Chapter 1
Defining and Understanding Service Chain Management

1.1 Introduction

The growth of the services sector in recent times has been phenomenal with services displacing manufacturing as the main driver of western industrialised economies. However, a disproportionate part of the yearly productivity growth in OECD countries is still due to improvements in manufacturing (Wölfl 2005). In this context, *Service Operations Management* (Johnston and Clark 2001; Schmenner 1995) is becoming increasingly important for companies and government alike to achieve productivity growth and a cost advantage over their domestic and international competitors. This includes technologies and systems for automating and optimising service operations within and across companies which we will refer to them collectively as *Service Chain Management*.

Service Chain Management can be seen as analogous to *Supply Chain Management* (Simchi-Levi et al. 2000; Vollmann et al. 2004) but for services. Supply Chain Management is concerned with the planning and management of activities from raw materials to the delivery of finished goods. Similarly, Service Chain Management is concerned with the planning and management of activities from support functions to the delivery of end-user services. The flow of materials is negligible in Service Chain Management thus techniques developed under Supply Chain Management are of limited direct value. The names *Services-Oriented Supply Chain Management* (Anderson and Morrice 2000) and *Service Management* (Fitzsimmons and Fitzsimmons 2001) are also in use to refer to related areas but either in a more specific context to service chaining or in a more general context to service operations respectively.

To a certain degree, Service Chain Management was until recently confined to studying the operations and systems of large and vertically integrated service organisations such as airlines, utilities, healthcare providers, banks, or the after-sales functions of manufacturers as in Lee et al. (2005). Nonetheless, there is an increasing trend of services outsourcing and offshoring; initially focusing on customer support such as call centres but recently moving onto a broader range of activities including

C. Voudouris, G. Owusu, R. Dorne, D. Lesaint, *Service Chain Management*

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engineering, software development and other tasks requiring high-skilled human capital (Bjerring-Olsen 2006). This trend, combined with the proliferation of service providers and resellers in telephony, the Internet, gas, electricity, insurance and other services, has resulted in cross-organisational service chains of three or more tiers making chain efficiency increasingly important.

From an IT perspective, Service Chain Management enables service organisations to improve customer satisfaction and reduce operational costs through intelligent and optimised forecasting, planning and scheduling of the service chain (internal or external) and its associated resources such as people, networks, information and other tangible (or intangible) assets. Despite the transition to a service-driven economy, logistical solutions for services lag significantly behind to what is available for product-driven industries. Enterprise Resource Planning (ERP) and Material Requirements Planning (MRP) systems have been in use in factories for years and they have substantially matured both in terms of breadth and depth of functionality, nowadays supporting fully the *Sales and Operations Planning* processes (Vollmann et al. 2005). Hopefully, Service Chain Management and related technologies could one day play a similar role in service firms.

1.2 Book Objectives

In this book, we present the latest innovation and technologies that can manage the operations of a service company. Our viewpoint is based on our experiences at BT plc as well as associated research and development in universities and partner companies such as Infosys Technologies. Several subject experts have contributed to the book each providing his/her unique perspective on their respective topics. The area is quite broad, covering field force and workforce management, network and asset optimisation, customer relationship management and also the linkages between them.

Our intention in this book is to not only look at Service Chain Management from the enterprise viewpoint but also from the service customer and service professional viewpoints. Service companies are human-centric which creates the need for enabling technologies for service personnel and customers alike. These human-centric technologies span areas such as customer analytics, process management, information management and unified communications.

The book investigates beyond traditional areas such as Operational Support Systems (OSS) which, despite standardisation efforts (TM Forum 2006), still lack a detailed framework for facilitating enterprise-wide resource planning. In addition, we are presenting the technical ground for bridging the large functionality gaps not filled by platforms such as CRM (Customer Relationship Management), HR (Human Resources) and ERP/MRP[1] when they are implemented in a service context.

[1] In services, ERP/MRP are mainly relevant in financial management and also, where applicable, inventory management for parts and spares

We put a strong emphasis on customer requirements and trends, methodologies for successfully developing and deploying enterprise solutions while provide advice on how benefits can best be realised out of technology investments.

In the next section, we detail the challenges faced by service firms which Service Chain Management and associated technologies are coming to address.

1.3 Challenges in Service Operations

Service companies are required to effectively plan and schedule their resources to offer an efficient service to customers. This is no different in principle to Manufacturing Planning and Control (MPC) (Vollmann et al. 2005) that gave rise to MRP, ERP and the more sophisticated Supply Chain Management systems. However, the main focus in services is on people and assets rather than materials management which is at the heart of MPC.

People are the core and essence of a service business. In the context of many services, they are not even confined to a particular facility (e. g., like the factory in a manufacturing context) but are mobile, offering service across a geography. Furthermore, in cases where the demand needs to be satisfied near-instantaneously (e. g., calls to emergency services); there is no inventory of finished products to protect operations whilst long waiting times are unacceptable. The enterprise needs to plan staffing so that demand is met with adequate supply for every minute of every hour of operation across several geographical areas; this represents a huge logistical exercise to plan and execute. On the financial side, the costs associated with staffing come under Operational Expenditure (or OPEX for short) and represent a large percentage of the costs associated with running a service business.

