BERNARDO NICOLETTI

AGILE PROCUREMENT

Volume I: Adding Value with Lean Processes

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Abbreviations

AI	Artificial Intelligence
AILOG	Associazione Italiana di Logistica
API	Application Programming Interface(s)
AR	Acquisition Request
ASC	Agile Supply Chain
B2B	Business to Business
BC	Business Continuity
BI	Business Intelligence
BMC	Business Model Canvas
BPO	Business Process Outsourcing or Business Process Optimization
Capex	Capital Expenditure
CFFR	Collaborative Planning, Forecasting and Replenishment
CFM	Cash Flow Management
CIM	Computer-Integrated Manufacturing
CM	Configuration Management
CNC	Computer Numerical Control
COPIS	Customer, Output, Process, Input, Supplier
CPFR	Collaborative Planning, Forecasting, and Replenishment
CPG	Consumer Packaged Goods
CPM	Corporate Performance Management or Critical Path Method

CPO	Chief Procurement Officer
CRM	Customer Relationship Management
CRS	Computer Reservation System
CTC	Critical to Customer
CTQ	Critical to Quality
DDLC	Document Development Life Cycle
DMADV	Define, Measure, Analyze, Design, Verify
DMAIC	Define, Measure, Analyze, Improve, Control
DRP	Distribution Requirements Planning
DSO	Days Sales Outstanding
ECM	Enterprise Content Management
EDI	Electronic Data Interchange
EMEA	Europe, Middle East, and Africa
EMS	Small and Medium Enterprises
EOBR	Electronic on-board Recorder
EOQ	Economic Order Quantity
EPC	Engineering, Procurement, and Construction
EPE	Every Part Every
ERP	Enterprise Resource Planning
ETL	Extraction, Transformation, and Loading
ETS	European Treaty Series
EU	European Union
EVI	Early Vendor Involvement
FMCG	Fast Moving Consumer Goods
FTE	Full-Time Equivalent
GDP	Gross Domestic Product
GPO	Group Purchasing Organization
GPP	Green Public Procurement
GPS	Global Positioning System
HR	Human Resources
IaaS	Infrastructure as a Service
ICC	International Chamber of Commerce
ICT or IT	Information and Communication Technology
IoT	Internet of Things
IP	Internet Protocol
ISO	International Standard Organization
JIC	Joint Integrating Concept

JIT	Just in Time
KPI	Key Performance (or Process) Indicators
KRI	Key Risk Indicator
LAN	Local Area Network
MMR	Mass Market Retailers
MRP	Manufacturing and Material Requirement Planning
MSA	Master Service Agreement
MTO	Make to Order
MTS	Make to Stock
NIST	National Institute of Standards and Technology
O & M	Operations and Maintenance
OEM	Original Equipment Manufacturer
Opex	Operating Expenditures
OPG	Order Processing Guideline
P2P	Procure to Pay
PA	Public Administration
PaaS	Platform as a Service
PC	Personal Computer
PERT	Program Evaluation and Review Technique
PIN	Personal Identification Number
PLM	Product Lifecycle Management
PO	Purchase Order
POS	Point of Sale
QFD	Quality Function Deployment
R2P	Requisition to Pay
RACI	Responsibility-Accounting-Control-Information
RE	Real Estate
RFB	Request for Bid
RFI	Request for Information
RFID	Radio-Frequency Identification
RFP	Request for Proposal
RFQ	Request for Quotation
RFX	Any type of Request for Procurement
ROA	Return on Assets
ROI	Return on Investment
S2P	Source to Pay
SaaS	Software as a Service

SCF	Supply Chain Finance
SCM	Supply Chain Management
SG&A	Sales, General, and Administration
S&O	Strategy and Operations
S&OP	Sales and Operations Planning
SIPOC	Vendor, Input, Process, Output, Customer
SLA	Service Level Agreement
SMED	Single Minute Exchange of Die
SMEs	Small and Medium Enterprises
SRM	Supplier Relationships Management
STP	Straight-Through Processing
SWOT	Strengths-Weaknesses-Opportunities-Threats
TCM	Total Cost Management
TCO	Total Cost of Ownership
TP	Transaction Processing
TPM	Total Productive Maintenance
TPS	Toyota Production System
TQM	Total Quality Management
UCC	Unified Collaboration and Communication
UK	United Kingdom
US or USA	United States of America
VA/NVA	Value Added/Non Value Added
VMI	Vendor-Managed Inventory
VoC	Voice of the Customer
VSM	Value Stream Mapping
WIP	Work in Process
WMS	Warehouse Management System
XML	Extended Messaging Language

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Introduction to Agile Procurement Processes

Organizations need to grow, notwithstanding market volatility, the push to reduce costs and delivery times, and the difficulty of forecasting. As the world economy becomes more competitive, organizations intensify their external activities. Better procurement may allow the organization to substantially improve its margins, due to the increased number of components of services and goods sourced externally to the organization.

The increasing complexity of the business environment requires significant intervention in the management of processes and information within each organization and in inter-organization relations. The main stimulus for change comes from the need for process improvement and the evolution of information and communication technology (ICT) in terms of development characteristics and potential benefits. Digital transformation is the right solution.

An increasingly important aspect is the visibility and alignment between processes and the overall objectives of the organization. These changes have a major impact on the management of the value network of the organization and hence on its main processes.[1] Therefore, organizations put more and more emphasis on the management of these processes.

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They should work together with vendors to refine their strategies and practices aimed at achieving the objectives defined in terms of scope, cost, time, and quality.

This book does not use the term supply chain or value chain. The term it uses is value network, underlining the importance of taking into account the value provided by the organization to its customers and the increasingly non-sequential nature of processes in the organization (see Fig. 1.1).

In the management of the value network of the organization, procurement processes can be defined as those of procuring, receiving, and managing goods, raw materials, services, and maintenance in exchange for financial considerations. Due to the trend of concentrating on the core business, relationships with vendors have become increasingly important. Organizations have begun to review their procurement strategies. In the past, organizations saw procurement as a service to its other functions, but it now plays an increasingly central role in successful organizations thanks to management attention to the value network. Consequently, it has come to have a greater impact on the operations and the creation of margins of the organization. The increasing outsourcing and globalization have led to greater amounts of supplies and stocks of work-in-process. The quality is increasingly critical, and delivery lead time is fundamental to the competitiveness of the organization. Managers have to adopt new models that emphasize procurement in the value network as a strategic key to success rather than simply a service organization.

In the volatile modern world, flexibility is essential to the survival and success of an organization. This flexibility is only possible in an agile enterprise.

Business agility is the "ability of a business system to rapidly respond to change by adapting its initial stable configuration."[2] Business agility can be maintained by adapting goods and services to meet customer demand, adjusting to changes in the business environment and taking advantage of human resources.[3]

Procurement is an essential function of the enterprise (it can control up to 80% of the costs of the organization). Therefore, it is fundamental to enterprise agility.

Fig. 1.1 From the supply chain to the value network

This book discusses an approach referred to as agile procurement to contribute to the improvement of value creation in procurement processes. It claims that in order for an organization to reach a state of agility, procurement must itself act according to an agile business model. The following chapters analyze in detail each basic component of the procurement business model.

In terms of the tools to be used to gain agility, this book underlines the importance of digital transformation. This can be achieved with a Lean Six Sigma approach combined with smart digitization.

The analysis of these concepts is the subject of this book.

The principles of agility and leanness, in combination with management automation, can provide a powerful support to enable organizations to meet their daily challenges, provide the needed flexibility, and make their strategies successful in the short, medium, and long term.

The current digital transformation affects not only production (Smart Manufacturing/Factory) and logistics (Logistics 4.0), but equally all other functional areas of the organization, especially procurement. The goal is to make processes more agile and at the same time to take into account the opportunities provided by process automation. Often one of the main problems encountered is the excessive separation between the improvement of processes and digitization, or between the organization and the information and communication systems. This challenge is even more evident if one considers the organization of services, where digitization increasingly manages the processes.

This book presents in detail the application of agile procurement to optimize processes by making them leaner and, at the same time, digitizing them. The objective is to reduce waste and defects while also improving cycle times. The book uses a business model applied to the procurement function, arguing that procurement is indeed a series of processes that should act as a business.

Agile procurement is a method and a set of tools. It is also, and above all, a culture aimed at the effectiveness, efficiency, economy, and ethics of an organization. It requires a change of paradigm. Agile procurement certainly presents an important opportunity, especially considering that there is already in procurement a base orientation toward effectiveness, efficiency, economy, and ethics.

