics	Customer Facing			Internal Facing	
	Reliability	Response	Flexibility	Costs	Assets
Rate of request fulfillment	X	X			
Request cycle time		X			
Demand flexibility			X		
Management cost				X	
Cost of Services				X	
Cash to Cash Cycle Time					X
Return on Assets					X

While the determination of metrics beyond Level 2 is not feasible at this time, there are suggestions for the types of Level 2 metrics. Table 11 describes potential metrics related to performance attributes for Level 2.

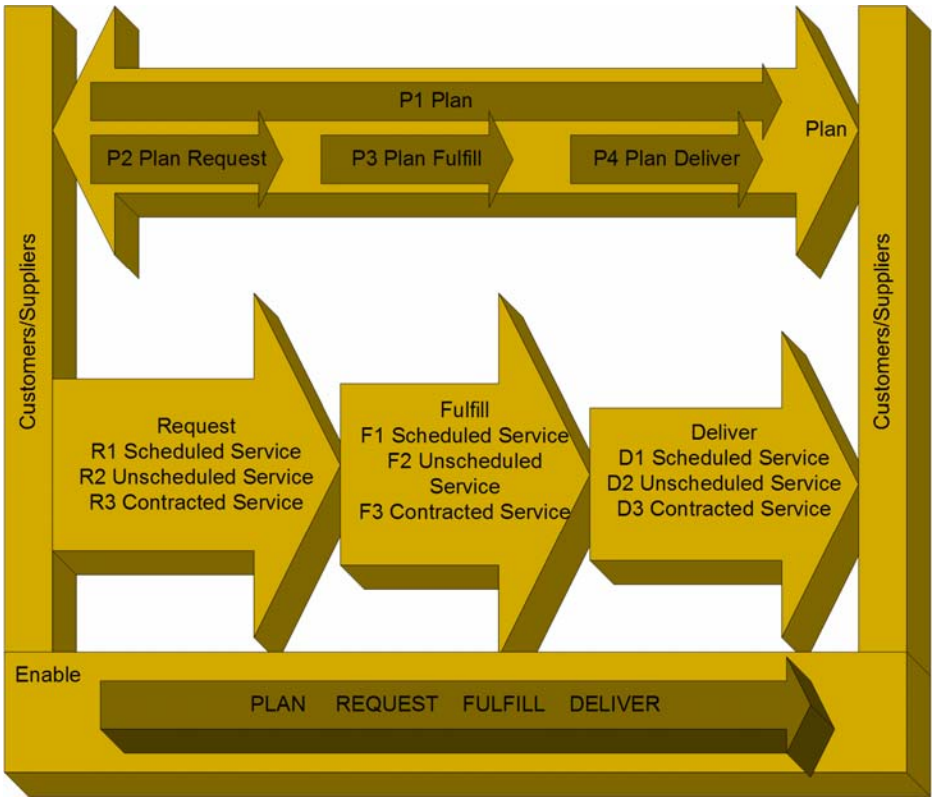
Table 11: Description of potential metrics for Level 2.

Performance Attribute	**Metric**
Reliability	Maintenance of scheduled activities
	Appointments cancelled due to oversubscription of available resources
	Time to identify and respond to request for service
Response	Time lag to first available service
	Are adequate reserves available for unscheduled requests
	Measured capacity to meet non-scheduled request
	Time period between notification of request for resources and confirmation of availability
Flexibility	Availability of plan reserved for unscheduled appointments
	Measure of resources available to handle non-routine requests
Cost	Cost of non-productive time or overtime to meet over subscription of services

Following is an overview model of how the Level 1 processes function using a presentation format similar to the SCC (Figure 10).

Model Implementation

Table 12 provides a description of the service processes and each of the sections within the model (PLANNIG, EXECUTION and ENABLE). Table 12 is associated with the document in the appendix.



(SCC, 2006)

Figure 10: Overview of Level 1 process interaction.

Table 12: Front matter section from the appendix describing the sections of the model and defining what a service is.

Process Identifier	**Service**
Description	The definition of service for this research is: Any material or non-material, definable asset requested by a customer where the customer is the initiator of a request, and the asset delivery occurs at any point in time a customer requests usage. The proposed model is defined by 3 process types: Planning processes; Execution Processes; and Enabling processes. Planning processes balance aggregated demand across a consistent planning horizon. Planning processes for this model occur at ad-hoc and regular intervals. Execution processes are planned or actual events. Execution processes include service requests, creation of solutions and request fulfillment. Enable processes manage knowledge, compliance, data and relationships used in planning and execution.

To implement the model the user first identifies the service to model. Using the service selected the user identifies all resources required. This requires development of an action plan and the establishment of an allocation plan (Table 13). The steps associated with P1 provide further detail to the action plan and support the service. At the P1 level (Level 2) are metrics. The metrics are a part of the action plan. The metrics provide data to compare to other industries and processes within the enterprise. A good plan will account for the gathering of the data necessary for calculation. The next step is to describe the Level 3 processes. At the end of the Level 3 processes, the result for P1 will exist.

Table 13: P1 specification from S^2COR.

PROCESS IDENTIFIER:	P1
DESCRIPTION	Develop and establish plan of action for allocation of resources.
CHILD PROCESSES	
P2,P3, P4, EP	
KEY INPUTS	**KEY OUTPUTS**
P2, P3, P4, EP	P2, P3, P4, EP
PERFORMANCE ATTRIBUTE	**METRIC**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
BEST PRACTICES	N/A

Table 14 is the first of the Level 3 processes to analyze. Referring to the child processes gives insight into how the P1.1 data affects other elements. Next, using the INPUT from the identified processes, develop a plan for aggregation of requirements. The processes for obtaining the requirements are at Level 4 and are specific to the organization. The model does not dictate how this process takes place.

Table 14: P1.1 specification from S^2COR.

PROCESS IDENTIFIER:	P1.1
DESCRIPTION	Develop and establish plan of action for identifying and prioritizing aggregate requirements.
CHILD PROCESSES	
P1.3,P1.4, EP	
KEY INPUTS	**KEY OUTPUTS**
P2, P3, P4	P1.3
PERFORMANCE ATTRIBUTE	**METRIC**
BEST PRACTICES	

Table 15 is the second of the Level 3 processes. Notice that no INPUT results from P1.1 for P1.2. P1.2 allocates resources for the service. At this point analysis of requirements and resources is separate. The results of the plan at

this element provide INPUT to P1.3 (Table 16). At this point, a resource allocation plan should exist.

Table 15: P1.2 specification from S^2COR.

PROCESS IDENTIFIER:	P1.2
DESCRIPTION	Develop and establish plan of action for allocation of resources.
CHILD PROCESSES	
P1,P2, P3, P4, EP	
KEY INPUTS	**KEY OUTPUTS**
P2, P3, P4	P1.3
PERFORMANCE ATTRIBUTE	**METRIC**
BEST PRACTICES	

Using the INPUT from P1.1 and P1.2, P1.3 balances the requirements with the resources. A plan should exist at the end of P1.3 that provides input to the final P1.4 process (Table 17). Notice that the Enable Plan element is also a key INPUT. This enables the planning process on a continuous basis and provides for coordination between processes, even at the supply-chain level.

Table 16: P1.3 specification from S^2COR.

PROCESS IDENTIFIER:	P1.3
DESCRIPTION	Develop and establish plan of action for balancing of resources and requirements.
CHILD PROCESSES	
P1,P2, P3, P4, EP	
KEY INPUTS	**KEY OUTPUTS**
EP	P1.4
PERFORMANCE ATTRIBUTE	**METRIC**
BEST PRACTICES	

The final step of the planning process is the creation and communication of the resource and requirements plan. INPUT aggregated by P1.3 provides the necessary information to create the plan. Output is to each of the ENABLE

processes, EP, ER, EF and ED. This is to ensure continuous operation between the Level 1 and Level 2 processes.

Table 17: P1.4 specification from S^2COR.

PROCESS IDENTIFIER:	P1.4
DESCRIPTION	Develop and establish plan of action for communicating plan.
CHILD PROCESSES	
P1,P2, P3, P4, EP	
KEY INPUTS	**KEY OUTPUTS**
P1.3	EP,ER,EF,ED
PERFORMANCE ATTRIBUTE	**METRIC**
BEST PRACTICES	

A schematic of the processes above is included with the document to provide a pictorial path of how the elements link (Figure 11). Notice that the INPUT and OUTPUT information is included as is the process identifier.

Implementation of each process follows the same path. Notice that in other process elements there are links between Level 3, Level 2 and Level 1 processes. What is also unique about this model is that in the Fulfill and Deliver processes there are links at Level 3 that specifically allude to other supply-chains.

This is intentional. The reason is a single supply chain alone cannot handle the materials management necessary for supplies or the customer relationship if a product is part of a service. Currently these are only suggestions, but recent discussion within the SCC alludes to this requirement. This is the first operations reference model including this process.

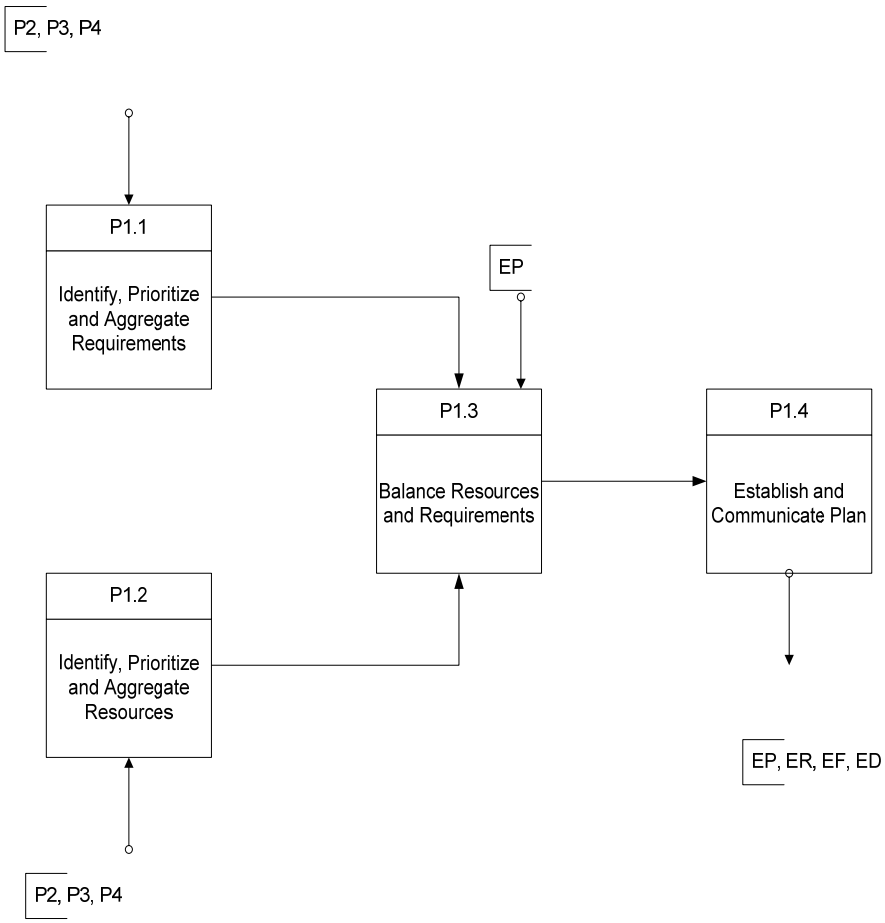
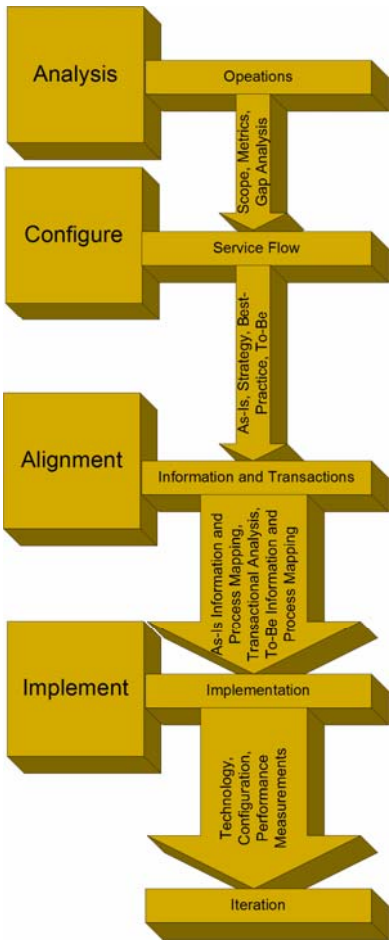


Figure 11: The schematic used to describe the P2 processes at Level 3.

Implementation Plan

To implement the framework requires a structured process (Bolstorff, 2003). Figure 12 depicts a structured flow suggested for the services supply chain framework. As with all business change, the first step is recognizing the need to implement a framework. Once establishing the need and management support, analysis of the operations involved in the services supply chain starts.

Operations analysis consists primarily of defining the scope of the services model and gap analysis. If this is part of the iterative improvement of the supply chain, inclusion of metrics analysis is also necessary.



(Bolstorff, 2003)

Figure 12: Implementation process flow for S^2COR.

The second step of the implementation process is configuration of the operational flow of the service rendered. This step focuses on the current processes, the to-be process and the application of best practices to the to-be

model to improve performance. Strategy alignment is also a consideration that leads into the third step of the process.

Information, technology, and the alignment of operations drive this step. The strategy defined in step two is the primary input and should influence the definition of processes and transactions. The need to influence processes and transactions results from the metrics gathered at Level 3. These metrics ultimately reflect the performance of the supply chain and indicate the degree of alignment of all processes with the strategy. The final step is implement the model described in the previous steps.

The primary implementation tasks are configuration and implementing performance metrics. Once implementation of the supply chain is complete, iteration of the above described processes begins to continuously improve. The key result of this plan is the ability to answer the following questions:

- Does the model define the service chain and reflect the organizational processes accurately?
- Once implemented, does the chain provide the data necessary to asses the established metrics?
- Using the metrics, how does the organization compare to the industry data or to pre-established goals?
- Are the metrics reflective of the organization strategy and is the supply chain succeeding in implementing the strategy?

- Are best practices implemented or is modification necessary to meet industry best practices?

The questions above outline the basic considerations to determine the success of the implemented S^2COR model. Questions that are specific to the organization are also necessary to determine success. Chapter 4 presents a case study describing the implementation of this structure using S^2COR.

Summary

This chapter presents the creation of a services supply-chain model, S^2COR. Creation of the model starts with deriving the characteristics that describe the processes used currently. The process characteristics serve as input into the development of the descriptive processes and terminology used to describe the supply chain. The linking of the processes creates the generalized supply chain. To elaborate on the linked processes and develop a sustainable framework, the structure of the model borrows from the Supply Chain Council's SCOR model. As such, the model uses a hierarchical representation of the business processes involved with the supply chain. The hierarchical model, through Level 3 concludes the chapter. To insure that the model is generalized at the macro-level, Chapter 4 presents a complex case study implementing Level 4 of the Supply-Chain Council hierarchy and extends the model using an accepted multi-view framework.

CHAPTER 4 CASE STUDY

The previous chapter presents a proposed services supply-chain model. This chapter verifies the model function. Verification of the model must satisfy three objectives. The first objective is implementation of the S^2COR framework using a comprehensive case study. The second objective is comparison of the first objective's results with the results from implementing the currently accepted service operations meta-model. The final objective is summarization of expert feedback regarding the S^2COR model.

Implementation of the model uses a case study from the health care industry. The case study presents the current service supply-chain environment in health care and provides an example implementation scenario. A comparison of the summary results from the implementation and the meta-model is the next task. Finally, experts provide feedback on the model and verify the feasibility of implementing the model in a service industry.

Case Study

Recently the service industry witnessed an unprecedented flurry of activity in the state and federal governments to legislate the business processes. Many view the legislation as the enforcement of best practices, while others view the legislation as cumbersome and interfering. The health care industry saw more

than its fair share of legislation and mandates in the last decade. In fact, besides the finance industry, health care was subject to many laws that changed business operations. One of the laws, the Health Insurance Portability and Accountability Act of 1996 (HIPAA) defined the services supply chain for health care. Recently, the introduction of additional mandates requires enhanced clinical data collection and exchange using electronic health records (EHR).

The intent of the legislation and mandates is the simplification of business processes and enhancement of enterprise-to-enterprise integration in the provisioning of services. If you recall, this is the function of a services supply chain.

Analysis of the legislation reveals many nuances of the services supply chain definition. In the purpose statement, the regulation requires combatting waste, simplification of processes and improved health care delivery. A key component to the legislation was the mandate to use standards in the exchange of data. The standard used is electronic data interchange (EDI).

The EDI standard makes use of HIPAA X.12 standards for the transmission of eligibility, service pre-authorization, claim status, claim submission, explanation of benefits, and claim payment. This standardization implemented a base ontology; however, the X.12 transactions selected use manufacturing related concepts.

Further enhancement of the health care IT infrastructure includes the proposal in the Fiscal Year (FY) 2005 budget of $125 million earmarked for

health care IT initiatives, an increase of $75 million, to enhance the health care IT infrastructure (McGee, 2005). The ultimate goal of the health care IT enhancement is the creation of a national health records network.

In response to HIPAA and the call for a national health records network, many government agencies and private companies formed consortiums to standardize, much like the consortiums that the supply chain frameworks spawned. Consortiums such as the Interoperability Consortium (consisting of Accenture, Cisco Systems, Computer Sciences, Hewlett-Packard, IBM, Intel, Microsoft and Oracle) intend to answer the challenge of implementing a national health record. While it is generally recognized that this will require health care providers to implement electronic medical records (EMRs), few organizations have done so (McGee, 2005). In fact, the big three software vendors in the provider market space (Cerner, Siemens-SMS, and McKesson-HBOC) have only recently been able to offer this capability. The discussion above recalls how early supply-chain frameworks implemented technology first, ignoring the need of a business process framework. Implementation of either HIPAA or EMRs requires elaboration of the health care operation. To provide a solid grounding of the business scenarios involved in analyzing a framework for health care a Harvard Business School Case study supports the case study described (R. Bohmer, Ferlins, E., 2005). The case study provides business input and provides generic operational processes. A description of the remaining operational processes is in the physician office description that follows.

The sample defines the enterprise operation of a physician office. Generically described is the external integration with other enterprises.

The primary office is the focal point for providing health care services. PHYSICIAN represents the office at the enterprise level. PHYSICIAN is representative of a multi-physician office or a single physician office. The medical professionals practicing in the PHYSICIAN enterprise are allocatable resources. Using PHYSICIAN as the point of reference the supply-chain includes customer interactions, supplier interactions, and any integration necessary to complete the provisioning of a service.

Service within the case study generically describes the entirety of health care services (HCS) provided. The expertise of the physician determines the HCS provided. PHYSICIAN provides care services and performs basic diagnostic tests, while other physician or ancillary enterprises perform the more complex diagnostics.

Physician is a single office entity providing and coordinating HCS with multiple physician offices (Physician 1, Physician 2, etc.), ancillary facilities (Ancillary 1, Ancillary 2, etc.) and the coordination of some patient care with hospitals (Hospital).

Coordination is by direct integration or referral management. Direct integration is the capability to update or schedule requests on behalf of a PATIENT directly with another PHYSICIAN or ANCILLARY enterprise. The generalization of referral management is when PHYSICIAN prescribes or

recommends that other HCS are required. PHYSICIAN provides the documentation necessary for the PATIENT to receive care from another PHYSICIAN or ANCILLARY.

If a PATIENT requires further treatment outside the scope of a PHYSICIAN or ANCILLARY, a referral to a hospital enterprise to provide the services or to another PHYSICIAN is in order.

Scheduling of all services is on an as-needed basis. Three types of schedules can occur for the PHYSICIAN. Scheduled is the first type of service, where a PATIENT has requested an appointment prior to visitation at the office. Confirmation and maintenance of the schedule occurs daily. Other non-routine scheduling also takes place, known as unscheduled services. These unscheduled services occur when a patient requests an appointment the day of the requested visitation or requests emergency services.

Since unscheduled services potentially conflict with scheduled services appointments occur based on appointment inventory availability. For the current office, there is no services provided originating from a contractual request.

PHYSICIAN acts as an intermediary for the PATIENT when requesting services for PATIENT from a designated INSURANCE enterprise, other PHYSICIAN or ANCILLARY enterprises. Therefore, multiple integration points within the daily operations of the office exist.

The above case provides insight into the health care environment that drives the need for an applied services supply-chain framework. Realization of

an implemented S^2COR occurs in the following section. Data from the above case provides the necessary data to implement Level 1 through Level 4 of the S^2COR model. A successful implementation satisfies the first and second objectives of this research, creation and implementation of a generic services supply-chain framework. Satisfaction of the final research objective, extension of the base model into a comprehensive supply-chain framework, follows the implementation.

Analysis

The analysis process begins by identifying each enterprise participating in the supply chain. Assignment of a role, customer, supplier or both occurs next. Roles are assigned based on characteristics identified in the literature (Lee, 2004; M. E. Porter, 1985; Sampson, 2000; Tan, 1994). Summaries of the characteristics associated with each enterprise identified with a role in the supply chain were then created. Identification of each Level 1 process each enterprise participates in takes place next. Table 18 summarizes the association of enterprise, role and Level 1 processes.

Data from the Level 1 analysis provides input to the Level 2 analysis. For this case study, Level 2 decomposition for the focus organization is necessary. Based on the data in the case, Level 2 processes necessary to provide a service are in Table 18. Recall the notation for Level 2 processes identifies the process

within the S^2COR model. For example, R1 is the REQUEST process for a scheduled service. Refer to Figure 9 for all of the Level 2 processes. Note that contracted services processes are not a part of the model at this point. This demonstrates the flexibility of the model to adapt to the business processes necessary for implementation.

Table 18: Enterprise, role, Level 1 and Level 2 association summary.