Assets are often networked and represent critical and expensive infrastructure. Examples of networked assets include telecommunication, electricity, gas, water, rail and road networks. Facilities are also important and they are either integral part of the network (e. g., telephone exchanges, railway stations, electricity stations, etc.) or stand-alone (e. g., hospitals, airports, retail outlets, warehouses, etc.). Equipment is either fixed and housed within the facilities or mobile and carried by service personnel. It can range from very expensive specialist hardware (e. g., medical scanners in hospitals, network switching equipment in telephone exchanges, etc.) to everyday tools such as mobile phones, laptops and various handheld devices. On the financial side, facilities and equipment come under Capital Expenditure (or CAPEX) and dominate the investment of service companies, nations or even multinational groups (e. g., multinational energy or transportation networks). Materials are also required and managed but they often represent only a small percentage of the overall turnover (e. g., 5% or less in businesses such as telecommunications).

It is a characteristic of the service industry that, in the majority of cases, the enterprise and its people and assets such as networks, facilities and equipment have to follow customers in terms of geography. This is generally not the case with manufacturing where production facilities can be centralised. In this respect, services are

less suitable to offshoring to lower cost geographies although service digitisation and modern communications have facilitated that in recent times (e. g., call centre migration to India). There are indications that this offshoring is actually having a productivity enhancing effect for service firms (Bjerring-Olsen 2006).

Constrained to operate in high cost geographies with an expensive asset base, it is sometimes puzzling why services have not excelled in Service Chain Management approaches across their operations. Why have systems not emerged for systematically planning resources at the enterprise level thus optimising the OPEX and CAPEX profile of companies? If materials management was the main issue then Supply Chain Management and manufacturing could lend a hand to bring inventories under control but, as mentioned above, materials account for only a small percentage of overall operations.

Clearly, competition is not as intense as in product industries with several service industries moving to privatisation only in recent years (e. g., telecommunications, energy and water utilities) or being under the state umbrella as with health, policing and education. Even in industries that have undergone privatisation, it is sometimes in the service "wrap" that competition is heavily emerging. The main assets such as electricity, water, rail and telecommunication networks are often owned and maintained by near-monopoly and heavily regulated players. Furthermore, several sectors are still enjoying high profit margins leaving room for the operational inefficiencies to "fly under the radar" so to speak.

Growth of services is also a factor working contrary to productivity as identified by Fixler and Siegel (1999). It could be the case that improvements are eventually motivated by intensified competition when demand (e. g., from manufacturing to outsource its services side to specialists) subsides relatively to production capacity in the services sector.

Overall, the situation is not static and, increasingly, services are following the manufacturing route searching for productivity gains. Increased competition will eventually lead to lower profit margins and a drive for efficiency to reduce operational and capital expenditure which, if it does not translate into better service, is ultimately passed on and burdening customers and tax payers. Call centres, transportation and retail are examples where this drive for efficiency is already taking place and it will not be long before other areas follow the same trajectory especially as a result of service liberalisation initiatives, e. g., within the EU (Bolkestein 2004).

1.4 Key Success Factors in Services

Given the increasing strive for productivity and other improvements, one may reasonably ask what should a service business aim for when it comes to Key Success Factors (KSFs)? One key success factor in manufacturing is to reduce inventories and associated costs, and it can be met by introducing techniques such as Just-in-time (Tersine 1998) and Vendor Managed Inventories (Disney and Towill 2003). What is the equivalent objective(s) in Service Chain Management? A number of

unique features, attributed to services, have been identified in the literature (Zeithaml and Bitner 2003; Fitzsimmons and Fitzsimmons 2001) and may provide direction in answering the question. We summarise these features below:

- *Services are intangible*. They cannot be seen, felt, tasted or touched in the same manner as tangible goods. The customer usually bases its judgment on peripheral cues and experiences.
- *Services are heterogeneous*. No two customers or employees are precisely alike. Human interaction makes defining quality a challenge and it may vary from one customer to the next.
- *Services are simultaneously produced and consumed.* Mass production is difficult. Customer satisfaction is in "real time" with the customer "observing" and "participating" in the process.
- *Services are perishable*. They cannot be saved, stored, resold or returned. More importantly, they cannot be inventoried. A service company may use inventory management (e. g., for spares) but this accounts for a very small part of the overall service operations.