The development of agile procurement is especially important during this time of financial and economic crisis. In such moments of crisis, any initiative for improving the value of business products for customers, reducing waste, and especially becoming more flexible and productive must be undertaken immediately and as a priority.

For this, especially in these years of economic crisis, agile procurement can be of great help in improving procurement, purchasing, logistics, and, in general, the end-to-end value network. In the past, organizations aimed to produce the best products to win the competition. Today they must try to implement all necessary measures to avoid waste, add value for customers, and become more flexible. This is what the agile procurement approach aims to do. This approach requires adopting the perspective of the customer and endeavoring to increase the value of products, services, and the organization for the benefit of the customer. The value added for the organization is a derived result.

The agile procurement culture must permeate all areas of the organization in order for it to achieve flexibility and, above all, ensure the survival and growth of the organization. This book examines all these areas of improvement in the procurement processes and suggests best practices for attacking them.

The treatment of agile procurement in this book is split into two volumes. The first volume deals primarily with the contribution of process improvement to agility. The second volume deals primarily with automation. While the topic is divided into two parts, this book argues that agile procurement requires an integrated approach that involves both leaning processes and digitizing them.

These two volumes take into account the existing challenges in terms of digital transformation. The final section of the second volume looks to the future and points to a series of very interesting emerging trends.

While these two volumes present a series of models, it substantiates them with many real-life examples of their successful implementation. Good practice should be the basis of any theory.

The book presents the more important tools for an agile methodology, leaving some of the others to specialized books.[4] Some of these agile methods and approaches include speedboats, innovation labs, venture-capital funds (to establish or support start-ups and own employees with

great business ideas), agile project management (design thinking, scrum meetings, burn out), and flexible working environment (work from home, virtual 3D conferencing).

Notes

1. Peppard, J., and Rylander, A. (2006). From value chain to value network: Insights for mobile operators. *European Management Journal*, 24(2): 128–141.
2. Leybourn, E. (2013). *Directing the Agile Organisation: A Lean Approach to Business Management*. IT Governance Publishing, Ely, UK. Wieland, A., and Wallenburg, C.M. (2012). Dealing with supply chain risks: Linking risk management practices and strategies to performance. *International Journal of Physical Distribution & Logistics Management*, 42(10).
3. Tsourveloudis, N.C., and Valavanis, K.P. (2002). On the measurement of enterprise agility. *Journal of Intelligent & Robotic Systems,* 33(3): 329–342.
4. Cummins, F.A. (2016). *Building the Agile Enterprise: With Capabilities, Collaborations and Values*. Morgan Kaufmann, Burlington, MA.

2

Procurement Processes

Introduction

This chapter describes the main processes associated with procurement. It begins with a distinction between the terms sourcing, logistics, supply chain management, and procurement and presents the main activities that make up these processes.

In order to improve processes, it is essential to define the current processes, describe them, analyze them, and then improve them.

Procurement Cycle

The meanings of the terms sourcing, supply, logistics, supply chain or value network, and procurement differ from organization to organization.[1] The following section clarifies how this book uses these different terms (Fig. 2.1).

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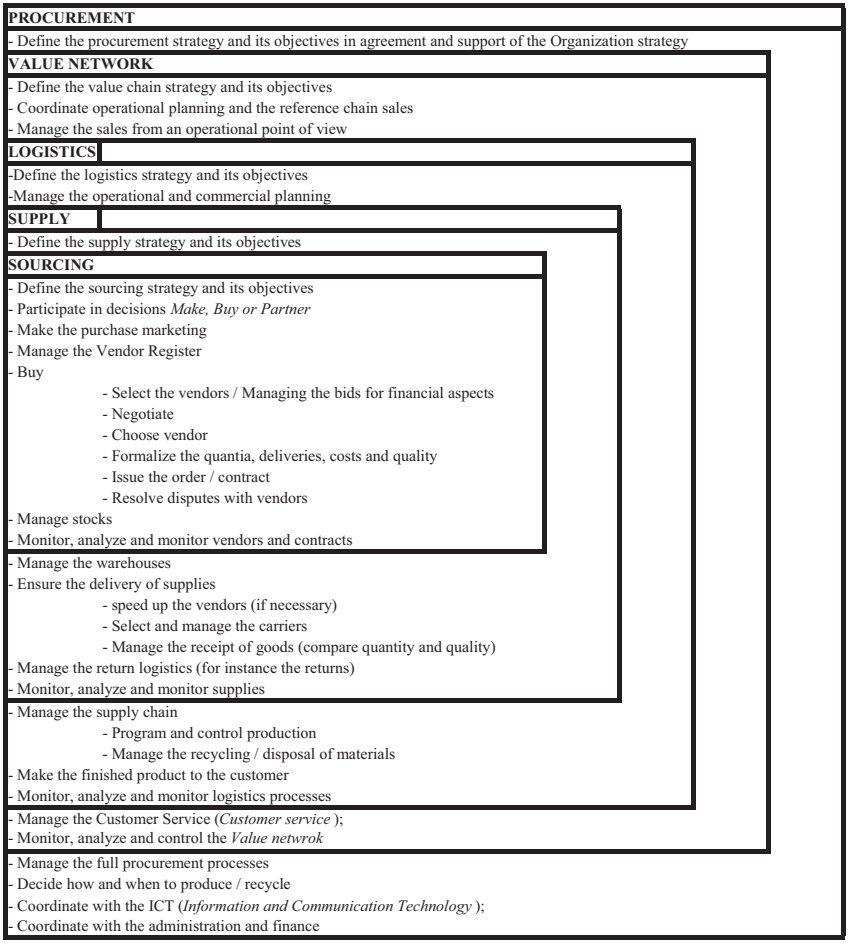

Fig. 2.1 Value network, logistics and sourcing

Sourcing

The sourcing function deals with purchasing products and services outside the organization as required by a department, a person, or an internal customer. This function acts according to a strategy and a plan aimed at achieving the organization's objectives.

The traditional activities included in this function are:

- definition of the sourcing policy based on the strategy of the organization;
- analysis of the types and volumes of purchases;
- decisions on which types of purchases to make (for example, outsourcing, e-procurement solutions, and so forth);
- analysis of the market;
- planning of the optimization of supply requirements;
- definition of the portfolio of vendors and model contracts;
- negotiation and relationships with vendors and purchase transactions;
- assessment of the cost structure;
- monitoring of activities and vendor rating.

The operational business of sourcing starts with the acquisition request and moves to the issue and comparison of tenders, negotiation, vendor selection, and allocation of the orders. Purchases must take into account the stocks available and the need to reduce the capital of the entire cycle, including vendors.

Supply

The supplies are for procurement of the raw materials, goods, and services necessary for the organization's operations. The supply, especially for economic and productive activities, is of considerable importance for the economics and the organizational life of the organization. The term supply indicates the evolution of the sourcing function and the enrichment of its role. It also includes responsibility for the availability of goods and services in terms of:

- provisioning times according to production plans;
- quality assurance;
- costs of transport, handling, and storing.

It is not always possible to pursue this range of objectives within an organization, even if it is desirable. There is a need for training, for having

an appropriate level of organization and awareness of the key roles necessary over the entire value network.

For the organization, it is important to adopt an effective, efficient, economical, and ethical procurement function. This is particularly true in mass production, where a lack of spare parts or excess inventory can have an impact on the costs of sales and service, due to the need to satisfy, and possibly delight, the customers.

Logistics

There are several possible definitions of logistics, with varying degrees of breadth of vision. The Italian Association of Logistics (AILOG) provides the following definition:

> The set of organization, management, and strategic governance for organizing the flows of materials and related information from its origins at the vendor sites to the delivery of finished products to the customers and after-sales service.

The logistics function is an extension of the activities and responsibilities of the supply chain function, adding:

- sales and operations planning (S&O);
- production scheduling;
- management of the flow of materials and components from vendors;
- delivery of the finished product to the customers or retailers.

Supply Chain Management

Supply chain management (SCM) has some additional functionalities with respect to supply (Hines et al. 2004).[2] It involves the systematic and strategic coordination of the functions and operational tactics within the organization first, and then along the various elements of the supply chain and distribution. Its goal is to improve the performance of the long-term

individual components of the whole chain.[3] It is a set of several entities (organizations or individuals) directly involved in the flows (upstream and/or downstream) of products, services, money, and/or information from the raw material to the last operation with the customer.[4]

There may also be return flows, usually included in the so-called reverse logistics. These return flows can involve the entire supply chain, from the point of view of:

- commercial relations with the customer;
- sourcing relationships with vendors and/or production;
- accounting for the administration.