Enterprise	**Role**	**Level 1 Processes**	**Level 2 Processes** (Focus Organization)
PATIENT	Customer/Supplier	Request, Fulfill, Deliver	R1, R2, F1, F2, D1, D2
PHYSICIAN	Customer/Supplier	Plan, Request, Fulfill, Deliver	ALL
INSURANCE	Supplier	Deliver	D1,D2
ANCILLARY	Supplier	Fulfill	F1,F2

At this point, it is necessary to identify the business functions associated with each Level 2 process. Table 19 summarizes the business function association with S^2COR process relationships.

Table 19: Business function and S^2COR process relations.

Level 2 Processes	**Business Function**	**Level 3 Processes**	**Business Process**
P1	Office Management	P1.1, P1.2, P1.3, P1.4	All
P2	Scheduling	P2.1, P2.2,P2.3,P2.4	Patient, Staff, Ancillary
P3	Clinical	P3.1, P3.2, P3.3, P3.4	Staff, Office management, patient records, patient finance, discharge management,

Level 2 Processes	Business Function	Level 3 Processes	Business Process
			ancillary
P4	Patient Finance, Medical records	P4.1, P4.2, P4.3, P4.4	All
R1	Scheduling	R1.1,R1.2,R1.3,R1.4,R1.5	Office Management, staff, clinical operation
F1	Clinical	F1.1,F1.2, F1.3, F1.4	Patient records, finance operations, discharge management, scheduling, ancillary, insurance
D1	Patient Finance, Medical records	D1.1, D1.2, D1.3, D1.4	Discharge management, finance, insurance, ancillary, scheduling,

These relationships provide the input necessary to determine the appropriate Level 3 processes to include in the model. For this case, notice that the scheduled services process stream mirrors the unscheduled services process stream. Therefore, it is not necessary to continue modeling both process streams. The step above demonstrates the model's ability to model only the necessary processes. Modeling the case using a GSCF based framework, however, would require inclusion of both processes to capture the interdependencies and functional operations. This is a significant advantage of using a business process based model.

Level 2 provides input to Level 3 that enables the selection of appropriate Level 3 processes to include in the model. Since no standardized association of

health care business processes currently exists, association of Level 3 processes and health care processes requires deductive reasoning using input from the Harvard Business case. Other input comes from the work performed by Beech and Vissers (Beech 2005). This is by no means a complete business process association with Level 3. This step should however demonstrate the association process adequately to decide on the feasibility of the model implementation.

At this point, implementation of the framework is completely customizable. Level 4 facilitates the customization process. Level 4 represents the connection of the processes and the process integration. Figure 13 depicts the P1.1 process at Level 4 and Figure 14 depicts the D1.4 process at Level 4. Notice the depiction makes use of standard flow-chart symbols. It is important to note that the specification for S^2COR, and for that matter any of the SC frameworks, does not specify a modeling methodology standard.

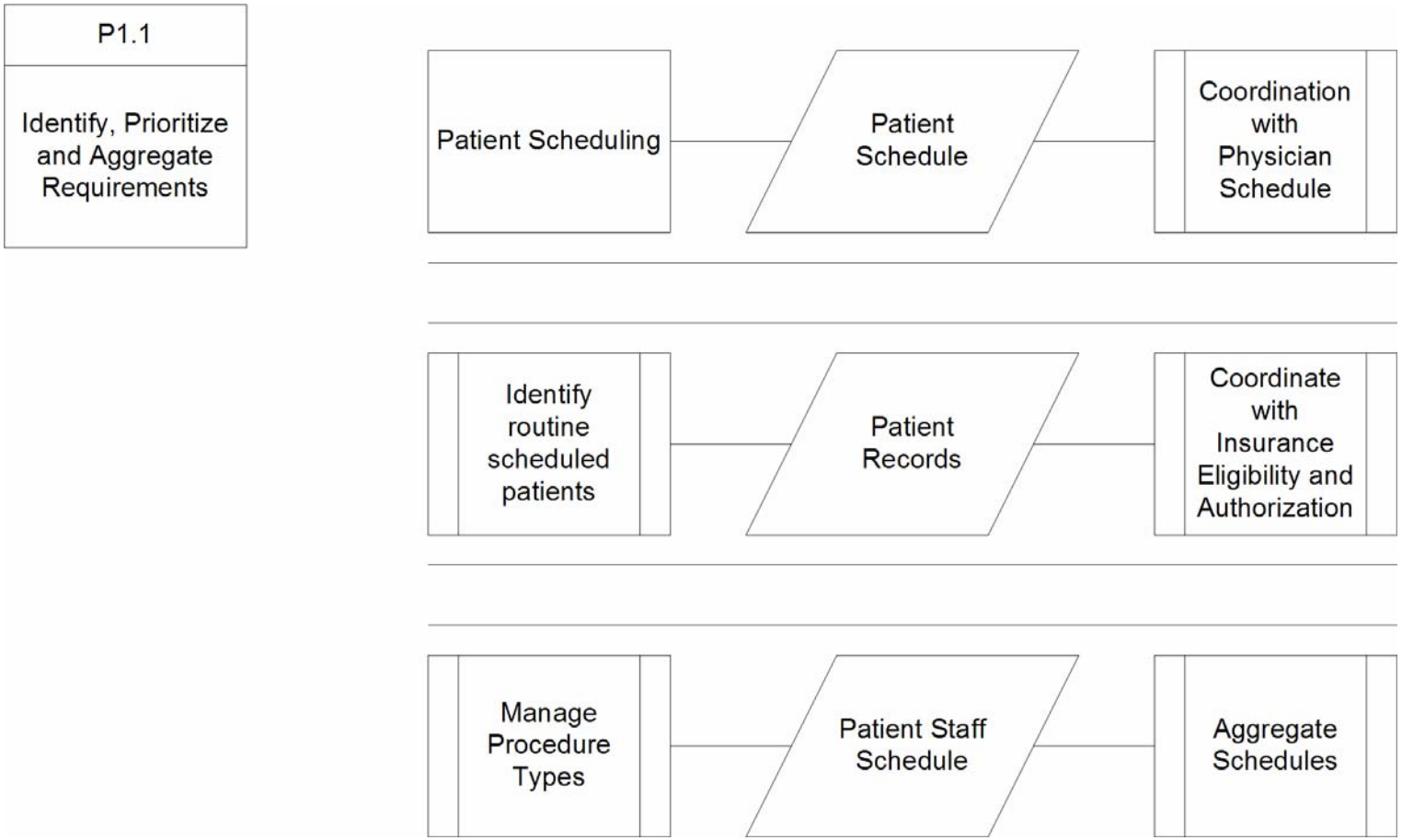


Figure 13: P1.1 process at Level 4.

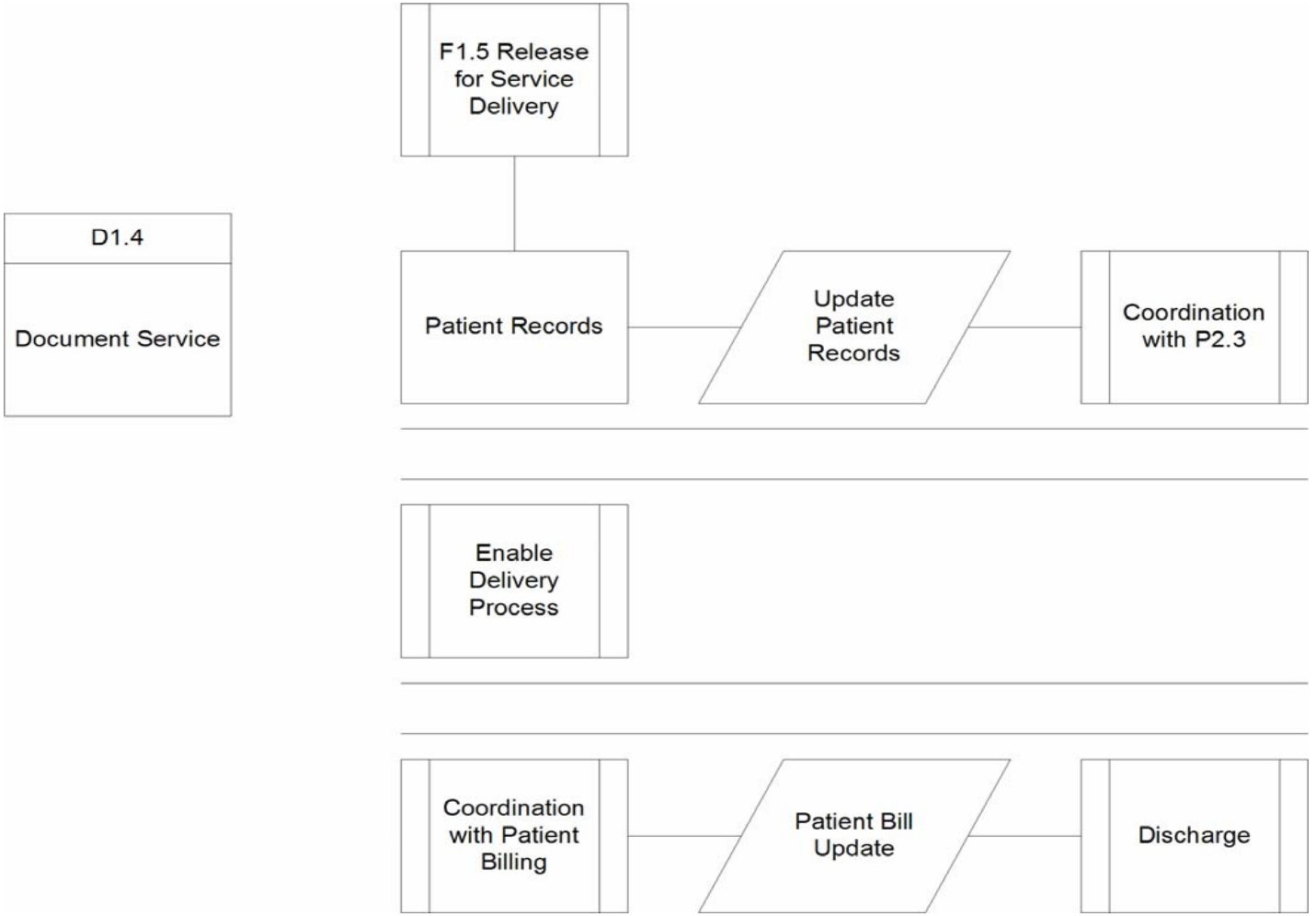


Figure 14: D1.4 process at Level 4.

A few points about information captured by the flow-charted processes are now in order. First, capturing the input and outputs at Level 3 in Level 4 is essential. This insures continuity of the process. If for some reason, the input/output does not match perfectly, questions should arise about the business process. The questions should focus on, do the processes follow best practices, are the inputs and outputs representative of the business and is the process flow diagram accurately depicting what is taking place. Answers to these questions will provide insight into the capability and maturity of the model created.

At this point, incorporation of the tenets of a comprehensive supply chain is necessary. Fayez (2005), in his research pointed out that the SCOR model failed to capture the views necessary to define comprehensively the supply chain. Listed below are the tenets from that research.

1. *"Processes*
2. *Performance Measures*
3. *Material Flow*
4. *Information and Information Flow*
5. *Information and Processes Interdependencies*
6. *Objects Flow*
7. *Information Resources and Application Systems*
8. *Decisions*
9. *Complex Interactions*
10. *Best Practices" (Fayez, 2005).*

These 10 tenets represent secondary views of the supply chain and are necessary to depict the intricacies of the supply-chain processes. The research

assigned each view created by a tenet to a SCOR interaction level. Definition of the SCOR interaction levels are Supply-Chain, Enterprise and Element. A depiction of how the interaction levels integrate is in Figure 15.

Supply Chain Level									
Suppliers' Suppliers	Carriers	Suppliers	Carriers	My Enterprise (Focus)	Carriers	Customers	Carriers	Customers' Customer	
Enterprise Level									
Suppliers' Suppliers Functional Units	Carriers Functional Units	Suppliers Functional Units	Carriers Functional Units	My Enterprise Functional Units	Carriers Functional Units	Customers Functional Units	Carriers Functional Units	Customers' Customer Functional Units	
Suppliers' Suppliers Elements	Carriers Elements	Suppliers Elements	Carriers Elements	My Enterprise Elements	Carriers Elements	Customers Elements	Carriers Elements	Customers' Customer Elements	
Element Level									
Suppliers' Suppliers Processes	Carriers Processes	Suppliers Processes	Carriers Processes	My Enterprise Processes	Carriers Processes	Customers Processes	Carriers Processes	Customers' Customer Processes	**Interaction Level**
Suppliers' Suppliers Information	Carriers Information	Suppliers Information	Carriers Information	My Enterprise Information	Carriers Information	Customers Information	Carriers Information	Customers' Customer Information	
Suppliers' Suppliers Information Resources	Carriers Information Resources	Suppliers Information Resources	Carriers Information Resources	My Enterprise Information Resources	Carriers Information Resources	Customers Information Resources	Carriers Information Resources	Customers' Customer Information Resources	
Suppliers' Suppliers Materials Product Structure	Carriers Materials	Suppliers Materials Product Structure	Carriers Materials	My Enterprise Materials Product Structure	Carriers Materials	Customers Materials Product Structure	Carriers Materials	Customers' Customer Materials Product Structure	
Suppliers' Suppliers Objects	Carriers Objects	Suppliers Objects	Carriers Objects	My Enterprise Objects	Carriers Objects	Customers Objects	Carriers Objects	Customers' Customer Objects	
Suppliers' Suppliers Decisions	Carriers Decisions	Suppliers Decisions	Carriers Decisions	My Enterprise Decisions	Carriers Decisions	Customers Decisions	Carriers Decisions	Customers' Customer Decisions	
Suppliers' Suppliers Performance Measures	Carriers Performance Measures	Suppliers Performance Measures	Carriers Performance Measures	My Enterprise Performance Measures	Carriers Performance Measures	Customers Performance Measures	Carriers Performance Measures	Customers' Customer Performance Measures	
Suppliers' Suppliers Best Practices	Carriers Best Practices	Suppliers Best Practices	Carriers Best Practices	My Enterprise Best Practices	Carriers Best Practices	Customers Best Practices	Carriers Best Practices	Customers' Customer Best Practices	

Fayez 2005

Figure 15: Association of the 10 comprehensive supply-chain tenets with interaction level.

Figure 15 shows how each of the views associates with the supplier, customer and supply-chain level. Table 20 summarizes the association of the tenets with each level and shows the associated views.

Table 20: Association of integration levels with Supply Chain views.

Integration Level	Level Description	View Used to Describe
Interaction	Connections and dependencies between levels and elements	Supply chain
		Enterprise
		Cross-functional
		Process Flow
		Interdependencies
		Information
		Information Resource
		Service Activity
		Multi-tier
Supply Chain	Supply-chain elements	Network
Enterprise	Enterprise elements	Multi-tier
		Cross-functional
Element	Definitions and components of each level	Process
		Information
		Service
		Information Resources

Each view models a different aspect of the supply-chain as defined by the tenet listed above. To capture the detailed information, it is necessary to select a standardized business process modeling methodology. Fayez selected the use of the IDEF standard. For this research, the Unified Modeling Language (UML) implemented the secondary views.

These methods, while not specific to supply-chain management describe processes, data and interactions. IDEF has the advantage that it is widely understood and has the ability to define the data schemas used in processes. IDEF also facilitates the capture of a significant amount of detail (Jones 1999).

In direct contrast is UML (Unified Modeling Language) resulting from the Rational Unified Process. UML approaches modeling initially from a Domain perspective and proceeds to detail the business model and finally use cases. The unified process also enables structured iteration of the design and reuse. This is in contrast with IDEF where there are various levels of the definition language used to capture the same information.

Therefore, each of the views will be captured using standard UML notation. For an explanation of using UML in Enterprise Modeling, refer to Enterprise Modeling with UML by Chris Marshall or The Unified Software Development Process by Jacobson, Booch and Rumbaugh. These are excellent references for those unfamiliar with UML. As such, this dissertation will not discuss the how of UML, but rather the association of views to particular components of the UML.

The building blocks of view development use the identified functions and processes described in Level 3 of the S^2COR model. The characteristics, functions and processes facilitate creation of a system use-case model.

Within the diagram, “actors” (Patient) depict the entity interfacing with individual use-cases. Within the methodology, the “actor” may represent a

customer or supplier within the SYSTEM diagram. The interface connection describes the information exchanged in the integration process.

The use-case in the SYSTEM diagram points to the high-level processes associated with the system described. Association of the use-case to other use-cases uses the “extends” component of UML. An “extends,” describes the way the use-cases exchange information, such as data and other attributes. The data and attributes provide “classes,” components of use-cases, information to describe and execute processes.

Figure 16 shows the integration of the Level 1 processes and decomposition of the processes into use-cases essential to creating the rest of the views. The system model depicts the SUPPLY-CHAIN view (the connection between the INSURANCE Enterprise and the PHYSICIAN Enterprise) and the ENTERPRISE view (use-cases of enterprise functions). These views are essential to coordination of supply-chains and inter-enterprise activities. The diagram also indicates where the customer interaction is, in this case with the physician.

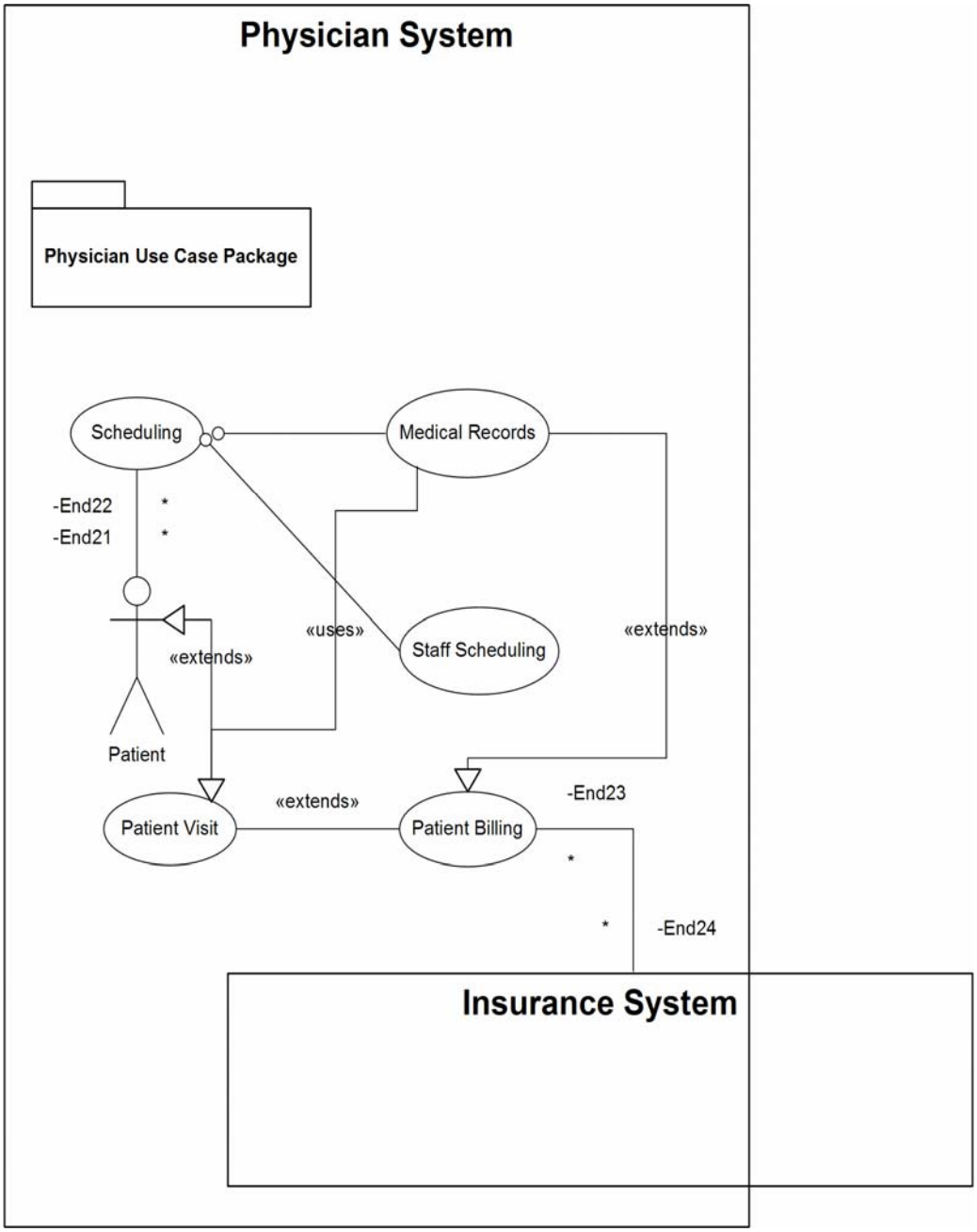


Figure 16: System diagram capturing the Physician supply-chain view and the Enterprise view.

Another aspect represented within the SUPPLY-CHAIN view is the coordination between supply chains. It is important to note that the SCC has not

indicated where in the processes supply chains should coordinate. For the research the supply chains can coordinate at any point in time within the REQUEST, FULFILL or DELIVER processes. This is to allow for flexibility within the enterprise and to allow for adaptability when the SCC decides what processes are required for supply-chain coordination.

Recall that Request, Fulfill and Deliver are the Level 1 processes of the S^2COR model. For this case, the following modifications to the root definitions apply:

Request – a customer requested, variable demand service to the body is requested

Fulfill – a single event customer request using finite inventory (physician time) is used to treat the patient

Deliver – a single event, customer requested, perishable inventory service acted upon in providing treatment to the body

Essential to the supply-chain operation is the efficient capture of data and the use of the data in the supply-chain processes. Here is where an advantage to using UML is evident. UML provides the capability to describe multiple views within a single diagram. An example is the descriptive capabilities of the use-case and classes. The use case captures the process and process flow information. At the same time, the class component of the use case captures the information, information flow and information resource views. This is facilitated by the ability to capture attribute and associated attribute information within the

class component. To demonstrate this capability, Figure 17 shows the use-cases for each supply-chain process. These use cases create “packages” of classes specific to the process. The “package” describing the Enable Request process in Figure 18 shows the next level of decomposition available. Again, notice the process flows and further description of attributes is available.