Let us focus first on the last point from the list which is service perishability. Capacity management is definitely a key factor when addressing the perishable nature of services and different strategies have been proposed (Sasser 1976; Armistead and Clark 1994). Customers are sometimes highly critical on this subject (especially on public services) arguing that organisations with overcapacity and idle resources are offering long waiting times due to gross operational inefficiencies within them and across their service chains. Whichever way this is perceived externally by customers and the specific strategies internally followed by companies, efficiently *matching supply with demand* is a key success factor for services and should particularly focus on the two following goals:

- Minimisation of *waiting time* for customers
- Minimisation of *idle time* for resources

But it is not all about minimising "hard" and measurable targets that makes the difference here. Services are human-centric and issues arising from intangibility, heterogeneity and simultaneous production and consumption also need to be taken into account too. Addressing these areas is that leads to superior efficiency and quality, and this is expressed by the further goals:

- Maximisation of *performance* for employees and other resources
- Maximisation of *experience* for customers

The performance of employees is not confined to productivity but extends to areas such as behaviour, quality of the work and also company culture. Similarly, customer experience is not confined to the service itself and satisfaction with it but extends to the peripheral tangible cues associated with its delivery such as facilities, websites, vehicles, equipment, personnel and everything else that affects the customer's perception of a service provider (Shostack 1977; Bitner 1990).

The four objectives outlined above, *Waiting, Idling, Performing* and *Experiencing* (we use the term *WIPE* for short) represent a set of meaningful and widely

applicable key success factors for services which can be detailed by organisations and management into appropriate measures and scorecards when applied to specific contexts. More interestingly, the four objectives are not standalone but interconnected. For example, waiting times have an impact on how customers are experiencing a service, but they are also dependant on the level of resource capacity and how it is put in place to avoid extremes such as overworking or idling[2]. If such extremes are not controlled then they impact on work quality and staff morale[3] leading to a drop in productivity and rework required to remedy faults, thus increasing further the waiting times and so forth. It is not difficult to see how companies can end up in vicious circles with "positive" feedback loops making a bad situation worse due to demand amplification effects across a service chain, see Akkermans and Vos (2003) for a case study.

Given the negative publicity over the years, and criticism on both public and private services, with regards to failing on one or more of the four objectives, one may argue that the *WIPE* challenge for the service industry as a whole is of equal scale to the inventory challenge faced by manufacturing. To achieve the above goals, services need to embrace technology rather than trying to remedy isolated problems from a solely marketing or management perspective. Technology and management methods need to work hand-in-hand towards a common goal to be able to help an industry as a whole. Furthermore, a Service Chain Management blueprint, similar to Supply Chain Management, would be required that represents best practice in *Service Planning and Control*. This blueprint, implemented through software suites from different vendors, could then be applied division after division, company after company, vertical after vertical, leading to efficiency improvements similar to those

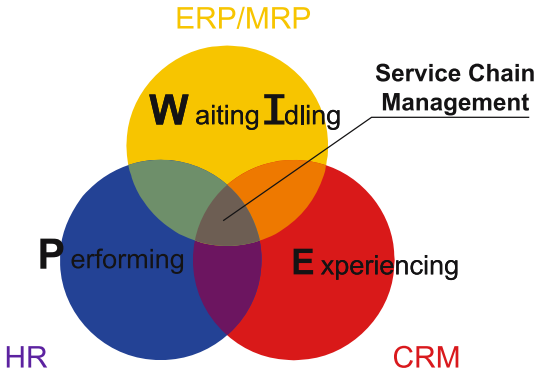

Fig. 1.1 The WIPE challenge and how it links to existing CRM, HR and ERP infrastructure with Service Chain Management covering functionality gaps and providing the orchestration across the system space

[2] Idling of resources is not always associated with a "lull" in demand but could be due to personnel being deployed at the wrong place, at the wrong time with the wrong skill

[3] Idling can sometimes be as demoralising as overworking if not more

experienced from the introduction of the MRP/ERP template and associated systems in the manufacturing sector.

The effort is not trivial, but it can draw on the existing CRM, ERP (mainly financials, possibly MRP where applicable) and HR systems with Service Chain Management technologies bridging the gaps and providing the orchestration across the system space in the context of a service business. A pictorial representation of these roles is provided in Fig 1.1.

In the next section, and as an example, we look at BT plc and more generally telecommunications/utility companies from a systems evolution perspective. We examine how they often arrive at a Service Chain Management blueprint and what elements such blueprint is likely to include.

1.5 Developing a Blueprint for Service Chain Management

In telecommunications but also in a general utility context, the main resources to be managed include call centre agents and field service engineers and also the networked assets of the company (e. g., telecommunication, electricity, rail, transport or other types of networks). Service companies employ field and office-based engineers, call centre agents and other personnel to install, deliver or terminate their services as well as upgrade, repair or maintain their assets. In addition to that, modern telecommunication and energy companies may incorporate an ever larger element of professional services personnel (i. e., ICT professionals in the case of telecommunications, risk management specialists in Energy, etc.). We examine here the trajectory of BT which can be considered as representative of leaders in this domain; they being a telecom, an IT-savvy company and one of the first large organisations to be recognised by the OR community through an INFORMS Franz Edelman Finalist Award for automating scheduling across its operations (Lesaint et al. 2000).