Procurement

This book uses the word procurement to refer to sourcing initiation, design, development, acquisition, and logistics of goods and services for the organization. Procurement further generalizes the supply chain management, including also strategic aspects and activities outside the organization.

The resources consumed in the process of procurement are used for goods and services that:

- contribute directly to the value added produced by the organization;
- are indirect to the core business, but are essential.

The process of procurement involves a large number of functions of the organization. It is characterized by several micro activities (see Fig. 2.1). If these are not properly organized, they can be a vehicle for serious ineffectiveness, diseconomies, and inefficiencies throughout the supply chain. The costs involved in well-structured procurement can be quite high, but the rewards are relevant. For instance, the procurement function is increasingly involved in strategic activities. For procurement, strategic activities refer to the definition of policies for sourcing, logistics, and structure and relationships with the vendor base.

Conclusions

In recent times, new challenges have increased the pressure on performance. It has become important to seize all opportunities also for the optimization of procurement processes and the elimination of waste. Today's challenges include:

- Focus on service level, especially quality and speed of execution: the transition from focusing on the purchase price to the total cost of ownership makes clear that it is not enough to get the best possible purchase price. Actually, it might be dangerous in terms of quality of the supply. The procurement function must have as its objectives:
  - increasing the value added for the customer starting at the earliest stages of the process;
  - reducing lead times and increasing quality in the execution of processes (correct supply at the right time, at the correct location, and certainly also at the best price).
- Research productivity and efficiency: the pressure to reduce operating costs pushes organizations to eliminate or at least reduce waste. In other cases, an increase in the scope of activities (higher volumes and/or the need to increase interactions with the other processes of the organization and potential outsourcers) brings additional work to procurement. In some cases this is even coupled with a reduction of staff and a need for different skills.
- Increasing integration with vendors in the value network: the impact of vendors on the ability to create value and innovation is now recognized as very important.
- Homogenization of behavior and increase in controls: the growing organizational complexity requires the standardization of behaviors to keep processes manageable and to ensure adherence to regulations and best practices.

Increasingly, the managers and buyers responsible for procurement processes should ensure they make a greater contribution to the value creation of the organization for customers, shareholders, and staff.

This chapter has defined the core activities of procurement according to a new, integrated perspective. This can bring significant improvements in the definition and negotiation phase of procurement processes. In terms of operational processes, they have not progressed with the same effectiveness, efficiency, economics, and ethics. The tools used for improvement often have been aimed at more automation of existing processes, without a clear vision of the business model to adopt.

In order to meet the growing need to provide customer value and productivity, it is necessary to pay attention to process optimization, applying the procurement methods developed in manufacturing for process optimization and automated management. This can be done through agile procurement. This path allows for extending the responsibilities of the procurement function, resulting in a focus on how and what to buy in addition to the traditional reduction of the purchase price.

This development must consider all the processes described in this chapter in the same way. The upstream part (planning, definition of the sourcing strategy, activation of supply sources, and negotiation) must be developed in an innovative and effective way. More attention should be devoted to the operational part of the processes for improving them and introducing information systems to support transactions and administration (ERP, electronic catalogs, EDI, and so forth).

The current challenge is to create synergy and fluidity in the processes of procurement, while respecting the roles and responsibilities of the different actors, internal and external to the organization, in order to add more value for the customer. This is the goal of the agile procurement approach developed in the following chapters.

Notes

1. This book uses the word "organization" to refer to a company or an institution, either private or a public body.
2. This book generally does not use the term supply chain, but rather value network, because the sequence increasingly is not along a chain or assembly line but works as a network. The main objective of the so-called supply chain is not to "supply" but to bring "value" to customers and the organization.

3. Mentzer, J.T. et al. (2001). Defining Supply Chain Management, *Journal of Business Logistics*, 22 (2), pp. 1–25, Autumn.
4. See endnote 3.

3

Agile Procurement

Introduction

During the current economic crisis, organizations have been working to become more streamlined and agile in order to adapt quickly to changing socio-economic conditions. The procurement function should be a full and integral part of this strategy because it can provide significant support to the entire organization. The strategy requires flexibility. The responsibilities of the buyer increasingly move towards monitoring, controlling, and steering tasks. This approach imposes new requirements on procurement in relation to changing tasks and processes.

Lean is a "mean," not an objective, for organizations. In a situation characterized by great turbulence and uncertainty, such as the current one, the objective of the organizations is to become more agile. Agility allows the organization to exploit market opportunities, respond to competitive treats, and face the myriad challenges that accidents may introduce to a global value network.

Procurement must be agile. Agility requires being lean and digitized. The tasks of procurement are strongly impacted by the new technological

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possibilities and solutions, such as predictive analytics software, new metrics, big data analytics, and the real-time availability of better information. New opportunities arise. The operational processes can run almost autonomously.

Before tackling automation, it is essential to improve processes. The introduction of methods for process improvement enables a reduction of time along the chain of decision-making among different subjects. In addition, these methods provide tools for process improvement and knowledge management. The brute management automation of existing processes does not solve the problems of organizations. If the process is incorrect, its automation only tends to produce problems more quickly. An integrated approach to reviewing processes and their automation is essential.

Lean Six Sigma is one of the most effective modern methods to satisfy customers in terms of product and service quality and simultaneously reduce cycle times.[1] These goals are achieved with methods and tools that allow for the elimination of waste, a reduction in the process time, and the simplification of operations.[2] Lean Six Sigma combines two methods:

- Six Sigma helps reduce the number of defects and the variability of the results of processes;
- lean thinking helps reduce cycle times and adds value for customers.

This book uses a method referred to as agile procurement that contributes in this direction, with a focus on procurement. The goal is to make processes more agile and hence leaner and at the same time take into account the opportunities provided by their automation. Often the main problem is the excessive separation between the improvement of the automated and manual tasks, including optimization and automation, or between the organization and information and communication systems. This problem is even more evident if one considers the organization of services, such as procurement, where the processes are increasingly managed by information and communication technology.[3]

One study addressed the question of how to introduce these principles to services.[4] Nicoletti has further extended the study and generalized it.[5,6,7] The method can be summarized as:

- map the manual activities and those already automated;
- Highlight and delete any activity without added value for the end customer and the organization;
- redesign the new process, taking into account the opportunities offered by automation;
- implement and verify that the improvement objectives have been reached.

Changes in Procurement

The challenges posed by market volatility, longer delivery times, and the increasing difficulty of forecasting are growing for organizations. Decisions on procurement may allow an organization to improve its margins. The principles of agility enable organizations to meet daily challenges and protect their strategy in the medium and long term.

As the world economy becomes more competitive, organizations increasingly open up to the outside world. Relations with the market and all its actors in many cases evolve from purchasing to relational problems and product. The increasing complexity of the business environment requires significant intervention in the management of processes and information, both internally and between organizations. The main stimulus for change stems from the need for process improvement and the evolution of automation and information and communication technology in terms of developmental characteristics and about the persons involved. The visibility of and alignment between processes and the overall objectives of the organization are also increasingly important.

These changes have a major impact on the management of the value network inside the organization and then on one of its main processes: procurement.[8] Consequently, organizations are paying more attention to the management of these processes. They should work together with ven-

dors to refine their strategies and practices aimed at achieving the objectives of scope, costs, time, and quality.

In value network management, the processes of procurement can be defined as those of procuring goods, raw materials, services, and maintenance in exchange for financial consideration. Today, the trend towards concentration on the core business often pushes organizations to outsource many internal processes. Due to the increased importance of vendors, organizations have begun to review their procurement strategies. In the past, procurement was seen as a service to the other functions. Now, it plays an increasingly central role in successful organizations thanks to the emphasis on the management concept of the value network. Consequently, its impact on the operations of the organization has become more important. The increased outsourcing and internationalization leads to larger amounts of supplies and stocks of work-in-process. The quality becomes increasingly critical and delivery lead time fundamental. Managers should adopt new models that emphasize the procurement value network as a strategic key to success rather than a simple support or service organization.

Drivers of Change in Procurement

Procurement is changing. It is facing an increasing number of challenges, which can be summarized as the (1 + 4) C (Fig. 3.1).