Decomposition of the enable “class” in the diagram would create the information, information flow and information resource views. Figure 19 depicts these views of the P1 “package.”

The use of UML also enables the description of other views within the use case and class diagrams beyond the obvious already presented. For instance, the process view describes the integration of the supply-chain within the enterprise while the supply chain view depicts the external enterprise integration. A process flow diagram of Level 2 and 3 processes defines not only the inter-enterprise integrations, but also the relationships between the classes, use-cases and actors involved. This is essential in understanding the interdependencies of the model.

The interdependencies are an important view of the model since they show the influence of processes across multiple tiers of the supply-chain. Relating the diagram to the multi-view model of Fayez, the diagram shows the interdependencies, multi-tier, process, and process flow views. These views provide significant insight into the capability of the supply-chain and the capability of the enterprise.

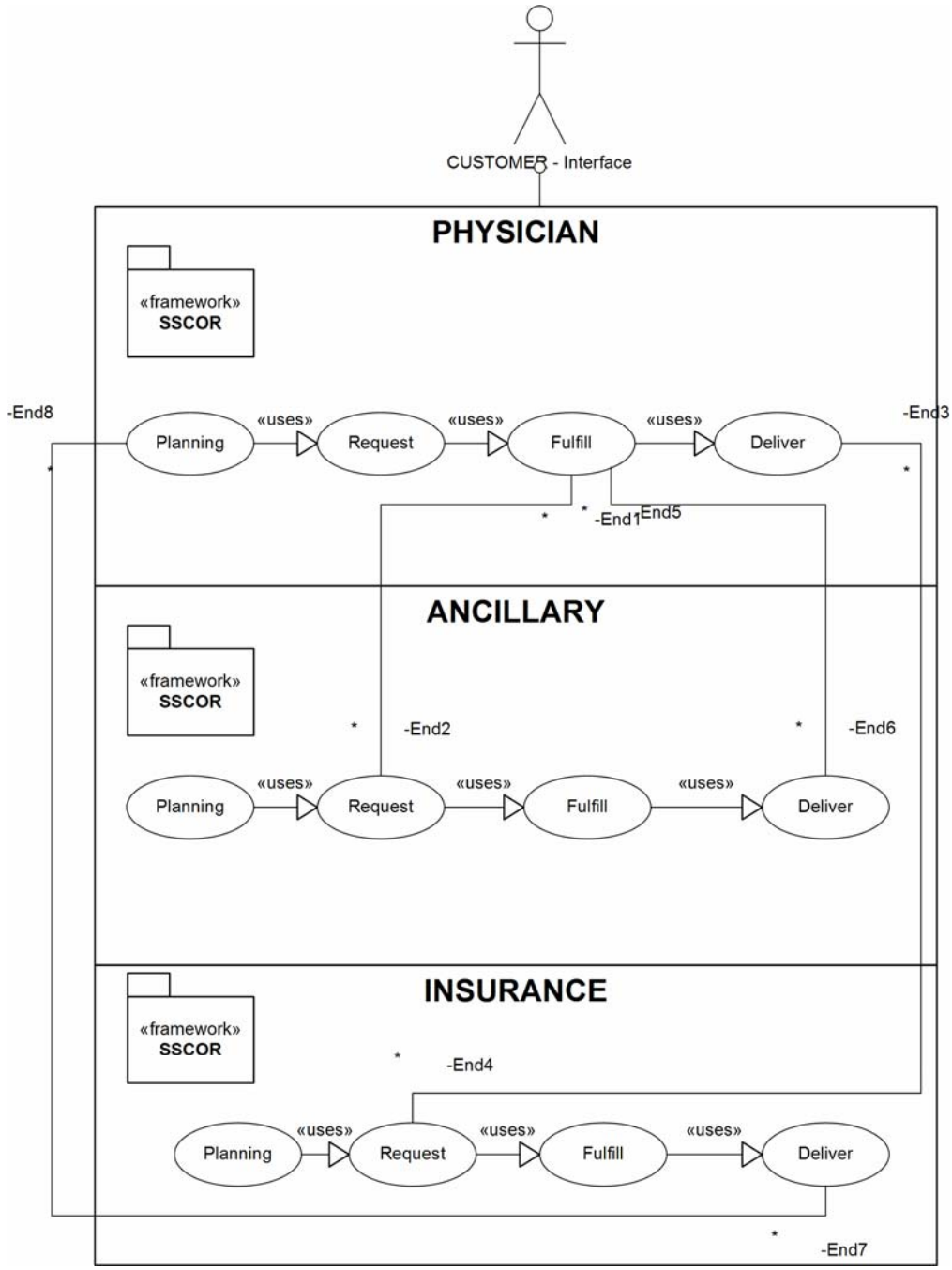

CUSTOMER - Interface
PHYSICIAN
«framework»
SSCOR
-End8
Planning
«uses»
Request
«uses»
Fulfill
«uses»
Deliver
-End3
-End1
End5
ANCILLARY
«framework»
SSCOR
-End2
-End6
Planning
«uses»
Request
«uses»
Fulfill
«uses»
Deliver
INSURANCE
«framework»
SSCOR
-End4
Planning
«uses»
Request
«uses»
Fulfill
«uses»
Deliver
-End7

Figure 17: Use case diagram capturing the process and process flow views of the supply-chains.

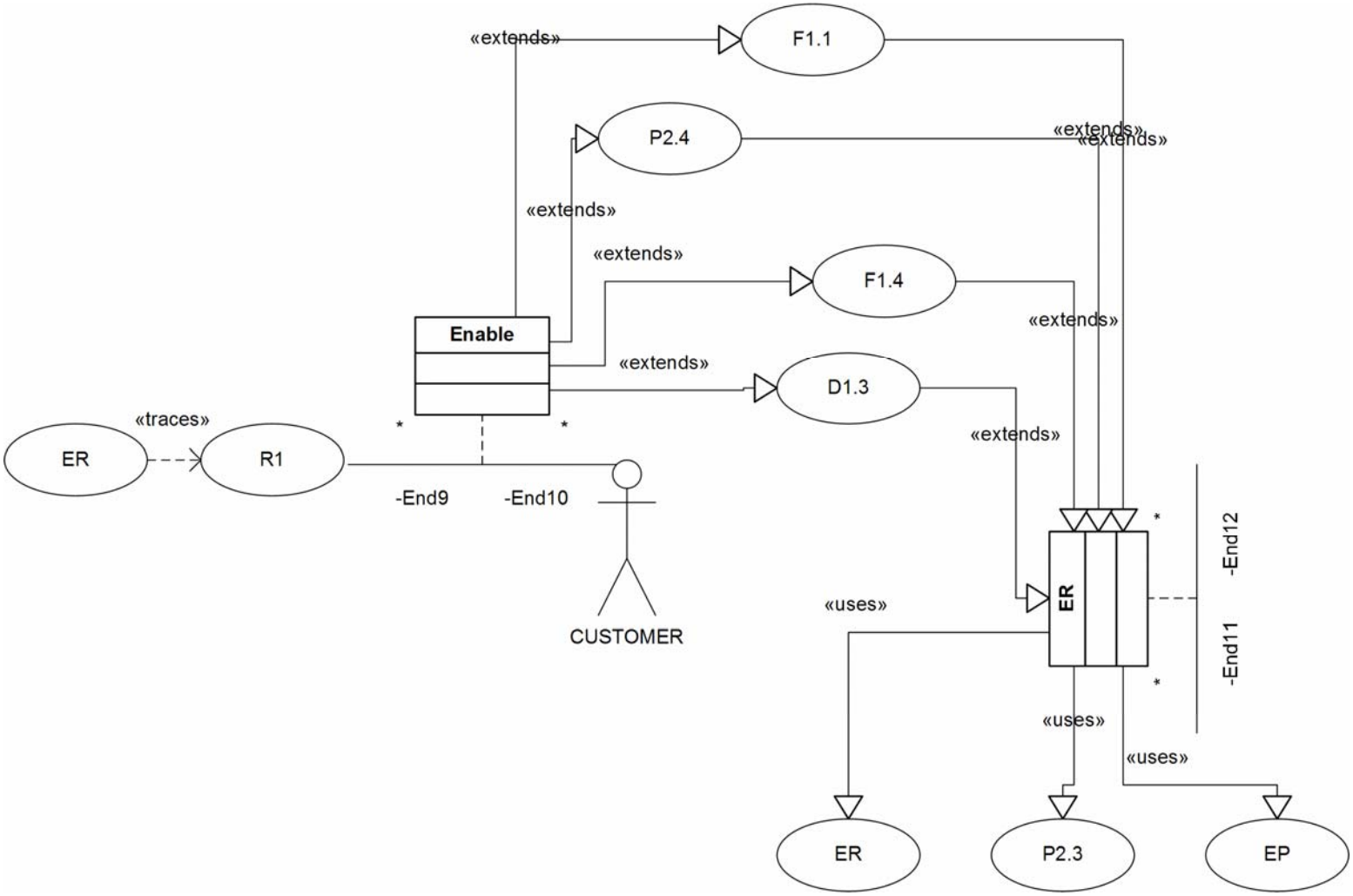


Figure 18: Enable use-case package describing processes and process flows.

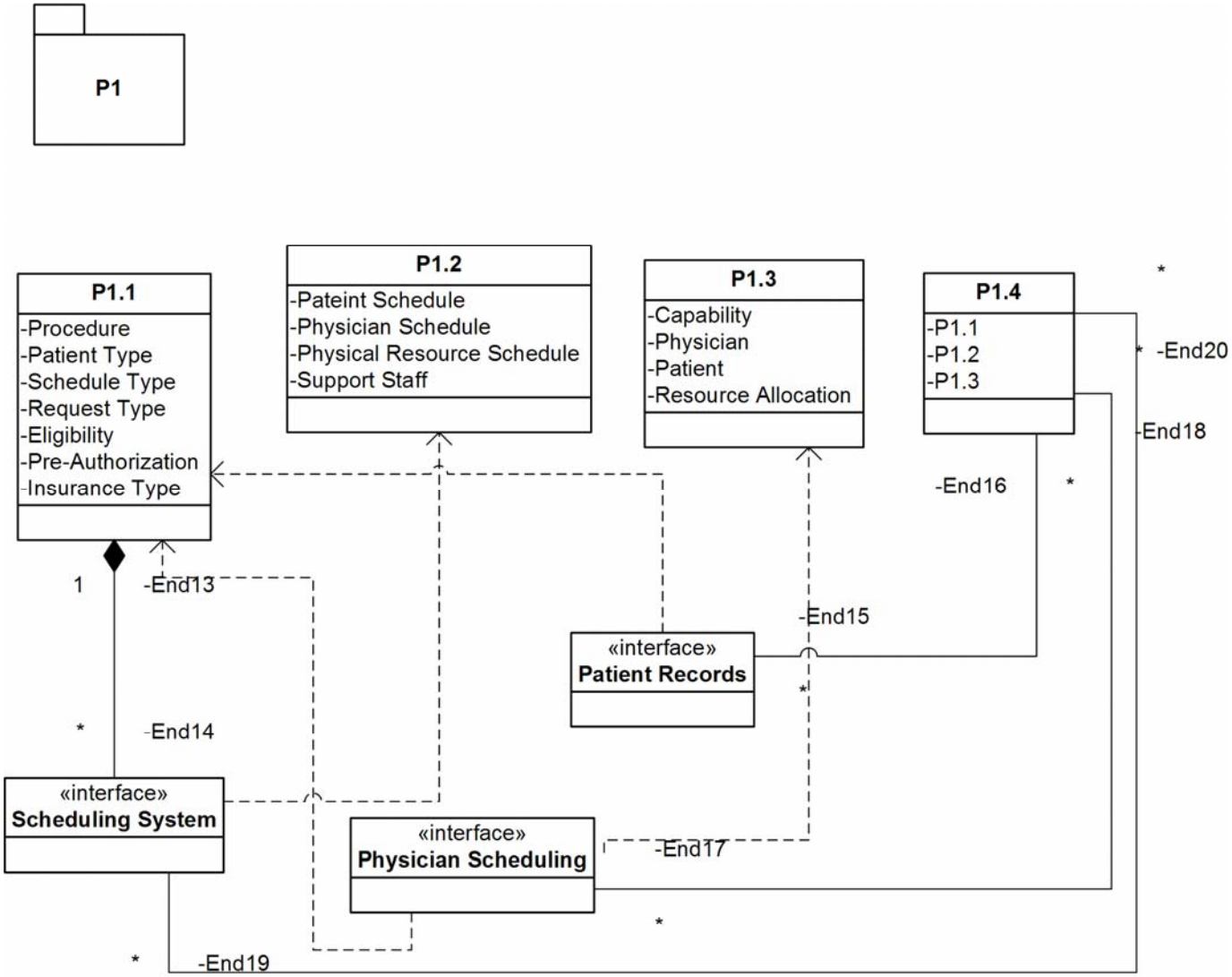


Figure 19: P1 package and the decomposed information, information flows and information resource views.

The rest of the views decompose various components of the use case and class diagrams to provide a finer level of detail.

For instance, the sequence diagram (Figure 20) depicts the movement of objects related to classes and the exchange of information. This is important to the process flow and service activity views associated with a comprehensive model. Contained in messages are information resources and information data that further details the classes and whence the use-cases associated with the diagram.

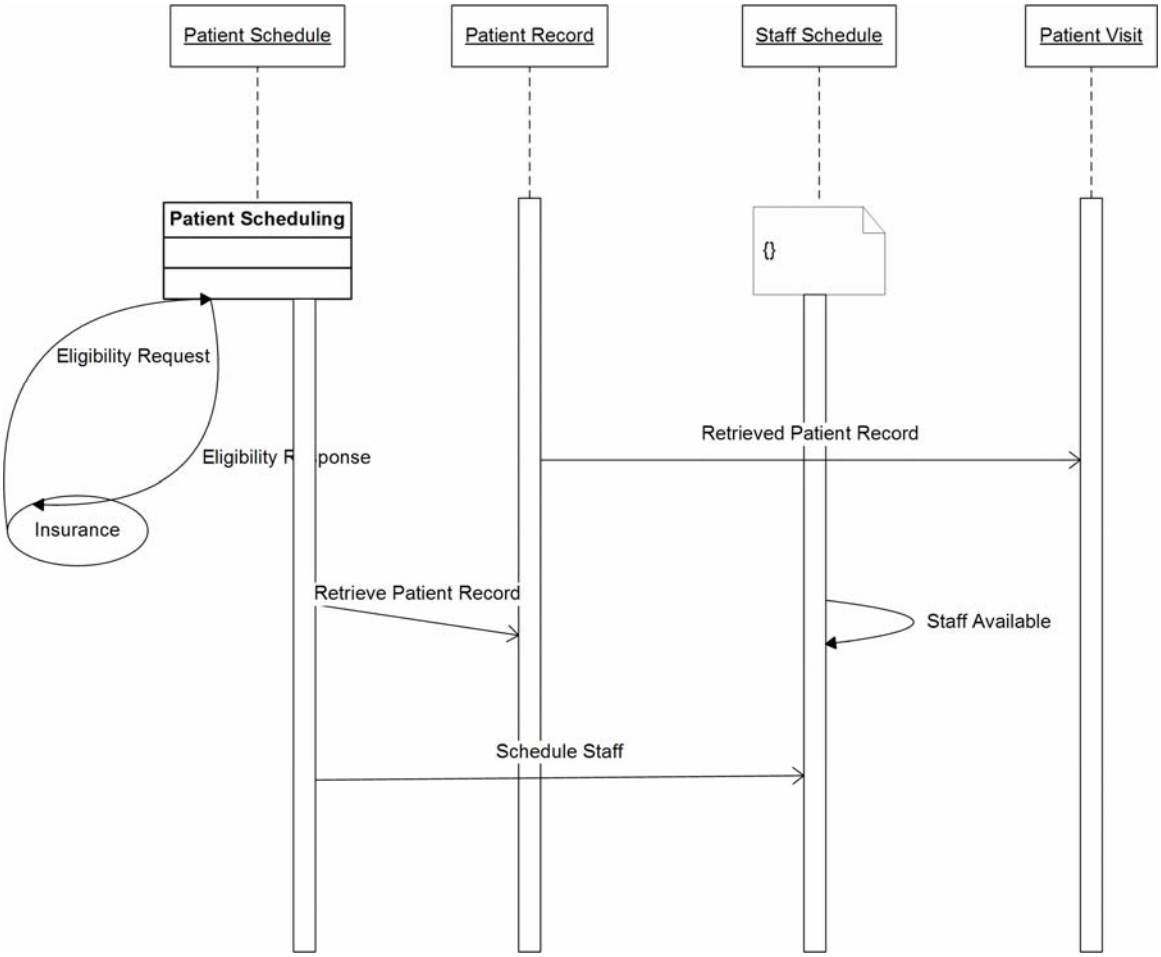


Figure 20: Sequence diagram of the patient record process.

An activity diagram clarifies the state of the processes. The information necessary to complete the activity diagram derives from the sequence diagram and use-case diagram.

The activity diagram is important to the comprehensive model in that it enhances the description of the service activity view and the process flow view. The data contained within the state describes internal actions and entry/exit conditions. Take for example the activity in Figure 21 showing the action state and the resultant state of interacting systems. This depiction is of the multiple tiers interacting at the Enterprise Level between the Physician System and the Ancillary System. The action states in the diagram are the processes feeding the resultant state, an object (Planning Information Exchange).

The activity diagram also captures the structure of the objects exchanged and the state of the object exchanged. If material flows were involved, the activity diagram could capture this information as well using the “Object in State” capability.

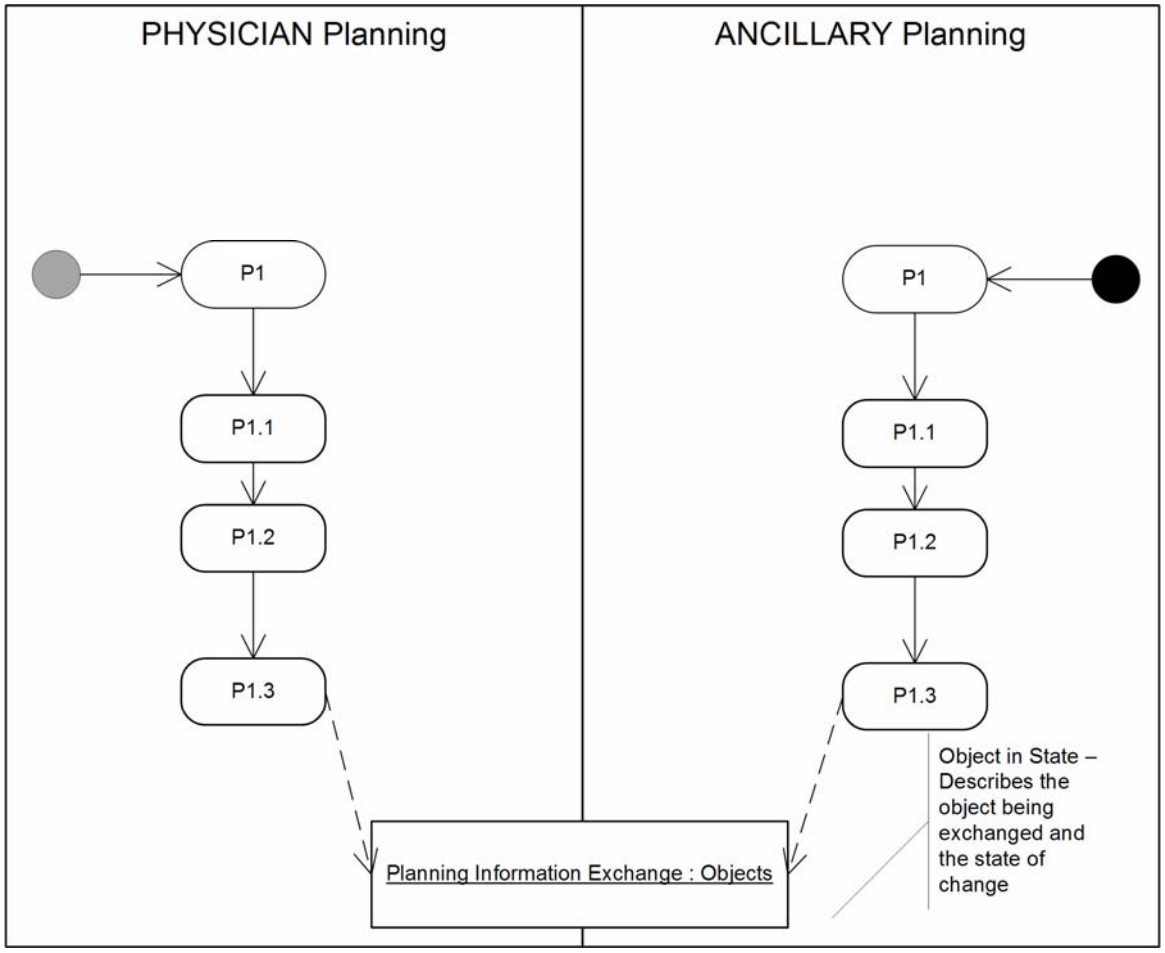


Figure 21: Activity diagram showing one of the planning interactions between the PHYSICIAN System and the ANCILLARY System.

The remaining tenets of a comprehensive supply chain use the information provided in the views and the base model. While the UML diagrams capture the process and process flow view, views of information, information flow and resources as well as object flow they cannot capture the other tenets. The capture of the other tenets is facilitated using other tools. For example, decisions can use a design structure matrix while performance measure and best practices

relate to the base model. The one tenet not captured in the supply-chain presented is that of material flow.

Material flow presents an interesting quandary within services. The issue is that materials per se are not an integral part of the service supply-chain. Instead, materials introduction is secondary to the supply-chain via a materials management supply chain. This is hinted at in the enterprise view by identifying the interaction points. As a result, this view should be the subject of future research.