1.5.1 Automating Scheduling and Dispatching

The late 1980s and early 1990s saw the first efforts being made within BT to fully automate and optimise the planning and scheduling of resources in call centres and in the field. This constituted the beginning of efforts to systematise Service Chain Management. Work started on the operationally hard problems of scheduling shifts in the call centres and dispatching jobs in field operations. As the latter proved the hardest, we focus below on field service automation.

The dawn of this era in BT saw the creation of the Work Manager system (Laithwaite 1995), between 1989 and 1997, which automated work scheduling for field personnel. Field service is an essential element of many industries (Vigoroso 2004), and as field operations can sometimes account for up to 50% of Operational Expenditure (OPEX) in service companies they are therefore a major consideration. In the

case of BT, the current field force exceeds 30,000 engineers in size; not long ago this number was over the 50,000 mark.

General examples of field service include the installation, repair and maintenance operations in utilities, emergency services such as ambulances and police, health visitors and community workers, automobile repair, construction and maintenance of buildings, equipment repair and maintenance. The area is also closely related to transportation and logistics and some times the two are treated under the same umbrella.

Field service is generally regarded as a challenging domain given that the mobility of resources increases the complexity in decision making by adding the spatial dimension on top of what is already required in terms of decision making in an office-based environment (e. g., planning and scheduling of shifts in a call centre).

Underlying optimisation problems such as the Vehicle Routing Problem in services can be seen as similar to the Job-Shop Scheduling Problem in manufacturing (Beck et al. 2003). Not surprisingly, the algorithms used in field personnel scheduling, which in the case of BT's system included simulated annealing and local search techniques (Lesaint et al. 2000), came from the same areas of Operations Research and Constraint Programming that were used in Finite Capacity Scheduling for manufacturing (Nuijten and Le Pape 1998). However, field personnel scheduling tends to be more of a reactive problem with many exceptions happening during execution due to external factors (e. g., traffic conditions, task delays and interruptions). This calls for dynamic scheduling systems which re-optimise the allocation of jobs to field resources at regular intervals to respond rapidly to emergencies (Laithwaite 1995; Lesaint et al. 2000).

1.5.2 Moving to Advanced and Systematic Planning

In the context of BT, and after the automation of scheduling processes, one question that was raised in the late 1990s amongst management was how automated capacity/manpower planning could be added on top of scheduling so that the company moves away from locally maintained solutions (e. g., specially-designed spreadsheets) and a system stack gradually develops similar to that we find in Manufacturing Planning and Control (Vollmann et al. 2004) linking Sales and Operations Planning down to capacity/manpower planning and to personnel scheduling. This desire was motivated by the fact that BT, as with other telecom operators, had begun to venture into new growth areas and products. This meant that an increasingly complex set of resources (engineers, call centres, professional services including the network assets) with hundreds of skill types had to be mapped to an increasingly complex set of services and properly planned to align with the overall company strategy.

It was at this point that the analogy between Supply Chain Management approaches in manufacturing and specifically Advanced Planning and Scheduling or APS (Stadtler and Kilger 2000) and how they can be adapted to services in their

entirety became a priority. In the case of BT, this motivated the creation of an integrated Service Chain Management blueprint in the form of the BT Field Optimisation Suite (FOS) (Voudouris et al. 2006; Owusu et al. 2006).

1.5.3 FOS: An Example Suite for Integrated Service Chain Management

FOS incorporates dedicated applications for forecasting demand, planning resources, scheduling work, reserving capacity and managing employee, customer, supplier links across a service chain in a way similar to Supply Chain Management (SCM) (Stadtler and Kilger 2000; Vollmann et al. 2005) for product-driven industries. The suite is intended for service operations with high volumes of low-to-medium complexity work (i. e., not large scale project or programme management) that have a strong element of repetition and standardisation. It is also intended mainly for field service operations as the name implies, although modules are also suitable, and currently used, in office environments.

The overall architecture of FOS is depicted in Fig. 1.2 alongside its links to CRM, ERP and HR systems.

The main modules of FOS are the following:

- *FieldForecast* models and forecasts service demand over different geographies, skills and time frames. It links to ERP financial applications for exchanging budgeting information.

