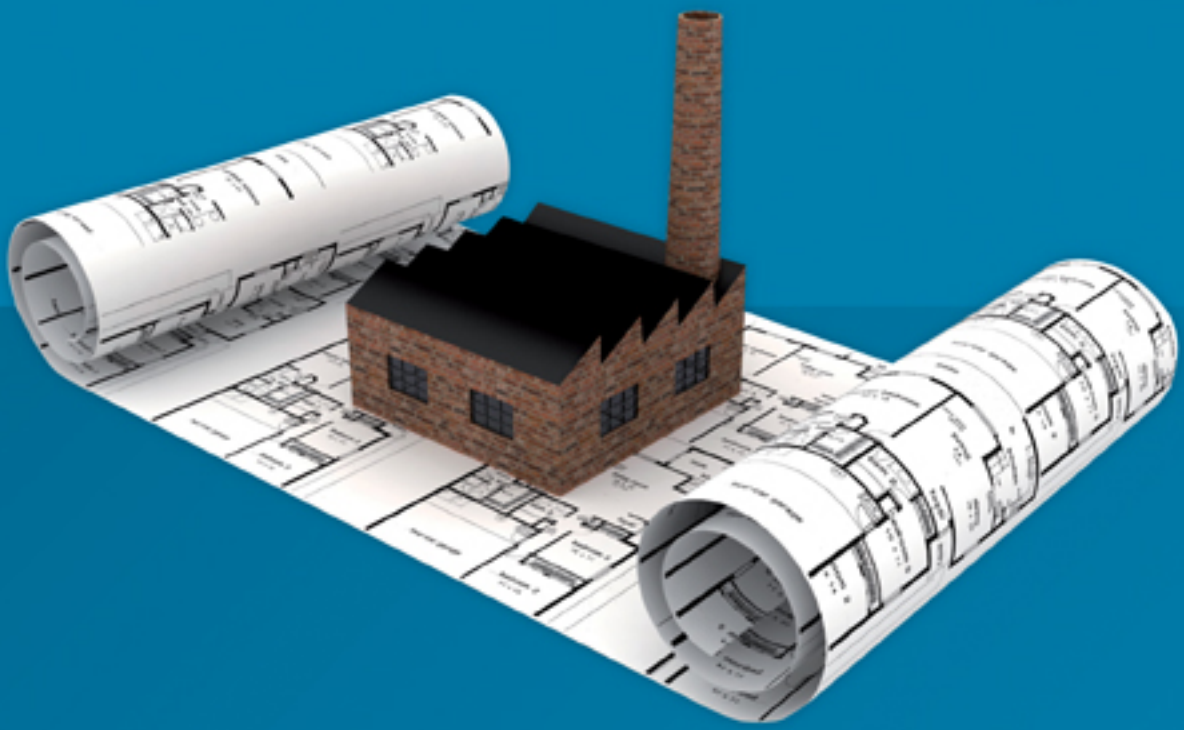
The IT Factory



Supply Chain Management for IT Infrastructure Services Using the SCOR Model

Hans van Aken

Van Haren Publishing

The IT Factory

Supply Chain Management for IT Infrastructure Services: Using the SCOR Model

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Preface

Am I losing it? Is it me getting older and unable to keep up to speed, or is it the IT industry at large doing a great job turning simple things into complex matters? Have I reached the limits of my comprehension considering that in my daily job, I'm frequently baffled by difficult academic terms and definitions? Not to mention people's ability to abuse important nouns such as flexibility, agility and adaptability. I often encounter these words coined as generic business requirements for IT Core Infrastructures without further context or meaning. Dozens or sometimes even hundreds of hard to understand, non-intuitive processes, procedures or routines aggravate the level of my confusion. And when I'm not paying attention, I'll probably add some of the complexities myself.

Much to my relief however, I'm seeing more and more evidence that many of us struggle with the same questions and that it's not just me losing it. Working from those premises, we can infer that we (as in the IT industry) really excel in complexity. For some reason we seem to lose ourselves in elaborate explanations, and rigid definitions; we lack the ability to explain things in a more down to earth way such that my neighbor's teenager might understand. It is therefore not so strange that outsiders who need to interact with the IT world have a hard time understanding any of it, let alone acting on it.

In my own endeavors to explain what's going on within my area of expertise in a clean-cut way, I was led to an investigation, the results of which are captured in this book. Interestingly enough, it turned out that I've been applying most of the factory and supply chain approaches described here successfully without even realizing it. If I had been more aware of all my dormant knowledge about the world of manufacturing, I would have had a much easier time communicating goals, structures and tangible results. It's been right under my nose for many years and I'm convinced many of you will share the same experience after reading the book.

My inspiration for this book comes from working with highly respected colleagues and surviving dozens of presentations, publications and documents about IT infrastructures which all more or less talk about highly standardized shared IT services. The move away from compartmentalized IT solutions into standardized shared layers is growing stronger every day and many times a

metaphor is used or an analogy drawn with a factory and a manufacturing style of producing IT services.

> *"We have moved deliberately to a factory metaphor. We have stopped focusing just on what data centers store and are asking ourselves, 'What do they output?'"*[1]
> Brad Ellison - Manager, Global Data Centers - Intel® Corporation

This concept is typically received very well since almost all of us can somehow relate to factories and manufacturing. Amazingly enough, it frequently stops right there, by just mentioning the concept. That's a pity because the analogy with a factory appeals to so many people and can therefore help to establish what an analogy is for: play a significant role in explanation, communication, problem solving, creativity and decision making.