As indicated by Fayez a comprehensive supply chain consists of multiple views and additional requirements beyond the base operational model (Fayez, 2005). The section above presents proposed model decomposed to Level 4, along with the views associated with the model, applied to a complex case study. The views presented include processes and process flows; information and information flows; interdependency identification, information resources, object flow and complex interactions. The base model captures the performance measures and best practices where applicable.

Summary

A comprehensive case study has been presented describing the construction of a service supply-chain in the health care industry. The case study demonstrated the feasibility and comprehensiveness of the model and the

extensibility of the model into the multi-view framework. Further verification of the model uses a comparison of the S^2COR model results above to the health care meta-model (Beech 2005).

Model Comparison

The current state of modeling service operations is lacking standards and capability. For instance, current methods include flowcharting processes (Figure 22) or the equation of processes using meta-models (Figure 23). What is evident at first glance comparing both models to S^2COR is the level of detail available. Using the Level 4 process description of S^2COR, not only are all input and output captured, but the impacts on the processes providing the inputs and outputs can be ascertained using the available Level 1 metrics. In addition, as the model matures and Level 4 metrics enhanced, process influences across the multiple levels can be determined. Further maturation of the process will allow for the capture of best practice data.

Comparing the S^2COR model to the flow chart highlights the minimal amount of data available in the flow chart. For instance, Level 4 descriptions provide detail about input and output along with the specification. The flow chart is limited to the information the designer wants to include. In the typical case, the flow chart includes the name of the process and the next step of the process.

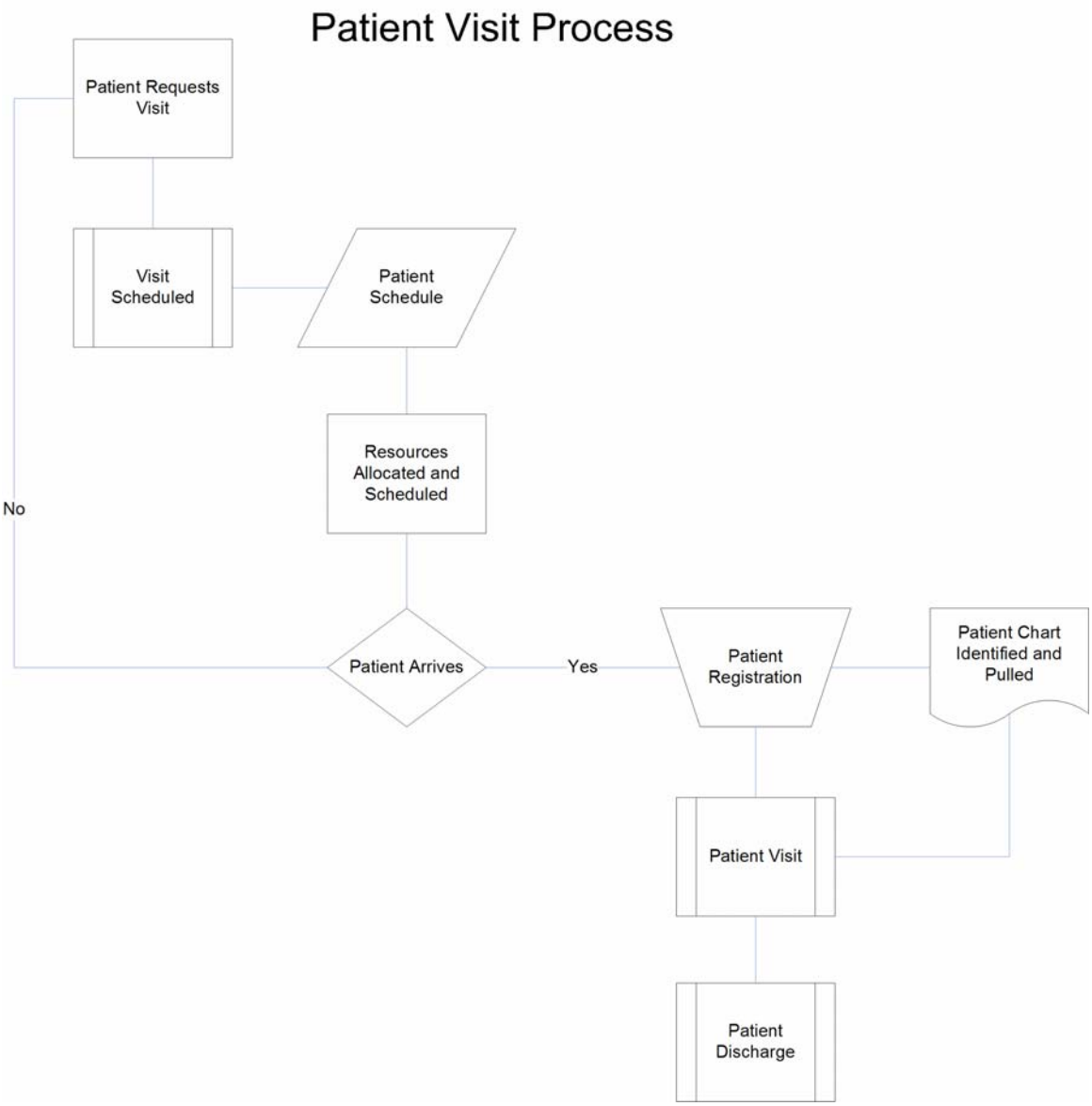
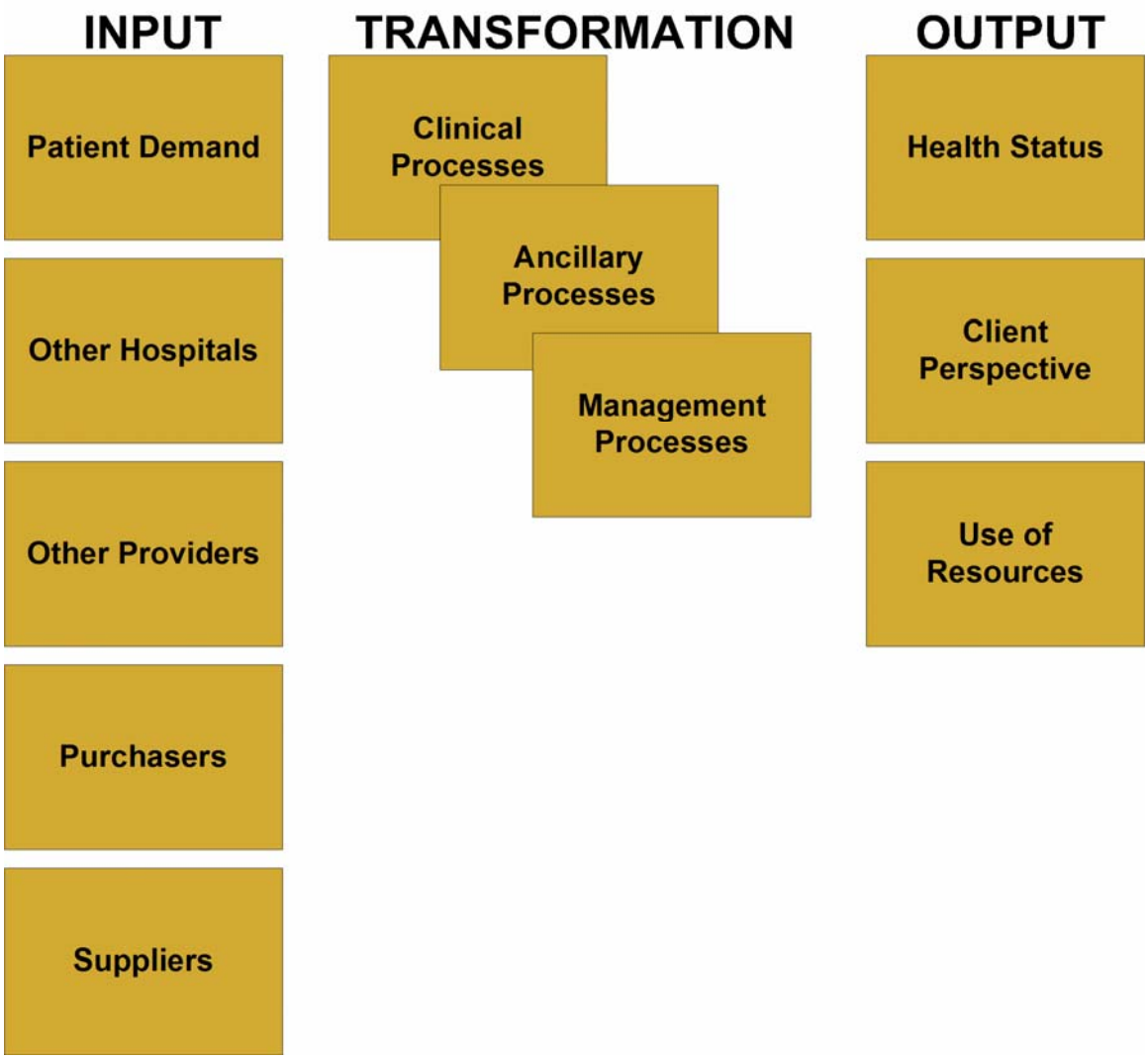


Figure 22: Typical patient process flow chart.



(Vissers, 2005)

Figure 23: Health care meta-model based on Beech and Vissers work.

The meta-model points out the lack of an available services supply-chain (Vissers, 2005). Here the model compares the significant leaps a services supply-chain model provides in terms of capability and descriptiveness.

First, underlying every process within health care is a clinical process and an associated business process that is the basis for the meta-model concept.

While the S^2COR acknowledges the existence of other processes, it focuses on the business. In the case of the physicians' office described in the case study, combining analysis of clinical and business would obfuscate the separate nature of both from a business model view.

Secondly, the meta-model describes the processes at the enterprise level, but does not connect the processes in any meaningful way. Further, no meaningful connections exist where enterprises external to the focus enterprise should interact.

Readily evident is also the fact that capturing the details of processes in a standardized, measurable method is not available within the model. S^2COR offers this tremendous benefit. Further benefits include the capability to capture repeatable processes, adding to the ability to mature a standard model and improve the business function.

The comparison of the models presents a bleak picture of tools available for use in depicting supply chains currently. The proposed model includes tools and processes to ameliorate this issue. To confirm the model does so, experts evaluated the model and provided three opinions for improvement. The next section presents the process and the results of the process.

Expert validation

Once the model development was complete, the verification process started. Verification of the model used the data to ensure the reasonable

representation of characteristics. A comparison of processes and scenarios was the first data point used. The second data point was the questionnaire developed for the case analysis. Consistency and validity of answers within the selected scenarios confirmed or negated the applicability of the associated characteristic. Finally, a modified Delphi method affirmed or negated the overall model applicability to the service industry.

Selection of the Delphi method allowed for input of expert opinion into the capability and feasibility of the model in a complex case scenario. Once the model was developed through Level 3, Level 4 was generated based on a complex health care case study. The case study was a patient's visit to a physician office and the associated ancillary needs. Once the case study and the Level 4 descriptions were in place, experts provided input and verified the model.

Expert selection focused on individual expertise in the health care Industry. To insure a comprehensive view, at least one expert from each of the fields within health care was selected. Individual expertise included health care payer operations, health care information technology operations, and clinical operations. Each expert was given an explanation of the S^2COR model, the Level 1-4 representation and the current operational meta-model representation. Using the given data each expert was to provide input via the structured questionnaire in Table 21. Any structural input to the model was provided in free

form response. Iteration of the process was anticipated; however consensus was reached within the first iteration.

Table 21: Questionnaire for expert validation.

1. How many years have you worked in the health care or insurance industry?
2. Have you ever worked with supply-chain? (any capacity)
3. Are you familiar with supply-chain frameworks?
4. Based on your expertise, does the proposed model demonstrate flexibility in the case study implementation?
5. In you opinion does the proposed model address the needs of the health care industry?
6. Do you feel that the model is generalizable to other areas of the service industry sector based on the examples given and your professional experience?
7. Does the model provide adequate detail to understand the processes and process-to-process influence?
8. Does the model provide adequate detail to implement as is or is further detail necessary?
9. Do you foresee tactical implementation of a services supply-chain or a strategic implementation?
10. Does the specification in the appendix provide adequate support for implementation? If not what is recommended to improve the specification?
11. Do the processes included in the model, at Level 1; capture the service industry processes adequately? If not please provide examples.
12. Does the description of scheduled, unscheduled and contracted services describe the nature of services adequately? If not please provide examples.
13. Do you feel that the proposed model is a benefit to describing the services supply-chain or an additional complexity? Please describe the benefit or detraction.
14. Would the current model benefit your organization or is maturation of the model necessary first?

The number of questions was kept under 20 to minimize the time impact on the expert's schedule. It has been found that too many questions may skew

results because of time required to answer. The recommendation regarding length of questionnaire is to err on the side of brevity while still addressing the subject matter required (Rea, 1997). The nature of the questions allows for single yes or no answers, to increase participation, with the ability to provide free form answers if desired (Rea, 1997). By constructing the questions in this manner, the experts should not feel constrained if they wish to provide additional input. Other important aspects of the questionnaire include the establishment of expert knowledge (Questions 1-3), evaluation of the general model (Questions 4,5,13,14) and evaluation of the application of the model (Questions all others). Ordering the questions this way may lead the experts to provide answers that they feel the research deserves, however this is an acceptable risk given that the experts selected are predisposed to giving frank answers. Table 18 summarizes the answers and includes pertinent notes.

Table 22: Summary of answers to expert verification questionnaire.

Question	Answer (Brief)	Pertinent Notes
1) How many years have you worked in the health care or insurance industry?	Average 15	Other industries are also included in work experience, answer however reflects health care or insurance only
2) Have you ever worked with supply-chain? (any capacity)	Peripheral exposure	One worked extensively with ERP systems, others are familiar with supply-chain concepts,
3) Are you familiar with supply-chain frameworks?	No	None of the frameworks mentioned in research
4) Based on your expertise, does the proposed model demonstrate flexibility in the case study implementation?	Yes	Two comments: Seems that Level 4 provides ability to customize adequately; Based on understanding of model able to select processes necessary to reflect

Question	Answer (Brief)	Pertinent Notes
		enterprise operations
5) In you opinion does the proposed model address the needs of the health care industry?	Yes	One comment: currently no structured framework available for implementation
6) Do you feel that the model is generalizable to other areas of the service industry sector based on the examples given and your professional experience?	Yes	Two comments: Prior experience indicates no structure model available to capture any business operations; Model provides insight into a gap in the management of business processes.
7) Does the model provide adequate detail to understand the processes and process-to-process influence?	(2) Yes Others no answer	Consensus after discussion seems to be yes, however required explanation of how the model works
8) Does the model provide adequate detail to implement as is or is further detail necessary?		Needs more detail for tactical end-user implementation, current model provides strategic insight into supply-chain
9) Do you foresee tactical implementation of a services supply-chain or a strategic implementation?		Consensus is the model provided is a strategic model.
10) Does the specification in the appendix provide adequate support for implementation? If not what is recommended to improve the specification?	Yes	The appendix provides adequate support, however needs to be modified for end-users to understand without knowledge of SCOR (Researcher Note: This insight is from discussion with experts.)
11) Do the processes included in the model, at Level 1; capture the service industry processes adequately? If not please provide examples.	Yes	No notes.
12) Does the description of scheduled, unscheduled and contracted services describe the nature of services adequately? If not please provide examples.	Yes	Qualified answer provided within the context, or scope, of the model. Unable to determine applicability outside of the model.
13) Do you feel that the proposed model is a benefit to describing the services supply-chain or an additional complexity? Please describe the benefit or detraction.	Benefit (1) Complexity	Complexity qualified from an end-user perspective this is a complexity, however implemented correctly should benefit enterprise.
14) Would the current model benefit your organization or is maturation of the model necessary first?		Maturity of model necessary

A key result from this is that the model adequately describes services from a business process standpoint. As you can recall, this is one of the primary objectives of the research. Secondary to this, the new model fit the health care services business processes and provided integration points to the clinical processes.

Contribution

Initial gains from the implementation of the S^2COR model are evident in the accurate depiction of business operations at both a strategic and tactical level. To address the influences on the business, the strategic level includes the enterprise and supply-chain level. At the tactical level, the model enables the benchmarking and measuring of processes. While the business currently takes measurements, influences of measurements on other operations are often difficult because of the non-standardized processes, metrics and benchmarks.

Satisfaction of three of the anticipated contributions takes place at this point. They are:

1. A new supply chain model specific to the health care services industry
2. An extension of existing supply-chain models enabling the services industries to adopt a scalable, enterprise integration based standard

3. The creation of a supply chain specific to the service industry through Level 4 and extended.

The final anticipated contribution, an object oriented based framework was also demonstrated by using UML to create the secondary views. With respect to the extension of existing supply-chains, the current model draws from the tenets that describe a comprehensive supply-chain based on the principles of enterprise integration.

Summary

Using a two-phased methodology enables the research process to focus on the important aspects necessary in building the contributing theory. The first phase focused on the creation of the model and the necessary steps to create the model. Phase II enhances the model to ensure the comprehensiveness necessary and the verification of the applicability of the model.

The Phase I contribution to the research is the delineation of the characteristics of the service industry. The work here should contribute to further understanding the nature of the services industry and allow for refinement of future research. The main contribution, however, is the creation of a model using the characteristics describing the service industry. A supply-chain model is one of the contributions outlined in Chapter 1.

Phase II meanwhile ensures the comprehensiveness of the SSCM from Phase I. The comprehensive model follows the tenets established in prior

research. As outlined in Chapter 1 this is one of the main contribution goals of the research.

CHAPTER 5 CONCLUSIONS

The preceding research proposed a new operations reference model to define a service supply chain. The service supply chain developed uses the SCOR model as a basis. Use of the SCOR model provides consistency for usage of terminology and capabilities within the operation reference framework. The following provides a summary of the contributions, conclusions, and discussion of future research possibilities.

Research Contributions

Past research conducted in the area of service supply chain is very limited. The current models services focus is on the service return aspect identified within SCOR. This resulted in the definition of service not being consistent with the definition of service as an industry. This research recognized that an independent model specific to the services industry was necessary.

The basis for the development of the service industry specific supply-chain model used the widely accepted framework and methodology defined by the Supply Chain Council SCOR model. Using the SCOR model as a basis allowed the development of a new services model employing the business process reengineering approach of the Supply Chain Council. Further, using SCOR allowed for consistency in terms of definitions, processes, metrics, and best practices. One final note of interest is that using SCOR allowed for the extension

of the supply chain into a comprehensive supply chain, thus insuring that the initial proposed model is as comprehensive as possible.

While the comprehensiveness of the model with respect to all service industries may be lacking due to the nature of this research, the S^2COR model does provide a starting point for the maturation of a services supply chain.

In summary, contributions to the body of knowledge include the following:

- First ever services supply chain framework,
- A hierarchical framework describing the enterprise, processes and interdependencies of the services supply-chain,
- A definition of the service supply-chain using semantics specific to the services sector,
- Identification of common characteristics exhibited by service industry supply-chain,
- Services supply-chain specific performance metrics; and,
- Extensibility using characteristics defining a comprehensive supply-chain.

Conclusion

The S^2COR model is a unique model in that it is the first describing for the services industry the supplying of services to customers. As this is an initial model, deployment of the model and other critical analysis has not yielded the potential shortcomings. However, as a foundation model, it provides for further

enhancement of what has been lacking in the services industry. Namely, until now, businesses employed a service operations management meta-model approach instead of a business process design approach.

By following a business process model (SCOR) as a guide for development and using the enhancements described by Fayez (2005), the S^2COR model provides not only the elements of process description, performance measures, and best practices but also describes the material elements, the object element, information and information resources and decisions that impact the model. Further, the process flows, interdependencies and interactions complete the comprehensiveness of the model.

Despite the inability of the existing supply chain models to describe the service industry, the overall processes, relationships, and presentation were useful in development of the initial services industry model. Suffice it to say, without SCOR, the task of developing a new services industry operations reference model would have been far more complicated. Further, by using the presentation layout and the descriptive items within SCOR, practitioners familiar with the original SCOR model may easily adapt to the proposed model.

The primary benefit of the S^2COR model is that it provides a comprehensive definition and a generic multi-view framework of the service supply chain. Comparison of the model with current operations management meta-models demonstrated the lack of comprehensiveness, continuity, and strict definitions of benchmarks and parameters within the meta-model. For instance

the proposed S^2COR model's multiple views of the business operations capture the necessary benchmark data, parameters, and metric data to drive decisions influencing the supply-chain. Another benefit of using the proposed S^2COR model includes the ability to capture knowledge. Further, the model enables traceability and transparency of operations within the business.

While the SCOR model influenced the development of the S^2COR, the method of developing the model's processes and verification were limiting factors. For example, the generation of the model is limited by the current understanding of the service industry. One only needs to look as far as how the field of operations management treats the service industry. As a result, numerous aspects of traditional operations management from a manufacturing setting do carry over into the service industry. This model, however, presented a fresh look without the bias towards the manufacturing sector.

For instance, during the research, the realization that presentation of the supply chain model to the end user community is a daunting task due to its complexity. The reason for this is that the operations reference models have historically been, and for this research are, presented as a standalone document that does not explain how to implement, but rather provides guidance for what to implement. As a result, the end user may not understand the full capability of the models presented within the final document. This weakness, unfortunately, is an accepted weakness in the past development of structured operations reference model documents.

Future Research

It is hoped that practitioners, academicians, and the supply-chain community will accept the proposed supply-chain reference model for the service industry in general. The direction of future research should be towards maintenance of the proposed model and enhancing the understanding of what constitutes a service industry. There are many areas to perform this in research, particularly:

- Developing an operations reference meta-model for the service industry that is generally accepted. For example taking the current knowledge available within the service management knowledge area and developing it will define a comprehensive operations reference model that links all industries considered by the US government as service industries.
- Extending the knowledge base of what constitutes a service industry supply chain. For example, the development of service industry supply chains that use Level 1 and Level 2 as proposed, however provide various Level 3 views to provide specificity to the industry.
- Extending the knowledge base of the service industry supply chain using conceptualization and ontological definitions.
- Extending the understanding of health care services and the complexities within the health care services supply chain to define the

information and knowledge exchanged between entities in a business framework.

