CTL.SC4x – Technology and Systems

Key Concepts Document

This document contains the Key Concepts for the SC4x course, week 8.

These are meant to complement, not replace, the lesson videos and slides. They are intended to be references for you to use going forward and are based on the assumption that you have learned the concepts and completed the practice problems.

The first draft was created by Dr. Alexis Bateman in the spring of 2017.

This is a draft of the material, so please post any suggestions, corrections, or recommendations to the Discussion Forum under the topic thread "Key Concept Documents Improvements."

Thanks,

Chris Caplice, Eva Ponce and the SC0x Teaching Community
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Supply Chain Systems:
Software Selection & Implementation

Summary

As we have journeyed through various types of supply chain systems, we will now cover the process of software selection and implementation. As firms are in the process of selecting their supply chain systems they will need to be aware of various factors that will guide their decision of whether to select the system or not. We discuss the process of software selection and evaluation criteria. While selecting the appropriate software system can be challenging, implementation is far more difficult. The process of implementation can be long and costly, using additional resources. In this lesson, we cover general guidelines on what to be prepared for when implementing software systems.

Architecture

Evolution of Architecture

To understand where supply chain systems stand now, it is helpful to understand the evolution of the architecture starting in the 1970's. The following are the various forms of architecture for the last fifty years:

- Mainframe (1970s)
- Personal Computers (mid-1980s)
- Client-Server (late 80s to early 90s)
- Wide Web and Web 2.0 (mid-90s to present)
- Cloud or Post-PC (today and beyond)

Today there are a variety of software systems available to businesses. In terms of architectural format, they can choose between "On Location" or "On Premise" – meaning that the firms host the software in their own facilities or on their hardware and within their own firewall. However, companies are increasingly opting for cloud computing options. This means that they have several deployment models available to them.

Cloud Computing

As cloud computing becomes increasingly more popular, there are a variety of offerings that can be tailored to firm needs. They are Infrastructure as a Service (IaaS), Platform as a Service (Paas), and Software as a Service (Saas). We discuss each format as well as benefits below:

Infrastructure as a Service (IaaS): In this format, the third party provides the firm with the computing infrastructure, physical or virtual machines and other resources. Firm owns and manages the software application. The benefits of this are:

- No need to invest in your own hardware
- Infrastructure scales on demand to support dynamic workloads
- Flexible, innovative services available on demand

Platform as a Service (PaaS): In this format, the third party provides firm computing platforms to include operating system, database, web server etc. Firm owns and manages the software application. The benefits of this are:
- Develop applications and get to market faster
- Deploy new web applications to the cloud in minutes
- Reduce complexity with middleware as a service

Software as a Service (SaaS): In this case, the third party provides firm with access to the application software and handles installation, setup, maintenance, and running.   Firm is charged by use. Benefits include:
- You can sign up and rapidly start using innovative business apps
- Apps and data are accessible from any connected computer
- No data is lost if your computer breaks, as data is in the cloud
- The service is able to dynamically scale to usage needs

While there are many benefits to cloud computing, there are widespread disadvantages of cloud computing that include but are not limited to: vendor outages, unrestricted government access, security & privacy risks, and key data and processes require network access.

Software Selection Sources

There are different sources of software that firms need to be aware of. These include a customized in-house system designed for a business, an ERP expanded system with additional bells and whistles tailored for a company, best of breed solutions (of market solutions, and best of breed platforms. These are discussed in further detail in the chart below:

Source	Advantages	Disadvantages
Customized In-House System	• Best fit to the firm and its processes.	• Exceptionally difficult and time consuming to develop • Most expensive total cost of ownership • Difficult to maintain • Can result in "inward looking" solution
ERP Expanded Systems	• Relatively fast implementation • Less expensive than in-house customization • Efficient from IT perspective • Easier to upgrade with ERP enhancements	• Tends to be inflexible in terms of process • Could require change in business processes • Not guaranteed to be best solution approach
Best of Breed Solutions	• Best performing market solution for each function	• Difficult to integrate different systems • Can have slow performance • Requires the use of middleware between the applications • Upgrading individual components can cause ripple effect problems
Best of Breed Platforms	• Very good, if not best, solution for each function with easier integration between individual modules	• Requires the use of middleware between the applications

Outsourcing

There is also the option of outsourcing some of these systems to different providers. For instance, in logistics, 3PLs or Third Party Logistics Providers, serve as an organization that can run the software as well as perform all of the business processes. Having a 3PL run your logistics eliminates the need for hardware and software. 3PLs can possibly replace personnel within the firm. The use of 3PLs is most common with smaller firms.