So let's take a closer look at the world of manufacturing, factories and supply chains and learn from the enormous amount of experience built up during several millennia. When you are able to grasp and communicate your IT environment in simple words using the language of factories and manufacturing, you may find so many fabulous opportunities for improvements that it might make your head spin.

I have learned a lot from the world of manufacturing and factories, which has made my life easier. I hope this book will make your life easier as well; I encourage you to experience the full potential of the analogy and, with whatever decision you need to make, unleash your knowledge about factories and supply chains. Welcome to the world where IT Infrastructure meets Manufacturing.

Notes

1. **Corporate Executive Board.** Hardwiring "Green" into Infrastructure and Data Center Investments - Defining and Implementing Meaningful Energy Efficiency Metrics. [Online] May 2008. http://www.executiveboard.com. Report number DCEC1A76HCB.

Acknowledgements

Writing a book for professionals cannot be done in isolation. It takes many others to learn from, provide inspiration, test ideas with, support and motivate you, keep you sane and stay away from jabberwocky.

From the vast number of friends, colleagues and supporters who, sometimes unaware, helped me to create this book, I would especially like to acknowledge:

Caspar Hunsche from the Supply Chain Council for his support and endorsement, together with anyone who ever contributed to the SCOR® model.

Chris Coggrave, Andreas Arts, Frank Kroon and André van der Meer for their friendship, support, collegiality, frankness and inspiration. They put their many years of experience in IT environments, gained at numerous international large and complex engagements in all types of industries, in reviewing this book. I am much obliged to them.

Foreword

When Hans first asked me to read his book *The IT Factory* I thought: "This has been done before." Organizations have adapted versions of SCOR® to describe and improve IT delivery processes. SCOR® allows companies with traditional supply chains to assess, analyze and improve supply chain performance using a repeatable and reliable method. SCOR® is built on the experiences from many companies running straightforward to complex supply chains. The processes of IT services deliver goods and services the same way supply chains do, with similar probability for complexity. The primary distinction is that the language used to describe these processes and their performance is different. Or is it?

Managing a supply chain involves developing a supply chain strategy that supports the business strategy, linking supply chain performance to supply chain configuration, managing process performance and aligning supply chain resources to enable processes and performance. Successful cloud computing implementations require equally well-defined IT supply chains to meet customer service requirements and optimal cost structures. Hans discusses the different IT services and how proven supply chain concepts can be applied to the world of IT.

Trends that apply to supply chain management apply equally to the IT services industry. In 2007 SCOR® introduced a set of foundational metrics to measure the environmental footprint of a supply chain (GreenSCOR). These metrics can be directly applied to the use of data centers and other IT services. GreenSCOR best practices can serve as ideas to improve energy consumption in the IT factory. Similarly, experiences from the IT factory may in return be applied to traditional supply chains in the future.

What makes this book different is that Hans describes the comparison between traditional supply chains and IT services supply chains in detail. In this book he extrapolates supply chain plants into the IT world: IT factories. He looks beyond the processes into metrics, thus introducing the ability to assess performance and root causes, analyze problems and reconfigure the IT supply chain or IT factory. These steps are simplified using a standard to describe the performance and processes.

Through this book the proven methods to assess, analyze and improve performance developed in the supply chain industry are now available in the relatively young IT Services industry.

Caspar Hunsche

Director of Operations, Research Director

Introduction

Introducing the IT Factory

Long ago, before we grew up and started on our first job, we asked questions about how things were made and drove our parents mad. We wanted to know where LEGO® came from, how machinery works, or even how a car worked. Our parents would answer the best they could and tell us about the factory that created LEGO building blocks out of lumps of plastic. Our teacher taught us about ore, raw materials and transportation. Later on probably, we even learned about demand and supply, assembly lines and supply chains. From a distance, it all looks, deceptively so, quite simple. We listened, accepted the explanation, and thought no more about it; the notion of a factory was put firmly in our minds. The older we got, the more we learned about factories, their supply chains and manufacturing processes; we might even have worked in or for a factory at some time or other. Then we started working in IT and somehow clean forgot all about the world of factories. This seems odd because if you take a good look at it, there are many similarities between factories and IT infrastructures. Why not put our latent knowledge and ideas of factories to good use for the way we structure and organize IT infrastructure services? Voila, **"The IT Factory"**.

Audience for this book

This book is written for business managers, IT architects, business consultants, strategists and key decision makers in the IT, or anyone else who is interested in understanding what it takes to create services from IT infrastructures in a factory style. The aim of this book is to unleash and exploit your latent knowledge about factories, manufacturing and supply chains and put it to good use in the world of IT.

The goal of the book is to improve your general understanding of IT infrastructure services, how these are constructed using supply chain models, how to talk about these services with non IT specialists and how to objectively measure the success of the services. You will be introduced to, and hopefully inspired by, the world of supply chains using the de facto industry standard reference model SCOR®. The generic processes for supply chains, which are part of this reference model, will be covered as well as their powerful metrics. All of this is in the context of IT infrastructure services.

After reading this book, you will have a new or improved point of view about IT infrastructure services. You can use this point of view for both diagnosing and optimizing your current IT environments, or to explore opportunities for the introduction of concepts such as IT shared services and cloud computing, whether as a services provider, consumer or as both.

Besides covering essential knowledge about services and supply chains in general, this book provides a step-by-step approach to get started with your own IT Factory. The approach used is based on a blend of mainstream industry IT Enterprise Architecture frameworks and the tested Supply Chain Excellence Method as described by Bolstorff and Rosenbaum in their book "Supply Chain Excellence"[1] and propagated by the Supply Chain Council (SCC)[2]. The industry IT architecture frameworks in general start with looking at the drivers and goals for doing any type of work and then go into the business and functional point of views, eventually followed by technology and implementation views.