- Develop the means to integrate clinical processes and business processes within the US health care industry.
- Merging the technologies used in providing clinical processes with the business processes to depict the actual cost of providing health care services.

Other future research should include the benchmarking of the services industry using generally accepted metrics. Also modeling of the generally accepted services supply chain to more provide a more room bust independent understanding of the services industry.

APPENDIX: SERVICES SUPPLY-CHAIN OPERATIONS REFERENCE MODEL

INTRODUCTION

Background – The Services Supply Chain Operations Reference (S^2COR) Model was developed in association with a comprehensive dissertation addressing the issues specific to the Service industry. The interactions between entities occur at the enterprise level. This model can serve as the starting point for future efforts related to the development of common business processes for the provisioning of Services and input to the development of a robust Service Supply Chain Operations Reference model.

The Model's structure and descriptive tools are adapted from the Supply Chain Operations Reference Model (SCOR) version 8.0 (Supply Chain Council 2006). While similar in presentation and detail, the model itself is the result of an original development effort. Input from the original SCOR model includes the adoption of the multi-level approach to hierarchical model development, the use of "PLAN" as an initial Level 1 Process and the Plan/Enable/Execute terminology. All other information is original.

This document provides users an introduction to the S^2COR model. The introduction includes guidance and technical details for the implementation of the model.

Scope- The development of the model focuses on the description of business activity associated with the fulfilling of a customer service request. Organization of the model is around four processes; PLAN – REQUEST – FULFILL – DELIVER. Similar to the original SCOR model, the hope is to describe very simple and very complex service supply chains using a common definition. The result is that multiple, disparate entities can communicate and exchange information, services and goods across multiple supply-chain models.

It is important to understand that the model does not attempt to capture all business processes or activities. Rather, the intent is to provide a broad enough framework in which to adapt to processes and activities specific to an enterprise.

As such, implementation of the model requires extension to Level 4 to account for organizational processes, systems and practices.

The Details – Like SCOR, S^2COR is based on multiple levels of detail. The Supply Chain Council (SCC) uses the term Level to describe the hierarchical association of processes. For example, Level 1 is the top level describing the types of processes. Level 2 is described as the configuration level and categorizes the processes, while Level 3 is the decomposition of the processes

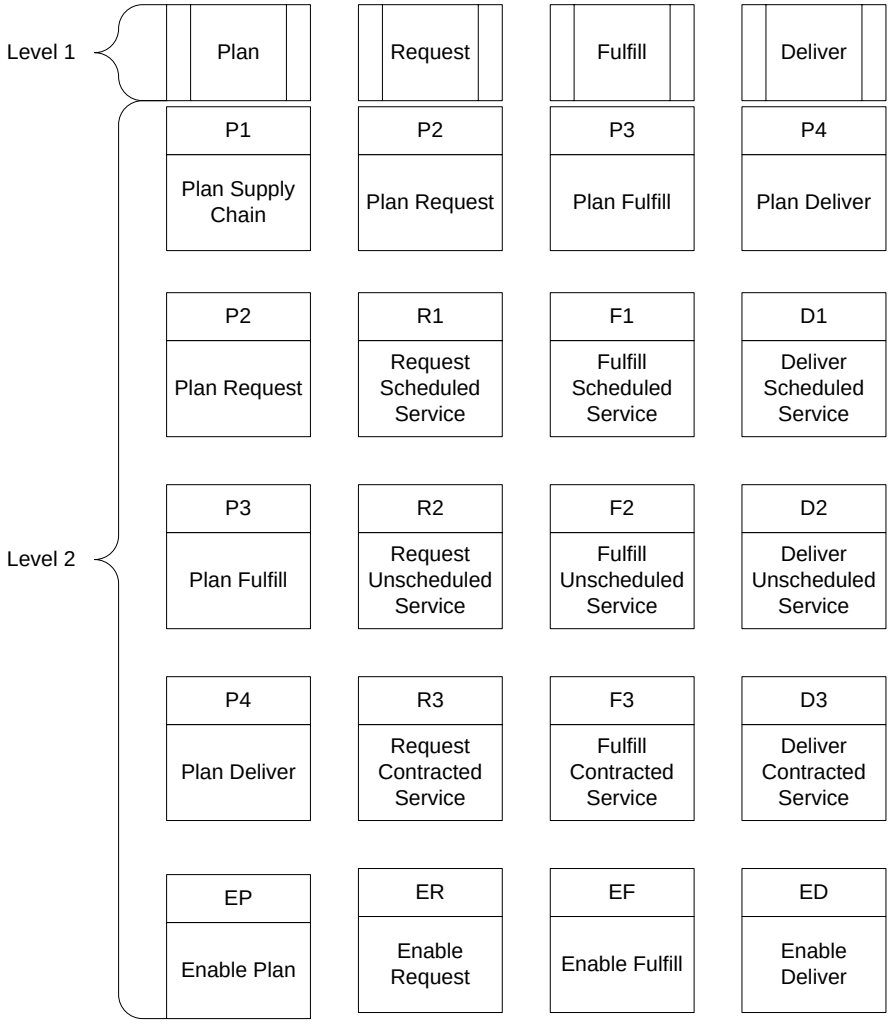
at the element level. Level 4 is the final level and describes the implementation. Level 4 is what impacts the end-user directly as it is the decomposition of the elements into the detailed processes.

S^2COR is also a business process reference model that links process elements, metrics, best practices and execution features associated with a business activity.

Model Structure – Supporting the organizational structure of PLAN, REQUEST, FULFILL, and DELIVER are three process types: planning, execute and enable. Borrowing from the SCC terminology, the following definitions apply:

Planning – generally occurs at regular intervals and can contribute to response time of the supply-chain.
Execute – triggered or planned activities based on planned or actual demand
Enable – prepare, maintain and manage information or relationships that the Planning and Execute processes rely on.

Description of the model uses a standard set of notation throughout the model. P relates to Plan elements, R to Request elements, F to Fulfill elements and D to Deliver elements. An E preceding indicates an Enabling process. For example EP is Enable Planning. Since the model is hierarchical, notation of Level 3 uses a decimal association with the process element. For example P1.1 indicates a Planning process at Level 1 associated with supply-chain planning at Level 2 and specifying the identification, prioritization and aggregation of requirements at Level 3.



Organization – Sections describing Plan, Request, Fulfill and Deliver use a standard structure. At the beginning of each section, a graphic depicts the relation of each process, input and output. Following the graphic is a text table identifying: 1) a standard name for the process element, 2) notation for the process element, 3) definition of the process element, 4) any performance attributes, 5) metrics and 6) best practices.

Within the each Level 1 process, a common internal structure germane to the performance of services is in use. The structure consists of three types of service requests; scheduled, unscheduled and contracted. Therefore, each process element will have a Plan Scheduled Service, Request Scheduled Service and so on for each type of service.

Each Enable process uses the same format, graphic and description process.

Metrics for this initial model are suggested at Level 1 only. This should allow for the development of Level 2 diagnostic metrics in future evolutions. Each metric corresponds to a performance attribute. The SCC defines performance attributes as characteristics that allow for comparison and effectiveness evaluation of supply-chains. Performance attributes associated with the S^2COR model are attributable to customer associated activities and internal activities. Customer activities measure reliability, response and flexibility. Internal activities measure costs and asset utilization. The following definitions correspond to the attributes:

Reliability – accurate delivery of the requested service
Response – speed with which service is completed
Flexibility – ability to respond to market, supply and demand changes
Costs – operation costs, both indirect and direct
Assets – management of assets used in the fulfillment and delivery of a service

The corresponding attribute and metric are described below.

Table 23: Specification metrics.

	Performance Attributes				
Level 1 Metrics	Customer Facing			Internal Facing	
	Reliability	Response	Flexibility	Costs	Assets
Rate of request fulfillment	**X**	**X**			
Request cycle time		**X**			
Demand flexibility			**X**		
Management cost				**X**	
Cost of Services				**X**	
Cash to Cash Cycle Time					**X**
Return on Assets					**X**

Figure 24: S2COR model. S^2COR Model

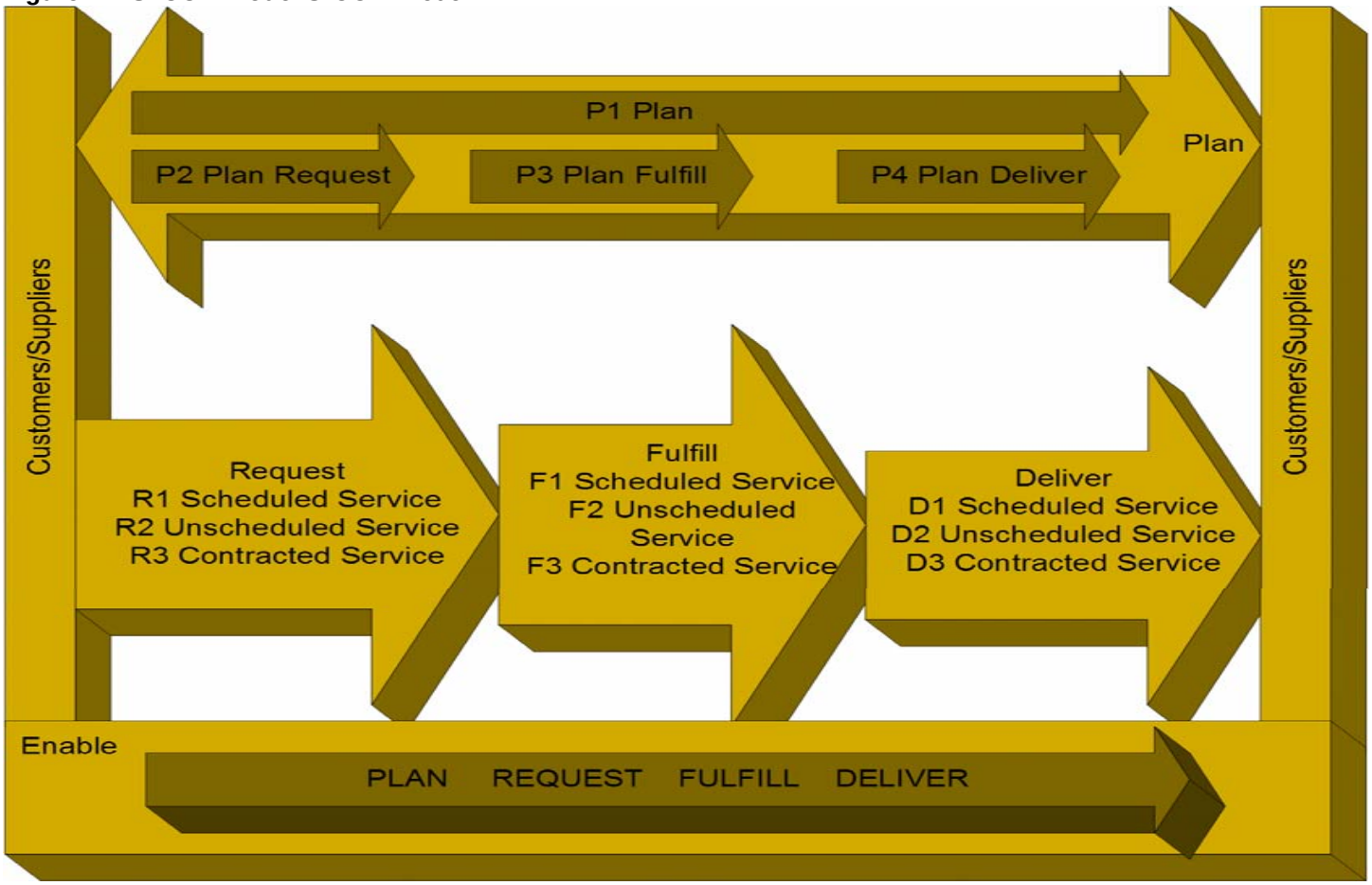


Table 24: S2COR explanation.

Process Identifier	**Service**
Description	The definition of service for this research is: Any material or non-material, definable asset requested by a customer where the customer is the initiator of a request, and the asset is delivered at any point in time a customer requests usage. 3 process types define the proposed model: Planning Processes; Execution Processes; and Enabling Processes. Planning processes balance aggregated demand across a consistent planning horizon. Planning processes for this model occur at ad-hoc and regular intervals. Execution processes are planned or actual events. Execution processes include service requests, creation of solutions and request fulfillment. Enable processes manage knowledge, compliance, data and relationships used in planning and execution.

Child Processes
▪ P : Plan ▪ R : Request ▪ F : Fulfill ▪ D : Deliver

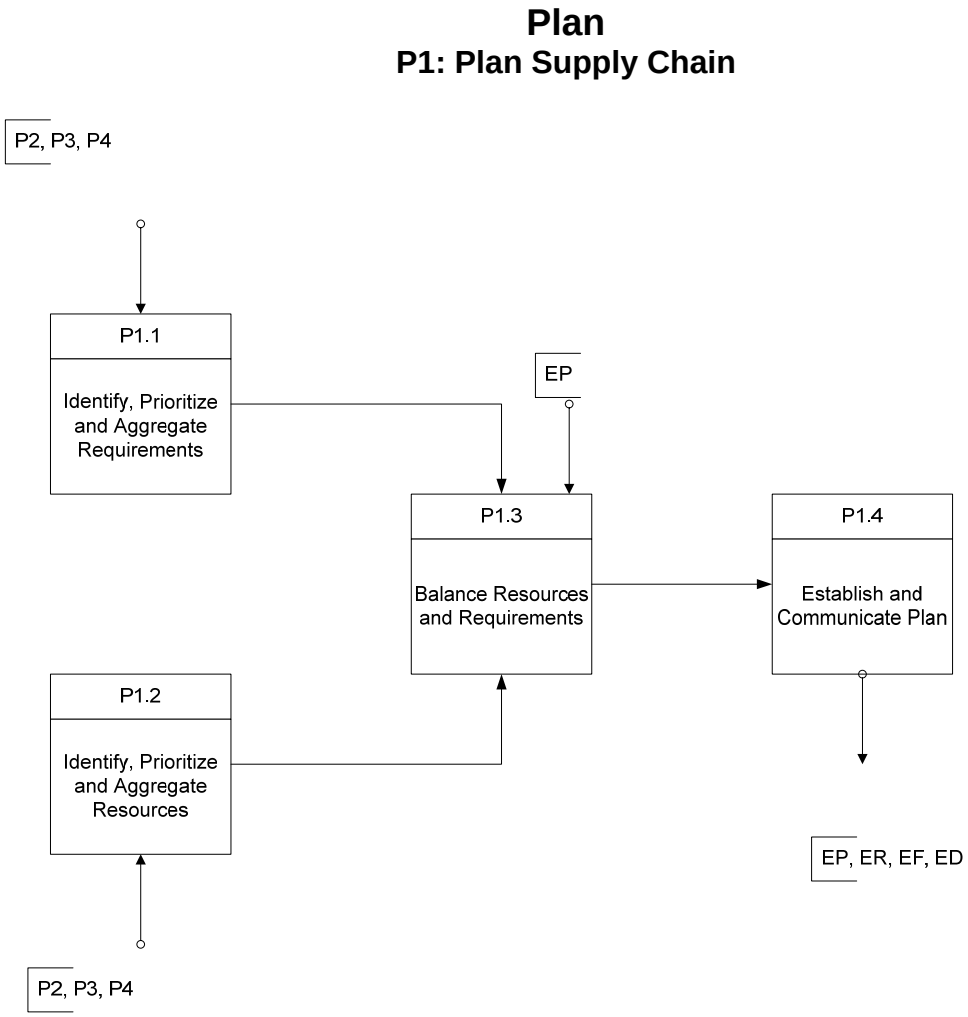


Figure 25: Plan supply chain process model.

Table 25: S^2COR planning processes P1.

PROCESS IDENTIFIER:	P1
DESCRIPTION	Develop and establish plan of action for allocation of resources.
CHILD PROCESSES	
P2,P3, P4, EP	
KEY INPUTS	**KEY OUTPUTS**
P2, P3, P4, EP	P2, P3, P4, EP
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	N/A
PROCESS IDENTIFIER:	P1.1
DESCRIPTION	Develop and establish plan of action for identifying and prioritizing aggregate requirements.
CHILD PROCESSES	
P1,P2, P3, P4, EP	
KEY INPUTS	**KEY OUTPUTS**
P2, P3, P4	P1.3
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	P1.2
DESCRIPTION	Develop and establish plan of action for allocation of resources.
CHILD PROCESSES	
P1,P2, P3, P4, EP	
KEY INPUTS	**KEY OUTPUTS**
P2, P3, P4	P1.3
Performance Attribute	**Metric**

Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	P1.3
DESCRIPTION	Develop and establish plan of action for balancing of resources and requirements.
CHILD PROCESSES	
P1,P2, P3, P4, EP	
KEY INPUTS	**KEY OUTPUTS**
EP	P1.4
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	P1.4
DESCRIPTION	Develop and establish plan of action for communicating plan.
CHILD PROCESSES	
P1,P2, P3, P4, EP	
KEY INPUTS	**KEY OUTPUTS**
P1.3	EP,ER,EF,ED
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A

P2: Plan Request

P2 Plan Request

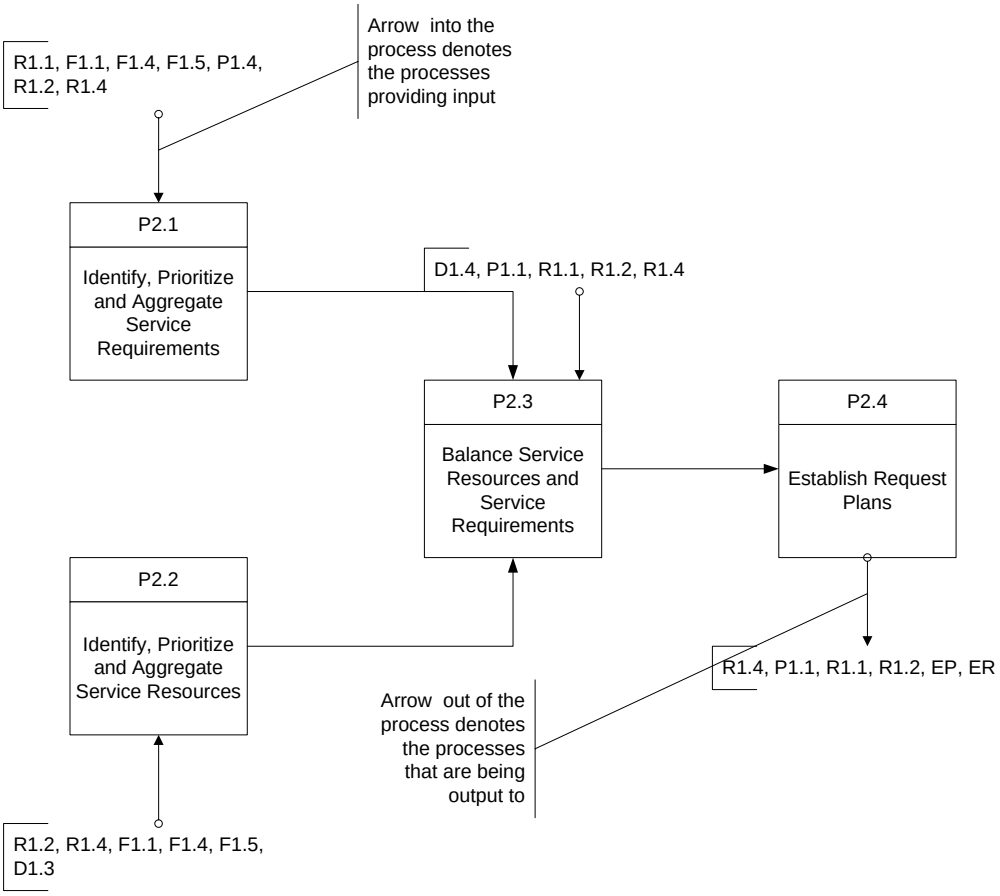


Figure 26: Plan request process model.