The main reasons to outsource are to reduce capital expenditure for software and hardware. It may also reduce costs as a result of partner's economies of scale; they often have the ability to do it faster and better as well as be more flexile and agile. It may also be an opportunity to increase levels of service at reasonable costs. Firm can focus on core business and bring in expertise that is not affordable in-house. There are myriad other reasons to outsource, but there are also many not to, discussed below.

At the top of the reasons not to outsource are security and privacy concerns; someone else has access to the firm's data. There are also worries of vendor dependency and lock-in. The firm may lose in-house expertise to a core function. There are also high-migration costs as well as concerns over availability, performance, and reliability. There are additional reasons not to

outsource. Firms need to weigh the pros and cons of outsourcing matched with business objectives to decide which is suitable for them.

Software Vendor Selection

In the end, a firm must select their vendor. Some firms throw a dart on the wall, and that is their choice. Others have an organized and formalized fashion to select a vendor and in general it goes as follows:

1. **Form a Project Team (Internal and/or External) & Objectives**
2. **Understand the Business and Needs**: review current business processes, prioritize needs/functionality, create Request for Information (RFI)
3. **Create Initial Short List of Potential Solutions & Vendors**
4. **In-depth Review of Short Listed Vendors**: have vendors conduct realistic product demonstrations, references from current users.
5. **Create and Distribute final Request for Proposal (RFP)**
6. **Make the Decision:** negotiate contract, price, and service level agreements (SLAs) and establish an implementation plan plan

While cost is one of the primary factors in decision-making, there are many other criteria that need to be evaluated on top of cost. They are:

- **Functionality** – does the system features fit the firm's processes and needs?
- **Ease of Use** – how fast is the initial learning curve and on-going use?
- **Performance** – what are the processing speeds?
- **Scalability** – how well can the system expand and grow with the firm?
- **Interoperability** – how well does the system integrate with other systems?
- **Extendibility** – how easily can the system be extended or customized?
- **Stability** – how reliable is the system in terms of bugs and up-time?
- **Security** – how well does the system restrict access, control confidential data, and prevent cyber hacking?
- **Support** – how is the quality of the vendor in terms of implementation, support, training, thought leadership etc. ?
- **Vendor Viability** – how is the vendor's financial strength and willingness to supply updates and enhancements? Will they be here in 3 years??

Because there are a variety of criteria that firms will be evaluating vendors on, a scorecard is a popular way to capture financial and non-financial attributes. The criteria can be scored as rank, ratings, and grades. Scorecards tend to be very detailed and can even be broken down by specific features. The selection can be made between vendors or between alternative hosting platforms.

Total Cost of Ownership

Software License: Direct cost of the software system itself – assuming ownership.
Maintenance: Ongoing annual costs to guarantee upgrades and bug fixes.

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Platform/Hardware: Cost of needed hardware to run the new software.

Training: Cost of training initial and on going personnel

Implementation: Cost of getting the system to go live! These vary widely between systems and firms.

Customization: Cost of modifying the system itself to fit the firm's processes. Nothing in SCM is used straight out of the box (vanilla).

System Integration

Cost of interfacing this system with other modules and modifying existing systems to fit

Implementation

While selecting a vendor can be difficult and time consuming, the actual process of implementation can take significant amount of time and consume a lot of resources. There are a few different approaches to implementation. They include Direct (or Big Bang), Parallel, Pilot, and Phased (or Rolling). Each of these has their own positives and negatives, but the approach must suit the needs of the business.

	# Modules Converted	# Locations Converted	Comments
Direct or Big Bang	All	All	• Switch from the old to new system occurs on one day • Pain of switch concentrated for entire firm • Fastest implementation time, but highest risk • Post-implementation productivity drop • High potential for system wide failures due to insufficient testing/training
Parallel	All/Some	All/Some	• Old and new systems kept on for testing period • Lowest risk of failure, but highest cost and longest implementation time • Employees do double entry work
Pilot	All	One	• Full implementation of all modules at one location • Identify bugs or issues that are corrected prior to larger rollout • Contains any potential failure from infecting all locations • Tests individual modules and integration simultaneously
Phased or Rolling	One	All	• Implementation of one module at a time across the network • Longer implementation duration than direct, but with lower risk • Users have more time & learn as they go - no dip in performance after • Learn and fix as you go – better process for later implementations • Loss of managerial focus over time and a continuous state of change • Potential for missing data during transitional implementation period • Might require temporary bridges from old to new systems during transition