In this book, setting up shop in Part II starts with this flow but stops at the point when it comes to specific technologies. The technology part should be done when an IT Factory is determined as viable with the technologies that are currently available. After the drivers and goals are covered, the focus is shifted to the supply chain excellence method. This method is used to figure out what the existing or future supply chains are, and then continues with defining metrics from a strategic or business point of view.

Organization of the book

This book is organized in two parts. Part I covers everything you need to know about the analogy with a factory, current issues, services and values, supply chains and processes and finally the IT Supply Chain Reference Model. This is a quick rundown of the chapters in Part I: Principles:

- Chapter 1, The IT Factory: addressing the challenges of the IT department
- Chapter 2, The main features of an IT Factory
- Chapter 3, The IT Supply Chain Reference Model: This chapter is fundamental for setting up supply chains for IT infrastructure services. It introduces the IT Supply Chain Reference Model, which covers eight blocks with demand-supply relationships. For each block, there is a detailed

explanation of the main components, its customers, suppliers, products or services and processes.

In Part II of this book (Practice), you can read all about the business and supply chain strategies for setting up your own IT Factory. The supply chain metrics are explained including why these metrics are pivotal for the arrangement of your IT supply chains. This Part also describes how to measure and prove your success, and also how to identify areas for improvements, including areas such as quality and financial considerations.

- Chapter 4, Set Up Shop: Setting the scene for setting up an IT Factory. Where to begin and what are the next steps?

- Chapter 5, Business Drivers and Business Strategy

- Chapter 6, IT Supply Chain Strategy – Part I: We know the customers and have an idea what services to produce but what is the strategy for the IT supply chains of these services?

- Chapter 7, IT Supply Chain Metrics: One of the jewels of the SCOR model, the metrics. These are the key performance indicators for your IT Factory. The metrics include customer facing metrics as well as metrics for your financial performance.

- Chapter 8, IT Supply Chain Strategy – Part II: Picking up the strategy from Chapter 6, after the intermezzo of the metrics.

- Chapter 9, Configuring the IT Supply Chain: All the information is here to start configuring the processes for an IT supply chain to meet the chosen objectives.

- Chapter 10, Next Steps: Lots of important information is covered up to this point and there is still plenty to do.

- Appendix A, Examples of IT Supply Chain configuration: Some examples of different IT supply chain configurations are provided, including examples about IT supply chains using multiple geographically dispersed locations, incorporating Clouds and an example using converged technologies.

IT infrastructure services

'IT infrastructure services' is quite a generic term and is interpreted in many ways. When doing some desk research on what these services are all about, you will find many different service offerings, definitions and descriptions. And after a while, you will find that there is no single version of a definition that is endorsed industry-wide and accepted. This book is neutral about all existing definitions of the term "IT infrastructure services", it will not introduce a new definition and you will not be menaced with many other definitions or academic discussions. Those are not appropriate in a factory environment.

However, for the sake of setting the scene and drawing a broad outline of the world of IT infrastructure services, think of the type of services that you could buy or sell from a catalog in the open market. Think of services such as:

- Provision of data center space if you need space for your IT equipment;
- Wide Area Networking connectivity to connect to another remote data center or an office;
- A managed or unmanaged simple Operating System for some quick development or testing activities;
- An Oracle® Web Service or an Apache® HTTP Server for running web sites or web shops.
- A Java™ Application Server for developing or running applications;
- An Oracle® or Microsoft® data base instance when data needs to be managed.

All of these examples, and many more you can think of, can be (but need not be) categorized or labeled as IT infrastructure services. The scope of these services is quite wide, ranging from the domain of data centers, up to services for running applications and everything in between. This is the primary scope of this book; however, you can there is nothing stopping you from using the supply chain concepts in an extended scope where information and business processes are included. The last chapter in Part I of this book shows you how this works.

Frameworks

Many industry best practices and frameworks will be combined but as mentioned before, you will not be tormented with all the definitions or details. The details are something you need to work out when you start implementing

your IT Factory. However, there will be frequent references to industry standards and it is useful to know a little bit about two of them before starting on Chapter 1: SCOR® and ITIL®. More in-depth information about these standards can be found on the websites of the governing organizations but a word of caution here. The combined number of pages to communicate just these two standards exceeds 2200 pages! No need to say that this contributes to the point in the Preface of too much gobbledygook.

SCOR® – Supply Chain Operations Reference

SCOR® is a process reference model[3] from the world of Supply Chain Management and has, at first sight, not much to do with the world of IT. You might not even have seen much of this model before but once you take a closer look, you'll find an enormous amount of valuable information and know-how and what is more, the SCOR model plays a pivotal role in the IT Factory.

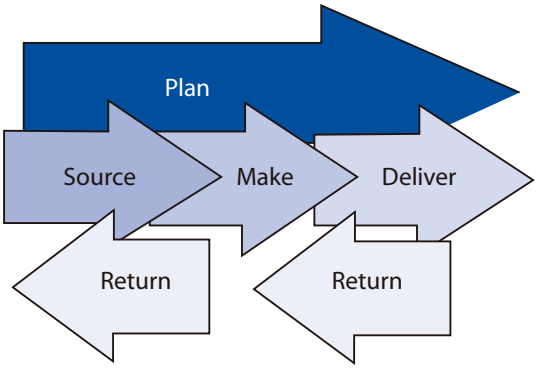

Figure 0.1 The SCOR® model is organized around five major types of processes

The SCOR model is governed by the Supply Chain Council (SCC). This is an independent, not-for-profit global trade organization consisting of many practitioners, with hundreds of corporate members worldwide from a wide range of industries who are operating the biggest and most complex supply chains you can imagine. This makes SCOR a model that can be applied to virtually any supply chain, including the supply chain of the IT Factory.