Table 26: S^2COR planning request processes P2

PROCESS IDENTIFIER:	P2
DESCRIPTION	Develop and establish plan of action for allocation of service related resources to fulfill requirements.
CHILD PROCESSES	
P2.1, P2.2, P2.3, P2.4	
KEY INPUTS	**KEY OUTPUTS**
P1, EP	P2, EP
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	N/A
PROCESS IDENTIFIER:	P2.1
DESCRIPTION	Develop and establish plan of action for identifying and prioritizing aggregate request requirements.
CHILD PROCESSES	
P2.3	
KEY INPUTS	**KEY OUTPUTS**
R1.1, F1.1, F1.4, F1.5, P1.4, R1.2, R1.4	P2.3
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	P2.2
DESCRIPTION	Develop and establish plan of action for aggregate allocation of resources necessary to fulfill request.
CHILD PROCESSES	
P2.3	

KEY INPUTS	KEY OUTPUTS
R1.2, R1.4, F1.1, F1.4, F1.5, D1.3	P2.3
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	P2.3
DESCRIPTION	Develop and establish plan of action for balancing of resources and requirements to fulfill request.
CHILD PROCESSES	
P2.4	
KEY INPUTS	**KEY OUTPUTS**
D1.4, P1.1, R1.1, R1.2, R1.4	P2.4
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	P2.4
DESCRIPTION	Develop and establish plan of action for all requests.
CHILD PROCESSES	
P1, P3, P4, EP	
KEY INPUTS	**KEY OUTPUTS**
P2.3	R1.4, P1.1, R1.1, R1.2, EP, ER
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A

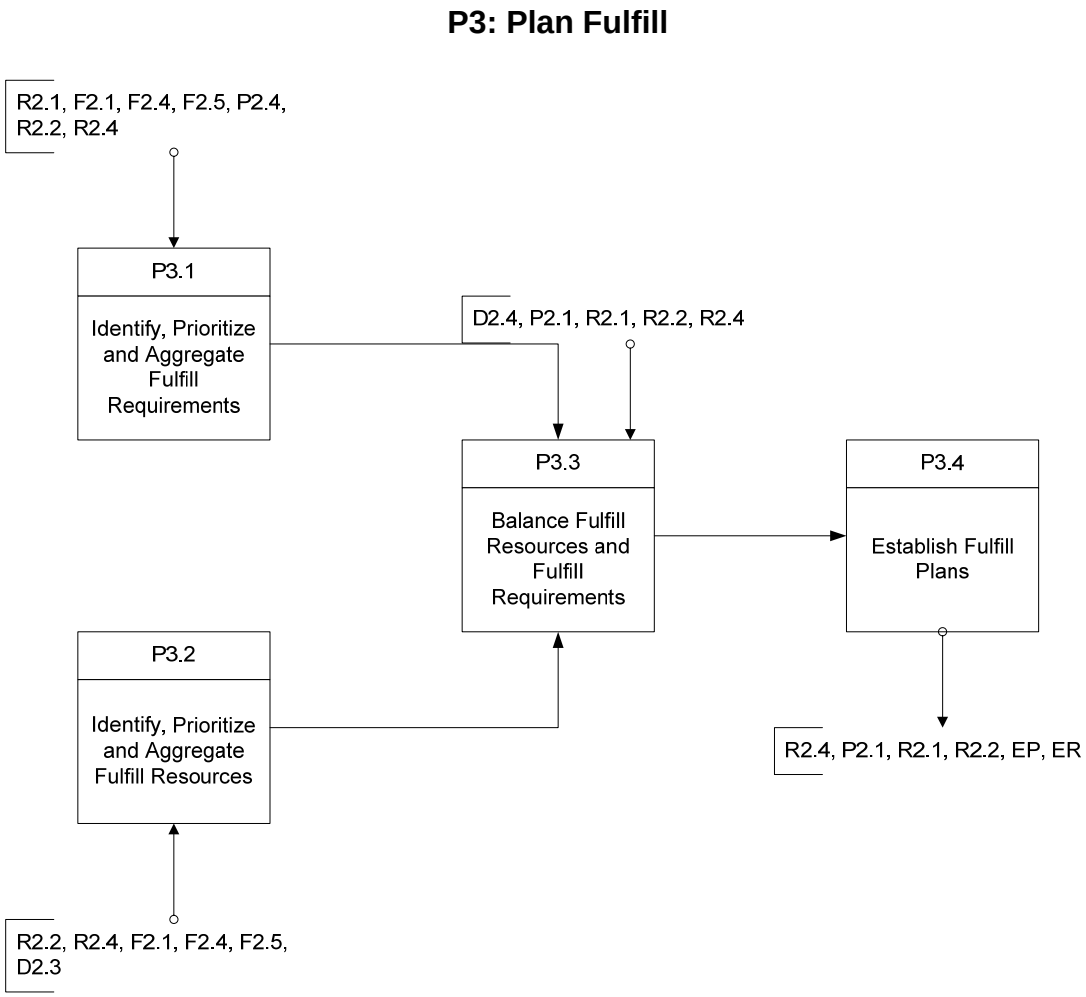


Figure 27: Plan fulfill process model.

Table 27: S^2COR planning fulfill processes P3.

PROCESS IDENTIFIER:	P3
DESCRIPTION	Develop and establish plan of action for allocation of service related resources to fulfill requested services.
CHILD PROCESSES	
P3.1, P3.2, P3.3, P3.4	
KEY INPUTS	**KEY OUTPUTS**
P1, P2, EP	P4, EP
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	N/A
PROCESS IDENTIFIER:	P3.1
DESCRIPTION	Develop and establish plan of action for identifying and prioritizing aggregate fulfillment requirements.
CHILD PROCESSES	
P3.3	
KEY INPUTS	**KEY OUTPUTS**
R2.1,F2.1,F2.4,F2.5,P2.4,R2.2,R2.4	P3.3
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	P3.2
DESCRIPTION	Develop and establish plan of action for aggregate allocation of fulfillment resources.
CHILD PROCESSES	
P3.3	
KEY INPUTS	**KEY OUTPUTS**

R2.2,R2.4,F2.1,F2.4,F2.5,D2.3	P2.3
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	P3.3
DESCRIPTION	Develop and establish plan of action for balancing of fulfillment resources and requirements.
CHILD PROCESSES	
P3.4	
KEY INPUTS	**KEY OUTPUTS**
P3.1,P3.2,D2.4,P2.1,R2.1,R2.2,R2.4	P3.4
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	P3.4
DESCRIPTION	Develop and establish plan of action for fulfilling all requests.
CHILD PROCESSES	
P1, P3, P4, EP	
KEY INPUTS	**KEY OUTPUTS**
P3.3	R2.4, P2.1, R2.1, R2.2, EP, ER
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A

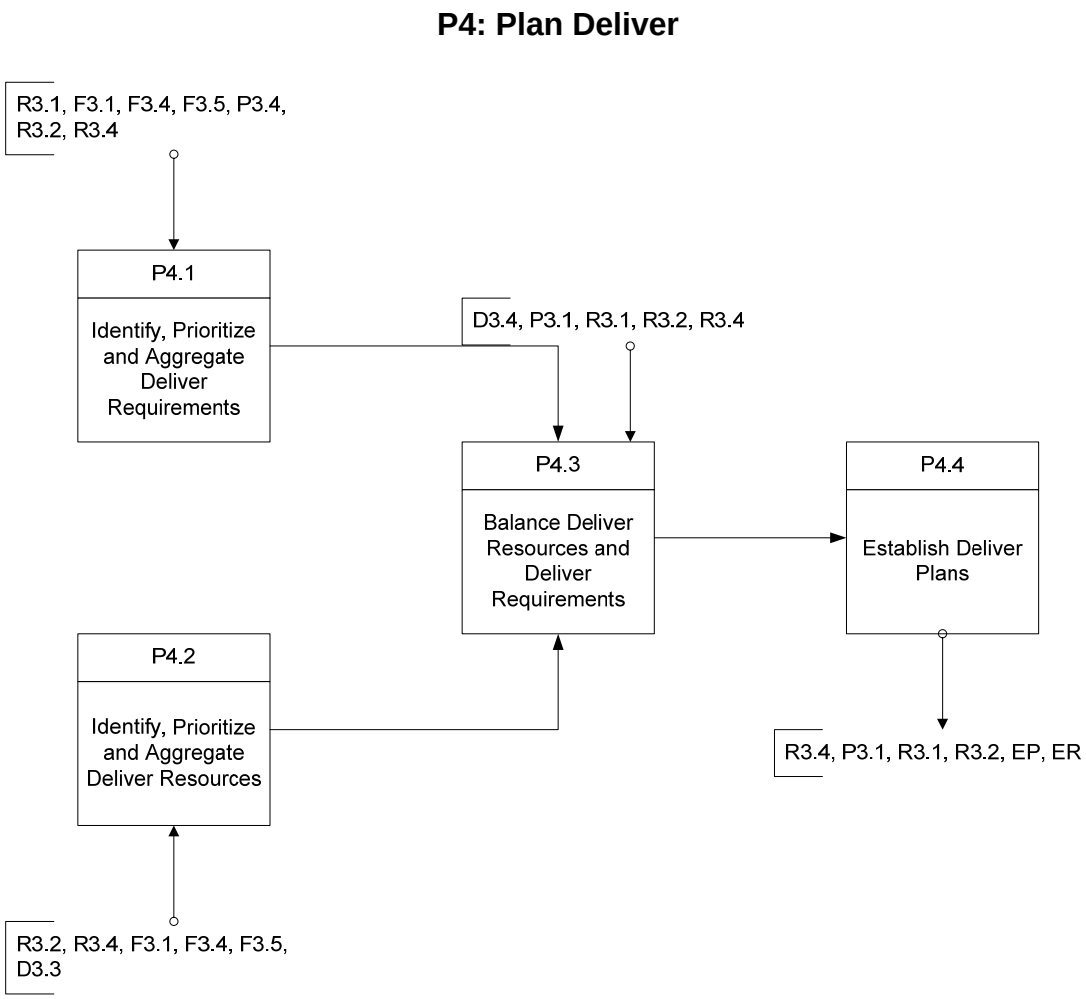


Figure 28: Plan deliver process model.

Table 28: S^2COR planning deliver processes P4.

PROCESS IDENTIFIER:	P4
DESCRIPTION	Develop and establish plan of action for allocation of service related resources to deliver requirements.
CHILD PROCESSES	
P4.1, P4.2, P4.3, P4.4	
KEY INPUTS	**KEY OUTPUTS**
P1,P2,P3, EP	P2,R3,ER, EP
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	N/A
PROCESS IDENTIFIER:	P4.1
DESCRIPTION	Develop and establish plan of action for identifying and prioritizing aggregate delivery requirements.
CHILD PROCESSES	
P4.3	
KEY INPUTS	**KEY OUTPUTS**
R3.1,F3.1,F3.4,F3.5,P3.4,R3.2,R3.4	P4.3
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	P4.2
DESCRIPTION	Develop and establish plan of action for aggregate allocation of delivery resources.
CHILD PROCESSES	
P4.3	
KEY INPUTS	**KEY OUTPUTS**

R3.2,R3.4,F3.1,F3.4,F3.5,D3.3	P4.3
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	P4.3
DESCRIPTION	Develop and establish plan of action for balancing of delivery resources and delivery requirements.
CHILD PROCESSES	
P3.4	
KEY INPUTS	**KEY OUTPUTS**
D3.4,P3.1,R3.1,R3.2,R3.4	P3.4
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	P4.4
DESCRIPTION	Develop and establish plan of action for delivery.
CHILD PROCESSES	
P1, P2,P3, P4, EP	
KEY INPUTS	**KEY OUTPUTS**
P4.3	R3.4, P3.1, R3.1, R3.2, EP, ER
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A

Request

R1 : Request Scheduled Service

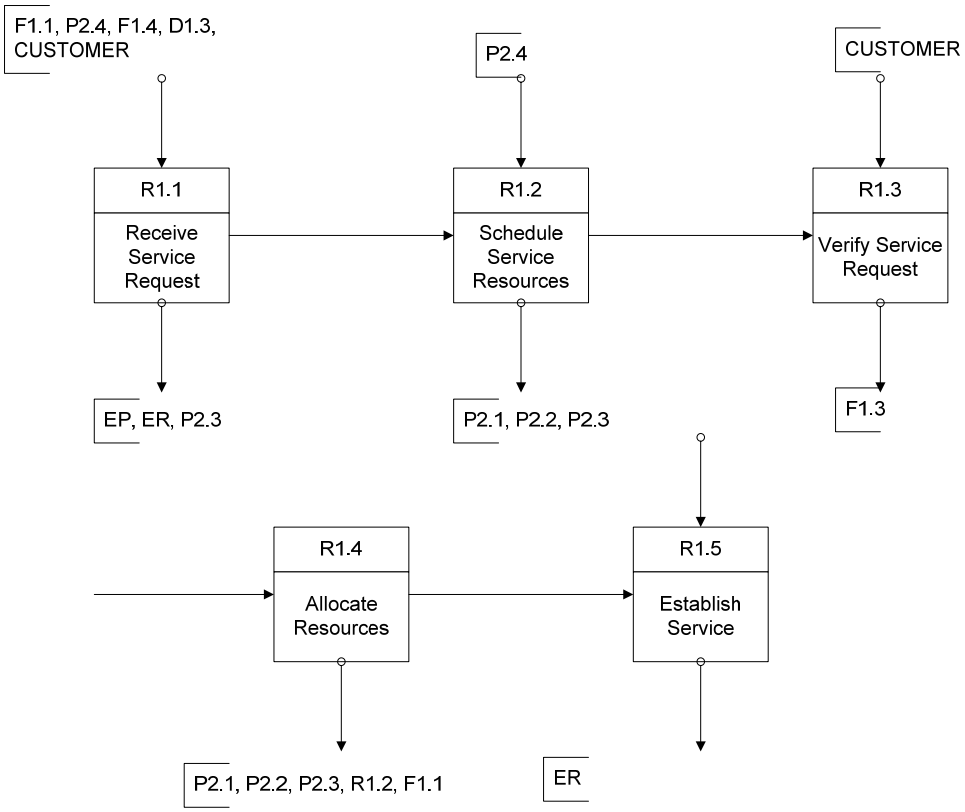


Figure 29: Request scheduled service process model.

Table 29: S^2COR request scheduled service processes R1.

PROCESS IDENTIFIER:	R1
DESCRIPTION	Receive request for scheduled service and verify availability of resources.
CHILD PROCESSES	
R1.1,R1.2,R1.3,r1.4,R1.5	
KEY INPUTS	**KEY OUTPUTS**
P1,P2,P3, EP, ER	R1.5,ER, EP
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	N/A
PROCESS IDENTIFIER:	R1.1
DESCRIPTION	Receive request for service and interface with customer to identify requirements.
CHILD PROCESSES	
R1.2	
KEY INPUTS	**KEY OUTPUTS**
F1.1,P2.4,F1.4,D1.3,CUSTOMER	EP,ER,P2.3,R1.2
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	R1.2
DESCRIPTION	Schedule delivery resources based on input from planning and requirements of customer.
CHILD PROCESSES	
R1.3	
KEY INPUTS	**KEY OUTPUTS**
P2.4,R1.1	P2.1,P2.2,P2.3
Performance Attribute	**Metric**

Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	NA
PROCESS IDENTIFIER:	R1.3
DESCRIPTION	Verify requirements and resource availability.
CHILD PROCESSES	
R1.4	
KEY INPUTS	**KEY OUTPUTS**
CUSTOMER	F1.3
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	R1.4
DESCRIPTION	Using input from R1.3 allocate resources based on pre-established allocation plan
CHILD PROCESSES	
R1.5	
KEY INPUTS	**KEY OUTPUTS**
R1.3	P2.1,P2.2,P2.3,R1.2,F1.1
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	R1.5
DESCRIPTION	Establish service in Plan and notify resources. Coordinate with other supply-chains as necessary to insure availability

	of goods and services.
CHILD PROCESSES	
F	
KEY INPUTS	**KEY OUTPUTS**
R1.4	ER
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A

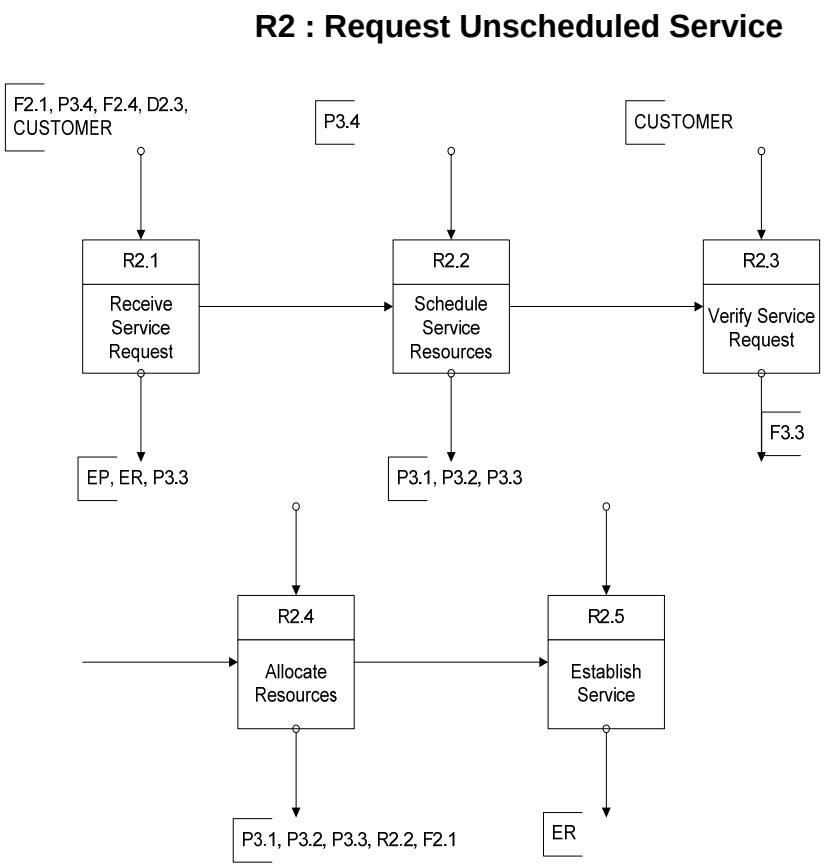


Figure 30: Request unscheduled service process model.

Table 30: S^2COR request unscheduled service processes R2.

PROCESS IDENTIFIER:	R2
DESCRIPTION	Receive request for unscheduled service and verify availability of resources.
CHILD PROCESSES	
R2.1,R2.2,R2.3,R2.4,R2.5	
KEY INPUTS	**KEY OUTPUTS**
P1,P2,P3, EP, ER	R2.5,ER, EP
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	N/A
PROCESS IDENTIFIER:	R2.1
DESCRIPTION	Receive request for service and interface with customer to identify requirements.
CHILD PROCESSES	
R2.2	
KEY INPUTS	**KEY OUTPUTS**
F2.1,P3.4,F2.4,D2.3,CUSTOMER	EP,ER,P3.3,R2.2
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	R2.2
DESCRIPTION	Schedule delivery resources based on input from planning and requirements of customer.
CHILD PROCESSES	
R2.3	
KEY INPUTS	**KEY OUTPUTS**
P3.4,R2.1	P3.1,P3.2,P3.3
Performance Attribute	**Metric**

Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	R2.3
DESCRIPTION	Verify requirements and resource availability.
CHILD PROCESSES	
R2.4	
KEY INPUTS	**KEY OUTPUTS**
CUSTOMER	F2.3
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	R2.4
DESCRIPTION	Using input from R1.3 allocate resources based on pre-established allocation plan
CHILD PROCESSES	
R2.5	
KEY INPUTS	**KEY OUTPUTS**
R2.3	P3.1,P3.2,P3.3,R2.2,F2.1
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	R2.5
DESCRIPTION	Establish service in Plan and notify resources. Coordinate with other supply-chains as necessary to insure availability

	of goods and services.
CHILD PROCESSES	
F	
KEY INPUTS	**KEY OUTPUTS**
R2.4	ER
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A

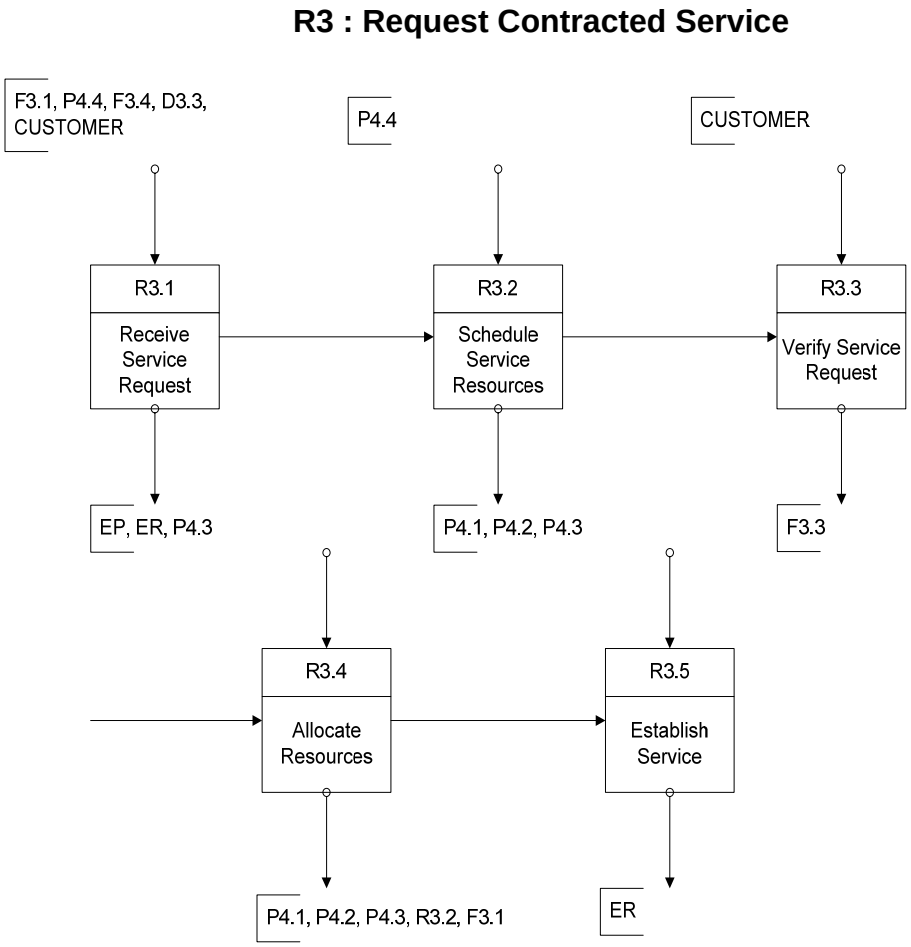


Figure 31: Request contracted services process model.

Table 31: S^2COR request contracted service processes R3.