The first C is change. Organizations push more and more in this direction. The change of the procurement portfolio is another challenge. The purchased goods are changing towards digital and innovative products and new components. They require a new level of technical expertise also in the procurement operators. Machines and tools for processing or finishing the new components and modules need to be purchased. The procurement portfolio will change more and more rapidly in the future, driven by developments in small-batch production up to lot size one. Procurement must be faster and flexible.

The other four Cs are the challenges that organizations must address in order to provide support for growth (and in many cases to survive!):

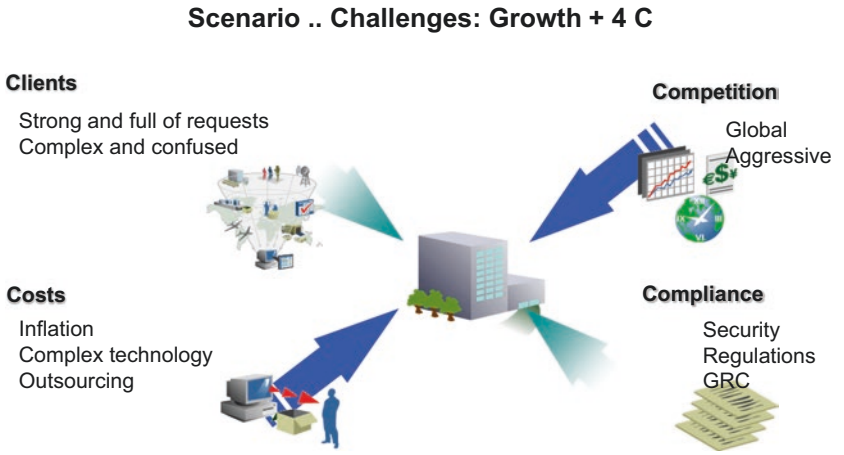

Fig. 3.1 The agents of change in procurement

- customers;
- competition;
- costs;
- compliance.

The following sections provide some details on these challenges. In facing them, it is necessary to take into account a number of aspects to ensure the effectiveness, efficiency, economy, and ethics of procurement. One must analyze carefully the changes that need to be made to the structure in order to meet the new challenges.

The solution should be based on the agile approach. This means a combination of lean thinking and the digitization of procurement processes in such a way that increases the agility of the organization.

This approach requires two paths: process and solutions innovations. This implies:

- the adjustment of procurement processes, structures, and ultimately also of the people in the organization in order to meet the challenges and opportunities of the digital revolution;

- selection and implementation of solutions and products that meet the needs of the market and of customers for digital solutions as well as the requirements of an increasing digitized service provision.

The following sections analyze the main changes that are taking place and their effects on procurement.

Changes in Customers

Today (and increasingly in the future) the customer, whether internal to the organization or the end user, is changing as the market changes. The situation is becoming increasingly unpredictable and competitive. Increasing time to market, that is, the speed at with which a product comes to market, product quality, and price are the most important elements for competing in the market. Procurement becomes the key factor in ensuring flexibility—the immediate response of the organization to the market.

From the perspective of the customers, the market is changing with growing consolidation and globalization. Increased globalization involves the transportation of materials, parts, and products over long distances and, increasingly, from emerging markets. The latter are a threat from the standpoint of competition. They are also a great opportunity. Note that their technological maturity is often limited but it is improving.

In addition, many organizations are increasingly outsourcing some operations outside the organization. This leads to a growing importance for procurement.

A survey on the "voice of the customer" discovered that customers want to:[9]

- use outstanding solutions for their products, but also improve on procurement;
- ensure 24/7 product deliveries without unplanned delays;
- allow continuous monitoring of the delivery of their products or spare parts;
- ensure 100% safety (zero accidents).

These assumptions about the development of the processes of procurement suggest an interesting perspective. Many factors, including psychological ones, contribute to the design of a process of procurement:

- value for customers;
- the need to contain costs;
- security;
- understanding the urgency factor;
- quality assurance of supply.

Given these requirements, the services of procurement must change. The main beneficiary of this change must be the customer. It must become less dependent on the vendor and more "cooperational" (a combination of cooperative and operational). This is important especially in the case of small and medium-size organizations.[10] The customer is also more autonomous in assessing the new offerings from organizations in the market. Organizations, in fact, have to review the basic processes of procurement, including the ways they interact with the business, their substance, and their often rigid structure. The process starts by considering a customer different from those that characterized the period of increased industrialization and automation of organizations.

Changes in Competition

The change in customers is combined with growing competition in the market. These two aspects push for improvements in the organization of work. It seems appropriate to aim more and more for good economic management of labor and, consequently, appropriate productivity. Management must ensure that these internal improvements provide better service for customers and, consequently, their loyalty.

The consequences of technological change on the activity of procurement are remarkable. The increasing presence of complex elements, such as computer systems and communications, pushes customer to choose vendors with high professionalism rather than based on generic characteristics.

In this situation, competition is becoming more aggressive, global, and comprehensive. Agile procurement can be a winning strategy. It becomes an important element of productivity and especially a way to achieve competitive advantage.

Changes in Costs

Today organizations worry about ensuring the profitability of procurement processes. Cost containment and reliability of service continue to be key elements in the customer–vendor relationship. They are often the main points in negotiations between vendors and their customers.

Organizations should work to ensure that the total costs of operating procurement are always under control and increase profitability. From an economic standpoint, there is strong pressure to "do more with less." Those responsible for finance and control are asking for more and more data and pushing for lower costs and increased productivity.

There is also a push within organizations to reduce staff. The journal *Plant Services* estimated that organizations are only replacing between three and seven of every ten employees who retire.[11] The result is an aging workforce. In addition, due to the reduction in personnel, there is an erosion in skills. Agility within an organization can help its efficiency, effectiveness, and economics.

Changes in Compliance

From the point of view of the rules, the future will be even more challenging than today. Governments and standardization bodies are introducing more and more regulations and laws. Their main goals are the protection of customers and the environment, and the improvement of safety at work. This trend will impact the entire organization, including procurement, where ethics will become more and more important.

Organizational Changes

To face all these changes, there is the need for a digital transformation of all functions including procurement. This can be achieved using hard and soft levers.

Hard Levers for Organizational Change

The hard levers of a digital transformation consist of strategy, organization, systems evaluation, and a combination of resources and operational mechanisms such as process mapping, project management, design reviews, a new system of optimization and monitoring, and a new map of responsibility.

In particular, making procurement agile requires reviewing some organizational choices in detail. It requires rethinking the logic of the general operations of the entire organization from an agile perspective. It is necessary to redesign the organization according to a cross responsibility (for the processes), redesign the content and profiles of management roles at various levels, and ultimately redefine the professional development paths.

The redesign of procurement processes leads to the emergence of several new professions, such as:[12]

- planning manager;
- team leader;
- efficiency manager;
- innovation manager.

Luxottica S.p.A.

Luxottica is a world leader in eyewear.[13] It initiated a collaborative project with a highly successful vendor of acetate, an important component in the manufacture of spectacles.

The deal is based on providing reciprocal visibility on plans and operations. The two partners share over the following three months the commitments in terms of capacity required to meet the orders of Luxottica. The

release of the orders is done in advance based on the time to resupply what is needed for the transformation process. It works on aggregate data by type of acetate in order to reduce the risk of errors with a forecast too detailed. The vendor reserves a portion of its production capacity based on the shared schedule.

Monitoring of progress is made directly by the two planning teams. There is no need to revisit commercial negotiations. The two teams meet weekly to analyze the forecasts, the coherence of the commitments of production capacity. They examine the key indicators to assess the performance of the process and possible improvements.

Specifically one of the major changes is to improve the strategic capacity and innovation. This can be achieved by spreading the culture of innovation at all levels, not just to the engineering design or the criteria for the evaluation and selection of technologies.

The new processes require simple procedures for defining the phases and control points based on the type of procurement. The processes should be categorized according to their complexity and their development time. The roles of the critical figures should be very clear.

The mode of development processes must take essentially a "pull" logic. Thanks to careful planning and knowledge of the actual availability of resources, the progress of the processes may take place in a well-structured manner, with the characteristics of:

- flexibility;
- clarity;
- shared objectives;
- analysis and resolution of technical and management issues.

Poltrona Frau Group

Poltrona Frau Group is a leading international group in the high-end furniture sector that comprises Poltrona Frau, Cassina, and Cappellini.[14,15] Haworth Inc., the global leader in the planning and production of flexible and sustainable work environments, acquired Poltrona Frau Group in 2014.[16]

To accelerate the process of change, the purchasing department of Poltrona Frau has been integrated into the supply chain department. Other functions have moved to the logistics department.