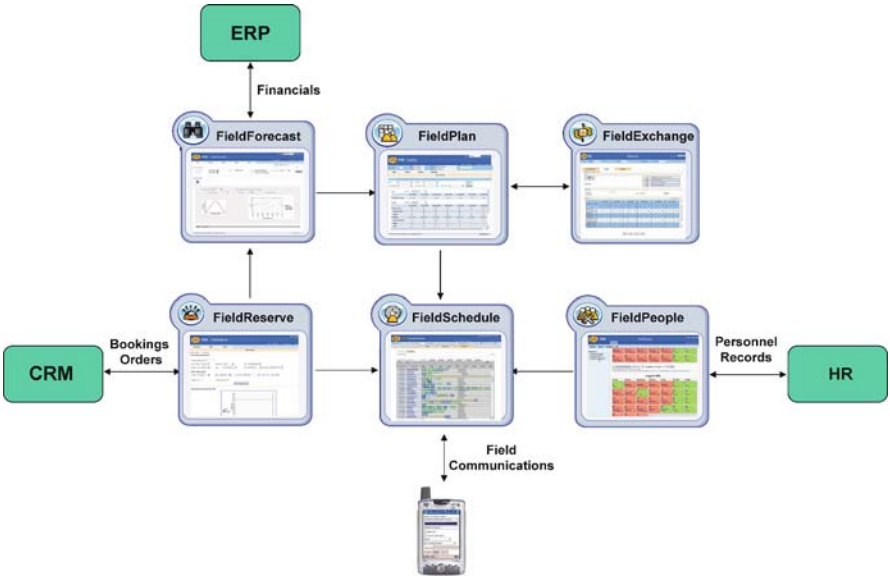

Fig. 1.2 Architecture for Service Chain Management based on FOS and links with CRM, ERP and HR enterprise systems

- *FieldPlan* plans resource capacity to meet expected demand. It supports "what-if" scenario modelling to balance cost against quality of service criteria.
- *FieldSchedule* schedules work to resources. Constraint technology allows for efficiently handling the variety of requirements which real-life schedules must comply with such as skill-matching, due dates, working shifts, staff breaks, regulatory constraints, temporal dependencies between tasks, and so on.
- *FieldPeople* manages all people specific information relating to rosters, attendance, skill and geography. A single system providing human resource visibility across the organisation. It receives personnel records from the company's general HR application.
- *FieldExchange* allows the balancing of resource capacity between divisions and subcontractors (i. e., supporting cross-organisational service chain management). Users can negotiate the acquisition, release, loan, or hire of resources with *collaborating internal or external partners*.
- *FieldReserve* is an automated reservation system enabling a customer to create or change bookings and appointments to suit his/her own circumstances. This module together with the scheduling application is normally interfaced with a CRM system to handle interactions with end-users over multiple channels although direct access through a web portal is also possible.

Contrasting the FOS architecture above with Supply Chain Management suites for manufacturing may provide clues to the essential elements of a blueprint for Service Chain Management and also how current enterprise platforms for services are likely to evolve.

1.5.4 Contrasting with Supply Chain Management

For that purpose, we use SAP's Advanced Planner and Optimizer (APO) product here as a contrasting example. SAP APO (Dickersbach 2003) provides a toolset for planning and optimising supply chain processes in manufacturing industries. The FOS and SAP modules, which address analogous problems, are identified and listed in the table below.

Having been developed independently and for different end-problems, it is worth highlighting that the same pattern of high-level functional blocks emerges for advanced planning and scheduling irrespective of whether it is a service or product.

Table 1.1 Feature comparison: BT FOS with SAP APO

FOS service modules	SAP APO modules
FieldForecast	Demand planning
FieldPlan/FieldExchange	Supply network planning
FieldSchedule	Production planning and detailed scheduling
FieldReserve	Global available to promise
FieldPeople	SAP ERP human capital management

Nonetheless, this similarity does not necessarily extend within the applications. In services, the focus is on manpower planning and operational issues centre on personnel scheduling while in product industries materials planning is key and operational issues centre on machine scheduling.

Service chain collaboration in FOS is supported by the FieldExchange application though functionality is not as extensive as that found in specialist products dealing with *supply chain collaboration*. Furthermore, compared to its manufacturing cousins the FOS architecture, is to some extent, incomplete as it deals with just one aspect of the resources, i. e., people, and does not integrate the planning of networks and other types of assets under the same umbrella. Network and asset planning, which represent a major resource management area for utilities and telecommunications, are usually addressed separately and under a Geographical Information Systems (GIS) (Longley et al. 2005) banner. To start bridging this gap, we include and specifically cover the subject of network planning in the book. Potential synergies are gradually emerging, such as assessing network/asset planning from a service requirements perspective and aligning it with human resources planning. These synergies may one day provide a holistic strategic planning capability, which links CAPEX to OPEX, by modelling how investment in asset infrastructure may impact operations and vice versa.

Drawing on the case of FOS and likely future enhancements as discussed above, one can identify some major milestones during its evolution path which are indicative of the general steps required in developing a Service Chain Management blueprint. These steps based on the FOS experience are presented in Fig. 1.3.

To expand on these findings further, we discuss below the situation across several service industry verticals.