PROCESS IDENTIFIER:	R3
DESCRIPTION	Receive request for contracted service and verify availability of resources.
CHILD PROCESSES	
R3.1,R3.2,R3.3,R3.4,R3.5	
KEY INPUTS	**KEY OUTPUTS**
P1,P2,P3, EP, ER	R3.5,ER, EP
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	N/A
PROCESS IDENTIFIER:	R3.1
DESCRIPTION	Receive request for service and interface with customer to identify requirements.
CHILD PROCESSES	
R3.2	
KEY INPUTS	**KEY OUTPUTS**
F3.1,P4.4,F3.4,D3.3,CUSTOMER	EP,ER,P4.3,R3.2
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	R3.2
DESCRIPTION	Schedule delivery resources based on input from planning and requirements of customer.
CHILD PROCESSES	
R3.3	
KEY INPUTS	**KEY OUTPUTS**
P4.4,R3.1	P4.1,P4.2,P4.3
Performance Attribute	**Metric**

Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	R3.3
DESCRIPTION	Verify requirements and resource availability.
CHILD PROCESSES	
R3.4	
KEY INPUTS	**KEY OUTPUTS**
CUSTOMER	F3.3
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	R3.4
DESCRIPTION	Using input from R1.3 allocate resources based on pre-established allocation plan
CHILD PROCESSES	
R3.5	
KEY INPUTS	**KEY OUTPUTS**
R3.3	P4.1,P4.2,P4.3,R3.2,F3.1
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	R3.5
DESCRIPTION	Establish service in Plan and notify resources. Coordinate with other supply-chains as necessary to insure availability

	of goods and services.
CHILD PROCESSES	
F	
KEY INPUTS	**KEY OUTPUTS**
R3.4	ER
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A

FULFILL

F1 : Fulfill Scheduled Service

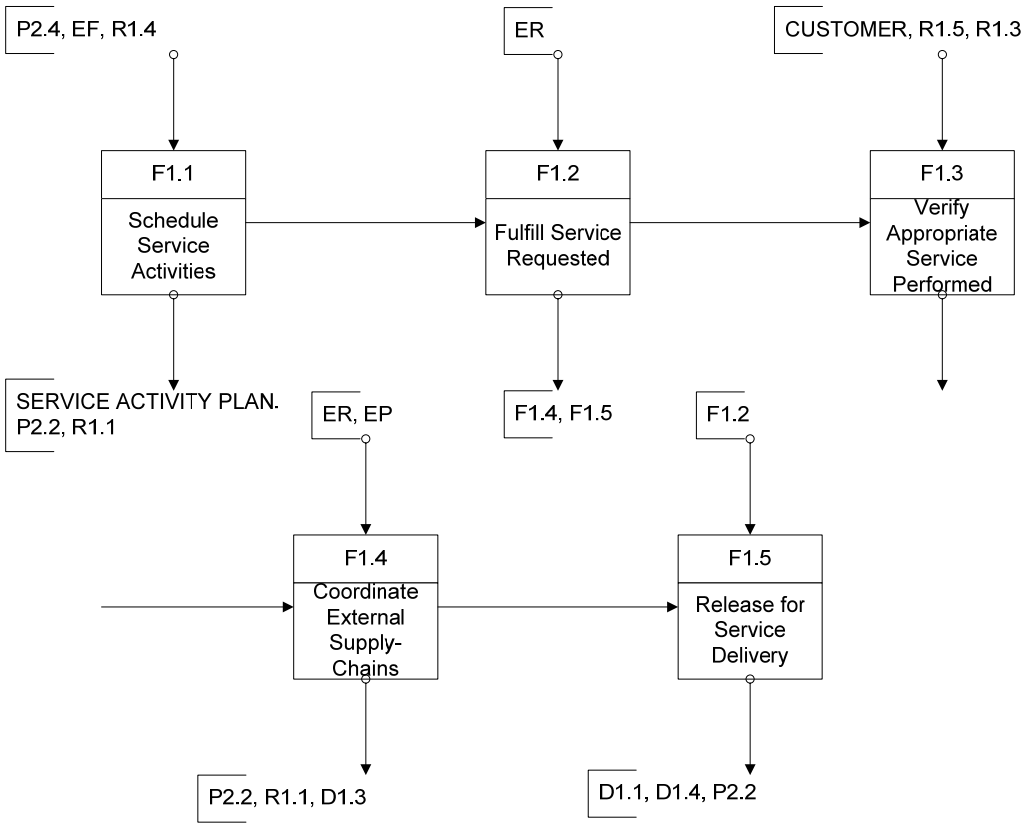


Figure 32: Fulfill scheduled service process model.

Table 32: S^2COR fulfill scheduled service processes F1.

PROCESS IDENTIFIER:	F1
DESCRIPTION	Fulfill request for scheduled service and verify delivery of service.
CHILD PROCESSES	
F1.1,F1.2,F1.3,F1.4,F1.5	
KEY INPUTS	**KEY OUTPUTS**
P1,P2,P3, EP, ER	F3.5,ER, EP,EF
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	N/A
PROCESS IDENTIFIER:	F1.1
DESCRIPTION	Prepare detail activity list for service to perform.
CHILD PROCESSES	
F1.2	
KEY INPUTS	**KEY OUTPUTS**
P2.4,EF,R1.4	P2.2,R1.1,SERVICE ACTIVITY PLAN
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	F1.2
DESCRIPTION	Fulfill requested service using allocated resources.
CHILD PROCESSES	
F1.3	
KEY INPUTS	**KEY OUTPUTS**
ER	F1.4,F1.5
Performance Attribute	**Metric**
Reliability	NA

Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	F1.3
DESCRIPTION	Perform quality check and confirm appropriate service rendered.
CHILD PROCESSES	
F1.4	
KEY INPUTS	**KEY OUTPUTS**
CUSTOMER,R1.5,R1.3	F1.4
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	F1.4
DESCRIPTION	Coordinate with external supply-chains as necessary.
CHILD PROCESSES	
F1.5	
KEY INPUTS	**KEY OUTPUTS**
ER,EP,F1.4	P2.2,R1.1,D1.3
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	F1.5
DESCRIPTION	Verify service is completed, document and release for delivery.
CHILD PROCESSES	
F	

KEY INPUTS	**KEY OUTPUTS**
F1.2	D1.1,D1.4,P2.2
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A

F2 : Fulfill Unscheduled Service

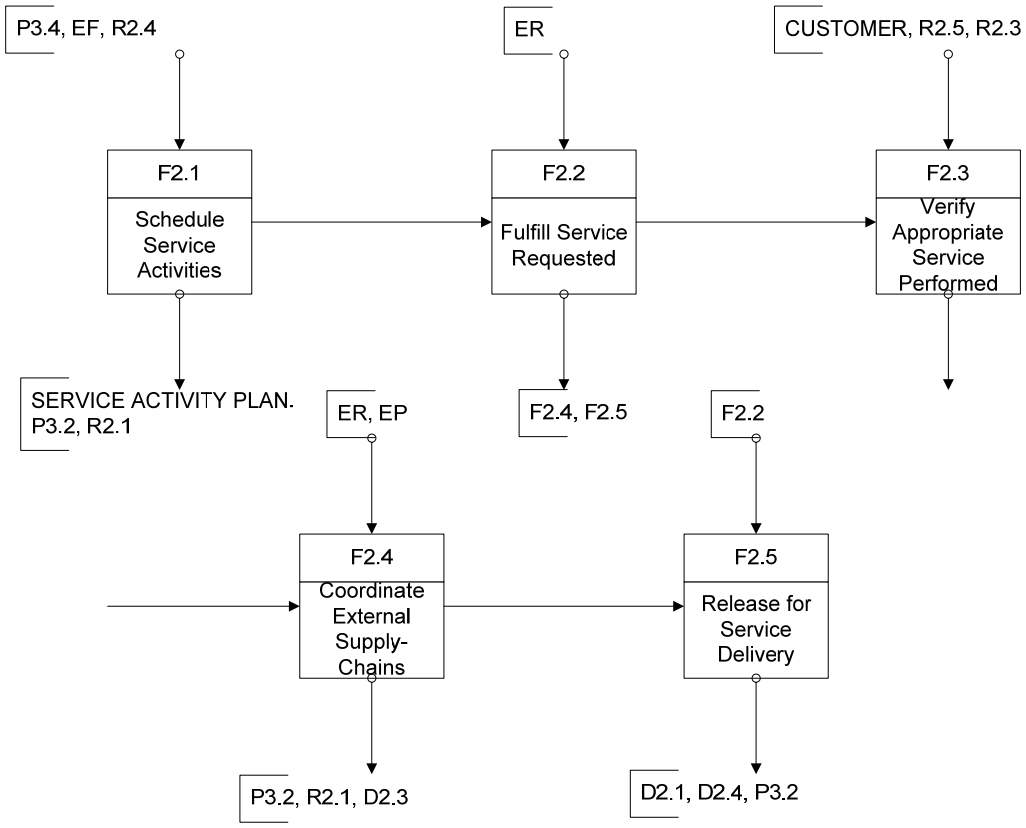


Figure 33: Fulfill unscheduled service process model.

Table 33: S^2COR fulfill unscheduled service processes F2.

PROCESS IDENTIFIER:	F2
DESCRIPTION	Fulfill request for unscheduled service and verify delivery of service.
CHILD PROCESSES	
F2.1,F2.2,F2.3,F2.4,F2.5	
KEY INPUTS	**KEY OUTPUTS**
P1,P2,P3, EP, ER	F3.5,ER, EP,EF
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	N/A
PROCESS IDENTIFIER:	F2.1
DESCRIPTION	Prepare detail activity list for service to perform.
CHILD PROCESSES	
F1.2	
KEY INPUTS	**KEY OUTPUTS**
P3.4,EF,R2.4	P3.2,R2.1,SERVICE ACTIVITY PLAN
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	F2.2
DESCRIPTION	Fulfill requested service using allocated resources.
CHILD PROCESSES	
F2.3	
KEY INPUTS	**KEY OUTPUTS**
ER	F2.4,F2.5
Performance Attribute	**Metric**
Reliability	NA

Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	F2.3
DESCRIPTION	Perform quality check and confirm appropriate service rendered.
CHILD PROCESSES	
F2.4	
KEY INPUTS	**KEY OUTPUTS**
CUSTOMER,R2.5,R2.3	F2.4
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	F2.4
DESCRIPTION	Coordinate with external supply-chains as necessary.
CHILD PROCESSES	
F2.5	
KEY INPUTS	**KEY OUTPUTS**
ER,EP,F2.3	P3.2,R2.1,D2.3
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	F2.5
DESCRIPTION	Verify service is completed, document and release for delivery.
CHILD PROCESSES	
F	

KEY INPUTS	**KEY OUTPUTS**
F2.2	D2.1,D2.4,P3.2
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A

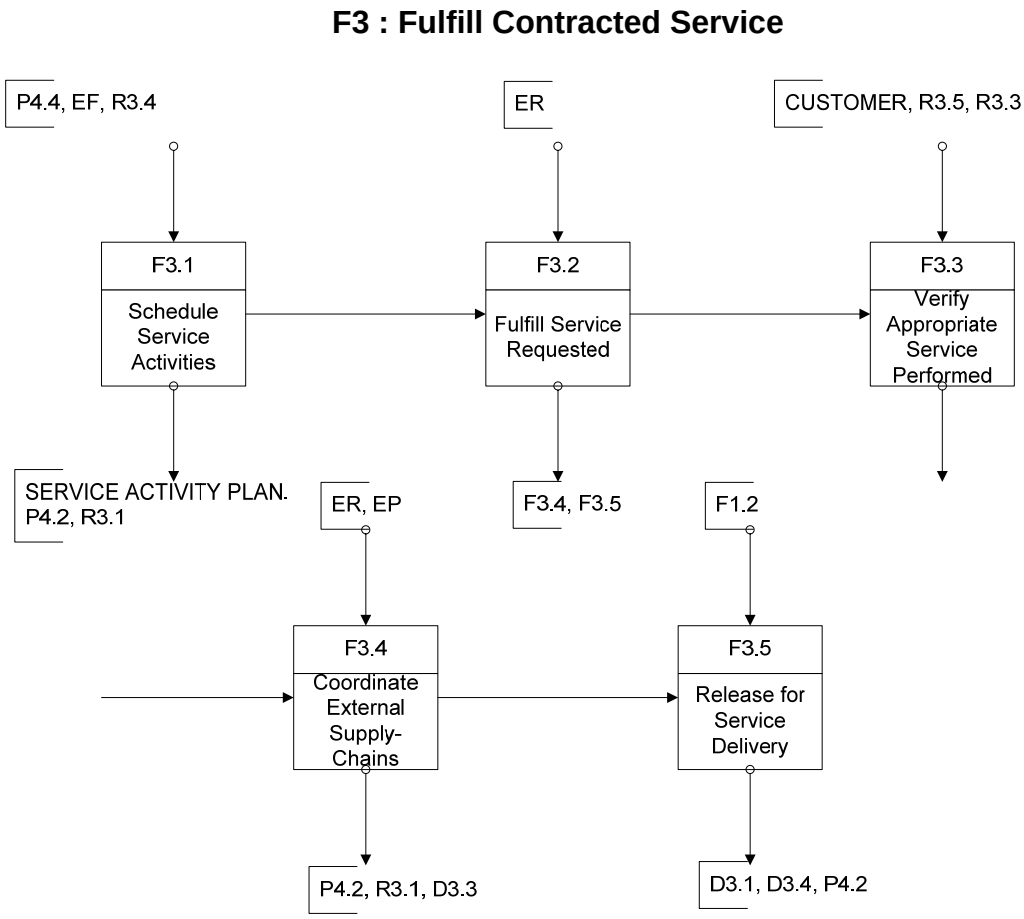


Figure 34: Fulfill contracted service process model.

Table 34: S^2COR fulfill contracted service processes F3.

PROCESS IDENTIFIER:	F3
DESCRIPTION	Fulfill request for contracted service and verify delivery of service.
CHILD PROCESSES	
F3.1,F3.2,F3.3,F3.4,F3.5	
KEY INPUTS	**KEY OUTPUTS**
P1,P2,P3, EP, ER	F3.5,ER, EP,EF
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	N/A
PROCESS IDENTIFIER:	F3.1
DESCRIPTION	Prepare detail activity list for service to perform.
CHILD PROCESSES	
F1.2	
KEY INPUTS	**KEY OUTPUTS**
P4.4,EF,R3.4	P4.2,R3.1,SERVICE ACTIVITY PLAN
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	F3.2
DESCRIPTION	Fulfill requested service using allocated resources.
CHILD PROCESSES	
F1.3	
KEY INPUTS	**KEY OUTPUTS**
ER	F3.4,F3.5
Performance Attribute	**Metric**
Reliability	NA

Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	F3.3
DESCRIPTION	Perform quality check and confirm appropriate service rendered.
CHILD PROCESSES	
F3.4	
KEY INPUTS	**KEY OUTPUTS**
CUSTOMER,R3.5,R3.3	F3.4
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	F3.4
DESCRIPTION	Coordinate with external supply-chains as necessary.
CHILD PROCESSES	
F3.5	
KEY INPUTS	**KEY OUTPUTS**
ER,EP,F3.3	P4.2,R3.1,D3.3
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	F3.5
DESCRIPTION	Verify service is completed, document and release for delivery.
CHILD PROCESSES	
F	

KEY INPUTS	**KEY OUTPUTS**
F3.2	D3.1,D3.4,P4.2
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A

Deliver

D1 : Deliver Scheduled Service

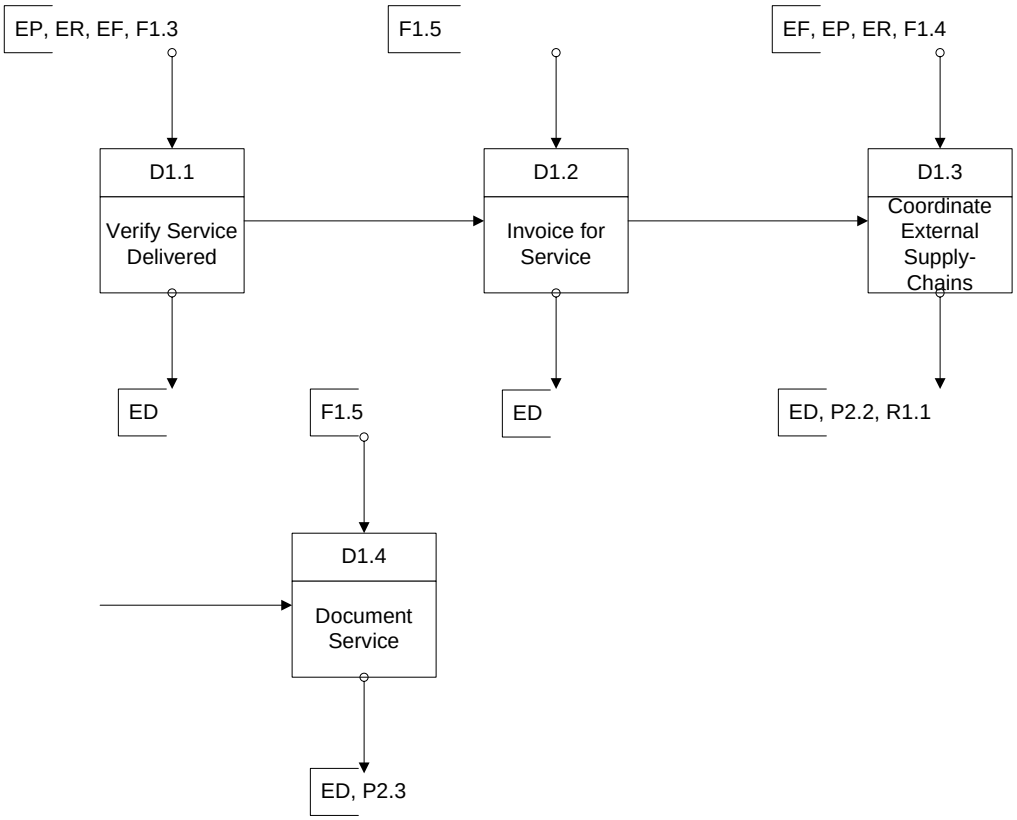


Figure 35: Deliver scheduled service process model.

Table 35: S^2COR deliver scheduled service processes D1.

PROCESS IDENTIFIER:	D1
DESCRIPTION	Complete the fulfillment of the scheduled service and finalize delivery of service.
CHILD PROCESSES	
D1.1,D1.2,D1.3,D1.4	
KEY INPUTS	**KEY OUTPUTS**
P1,P2,P3, EP, ER	D1.4,ER, EP,EF
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	N/A
PROCESS IDENTIFIER:	D1.1
DESCRIPTION	Verify that the service requested was delivered.
CHILD PROCESSES	
D1.2	
KEY INPUTS	**KEY OUTPUTS**
EP,ER,EF,P1.3	ED
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	D1.2
DESCRIPTION	Invoice to responsible party.
CHILD PROCESSES	
D1.3	
KEY INPUTS	**KEY OUTPUTS**
F1.5	ED
Performance Attribute	**Metric**
Reliability	NA

Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	D1.3
DESCRIPTION	Coordinate external supply chains as necessary
CHILD PROCESSES	
D1.4	
KEY INPUTS	**KEY OUTPUTS**
EF,EP,ER,F1.4	ED,P2.2,R1.1
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	D1.4
DESCRIPTION	Document services rendered and track invoice.
CHILD PROCESSES	
ED	
KEY INPUTS	**KEY OUTPUTS**
F1.5	ED,P2.3
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A

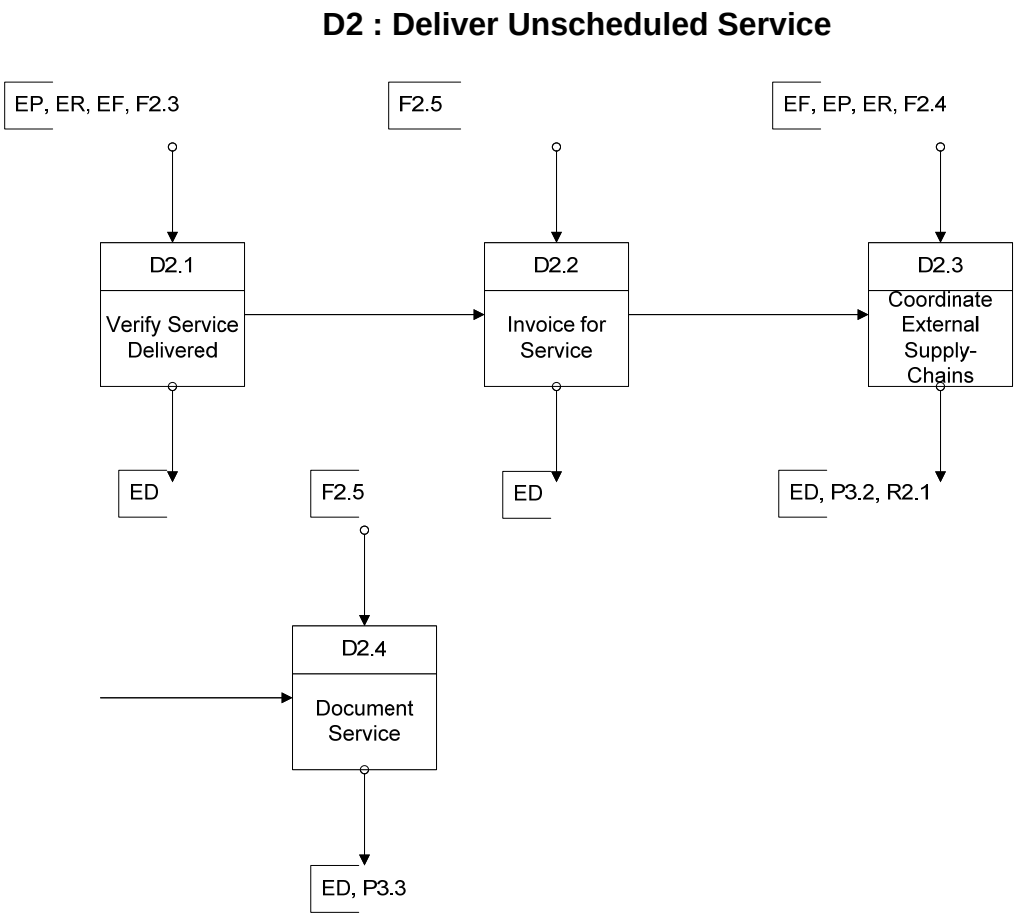


Figure 36: Deliver unscheduled service process model.

Table 36: S^2COR deliver unscheduled service processes D2.