Supply Chain topics such as planning, manufacturing, order management including invoicing, logistics and all customer and market interactions are covered by the SCOR model and are in line with Michael Porter's renowned framework for the Value Chain[4]. The SCOR model is organized around five major types of processes: Plan, Source, Make, Deliver and Return as can be seen in Figure 0.1 from the Supply Chain Council. These process types

are worked out in categories, described up to the level of process elements and enriched with a vast repository of powerful metrics, best practices and technologies.

The SCOR model has evolved over the years into a very comprehensive framework. In version 9 the integration with GreenSCOR has been introduced, which adds process elements and metrics for environmental management. This is good news since Green IT is a 'must' on the agenda of every business these days, and GreenSCOR can help with awareness of and accounting for the environment by adding environmental metrics and processes.

One final argument why SCOR is *the* model to use for any supply chain is visible in the SCORindex[5]. SCORindex contains a chart where the value of an aggregate 70 company SCC members is tracked since 2003 and is compared to the performance of the Dow Jones and Standard and Poor's (S&P) indices. The SCORindex consistently outperforms the Dow Jones and S&P.

ITIL® – Information Technology Infrastructure Library

Most of us in IT know at least about the existence of ITIL®[6] (Information Technology Infrastructure Library). It is an industry best practice approach for IT Service Management and provides guidance with frameworks. Version 3 of ITIL covers the lifecycle of services and is much more aligned towards the customers of services than Version 2. ITIL V3 consists of five core books of which the interrelationships can be seen in Figure 0.2.

- Service Strategy. Descriptions of strategies, demand management and business service management are on the same turf as the Plan processes of SCOR.
- Service Design is about the development and design of services. This is not really covered by SCOR itself but in an affiliated model DCOR™ (Design Chain Operations Reference).
- Service Transition forms the bridge between the development of services and putting these into operation.
- Service Operation contains information about the continuous delivery of services.
- Continual Service Improvement mainly deals with the quality aspects across Strategy, Design, Transition and Operation.

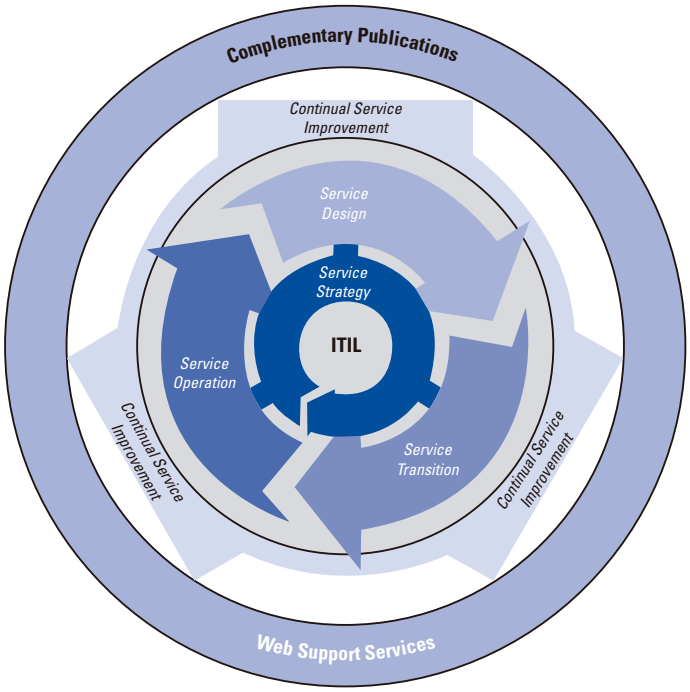

Figure 0.2 The ITIL Core

The summaries above do not fully do justice to ITIL but should be sufficient as base information for reading this book. For all the details, see the Notes section where you will find more information.

Notes

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PART I: PRINCIPLES

1 The IT Factory: addressing the challenges of the IT department

1.1 Service trends in the IT industry

Supply Chain Management of IT Infrastructure Services using the SCOR model is the subtitle of this book and it is about using the analogy of factories and manufacturing for creating IT infrastructure services. A broad outline of IT infrastructure services, with some examples, has been covered briefly in the Introduction and you will frequently come across such services as part of a trend in the IT industry:

Adaptive Infrastructures, Utility Computing Infrastructures, Platforms as a Service, Service Oriented Infrastructures, Cloud Computing Infrastructures, Infrastructures as a Service, Real-Time Infrastructures, On-Demand Computing, Grid Computing…

There are many more examples of such trends that can be found in the industry, some already outdated, some new or still to be invented. Looking from a distance at these trends, they all share some key characteristics. They deal with delivering services in an efficient, automated way, are easily able to adapt to changes in demand and sound very appealing to anyone who wants to develop new business services quickly. These infrastructures are typically shared between multiple tenants and can, in a manufacturing style, produce large quantities of standardized services on a pay-as-you-go basis. The most notable difference between all the trends is in the area of the scope or boundary of the services. Some are limited to just providing compute capacity or hardware, others include operating systems and some go into the domain of middleware, applications or databases.

Putting these infrastructures in place is far from easy but fortunately there are real-life implementations that hit the mark – and they almost all appear to work as a factory would.