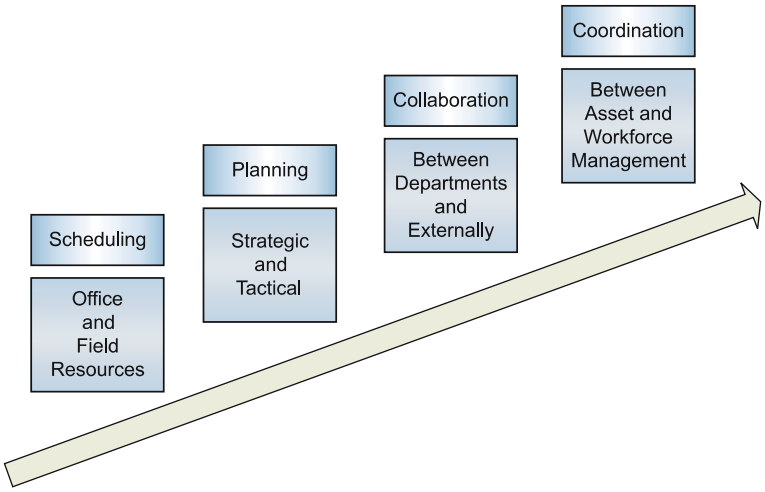

Fig. 1.3 Steps in the development of a Service Chain Management blueprint

1.6 The Broader Picture Across Verticals

Service Chain Management having to deal with the unpredictable human-centric nature of services is a notoriously complex and uncertain domain to be attacked at its entirety with readily available technology tools. Market needs in certain areas have begun to be addressed such as call centres or field service, in the case of utilities, but as yet, no solutions exist for managing a service business in the way that ERP manages production in a manufacturer.

Even in utilities, as discussed above, managing the networks, assets and personnel using a single platform which translates business planning to capacity planning and then to discrete schedules for network or people resources, all in an optimised way, is not presently available. We are simply describing, here, the equivalent of an ERP logistics module for manufacturing yet the reader may appreciate the challenges involved when attempting to apply a similar template to all the different and complex service contexts and situations.

There is one exception to this, namely with the airlines. They currently have what can be described as an integrated service chain management approach. This is due to the pioneering work of the internal departments of companies such as AMR, the parent of American Airlines. This, in turn, gave rise to companies, such as Sabre (Cook 1998; Horner 2000), which subsequently transformed the IT side of their industry. With regards to the other verticals, solutions are largely embryonic addressing only specific operational problems and areas (e. g., nurse scheduling, police dispatch etc.).

Overall, we would rather be optimistic about the future. The "point" solutions or early software suites of today are likely to be enhanced in the next 2–5 years into integrated application suites. Increased automation will start to penetrate additional domains such as rail companies, retail, health care and emergency services which are generally lagging behind in managing their service chain element. In 5–10 years from now, we can expect collaborative solutions also to emerge that automate cross-company transactions through service markets (e. g., between companies and/or with their subcontractors) to squeeze costs out of cross-organisational service chains. We may also see process and information holistically managed using the same solutions.

Obviously, there are a number of scenarios as to how this is going to play out. Certain aspects may be delayed or brought forward depending on macro-economic factors and technology advancements. Complementary technologies such as RFID and location-based services are showing promise too with respect to their application to service verticals (Woods 2005; Lopez et al. 2007) thus accelerating adoption of service chain management (e. g., solutions combining scheduling with tracking for field resources are increasingly popular, see Chaps. 10 and 20).

A rather insightful picture is presented in Fig. 1.4 where we project a potential future for Service Chain Management solutions over the next decade in terms of the following dimensions:

1. *sector coverage* of solutions in terms of substantial penetration and impact;
2. *operations coverage* in terms of processes and functionality to be gradually integrated under a single enterprise platform;

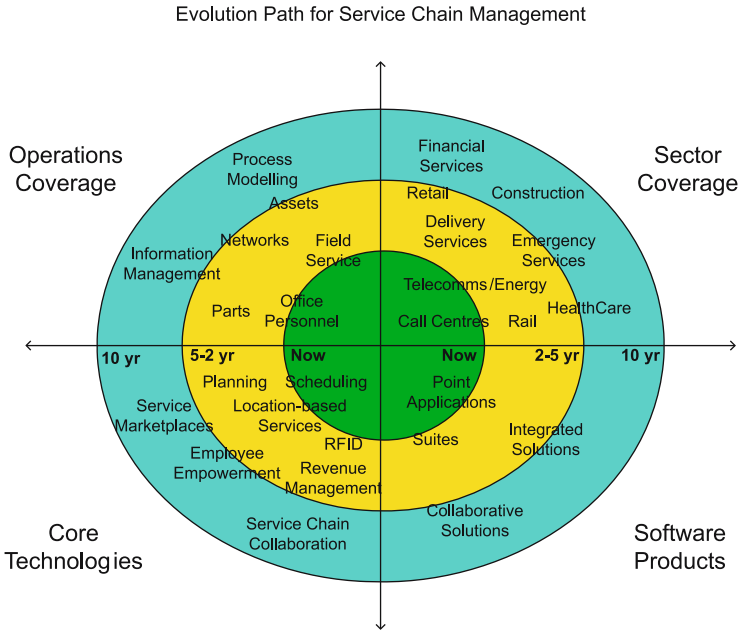

Fig. 1.4 Potential evolution path for Service Chain Management solutions

3. *core technologies* to be developed and incorporated into commercial off-the-self solutions;
4. maturity of *software products* available from vendors.