The buyer's profile was impacted the most. The job title changed from category buyer to efficiency manager. These profiles are characterized by high seniority and a drive to find new opportunities for procurement. The major change was from a passive approach (to satisfy an acquisition request and issue an order) to a proactive approach. The efficiency managers are expected to make proposals on new opportunities to reduce costs and improve service, quality, or production methods (make or buy or partner).

The number of efficiency managers has decreased with respect to the category buyers by about 40% in two years. The efficiency managers still in charge have extensive experience and/or are well prepared. They focus on innovation, looking for vendors in any part of the world and identifying ways to reduce and rationalize the value network. An example of this effort was the extensive reduction in work accounts. This has allowed the company to:

- reduce operational costs;
- increase bargaining leverage with vendors due to higher volumes;
- simplify management of the production cycles.

Soft Levers for Organizational Change

It is important to pay particular attention, in the typical soft levers, to:

- the values and culture of the organization: leadership, ability to diagnose the organizational climate, and motivation;
- the skills and training of management and the first lines of the organization.

With the implementation of the agile and lean methods it is possible to achieve important results in design, such as:

- compliance with the development plans of all new projects and margin targets;
- a substantial reduction in time to market;
- growth of the motivation and the desire to act;

- a unified vision of ongoing projects to support the transformation of procurement;
- the empowerment of resources;
- the elimination of barriers to the transformation.

Organizational transformation to agile procurement requires the development of the managerial skills of the buyers. In addition, raising the level of delegation and consequently flattening the organization involves the empowerment of resources and an increase in their autonomy.

As happened in strategic processes, operational processes need a new perspective that allows them to achieve a higher level of excellence.

Education and Training

In starting on a program of agile procurement, the organization should carefully consider the need for education and training of its personnel and, in an extended concept of value network, of the relevant vendors. Agile procurement can bring extraordinary results. It is essential to take into account human resources.

When it comes to having professional experts in the agile method, some organizations believe it is better to train a group of professionals within their organization and then let them manage projects on a continuous basis. This is the preferred approach based on education and training in agile procurement of some key persons in the organization. It is then left to them to take charge of owning the processes and training the remaining employees.

This "viral" method of training the trainers allows for the education of hundreds of people inside the organization in a relatively short period at limited cost. It also allows for accelerating the launch of new transformation projects. At the same time, it allows for the training of improvement experts in a much more continuous way. The organization gains several advocates of change who will be active and confident.

After the formal training in the classroom, each area or plant should identify a problem or a challenge that the organization should address. It

is important to create a project team that addresses those problems. That group is trained in agile and lean tools to address problems, work on continuous improvements, and find a solution while working as a team. Later, the members of the team return to their departments to implement these solutions and monitor their sustainability over time.

It appears to be quicker to train teams based on hypothetical scenarios. However, it is more effective during training to choose real problems in the workplace on which to exercise because it:

- is a good use of the valuable time of the team members;
- allows the team to see that, although the agile and lean tools seem complex, they are actually very practical and applicable.

Once they have seen how well these tools work, there is no additional need to sell them on the merits of using the tools.

The organizations that have used this approach have found it possible to deal with dozens of very different projects in the area of procurement, such as:[17]

- use of space;
- storage and picking;
- packaging;
- acceptance processes;
- flows of documentation;
- labeling;
- administrative work;
- use of productivity packages;
- disposal of paperboard boxes;
- assemble-to-order.

The key is to achieve some successes and then advertise them inside the organization and among vendors. It is important to share some news on the advancements of the projects or their successes on a board in a place of transit of personnel in order to propagate the successes. To implement this approach, it is important, in the early days of the program, to encourage

the project teams to focus on rapid successes and incremental improvements. This serves to show that the method works and pushes emulation.

It is also important to make the program of agile procurement as quantitative and measurable as possible. There should be clear objectives for the program and the results obtained. There must be clear and frequent communication on the progress of the organization in achieving them.

If necessary and appropriate, it is possible to support the acceptance of the initiative of agile procurement with financial incentives, bonuses, awards, and salary increases to motivate the members of the improvement teams.

Organizations must operate on the philosophy that the continuous improvement programs need continuous improvements. It is necessary to always look for fresh and interesting initiatives in agile procurement. Sometimes this involves the introduction of new advanced tools when the teams appear ready to use them. At other times it means more training options (such as online training to reduce costs), upgrading systems to allow for easier sharing of information on the processes, or the creation of a sort of internal newsletter or intranet site to help keep people better informed.

Agile Procurement

Margaria and Steffen stressed the simplicity of the agile approach.[18] Its importance in introducing innovation in software development has been pointed out by several authors. Brown and Bessant also highlighted how an agile approach can foster innovation.[19] A similar concept was introduced for instructional systems development.[20]

The Agile Manifesto is based on twelve principles.[21] These can be customized in connection with lean and digitize innovation:[22]

1. Customer and organization satisfaction should be pursued by rapid delivery of useful innovation.
2. Requirement changes should be welcomed, even late in the innovation process.

3. Incremental working innovations should be delivered frequently (for instance, every few weeks rather than months).
4. Incremental working innovations are the principal measure of progress.
5. Development should be sustainable; the team must be able to maintain a constant pace.
6. There should be close, daily cooperation between business people and the innovation team.
7. In-person conversation is the best form of communication (co-location but also virtual teams).
8. Projects should be built around motivated individuals, who should be trusted.
9. Continuous attention should be paid to technical excellence and good design.
10. Simplicity—the art of maximizing the amount of work not done—is essential.
11. Teams should be self-organizing.
12. Adaptation to the changing environment is encouraged.

Agile management was developed to improve ICT projects. In time, it has been extended to organizational management.

The objectives of agile management are to:[23]

- improve effectiveness and efficiency in the management of the organization;
- deliver quickly;
- avoid delivering late in the project essential requirements;
- motivate teams.

The tools most often used are:[24]

- epics and stories;
- prioritization;
- dividing the work into sprints;
- having frequent meetings, called scrums.

The key objective of agile procurement is to design and implement processes that are able to provide capacity planning and collaborative process execution in procurement. This agility allows for seizing the opportunities offered by the market. It also helps keep processes of procurement from crystalizing. On the contrary, it provides support for organizations to adapt to the increasingly rapid changes in the customer and supply markets.

Agility is essential, for example, when trying to merge two organizations with different systems, business models, and processes in procurement. Global organizations require a degree of standardization for measuring the operational and financial performance in the market. They need to balance this with the regional differences that determine the different operating modes of organizations.

In moving to agile procurement, it is interesting to follow a concept called the "path to agility."[25] The agile business is one that can adapt to changing customer demands and market pressures, seize opportunities and respond immediately to customer requests or unexpected profitably. The agility course is perhaps best represented as a continuum that begins with integration and moves through visibility, collaboration, control, and finally agility. The best way to describe this process is to start clarifying the final target and work backwards.

Some factors are necessary for navigating a path to agility.

- It is only possible to make decisions that can optimize a part of the process if the entire playing field is clear. This requires adequate visibility. It is hard to have visibility of a sector if not all information can be accessed in an integrated manner. It is necessary to have all the pieces of the puzzle, that is, a single view of customers, orders, and vendors. These integration capabilities must be able to combine all the necessary data for visibility. This visibility provides the control and the control in turn gives agility.
- The more collaboration there is, the more flexibility and hence agility there will be.
- It is hard to be agile if the process is not under control. It is essential to know the levers for acting on the transformation of the organization.

Characteristics of Agile Procurement

Quality of service is a strategic element. It allows organizations to gain competitive advantages, reduce costs, and increase market share and margins.[26,27] The service processes involved in procurement are fundamentally different from manufacturing processes. Some of the factors that differentiate procurement services from manufacturing include:[28]

- active participation of the customer in the delivery process;
- place of delivery and consumption of the service is often the same;
- intangibility of services;
- difficulty in making services homogeneous.