1.2 Managing expectations

When one of the phrases mentioned above is coined as an ambition for a new infrastructure to be developed, the expectations that come with it are typically pretty high. The new infrastructure is supposed to be flexible, provided at low cost, adaptive, automated, able to scale seamlessly, reliable, adaptable to business changes and demand, elastic, virtual, fast and easily ordered, predictable, enabling business growth, agile, standardized, secure, highly available and efficient but most of all KISS (Keep It Simple, Stupid). Does this sound familiar? And this is definitely not the complete list you can encounter. But how on earth can anyone live up to all of these expectations? And where do you start to realize some or all of these? How do you try to explain what you intend to do to your CEO, CIO and/or the IT Executives in simple understandable terms that anyone can understand?

Without being crystal clear about these types of high expectations, you will end up with a lack of mutual understanding and potentially create unrealistic expectations. Many organizations have already been here before. A global survey from the Economist Intelligence Unit[1] showed that 33 percent of the respondents (CEOs, board members and IT executives) considered "Lack of understanding from senior management of how IT should support business objectives" as the number one chief obstacle to the ability to align IT infrastructures with business objectives. Although this survey is from 2006, there is no evidence that things have got any better; sometimes there is even a growing impression that the degree of alignment and mutual understandings is worse than before. This is not an encouraging prospect to start your endeavor with.

Alleviating some of the misunderstandings, reducing disappointments and getting to realistic starting points and expectations is the 'sweet spot' where the analogy with factories and manufacturing kicks in. As discussed in the Introduction, whether you or your contacts are from the IT or business side of the house, we all share some knowledge about factories and manufacturing. And it is this common ground which is an excellent starting point for using a universal vocabulary, fundamental for better understanding and setting realistic expectations.

1.3 A vocabulary for the IT Factory

Let's start by seeing if some of the vocabulary of traditional factories, which we all learned early on in our school days, can be easily applied and makes sense in an IT environment. The following table contains some ad hoc translations from traditional IT terminologies into a vocabulary that can be used inside the IT Factory.

Table 1.1 Traditional IT terminology versus IT Factory terminology

	Traditional IT	IT Factory
Production Facility	Data Center	Factory Building
Production Area	Raised Floor or White Space	Shop Floor
Suppliers	Deliver hardware, software and services.	Deliver raw materials or semi-manufactured products.
Stock items	Spare capacity in a resource pool	Stock items on the shelf in the warehouse
Product changes	Upgrades, updates, patches, fixes, …	Maintenance, Repair and Overhaul (MRO).
Tailor-made production method	One-off departmentalized IT Project	Job Production
Ready-to-wear production method	Shared Services	Batch or Mass Production
Automation	Data Center Automation	Robots
Automation department	IT for IT	IT department of the factory
Operations Center	Network Operations Center (NOC)	Control Room
Leaders	Team leads	Foremen
Workers	System Operators	Shop Floor Operators
Build approach	Waterfall model	Engineer-To-Order (ETO), Make-To-Order (MTO) or Make-to-Stock (MTS)
Provisioning process	?	Configure To Order (CTO)

Just to be clear, I am not advocating that you permanently change your vocabulary of IT. That would be ridiculous. This approach is positioned as an aid to help communicate with parties who are not IT literate.

With a little bit of imagination, it is quite easy to make this a very long list and of course there are some differences as well. After all, the factory is an analogy and is thereby, by definition, not identical to the world of IT infrastructure services. Another characteristic of any analogy, including this one, is that if you push it far enough, it will certainly break down and starts to become

counterproductive; that's why it remains an analogy. But let's stay focused on the similarities and the main positive contributions of this analogy in the areas of communication, problem solving, creativity and decision-making.

1.4 Strategic metrics for the IT Factory

Before investigating more background information, here are two more examples of how the vocabulary from the world of factories and manufacturing can be used for the IT Factory and for manufacturing IT infrastructure services. These examples are in the area of strategic[1] SCOR model metrics for the processes of the IT Factory. These strategic metrics can be used as Key Performance Indicators (KPIs), set expectations for your customers and lead the organization of supply chains.

One of the top-level strategic metrics in the SCOR model is "**Perfect-Order-Fulfillment**"[2]. This is the percentage of all the orders where the whole order fulfillment went perfectly. The orders have been delivered as expected and the customers received and accepted their orders within the promised timeframe, at the right place, in the right quantity, undamaged, working as specified, fully documented etcetera. Think about this metric when you order a couple of books from an online bookstore. When you agree to the price and the date of delivery for the books and you push the final buy-button, you expect to get all the books on that date, at the location of delivery you specified, undamaged and with the correct invoice. If all of that is ok and up to the expectation set at the time of ordering, than that delivery is counted as a perfect order. As a customer, you prefer or expect this to be the case for every order (100 percent) you place. However realistically, you also understand that this is difficult and expensive to realize for every single order for every single customer. There is always something that can, and therefore will, go wrong sometime, somewhere, somehow.

Setting this metric to 100 percent of the orders is a bit unrealistic for IT infrastructure services (or for any other service for that matter) but if, let's say 95 percent of all the IT infrastructure service orders would have been perfectly fulfilled, that would be quite an accomplishment compared to today's best practices (more on today's achievements for this metric later). Perfect-Order-

1 Next to these strategic metrics, there are many diagnostic metrics in the SCOR model as well
2 Another broadly known logistical metric in this area is "On Time In Full" or OTIF

Fulfillment is a metric that the business can relate to and the IT Factory can use and work with to show its reliability.

"Order-Fulfillment-Cycle-Time" is another top-level strategic SCOR model metric. This metric deals with the average time that elapses from the moment a customer places an order up to the moment when he/she accepts the delivery. In the previous example of ordering books, this time starts when the final buy-button is pushed up to the moment when the customer signs the delivery slip for acceptance. This metric expresses the average time that is needed for all orders of all customers of this online bookstore.