PROCESS IDENTIFIER:	D2
DESCRIPTION	Complete the fulfillment of the scheduled service and finalize delivery of service.
CHILD PROCESSES	
D2.1,D2.2,D2.3,D2.4	
KEY INPUTS	**KEY OUTPUTS**
P1,P2,P3, EP, ER	D2.4,ER, EP,EF
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	N/A
PROCESS IDENTIFIER:	D2.1
DESCRIPTION	Verify that the service requested was delivered.
CHILD PROCESSES	
D2.2	
KEY INPUTS	**KEY OUTPUTS**
EP,ER,EF,F2.3	ED
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	D2.2
DESCRIPTION	Invoice to responsible party.
CHILD PROCESSES	
D2.3	
KEY INPUTS	**KEY OUTPUTS**
F2.5	ED
Performance Attribute	**Metric**
Reliability	NA

Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	D2.3
DESCRIPTION	Coordinate external supply chains as necessary
CHILD PROCESSES	
D2.4	
KEY INPUTS	**KEY OUTPUTS**
EF,EP,ER,F2.4	ED,P3.2,R2.1
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	D2.4
DESCRIPTION	Document services rendered and track invoice.
CHILD PROCESSES	
ED	
KEY INPUTS	**KEY OUTPUTS**
F2.5	ED,P3.3
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A

D3 : Deliver Contracted Service

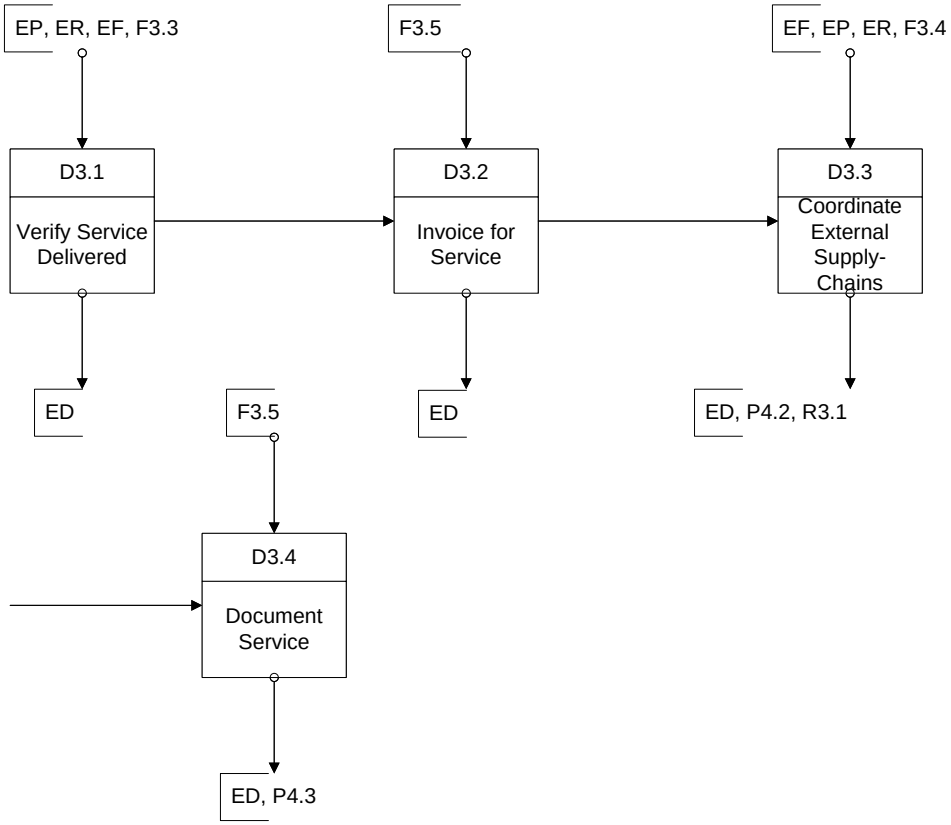


Figure 37: Deliver contracted service process model.

Table 37: S^{2}COR deliver contracted service processes D3.

PROCESS IDENTIFIER:	D3
DESCRIPTION	Complete the fulfillment of the scheduled service and finalize delivery of service.
CHILD PROCESSES	
D3.1,D3.2,D3.3,D3.4	
KEY INPUTS	**KEY OUTPUTS**
P1,P2,P3, EP, ER	D3.4,ER, EP,EF
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	N/A
PROCESS IDENTIFIER:	D3.1
DESCRIPTION	Verify that the service requested was delivered.
CHILD PROCESSES	
D3.2	
KEY INPUTS	**KEY OUTPUTS**
EP,ER,EF,F3.3	ED
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	D3.2
DESCRIPTION	Invoice to responsible party.
CHILD PROCESSES	
D3.3	
KEY INPUTS	**KEY OUTPUTS**
F3.5	ED
Performance Attribute	**Metric**
Reliability	NA

Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	D3.3
DESCRIPTION	Coordinate external supply chains as necessary
CHILD PROCESSES	
D3.4	
KEY INPUTS	**KEY OUTPUTS**
EF,EP,ER,F3.4	ED,P4.2,R3.1
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A
PROCESS IDENTIFIER:	D3.4
DESCRIPTION	Document services rendered and track invoice.
CHILD PROCESSES	
ED	
KEY INPUTS	**KEY OUTPUTS**
F3.5	ED,P4.3
Performance Attribute	**Metric**
Reliability	NA
Response	NA
Flexibility	NA
Cost	NA
Asset	NA
Best Practices	N/A

Enable Plan

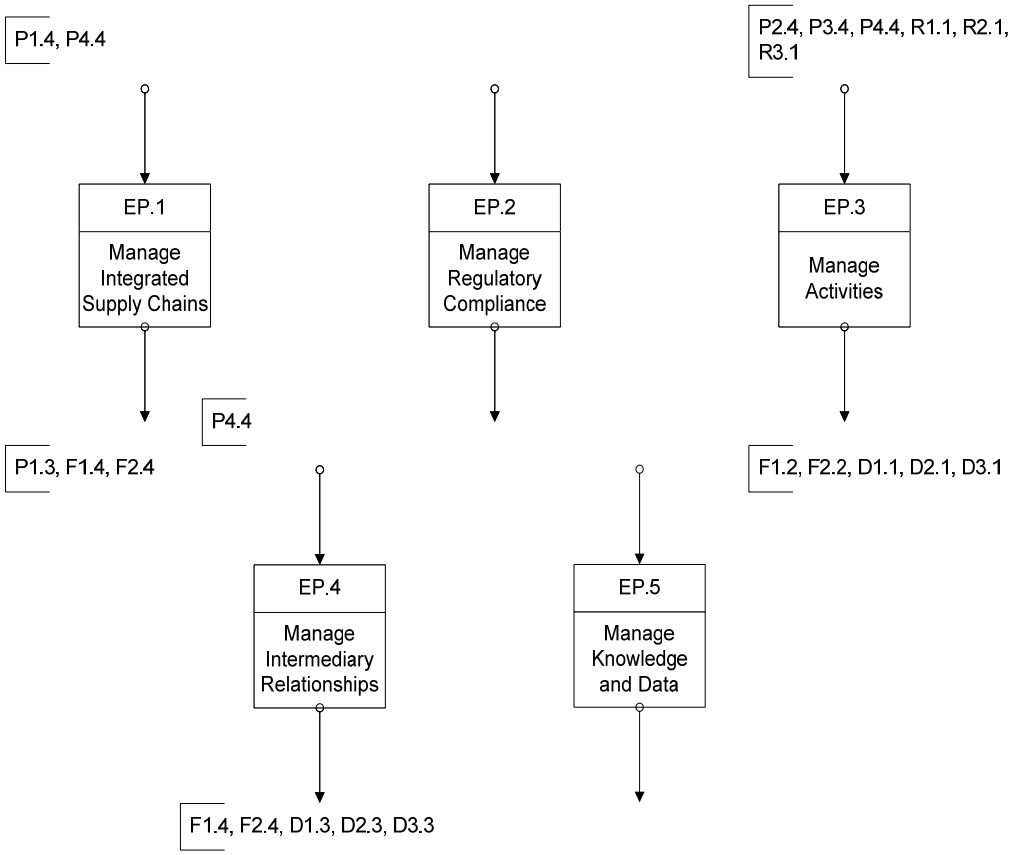


Figure 38: Enable plan process model.

Table 38 : S^2COR enable planning processes EP.

PROCESS IDENTIFIER:	EP.1
DESCRIPTION	Continuously plan the management of the integrated supply chains.
CHILD PROCESSES	
KEY INPUTS	**KEY OUTPUTS**
P1.4, P4.4	P1.3, F1.4, F2.4
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	
PROCESS IDENTIFIER:	EP.2
DESCRIPTION	Continuously manage the regulatory compliance plan.
CHILD PROCESSES	
KEY INPUTS	**KEY OUTPUTS**
Performance Attribute	**Metric**
Reliability	
Response	
Flexibility	
Cost	Management Cost Cost of Services
Asset	
Best Practices	
PROCESS IDENTIFIER:	EP.3
DESCRIPTION	Continuously plan the management of activities related to the supply-chain
CHILD PROCESSES	
KEY INPUTS	**KEY OUTPUTS**
P2.4, P3.4, P4.4, R1.1, R2.1,	F1.2, F2.2, D1.1, D1.2, D3.1

R3.1	
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	
Asset	
Best Practices	
PROCESS IDENTIFIER:	EP.4
DESCRIPTION	Continuously manage intermediary relationship plans to implement the integrated supply-chain.
CHILD PROCESSES	
KEY INPUTS	**KEY OUTPUTS**
	F1.4, F2.4, D1.3, D2.3, D3.3
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	
PROCESS IDENTIFIER:	EP.5
DESCRIPTION	Plan the continuous management of the data and knowledge created by the supply-chain.
CHILD PROCESSES	
KEY INPUTS	**KEY OUTPUTS**
Performance Attribute	**Metric**
Reliability	
Response	
Flexibility	
Cost	
Asset	
Best Practices	

Enable Request

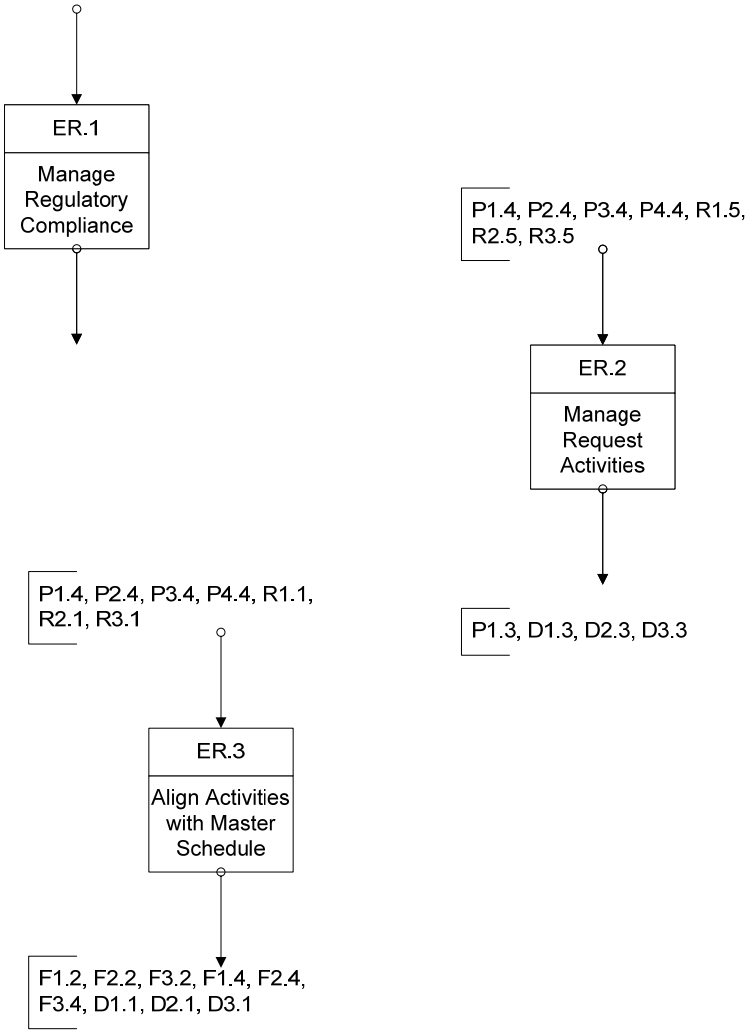


Figure 39: Enable request process model.

Table 39: S^2COR enable request processes ER.

PROCESS IDENTIFIER:	ER.1
DESCRIPTION	Continuously manage the regulatory compliance with respect to types of requests.
CHILD PROCESSES	
D3.1,D3.2,D3.3,D3.4	
KEY INPUTS	**KEY OUTPUTS**
P1,P2,P3, EP, ER	D3.4,ER, EP,EF
Performance Attribute	**Metric**
Reliability	
Response	Request Cycle Time
Flexibility	
Cost	
Asset	
Best Practices	
PROCESS IDENTIFIER:	ER.2
DESCRIPTION	Continuously manage request activities related to the supply-chain operations and plan.
CHILD PROCESSES	
KEY INPUTS	**KEY OUTPUTS**
P1.4, P2.4, P3.4, P4.4, R1.5, R2.5, R3.5	P1.3, D1.3, D2.3, D3.3
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	N/A
PROCESS IDENTIFIER:	ER.3
DESCRIPTION	Continuously manage the activities in relation to a balanced supply-chain plan. Insure the resources and requirements are balanced.
CHILD PROCESSES	

KEY INPUTS	**KEY OUTPUTS**
P1.4, P2.4, P3.4, P4.4, R1.1, R2.1, R3.1	F1.2, F2.2, F3.2, F1.4, F2.4, F3.4, D1.1, D2.1, D3.1
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	N/A

Enable Fulfill

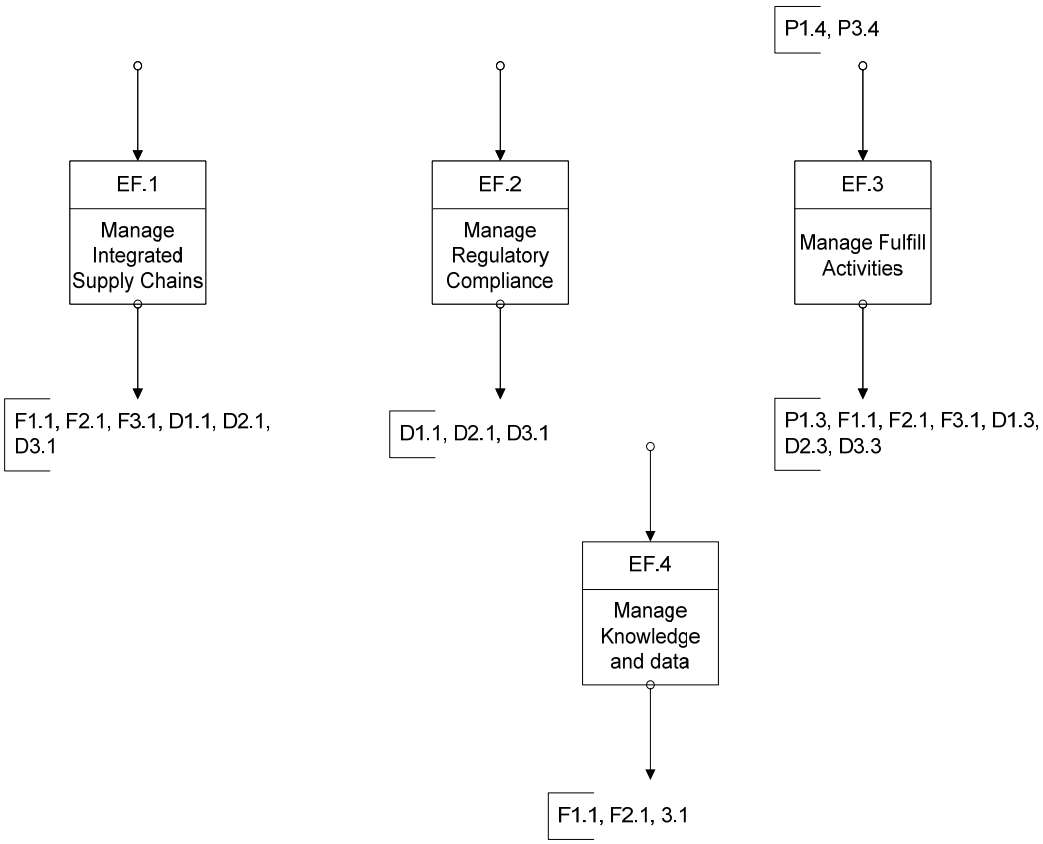


Figure 40: Enable fulfill process model.

Table 40: S^2COR enable fulfill processes EF.

PROCESS IDENTIFIER:	EF.1
DESCRIPTION	Continuously manage the fulfillment of requests within the integrated supply chains.
CHILD PROCESSES	
KEY INPUTS	**KEY OUTPUTS**
	F1.1, F2.1, F3.1, D1.1, D2.1, D3.1
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	
PROCESS IDENTIFIER:	EF.2
DESCRIPTION	Continuously manage the regulatory compliance of fulfilling requests and once the request is fulfilled.
CHILD PROCESSES	
KEY INPUTS	**KEY OUTPUTS**
	D1.1, D2.1, D3.1
Performance Attribute	**Metric**
Reliability	
Response	
Flexibility	
Cost	Management Cost Cost of Services
Asset	
Best Practices	
PROCESS IDENTIFIER:	EF.3
DESCRIPTION	Continuously manage the fulfillment activities of the balanced supply-chain plan. Insure the resources and requirements are balanced.
CHILD PROCESSES	

KEY INPUTS	**KEY OUTPUTS**
P1.4, P3.4,	P1.3, F1.1, F2.1, F3.1, D1.3, D2.3, D3.3
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	
PROCESS IDENTIFIER:	EF.4
DESCRIPTION	Continuously manage the data and knowledge created by the supply-chain fulfillment processes.
CHILD PROCESSES	
KEY INPUTS	**KEY OUTPUTS**
	F1.1, F2.1, F3.1
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	
Flexibility	
Cost	
Asset	
Best Practices	

Enable Deliver

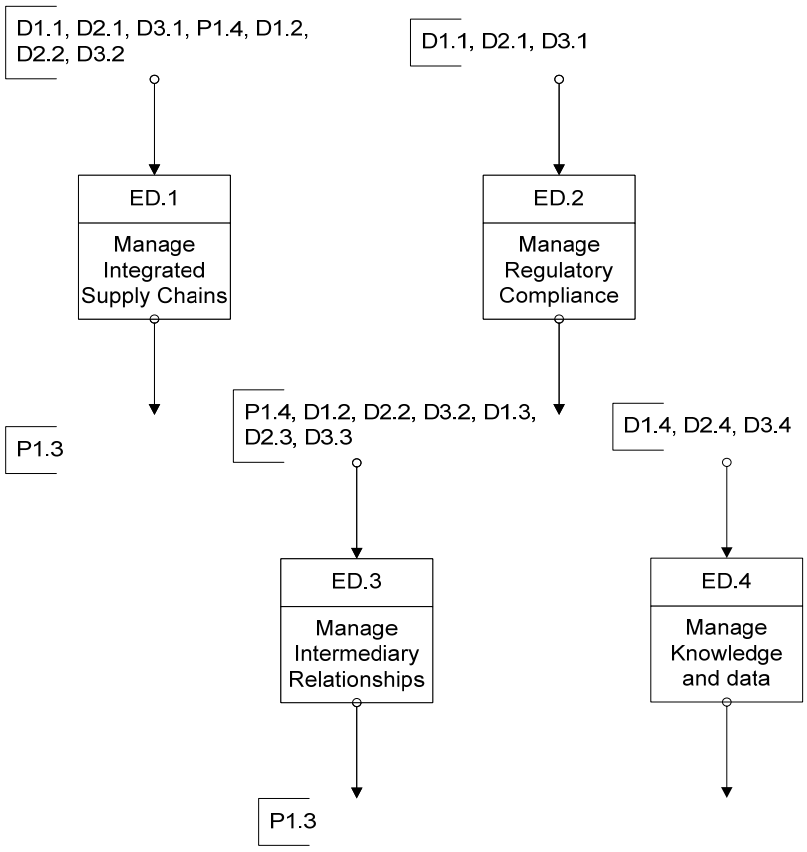


Figure 41: Enable deliver process model.

Table 41: S^2COR enable deliver processes ED.

PROCESS IDENTIFIER:	ED.1
DESCRIPTION	Continuously manage the delivery of requests within the integrated supply chains.
CHILD PROCESSES	
KEY INPUTS	**KEY OUTPUTS**
D1.1, D2.1, D3.1, P1.4, D1.2, D2.2, D3.2	P1.3
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	
PROCESS IDENTIFIER:	ED.2
DESCRIPTION	Continuously manage the regulatory compliance of delivering requests and once the request is delivered.
CHILD PROCESSES	
KEY INPUTS	**KEY OUTPUTS**
D1.1, D2.1, D3.1	
Performance Attribute	**Metric**
Reliability	
Response	
Flexibility	
Cost	Management Cost Cost of Services
Asset	
Best Practices	
PROCESS IDENTIFIER:	ED.3
DESCRIPTION	Continuously manage the intermediary relationships influencing the balanced supply-chain plan.
CHILD PROCESSES	

KEY INPUTS	**KEY OUTPUTS**
P1.4, D1.2, D2.2, D3.2, D1.3, D2.3, D3.3	P1.3
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	Request Cycle Time
Flexibility	Demand Flexibility
Cost	Management Cost Cost of Services
Asset	Cash to Cash Cycle Time Return on Assets
Best Practices	
PROCESS IDENTIFIER:	ED.4
DESCRIPTION	Continuously manage the data and knowledge created by the supply-chain delivery processes.
CHILD PROCESSES	
KEY INPUTS	**KEY OUTPUTS**
D1.4, D2.4, D3.4	
Performance Attribute	**Metric**
Reliability	Rate of Request Fulfillment
Response	
Flexibility	
Cost	
Asset	
Best Practices	

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