Service processes are often less efficient than manufacturing processes.[29] This implies the need to transfer to services some practices commonly adopted in manufacturing environments.[30] In the 1950s, Eiji Toyoda and Taiichi Ohno worked together to improve mass production on assembly lines.[31] They defined the so-called Toyota Production System (TPS). TPS is the originator of lean thinking, while James Womack, Daniel Jones, and Daniel Roos coined the term in their book *Lean Thinking: The machine that changed the world*.[32] The main objective of lean thinking is the elimination of the so-called three Ms: *Muda* (waste), *Mura* (unevenness), and *Muri* (overload). Although the strategy of Lean Six Sigma has been applied in the context of services, in the literature there is not significant evidence of the ways to achieve it within procurement, especially in cases where there is widespread use of ICT. This book advocates the application of a method for optimizing processes, and at the same time digitizing them, in order to reduce waste and defects in the field of procurement. This method has been successfully applied in several cases.[33] These cases have shown that the digitization of a process should not be separated from its preventive optimization, to avoid relevant problems.

Implementation

There are a number of ways in which organizations can create value using agile procurement. It is necessary to identify them before starting the transformation to agility.

Researchers have identified three indicators of agility in procurement:[34]

- level of response to requests (from the point of view of both internal and end customers);
- ability to quickly identify market changes and respond to them;
- coordination and collaboration with vendors and partners in the value network.

The approach of agile procurement contributes to this. There are also other improvements, such as the improvement in the procurement strategy.

The results of one empirical study indicated that both strategic sourcing and a firm's strategic flexibility were significantly related to the organization's value network agility. In addition, while a full mediation effect was not found on the part of strategic flexibility, there was evidence for partial mediation.[35] A closer look at organizations that have used agile procurement shows two potential routes.

- The first route is to make investments in strategic procurement. This allows organizations to increase agility directly in the value network.
- The second route is indirect. It consists of using strategic procurement to strengthen the operational flexibility of an organization, improving its agility and integration along the value network.

Some examples of agile approaches are as follows.

An organization with a turnover of several million dollars in the global oil services sector wanted to gain more control over the cash conversion cycle.[36] The organization added business processes tools in their value network by using key performance indicators to measure volume, speed, quality, value, and risks. In order to avoid the "silo effect," management has fully supported the project and pointed out that the project could

benefit the entire organization. The result was that through a combination of suitable software tools, strong internal and external collaboration with vendors, and a significant amount of work, it was possible to reduce the days of credit recovery (days sales outstanding, or DSO). It is a major achievement since every day of credit for this organization represents a value of $50 million. All nine regions of the organization adopted the process within one year of its introduction.

In another example, an organization with a turnover of several million dollars in the production of consumer packaged goods (CPG) and food wanted to improve customer satisfaction of service level agreement (SLA) and achieve at the same time lower operating costs. The close monitoring of partner activities for transportation, warehouse operators, and the synchronization of internal activities with those of vendors allowed them to reach their targets. Shipments previously did not arrive on time because the carriers had to wait several hours to be loaded. In many cases, drivers went over the daily work time. The result was a missed SLA and higher costs of conservation. The warehouse workers remained idle because the transporters did not respect the planned delivery times. The result of a review of the process using agile optics provided a significant increase in customer satisfaction and millions of dollars in reduced logistics costs provided by third party vendors

These examples fall within the overall strategies of both organizations. The first organization decreased the amount of capital needed to fund operations by shortening the cash cycle. The second organization has been able to operate more efficiently and at the same time to increase its organic growth. Customers appreciated the rapid improvement in the services provided. The sales team achieved a competitive advantage. Following the approach to providing agility to the procurement function, both organizations were able to achieve significant benefits for their organizations.

Agile Procurement as an Opportunity

Agile procurement is a method and a set of tools. It is also, and above all, a culture aimed at the effectiveness, efficiency, economy, and ethics of an

organization. It is a customer-obsessed, fail-fast/trust culture with a focus on results (objectives, monitoring dashboards, and so on) and is innovation-oriented.

In the case of traditionally minded organizations, a change of paradigm is necessary. On the other hand, agile procurement represents a significant opportunity, especially considering that there is already a natural orientation toward efficiency in procurement. The agile procurement opportunity is especially important in this time of economic crisis. In moments of crisis, any initiative to improve value for customers, reduce waste, and foster collaboration must be undertaken immediately. Especially in these years of economic crisis, agile procurement can be of great help in improving procurement and, in general, the value network of an organization.

In the past, organizations aimed to produce the best in order to win the competition. Today they must try to implement all necessary measures to avoid waste, and therefore reduce costs, and to minimize cycle time. This is the objective of agile procurement. It pushes for the adoption of the perspective of the customer and endeavoring to increase the value of products, services, processes, and the organization for the customer.

The agile procurement culture must permeate all areas of the organization in order for it to achieve the goal of agility and, above all, ensure the survival of the organization.

Zara

Zara is a fashion label and chain of clothing stores established in 1975 by the Spanish group Inditex, owned by Amancio Ortega.[37] In addition to the label Zara, the group owns Bershka, Massimo Dutti, Pull and Bear, Stradivarius, Oysho, Zara Home, Zara Kids, and Uterque. During the last two decades, Zara tripled its profits and number of stores. Nowadays, it is ranked the third largest retailer worldwide.[38]

Every organization purchases items, meaning every organization purchases supplies, perhaps as raw materials, components, sub-assemblies, spares, equipment, services, and consumables. The procurement of these involves either buying or leasing them.

Procurement interacts with every single unit in the organization, from marketing and sales to engineering, design, and manufacturing, and is therefore very important for the organization for a number of reasons.

- Materials change: global markets and agile supply can provide various materials with different delivery times and different prices. This affects directly the final product, making it more competitive, possibly cheaper, and especially more appealing to customers.
- Customer demand: the organization's product mix has increased recently, while product life cycles have been shortened. A good example are Zara designs. They produce small quantities and wide variety. In this way, they can update the shop outlook every week and cut down on promotions and price rebates.
- Price variation: new technologies allow a product price to change a couple of times a day, depending on supply and demand. The same technologies allow for monitoring of that process.
- Procurement is a value-adding process and not a cost center.
- Manufacturing: it is important for manufacturing materials to be delivered on time, with the correct quality, to the correct place, in the correct condition, and at the right total cost.
- SCM: supply chain management puts great emphasis on procurement, subcontracting, and outsourcing, in order to become more cost effective.

Procurement is directly connected to company profits. Every cent saved in purchasing is a profit, while every sale brings additional cost of sales.

In fast fashion, purchasing activities play a critical role through vendor selection and product decision-making. Sourcing is changing from a purely operational function to a strategic activity.[39,40]

In recent decades, Zara introduced the agile supply chain (ASC) to the fast fashion industry.[41] Also thanks to this approach, it positioned itself as third in the world retailers' ranking. This came about because of close communication between customers and designers, and the ability to ship the desired items within a week to catch the sales moment.[42] All these benefits prove that ASC is enhancing competition among organizations.

Another lesson to be learned from Zara is that efficient production organization with a good balance between in-house and outsourced tasks leads to minimum lead times and an increase in market share. The value network is not an isolated agile process at Zara. The whole organization is agile and works very efficiently.

By quickly responding to customer demands, Zara aims to reduce both excess stock holding in the value network and risks associated with forecasting, as product specifications are not finalized until closer to delivery.[43]

The lessons learned from Zara's success from the perspective of speed is that several benefits, such as improved customer satisfaction, increased market opportunity, decreased overall risks, and reduced total costs, can be simultaneously achieved by being agile and fast in the market and in production.[44]

Business Model for Agile Procurement

The Business Model Approach

An organization interested in launching an agile procurement initiative should first answer some basic questions: what value are they adding for customers? What is their business model? How do they earn/save money? In order to provide these answers, it is important to have a specific model for describing their business.

One of the most important aspects to consider in an effort to transform an enterprise is the business model of the organization.[45] An organization may be either a single entity or a collection of entities working together to deliver a product or service that creates value for their target customers.[46]

In order to understand how to make the procurement agile, it is important to consider the procurement function as a business in itself. Therefore, it is necessary to act on the components of its business model.