When such a bookstore measures and calculates about thirty days as average for fulfilling orders, the bookstore might be due for some supply chain improvements to stay competitive. However, when this average is between one and two days, it looks in good shape and the bookstore is responsive to customers' orders.

This metric is also very important for the actual implementation and organization of the IT Factory's supply chains. At the highest levels of Infrastructure Maturity as defined by Gartner[2], this elapsed time between ordering an infrastructure service and its accepted delivery would average around seconds to minutes and requires sophisticated, highly automated and policy-based provisioning tools (or "software robots" in IT Factory language) which do not require any human intervention. Today, this is technically feasible but a little too ambitious or just plain overkill for most IT Factories and not considered as core business, a niche at the most. A more likely scenario is where an application developer requires a development environment and the IT Factory can respond within, say, two days. For some this timeframe seems like a great achievement, for others it may well be a long time but that is not the point. The point here is that the business and IT can make upfront agreements about an acceptable Order-Fulfillment-Cycle-Time and track and report on the responsiveness of the IT Factory.

Besides these two examples of metrics for reliability and responsiveness focused on the customers of the IT Factory, the SCOR model covers agility metrics and metrics focused on internal efficiencies for supply chain costs and assets. All of these are great and crucial for tracking the performance of the IT Factory and can be used to identify areas for improvements. These very important metrics will be covered in more detail for the IT Factory when Setting Up Shop in Part II.

One company that is already using some factory vocabulary and metrics inside its IT environment and data centers is Intel. It uses terms such as "Efficiency of supplying raw materials to the manufacturing process", "Efficiency of turning raw materials into finished goods" and "Cost to produce a unit of finished goods" to measure the efficiency of its data centers[3].

1.4.1 Summary

This all sums up to the observation that there is a useful universal vocabulary that can be activated to streamline communications between the business and IT side of the house. By setting the right expectations, you reduce disappointments and get to realistic starting points. In the remaining parts of this book, a mixture of IT and simplified factory terminology will be used, to explain the IT Factory in simple words. A dictionary for translations is not included and does not exist, but don't worry, you will not be needing one. If one of the terms used does not feel intuitive to you, just search for another term that fits better. As long as the term simplifies things and you don't push the analogy too far, it will have the desired outcome. A word of caution: always check with the people you communicate with, that the essence of the term you selected is interpreted similarly.

1.5 The challenges of traditional IT departments

Any traditional IT department - please do not interpret 'traditional' as 'old-fashioned' - will have its fair share of challenges. Some are related to day-to-day operations and dealing with incidents for example; others are more long-term and at the tactical or strategic levels. Without neglecting the day-to-day challenges, it is the more tactical and strategic challenges that need to be addressed when considering an IT Factory.

Here are four of the most prominent challenges of traditional IT departments:

- Production methods and 'techno-tribes' – technology-focused groups working independently of each other
- Levels of control between customer and IT department
- Turnaround time from the customer placing an order to taking delivery
- Keeping up with the pace of change

1.5.1 Production methods and 'techno-tribes'

Besides the challenge to use understandable vocabularies, traditional IT departments with traditional ways of manufacturing IT infrastructure services face a challenge when it comes to sustainability. These IT departments mainly

use job production as the method for manufacturing one-off, tailor-made and departmentalized IT infrastructure services; bespoke Engineer-to-Order processes and activities are common practice here. For each new IT request (an order), a new infrastructure service is designed and created (or engineered, hence Engineer-to-Order).

In addition, one single traditional IT department typically contains many small, strongly technology focused groups of subject matter experts (equivalent to workshops with craftsman in factory terminology). Such technology groups typically focus on delivering individual or group assignments, and collaboration between groups is not always self-evident. Sometimes groups are even competing for work up to points where tribal behavior results in less optimal outcomes. Think for example about one group working with Windows® based environments and another group focused on Linux®. Job production, Engineer-to-Order and techno-tribes are not very productive for long-term sustainability of an IT Factory.

1.5.2 Control

The second challenge is in the area of the level of control or authority on what specific infrastructural solutions to use, and how to manufacture infrastructures. Traditional IT departments put their processes into motion when a customer, typically from a department dealing with applications, requests a new IT infrastructure service for the support of a new application. Frequently such a customer strongly insists that a specific infrastructure solution from a specific vendor needs to be used. They sometimes even position such infrastructure solution as the only viable, supported and non-negotiable solution for their application. In extreme situations, the customer might have already bought the infrastructure components as part of a software deal and presents this to the IT department.

If the IT department has to oblige and must use such infrastructural solutions, then every customer of the IT department has a high level of control about how, and with what tools and components the IT department should operate. The result is likely to be an IT department's workspace full of all sorts of different machineries and tools, each with their own specific processes and manuals. This is quite inefficient and high costs are involved. For an IT department to improve operations from a quality, cost and efficiency point of view, the challenge is in regaining control about how and with what tools and components to manufacture infrastructure.