The figure was compiled on the basis of several analyst reports and the state of current IT solutions, as observed through interactions with companies, in addition to the trajectory of vendor offerings in the now mature area of Supply Chain Management which, as a pattern, is likely to repeat itself here.

1.7 Technologies for Services and Book Structure

The book provides information on foundation technologies for Service Chain Management. These technologies can provide the basis for innovation within companies and across service chains, leveraging the fact that we are increasingly operating in an increasingly digitally-networked and information-rich world.

As with supply chains, advanced planning and scheduling lies at the core of our chosen subject. Planning for services is covered in Part 1 of the book. We look at strategic resource planning in Chap. 3, demand forecasting in Chap. 4 and tactical planning and resource deployment in Chap. 5. These areas are highly interlinked, underpinning Service Sales and Operations Planning processes; demand forecasts drive decisions on strategic resource planning which in turn constrains tactical plan-

ning. This, ultimately, enables the management of short term demand fluctuations by optimising the configuration and deployment of resources. Network planning is examined in Chap. 6 providing a more complete picture (as discussed in Sect. 1.5.4) of the technological capabilities and options in optimising assets as well as people resources.

Part 2 deals with the operational timeframe and the execution of services. The area is heavily reliant on reservation and scheduling techniques. We examine, in Chap. 7, how reservation systems operate and their links to CRM. The pricing of services to complement a reservation function and underpin customer segmentation strategies is discussed in Chap. 8. The scheduling of shifts and work allocation, which are the most complex and challenging areas, are examined in Chaps. 9 and 10 respectively. Chapter 11 examines the all-important IT side of human resources which can act as a data hub, providing information to scheduling and other systems.

Several complementary and supporting technologies work in synergy with the above. These technologies are covered in Part 3 of the book. In Chap. 12, we examine workflows and service-oriented architectures which are vital in the design and modelling of digital service processes, more so when they are geared for flexibility and human-centricity. Personalised communications, which can empower customer and employees, is examined in Chap. 13. Chapter 14 examines customer analytics and business intelligence; the main bridge between marketing and operations management and an important tool in a service chain for sensing and acting upon internal and external signals.

Part 4 examines technologies for the future service chain. Chapter 16 looks at emerging cross-organisational issues and ways to develop a truly collaborative forecasting process across tiers. The impact of the Internet and opportunities in online revenue management are examined in Chap. 17. The use of electronic marketplaces for trading services is explored in Chap. 18, while Chap. 19 explores the application of similar concepts to implement employee empowerment by moving services away from the "command and control" mentality.

Finally, the above technology-oriented chapters are complemented with three important chapters placed at strategic points in the flow of the book which examine emerging customer trends (Chap. 2), agile methods for successfully implementing technology solutions (Chap. 15) and ways of ensuring realisation of benefits from technology investments (Chap. 20).

Before jumping into the main content of the book, we explore one final and emerging dimension that the reader should bear in mind when considering the technology and management insights to be presented in this work.

1.8 The Emergence of Digital Services and Chains

Current perspectives of the Service Chain Management and related subjects are focused on improving the management of physical resources and services as delivered

by the mainstream established industries of today. This chapter would have been incomplete if we did not examine another concept and dimension, which is that of the *Digital Service Chain*. The digitisation of services is an ever increasing trend introducing efficiencies in the design and delivery of services. It is also promising to boost cross-country commerce in services which, although it is in the increase, is still far behind goods which constitute the main form of international trade (Wölfl 2005). The "fuel" for this digitisation is the Internet, which enabled by Web 2.0 (O'Reilly 2005) and the ever increasing computing power and network connectivity, creates opportunities for existing products/services to be delivered electronically in complementary, or totally new, ways with new underlying business models (Jopling 2006).

Given this background, we are starting to experience digital service chains which, to a large degree, depend on the digital transportation and processing of information from "raw" inputs to "finished" outputs delivered over bandwidth-rich computer networks to a variety of computationally powerful consumer devices. Prominent emerging such chains can be found in:

- Software Services and
- Entertainment and Media Services,

although other areas such as e-Health and e-Government are also experiencing growth (European Commission 2007).

None of these areas are entirely new. They rather represent the natural switch to digital delivery and, in the form of services (e. g., Software as a Service), of existing "products" in the broader sense. More specifically, *Software Services* can be seen as the evolution of the hosting and networking business into on that provides turnkey and fully configurable ICT solutions on demand which previously would have required a complex physical delivery and installation of hardware/software into the customer's environment. Similarly, *Entertainment and Media Services* focus on the digital delivery of movies, music and other content over the Internet with ever increasing quality (e. g., High Definition TV) without the involvement of physical resources such as CDs, DVDs or the requirement for dedicated service facilities (e. g., Cinemas).

The above mentioned examples have clearly created opportunities for new business models and ways of using software functionality or experiencing content (e. g., as demonstrated by the iPod and iTunes from Apple or Salesforce.com in the CRM on-demand space).