The business model literature originated in the entrepreneurship and strategic management literature describing the phenomenon of fast-growing Internet businesses, which outperform traditional organizations.[47] Research on business models aims to answer the question of how organizations create value. It has either been described as a concept from a customer-centric perspective or by highlighting boundary-spanning aspects. Most researchers agree that value creation, value delivery, and value capturing describe parts of a business model.[48,49]

In order to understand which components to act on to make procurement agile, this book considers the business model canvas introduced by Osterwalder and Pigneur.[50]

Business Model for Agile Procurement

Osterwalder and Pigneur (2010) defined their model as the BMC.[51] This is an effective visual tool for analyzing a business model. It explains the rationale of why, how, and through which tools an organization creates,

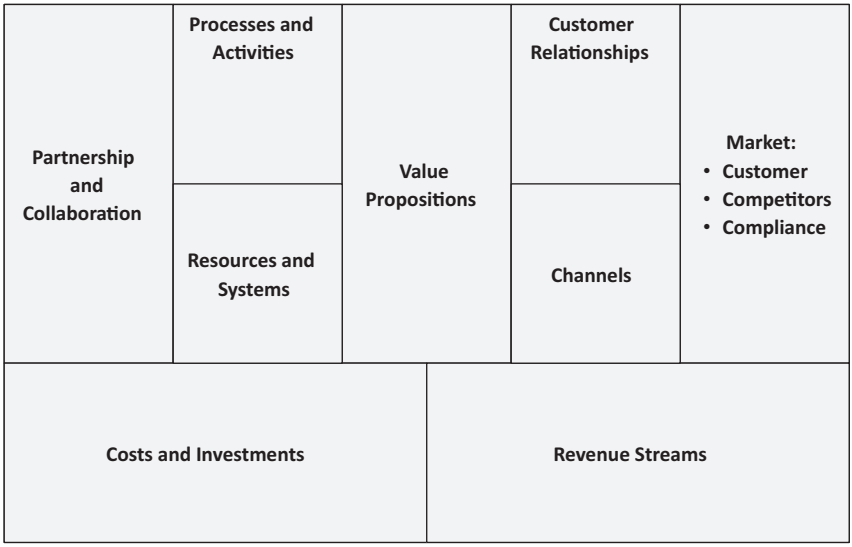

Fig. 3.2 Business model canvas

delivers, and captures value. From a visual point of view, the BMC is a poster format chart (a canvas) that makes it possible to describe nine elements of a business model for discussion by a group of people working together. The nine elements are (see also Fig. 3.2):

- Market: this includes three important aspects, the so-called 3 Cs—target customers, competitors, and compliance with operational regulations. For whom does the procurement initiative aim to create value? Who are its target customers? What are the rules it must respect?
- Value propositions: which products and/or services are included in procurement? What value does procurement deliver to both internal and end customers in a given segment? Which needs are important to satisfy?
- Channels: how does the organization intend to reach the target customers? What is the most convenient channel for the customer? Are the different channels integrated?

- Customer experiences: what is the internal customer's experience? How can the procurement organization build, maintain, and improve it to satisfy the customer? Does it fit perfectly with the aims of both the organization and its customers and prospects?
- Key resources and systems: which resources are critical to delivering the value proposition through the channels and to maintain, enhance, and improve the customer experience? What organization should be set up?
- Key processes and activities: what are the most important activities and processes to make procurement successful?
- Key partnerships and collaborations: who are the key partners and vendors? Which key resources do they provide and what key processes/activities do they operate? What is in it for them? What should the relationship with them be?
- Revenue stream: what will the end customers pay for? How much will they pay? What are the pricing models and the impact of proper procurement on the revenues of the business?
- Costs and investments: what is the finance (costs and investments) implied by the business model for the procurement organization? Which ones are most relevant? What is fixed and what is variable? What are the main cost drivers and risks to consider?

The BMC comprises nine inter-connected components. Each of them is critical and deserves attention. It is important to consider how procurement agility could be implemented in the different components of the business model. All the components are equally important, whether one considers transformation that covers multiple components in the canvas or acts on a single component. It is important also to take into account that transformation in one of the components normally requires adjustments in the other components as well.

The following chapters, both in this and in the second volume, after an initial chapter describing procurement processes, consider each of the components of the BMC as it applies to procurement in an organization.

Conclusions

This chapter has clarified an interpretation of agile procurement and why it is needed. It also defined a business model for the procurement organization to support. The areas included in the business model and covered in the following chapters, as defined by the BMC, include:

- market;
- value proposition;
- channels;
- customer experience;
- key resources;
- key processes and activities;
- key partnership and collaboration;
- revenue streams;
- costs and investments.

Notes

1. Jones, D.T., Womack, J.P. (2006). *Lean Thinking. Come creare valore e bandire gli sprechi*, Guerini, Milano, Italy. Atkinson, P. (2004). Creating and implementing lean strategies, *Management Services*, Feb.
2. Womack, J.P., Jones, D.T., and Ross, D. (1990). *The Machine that Changed the World*, Free Press, New York.
3. Piercy, N., and Rich, N. (2009). High quality and low cost: The lean service centre. *European Journal of Marketing*, 43 (11/12): 1477–1497.
4. Bortolotti, T., Romano, P., and Nicoletti, B. (2010). Lean first, then automate: an integrated model for process improvement in pure service-providing companies, *Advances in Production Management Systems* (Best Paper Award), Springer, Berlin, Germany, pp. 579–586.
5. Nicoletti, B., (2012). *Lean and Digitize: An Integrated Approach to Process Improvement*. Gower Publishing, Farnham, UK.
6. Nicoletti, B. (2010). *Gli strumenti del Lean & Digitize*, FrancoAngeli, Milano, Italy.
7. Nicoletti, B. (2006). Nuovo Pignone, L'arte di fondere Lean Management e Six Sigma, *Computerworld Italia*, 6 Dec.: 1–2.

8. Allee, V. (2000). Reconfiguring the value network. *Journal of Business Strategy*, *21*(4): 36–39.
9. Nicoletti, B. (2012). *Lean Procurement*, FrancoAngeli, Milano, Italy.
10. Berlak, J., and Weber, V. (2004). How to make e-procurement viable for SME suppliers. *Production Planning & Control*, *15*(7): 671–677.
11. http://www.plantservices.com/industrynews/2010/181/, Accessed 25 February 2017.
12. Bonfiglioli Consulting (2012). *Il Lean-thinking dalla produzione alla progettazione*, FrancoAngeli, Milano, Italy.
13. Lovatin, F. (2012). Analisi dell'implementazione di insiemi di pratiche lean: il caso Luxottica-Tristar, *Tesi Magistrale Universita' di Padova,* Padova, Italy.
14. http://www.lucianoattolico.com/2014/09/05/lean-innovation-al-magister-adaci/, Accessed 24 February 2017.
15. Secchi, R. (2012). *Supply Chain Management e Made in Italy: Lezioni da nove casi di eccellenza*, EGEA, Milano, Italy.
16. http://www.poltronafraugroup.com/en, Accessed 25 March 2017.
17. Jacobs, J. (2011). Learn on This, http://www.sdcexec.com/article/10282452/lean-on-this, Accessed 27 September 2016.
18. Margaria, T., and Steffen, B. (2009). Agile IT: thinking in user-centric models. *Leveraging Applications of Formal Methods, Verification and Validation*: 490–502.
19. Brown, S., and Bessant, J. (2003). The manufacturing strategy-capabilities links in mass customisation and agile manufacturing–an exploratory study. *International Journal of Operations & Production Management*, *23*(7): 707–730.
20. Groves, A., Rickelman, C., Cassarino, C., and Hall, M.J. (2012). Are you ready for agile learning design? *TD Magazine*, 66(3): 46–50.
21. Beck, K., Beedle, M., Van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M., … Kern, J. (2001). *The Agile Manifesto*.
22. Nicoletti, B. (2015). Optimizing innovation with the lean and digitize innovation process. *Technology Innovation Management Review*, 5(3): 29–38.
23. Siddhartha, and Sachan, A. (2016). Review of agile supply chain implementation frameworks. *International Journal of Business Performance and Supply Chain Modelling*, *8*(1): 27–45.