1.5.3 Turnaround time

Thirdly, a traditional IT department takes many weeks to months of labor and idle time to manufacture an Engineer-to-Order infrastructure service of reasonable size. It takes many meetings, numerous processes, piles of paperwork that are frequently ignored[3] later on, thorough testing and some magic to produce a nice piece of tailor-made infrastructure that fits like a glove. By bringing the best architects and engineers together, the IT department every time constructs professional artwork fully optimized to support the application. The application department puts it to good use by installing and thoroughly testing the application and when satisfied, releasing the requested functionalities to the business. But this final step will only occur if that business still exists and the functionality is still needed and after so many months of engineering…

1.5.4 Keeping up with the pace of change

The last remark is a main area of concern and challenge for traditional IT departments where the disadvantages of job production and Engineer-to-Order (e.g. high costs, specialized labor and long duration) cannot follow the increasing pace of change in the business any more. Research by Foster and Kaplan(4) in 2001 showed that this pace of change in the business is continuously increasing. They found that the average lifespan of a company steadily decreases and "most of these companies will die or be bought out and absorbed because they are too damn slow to keep pace with change in the market". They even forecast that "By 2020, more than three quarters of the S&P 500 will consist of companies we don't know today". The same goes for products where the pace of new product introductions is continuously increasing and the economic lifespan of products decreases. Overwhelming examples in this area are easily found in consumer markets for products such as smartphones and service offerings from Internet Service Providers. There is not much more debate or research necessary to realize that this accelerating pace of change in such products and businesses is actually happening.

Another allied indicator for the need to speed up and change the method of production is found in the statistics of failed IT projects(5). The trend here is a yearly increasing number of failed IT projects - cancelled before completion

3 This is called Muda in terms of Lean Manufacturing. Muda is a traditional Japanese term for activities or work which are wasteful and do not add value.

or delivered and never used - up to 24 percent as reported in 2009. And what is the most likely reason for a project to be cancelled before completion? Very often it is because the initial benefits to the business change during the lifetime of a project - the project lifetime is too long. Even more wasteful of time, money and energy are projects delivering something that will never be used. Why never used? Because nobody needs the benefits any more by the time the project finally finishes - the business has changed and the project lifetime is again too long. Of course, not every failed project is due to late delivery of IT infrastructure services but the numbers also do not imply that the projects which were completed had a smooth ride. Only 32 percent of the projects succeeded within the initially set scope, budget and time. Remember the discussion about Perfect-Order-Fulfillment? 32 percent appeared to be the average of perfectly fulfilled IT projects as reported in 2009. Even though the reported numbers in 2011 are better than the ones reported in 2009, these are still not even close to an achievement to cheer about in a manufacturing environment.

These rapid changes in the business environments are one of the reasons for some companies to introduce policies about the maximum amount of time any IT project may take, including the realization of infrastructure services. In terms of supply chains, they have set the Order-Fulfillment-Cycle-Time metric to a maximum of, for example, six months. These companies realize that everlasting IT projects never deliver any benefit to the business since that business does not look the same any more compared to the time when the project started. They also do not use job production as their manufacturing method any more since this just consumes too much time, which they simply cannot afford.

The need to speed things up becomes more apparent every day. In a poll by Gartner about the main driver for companies to make use of private clouds[6], 55 percent of the respondents mentioned agility/speed as the primary driver (the second was cost at 21 percent). Cloud environments are typically targeted at delivering services fast and this speed of delivery is one of the major distinctions between cloud environments and environments that are more traditional.

1.6 Switching from Engineer-to-Order to Make-to-Stock

The era of job production and Engineer-to-Order as manufacturing methods for IT infrastructure services is becoming a thing of the past because these methods are just "too damn slow to keep pace with change in the market". It is time to switch gear to methods that are better suited to address today's challenges: batch or mass production, Make-to-Order, Make-to-Stock and Configure-to-Order.

These methods of production have some benefits over job production especially in the area of speed of production by using capital-intensive automation and streamlined assembly lines. This increased productivity reduces the likelihood that a piece of infrastructure is never used since the supply of the infrastructure is very close to the point at which the demand for it was initially formulated.

The downside is obviously that mass production delivers some-sizes-fit-most IT infrastructures services and not the tailor-made ones that each time fit like a glove. This requires some flexibility on the customer's side to accept these "ready-to-wear" infrastructure services instead of the tailor-made. This is something which is completely accepted in the "normal" day-to-day life when, for example, ordering a car with a limited choice of some-sizes-fit-most engines. There is no reason not to accept "ready-to-wear" for IT infrastructure services.

Before drafting and setting up an IT Factory that uses batch or mass production as the manufacturing method, there are some important fundamentals you need to know about. These are about the value of services of the IT Factory, demand and supply, the SCOR model processes, an IT supply chain of the IT Factory and some more key considerations. This is all information that needs to be clear before Setting up Shop in Part II.

1.7 The value of services

Services are only useful when they add value.

This may sound like a no-brainer but there is a little bit more to it than just that. People working in IT environments typically do not have a strong reputation in clearly specifying the value of services. The perspective IT frequently takes

about promoting services is rarely about the actual *value* of services but more often about the plain and abstract functionalities, which are communicated in plain and abstract specifications about what the service delivers.

Even though the specification of a service is important, it is not very useful when the real added value *for the customer* of the service is blurred. What if the services you offer are top notch and the best services money can buy, but nobody is actually willing to pay for them? That leaves you, even with the best and most sophisticated service ever, empty-handed. The key here is not to specify what a service does or how this service is constructed, but to specify what the contribution of your service is to the business of your customer. Specify why your customer should consider buying your service. All of this is not really new and has already been captured in a strong statement by Michael Porter in 1985:

> *"Value is the amount buyers are willing to pay for what a firm provides them" M. Porter (1985)*[7]

Value is again an area where IT can take advantage of all the experiences from the world of manufacturing and factories. Let's look for example at a principle of Lean Thinking[8] which talks about value. This principle is the first of a set of five basic principles, originating from the manufacturing industry and which are specifically derived from the renowned and best-in-class Toyota Production System[9]. Womack and Jones formulate this principle as follows:

> *"The critical starting point for lean thinking is value. Value can only be defined by the ultimate customer. And it's only meaningful when expressed in terms of a specific product (a good or a service, and often both at once), which meets the customer's needs at a specific price at a specific time"*

This principle is in line with Porter's and adds the factor of time. If you want, you can also add location to such a principle but the key is the willingness to pay. Take the example of the man who is walking in a big city and is a little bit thirsty. He might be willing to spend a couple of dollars on a glass of cool water in a pleasant and comfortable outdoor café. However, if the price of this glass of water is more than ten dollars, he might walk by to the next café or even buy a cheap bottle of water in a supermarket. The location of the café is great, the water clear and cool but this man is not willing to pay the price. Now consider this same man in the middle of a blistering desert with an empty water tank. He now might be willing to pay hundreds of dollars for a plastic

cup with warm water. The location is terrible and the water stinks, but he is now willing to pay since this water is of high value to him.