The structure of these digital service chains is not dissimilar to traditional service or product chains and it consists of the following steps:

1. Content Creation: This is often an intense human process to create complex content such as enterprise software, computer games, movies, music, artwork, etc.;
2. Aggregation: This is often a step that gathers together digital information into a useful collection such as a software application suite, television channel, image gallery, etc.;
3. Distribution: In this step, the software or information is placed on a networked computer platform which is using the appropriate distribution system to manage

delivery to multiple users as a digital service (i. e., IPTV platform, Music Server, Software Application Server);
4. Data Transport: A fixed/mobile network and/or a terrestrial/satellite broadcasting platform transfers data on the forward and (increasingly) the reverse path to/from customers;
5. Digital Experience: The digital service is experienced through a variety of devices with convergent products which combine several functions spurring interest and creating new experiences (e. g., media centre which marries PC with TV functionality, smartphone which combines PDA with mobile phone, camera and MP3 player functionality).

The above steps for the two examples mentioned of software and media are illustrated in Fig. 1.5.

Although the domain is fairly new, we can already see some potential opportunities for applying Service Chain Management. For example, one main advantage of current supply chains is the extensive availability and use of Point Of Sales (POS) data in planning. A similar electronic feedback loop is currently largely missing in the digital world with little information captured in real-time on what digital services or content is accessed and by whom. Such a feedback loop possibly based on customer analytics (as examined in Chap. 14), if it is anonymised and non-intrusive, can assist in advanced planning and scheduling of resources across all the service chain steps.

Personalisation of digital services (discussed in the context of communications in Chap. 13) is a largely unexplored area. With ever increasing bandwidth and emerging software/content configurability, capturing user preferences and then using them to customise the experience has obvious potential. Service design and operations would need to adapt and be ready to support mass customisation; learning from similar experiments in manufacturing (Seifert 2003).

Revenue management and online dynamic pricing (examined in Chaps. 8 and 17) have a lot to offer given that the variable cost of digital offerings is often minimal

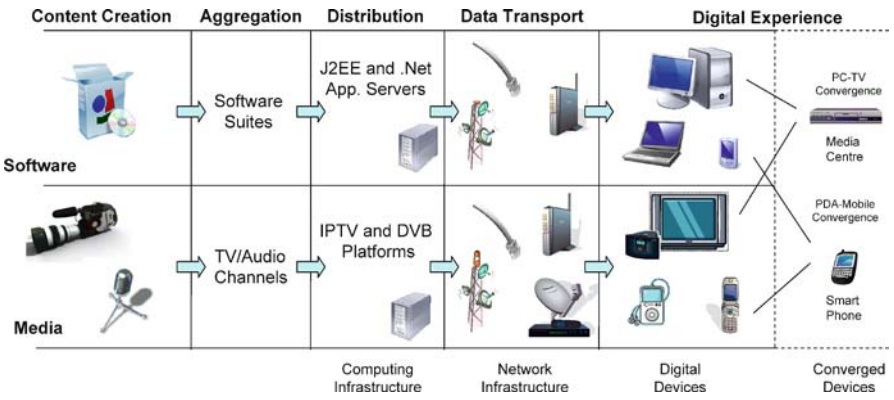

Fig. 1.5 Emerging digital service chains in software and media

(i. e., production of additional units once the first one is produced). Fierce competition can sometimes lead to heavy discounting converting once premium products into cheap commodities, as past cases like CD phone directories have shown (Shapiro and Varian 2000).

Electronic marketplaces (as discussed in Chap. 18) also present us with opportunities. From advertising slots to software components to games, music and movies, communities involving businesses or individuals as in (Kirovski and Jain 2006) could develop and leverage Service Chain Management technologies to digitally trade between them.

1.9 Summary

In this chapter, we defined and then elaborated on the general area of Service Chain Management. The inspiration in defining and analysing this area has been its parallel with manufacturing, known as Supply Chain Management which has received extensive attention by business and academia in recent times.

We believe that services with an ever growing economic influence deserve similar, if not a more, concerted effort to improve productivity through technology and make it easier to trade globally. Using planning and scheduling at its core, Service Chain Management can take advantage of recent advancements in communications, workflow, analytics, mobility and the ability to "digitise" services. This will allow the gradual emergence of an architectural blueprint and associated systems that can help an enterprise institute best practice in the planning and control of its service operations.

In that context, we examined the case of BT and utilities with FOS presented as example of a Service Chain Management platform. Similar, if not better, progress has also seen in airlines, with all service sectors increasingly looking at automation for addressing their service challenges. The emerging concept of the Digital Service Chain was also presented with two example service chains discussed.

The technologies, as they will be presented in the book, were outlined with links made on their utility and relevance in the management of the present and future services and chains. Emerging customer requirements and trends can provide additional insight in this direction by highlighting developments in customer service and their likely impact on operations. We provide this customer angle and perspective in the next chapter.

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