There are a few **best practices** to keep in mind when going about implementation. They include:

1. Secure senior executive commitment: ability to gather and use resources, empower team.
2. Form interdisciplinary team(s).
3. Create a clear and specific scope document:
4. Build extensive testing into the project plan (you can't do too much)
5. Include extensive user training into the project plan

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Learning Objectives

- Recognize selecting a software vendor is an intertwined decision between architecture and source.
- Understand tradeoffs between On-Premise and Cloud based systems.
- Know the differences between In-House, Best of Breed, ERP Extensions, and Outsourced forms of software systems.
- Review the selection process, recognizing there are multiple attributes, and the total cost of ownership is complex.
- Understand the challenge of implementation and the various approaches to implementing systems within a firm.
- Review best practices of implementation.

Technology Trends

Summary

As future (or current) supply chain professionals, you will be constantly faced with technology trends that will influence your work and future planning. Many of the tools we have armed you with are tried and true methods and may not change. Others, such as various systems and technologies will change continuously. It is important to be aware of a few emerging technology trends we see today (as of 2016). We will introduce you to a few of these in the next lesson. Each trend will be cover what the trend is, its status, and potential impact.

Trend: Autonomous Vehicles

Autonomous trucks are trucks and other vehicles that can operate with minimal (or no) human interaction. There are various levels of Automation from None (0) all the way up to Limited Self-Driving Automation (Level 3). The status as of today is that autonomous delivery has already happened. The first paid autonomous deliver occurred in Colorado in October of 2016; Otto delivered a full TL of beer. There have been significant investments in technology such as Uber acquiring Otto in 2016 for $680M. Intel acquired Mobileye in 2017 for $15B. The direct impact is huge:L a single day range of trucks could double for about 1000 miles. It could lower fuel costs due to lower speeds.

Approach
- Network modeling with new transport characteristics
- Trucking industry strategy (Porters 5 Forces Model)

Trend: Delivery Drones

You have almost definitely heard of delivery drones as the future of delivery. Delivery Drones are an unmanned aircraft that can navigate autonomously, without direct human control or is guided remotely. It was used in military operation starting in 2000. Drone Deliveries have already happened such as on Dec. 7 2016, Amazon Prime delivered an Amazon Fire TV and a bag of popcorn by drone to a man near Cambridge, UK. Flirtey and 7-Eleven delivered a chicken sandwich, donuts, candy, Slurpees and hot coffee via drone in July 2016 in Reno NV.

Direct impacts include the ability to send small loads to remote location quickly. It expands delivery capabilities using open air without using existing infrastructure. It will essentially serve as a new transportation mode for very fast replenishment of very small shipment size over a close distance.

Analysis Approach
- Network modeling with new transport characteristics

- Demand planning – new service offering

Trend: Mobile Computing

The next major technology trend is mobile computing. It is a technology that allows transmission of data, voice and video via a computer or any other wireless enabled device without having to be connected to a fixed physical link. Today mobile computing has grown 18 fold over the past five years of use. There are 8 billion mobile devices (including 325 million wearable devices) currently in use). Smartphone usage grew in 38% in 2016, but they are only used as phones 3% of the time.

Immediate direct impacts are obvious. We use it constantly. Anyone with a smartphone is able to access data and systems for anywhere at any time. For supply chains, it means new paradigms of shipping and retail supply chains such as Omni channel.

Analysis Approach
- Demand planning models – impact of location and signals for better forecasting
- Inventory modeling – changing stocking points and functions
- Transportation modeling – delivery for more diverse locations
- Warehousing – changing the function of facilities

Additive Manufacturing

The final trend we will talk about in this lesson is additive manufacturing. There are of course many others that you will cross in your path as a supply chain professional; these are just a few to show what is coming down the line currently. Additive manufacturing is the process of making a physical object from a three-dimensional digital model, typically by laying down many thin layers of a material in succession. As of 2016 additive manufacturing grew 26% to $5.16 B. There are many different processes that include but are not limited to: material extrusion, material jetting, binder jetting, sheet lamination. Materials include polymers, composites, metals, ceramics, paper, and more. It has expanded beyond hobby and prototyping uses. A primary example is GE acquiring Sweden based Arcam and Germany based SLM solutions for $1.4B in 2016.

Learning Objectives
- Technology is always changing!
- As supply chain professionals you will be continuously faced with new technology trends and decide what is viable.
- Be introduced to critical thinking about technology trends, their potential direct and indirect impacts, and timelines.
- Review current technology trends.