In another example, suppose there is a courier service delivering packages to another continent with a guaranteed delivery time within a week. If your retired neighbor really needs to have a small package delivered in another continent within a week, he has the option of taking it himself, which will cost him a lot of time and money for traveling, or he can purchase a service from this courier. If the time taken by this retiree is not an issue, than the price of this "guaranteed delivery within a week" service is very important whether or not the service has any added value to him. Suppose the price of the service is way too high, triple the cost of taking it himself? That makes the alternative of taking it himself very appealing; he might then not be willing to pay for this excellent courier service and starts traveling himself. For this retired neighbor, the courier service does meet all his functional needs but he is simply *not willing to pay for it*.

This scenario would be different if the price is, say, only one tenth of the cost of taking it himself. That would save him quite a lot of money and might make him willing to pay for the service.

In both examples, the functional specifications of the services for a glass of water or transporting a package did not change. These remained exactly the same. The only difference between selling and not selling these services, is in the amount *buyers* are *willing* to pay for it.

A word of caution for IT Factories: the retiree did have an alternative to fulfill his need by transporting the package himself. Such an alternative is typically not the case when customers are forced by company policies to purchase from their internal IT Factory without being allowed to consider external alternatives. Willingness to pay for a service then does not seem to be very important, which is a mistake not to make. Such obligations to purchase from an internal IT Factory are no excuse for this IT Factory to treat customers differently than when running the IT Factory in an open market for external customers. In all situations, neglecting the added value, willingness to pay and pushing services onto customers will either result in unhappy customers or no customers at all. Neither scenario is in anyone's interest and will eventually turn things south.

1.8 Added value of the IT Factory

So what could then be the added value of the services of the IT Factory for its customer? That depends since, as just described, it is each customer who individually defines value, and it is up to each specific IT Factory to investigate the needs of their customers, where value can be added and to what extent the customers are willing to pay for it. In Part II, there will be some guidance on identifying your potentially best customers and topics to discuss with them from a supply chain perspective. Even though it remains up to the customers who define the value, here are some examples of what the added value of IT Factory services could be:

Suppose there is a project manager with a team of application developers. When there is a need for a new application development environment, the project manager has at least two options. The first option is to buy equipment and software from an external vendor, using money from his budget for the project, and have a team member install this environment exactly to the needs of this developer. When going for this option, the project manager is in full control of this process and it will provide him with exactly what he wants, and probably at the time he wants it. However, this process will take him or his team much time and effort to select, procure, install and configure equipment and software, find a location where to host it, connect it to the network, arrange for backups and so on. And eventually, when the project is cancelled or the environment is not needed any more, he has to reverse this complete process and dispose of the assets. All very 'do-able' and, except for the dismantling and disposal part[4], has been done many times before.

His second option is to spend some money out of his budget on a service from the IT Factory targeted at application development environments and delivering equivalent functionality. This is an off-the-shelf, 'ready-to-wear' service which does not need any project time or effort to install or configure and can be delivered almost instantly, thereby beating any time the project manager could possibly achieve by himself. And, whenever this environment is not needed any more, it can be simple returned by pushing a button and cancelling the service.

4 This is one of the reasons for over-provisioned computer capacity and up to 30 percent comatose servers in data centers[20].

What could be the reasons for this project manager that make him willing to pay for this service? Clearly this service will save him lots of hassles and time (and time is money) by delivering the environment faster than he can have it done himself. However, if time is no constraint for this project manager, he still might want to build a development environment within the scope of his project to stay in full control. But seriously, when was the last time that a project manager was not constrained by time?

Another argument that could prevent him from being willing to buy this service is the amount of money he has to pay for it. If his alternative of arranging the environment by himself is much cheaper (all costs considered), he will have second thoughts about buying the ready-made service from the IT Factory. However, when the combination of time and price is in his favor, this project manager will be a happy customer who is willing to pay for this service.

Once the development phase of his project is almost finished and a production environment is needed, the project manager might again have an option to buy and build this production environment within the scope of his project or to buy such a production environment from the IT Factory as a service. When making this decision, he should once more be informed about the added value of buying from the IT Factory. This time added value is not only in the area of saving time but also with the guarantee that the production environment will be based on well-understood quality standards of the IT Factory with trouble-free management and predictable operations included for years to come. His alternative of building the environment within the control of his project will come with lots of cumbersome meetings and some fairly severe headaches about how this environment is going to be installed, configured, managed and maintained by the traditional operations department. Most project managers do not enjoy this process and highly appreciate (and are thereby willing to pay for) the alleviating, all-inclusive services from the IT Factory.

Even though this all seems to make sense, it is not always common practice in IT; project managers for individual projects frequently still buy and build their own custom IT infrastructure solutions. Hence the challenge for traditional IT departments to regain control over the tools and components of IT infrastructure.