24. Patanakul, P., Henry, J., Leach, J. A., Martinelli, R. J., and Milosevic, D.Z. (2016). Agile project execution. *Project Management ToolBox, Second Edition*: 301–322.
25. Brook, D., and Riley, S. (2012). Follow the path of agility. http://www.sdcexec.com/article/10784962/follow-the-path-to-agility, Accessed 30 August 2016.
26. Thompson, P., Desouza, G., and Gale, B.T. (1985). Strategic management of service quality. *Quality Progress*, June: 20–52.
27. Zeithaml, V., Berry, L. and Parasuraman, A. (1988). Communication and control processes in the delivery of service quality. *Journal of Marketing*, 52 (2): 35–48.
28. Fitzsimmons, J., and Fitzsimmons, M. (1994). *Service Management for Competitive Advantage*. McGraw-Hill, Inc., New York, NY.
29. Lovelock, C., and Gummesson, E. (2004). Whither services marketing? In search of a new paradigm and fresh perspectives. *Journal of Service Research*, 7 (1): 20–41.
30. Smith, T., and Waterman, M. (1981). Identification of common molecular subsequences. *J. Mol. Biol.,* 147: 195–197.
31. Ohno, T. (1988). *The Toyota Production System*. Productivity Press, New York, NY.
32. Womack, J., Jones, D., and Roos, D. (1990). *The Machine That Changed the World*, Rawson Associates, New York, NY.
33. Nicoletti, B. (2013). *Lean Procurement*, FrancoAngeli, Milano, Italy.
34. Chiang, C., Kocabasoglu-Hillmer, C., and Suresh, N. (2012). "An empirical investigation of the impact of strategic sourcing and flexibility on firm's supply chain agility", *International Journal of Operations & Production Management*, 32(1): 49–78.
35. See endnote 35.
36. http://www.genpact.com/docs/resource-/smarter-order-to-cash-processes-taming-complexity-to-unlock-value-across-the-enterprise, Accessed 27 February 2017.
37. Zhelyazkov, G. (2011). Agile supply chain: Zara's case study analysis. *Design, Manufacture & Engineering Management,* Strathclyde University Glasgow, UK: 2–11.
38. Zhang, Q. (2008). Analysis on the successful case of efficient supply chain in Zara, *IEEE*, ISBN:978-1-4244-2107-7: 1–4.
39. Bruce, M., Daly, L. (2006). Buyer behaviour for fast fashion, *Journal of Fashion Marketing and Management*, 10(3): 329–344.

40. Bititci, U. (2010). *Supply Chain Operations Course Hand Out Papers*, DMEM, Strathclyde University of Glasgow.
41. Chan, A.T., Ngai, E.W., and Moon, K.K. (2017). The effects of strategic and manufacturing flexibilities and supply chain agility on firm performance in the fashion industry. *European Journal of Operational Research*, *259*(2): 486–499.
42. Zhang, J. (2016). How may fashion retailers incorporate lean management in their supply chains? A case study of the current supply chain of a small and medium-sized fashion retailer and suggestion of a model for future lean implementation in supply chain management, master's thesis, NTNU, Trodheim, Norway.
43. See endnote 40.
44. Cai-feng, L. (2009). Agile supply chain, *Management Science and Engineering*, 3(2).
45. Chesbrough, H., and Rosenbloom, R. S. (2002). The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies. *Industrial and Corporate Change*, 11(3): 529–555.
46. Grönroos, C., and Voima, P. (2013). Critical service logic: making sense of value creation and co-creation. *Journal of the Academy of Marketing Science*, 41: 133–150.
47. Moser, D., and Gassmann, O. (2016). Innovating platform business models, *Proceedings of ISPIM—International Society for Professional Innovation Management*, Porto, Portugal, 19–22 Jun.: 1–14.
48. Casadesus-Masanell, R., and Tarziján, J. (2012). When one business model isn't enough. *Harvard Business Review*, 90 (February): 132–137.
49. Osterwalder, A., Pigneur, Y, Smith, A.and 470 practitioners from 45 countries (2010). *Business Model Generation*, self-published.
50. Osterwalder, A., and Pigneur, Y. (2010). *Business Model Generation: A Handbook for Visionaries, Game Ghangers, and Ghallengers*. John Wiley & Sons, Chichester, UK.
51. See endnote 51.

4

Agile Procurement Support of the Value for the Customer

Introduction

The more complex the environment in which an organization operates is, the more important it is to adopt an agile methodology. All the items that are improved with agility are at the top of the list of the challenges an organization must cope with:

- quick response to changes while following a pre-defined plan;
- rapid intervention to minimize counterproductive disruption;
- iterative testing of facts over opinions and status quo routines;
- pilot-based testing prior to making large commitments;
- collaboration and sharing of knowledge/insights to prevent organizational silos.

These are some characteristics that an agile organization develops. This chapter deals with how to apply the agile procurement method and the tools that add value for customers and the organization. It starts from the challenges that procurement management faces, then presents some solutions that can be adopted.[1]

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Managing procurement has never been so complex. One study indicates that it represents more than 10% of a nation's GDP, and it is increasing.[2] The main reasons are higher inventory costs, warehousing, and transportation. Fuel now costs several times more than in the past, and prices are on the rise. To all this, it is necessary to add that the operating environment in which procurement operates has become very complex over time, with vendors, carriers, ports of call, and warehouses, both proprietary and contracted, distributed globally.

Integrated operations for end-to-end procurement are essential to managing the organization profitably. Clear visibility on all nodes of the value network is the key that allows organizations to prevent disruptions along the value network and to ensure more rapid and profitable operations throughout the global network.

Recent years have seen the emergence of agile methods and tools in different organizational environments through an extrapolation of concepts born in projects and factories. An agile approach helps organizations perform effectively, efficiently, and economically to supply operations, storage, handling, and delivery of products and services through processes integrated end-to-end on a single digitized platform.

Organizations that have used the agile procurement processes have been able to:

- reduce the cost of procurement, decrease stocks, and use fewer resources along all processes of procurement;
- improve service levels, providing the right product, in the right place, at the right time, and at the right level of quality;
- achieve higher levels of integration in the value network;
- manage complexity through improved cooperation, regulatory compliance, and visibility of all network layers.

Lean thinking has also been applied in the context of services. Hines and Rich,[3] Abdi et al.,[4] and Sarkar have written interesting papers on this subject.[5] These studies have focused on the process of rationalization of services associated with products (Taco Bell, Tesco, and others), services in support of production (management of a manufacturing organization), and services in health organizations. There have been limited applications so far in the area of procurement.

Sugimori et al. have argued that the use of the technologies of information and communication for production planning presents unnecessary costs, overproduction, and uncertainty.[6] This theory is at odds with the trends of recent decades. In these years, the interest in and dissemination of manufacturing and material requirement planning (MRP) and enterprise resource planning (ERP) systems, computer numerical control (CNC) machines, and fully automated production lines have been widespread. Highly automated organizations were less vulnerable to the problems typical of manual labor. However, there were examples of overinvestment in automation. In certain cases, it worsened the firm's flexibility and its ability to respond to changes in demand (General Motors in the 1980s; Computer Integrated Manufacturing (CIM)).[7] E-procurement has contributed substantially to streamlining procurement processes and helped with internal and external coordination, especially for indirect purchases.

As part of the integrated solutions in procurement, this chapter highlights the need for:

- a strategy and a global organization of procurement;
- an array of different solutions through the entire process of procurement;
- an integrated system architecture.

Organizations must realize that there are no standard solutions of e-procurement and that important success factors are not technical in nature.[8,9] Lean thinking focuses on flexible automation and intelligent and low-cost technologies. MRP is replaced by the tools of the just-in-time and kanban as the Heijunka box, which is very simple and controllable. The numerical control machines and fully automated production lines are replaced by cells with less automation but with the possibility of having a flow even in the case of small production lots. However, it is unclear from the literature whether the principles, techniques, tools, and approaches of agile and lean can be applied in a service environment such as procurement. In this case, there has been until now an intensive use of information and communications technology and digitizing processes to support the huge amount of information and documents which are the

backbone of the processes of procurement.[10] On the other hand, the only use of automation to improve performance remains uncertain. If, in fact, the process is invalid, automation can make the situation worse, in the sense that it accelerates the production of defects.

This chapter includes a substantial section on the use of procurement to improve the supply of energy. The reasons are several:

- Energy costs represent a substantial cost for an organization.
- These costs are on the rise, due to an increased cost of energy and greater use of machinery.
- An organization must also take into account sustainability in order to be a valid member of the community from a social point of view.

Green procurement is an increasingly important part of the value that procurement can provide to organizations.

Value Proposition

The value proposition of agile procurement is to effectively, efficiently, economically, and ethically link the enterprise departments to external vendors in order to satisfy the needs of the business.

As complete as this definition may seem, it entails a number of activities that currently are not directly addressed. The mechanisms of interaction and the way procurement processes are shaped very much impact the way the organization runs. Procurement is not only concerned with generating value for its direct customer (the functional departments) but also with the way its direct customer perceives its needs, the way the need is then received by vendors, and the impact of this on the organization's overall spend, investment structure, and risk challenges.

Therefore, the value proposition of an agile procurement organization is the consistent delivery of:

- insight on business needs through early involvement in transformational projects;

- consistent effort in managing relationships with key vendors, also through vendor consolidation;
- periodical diagnostic reviews of upcoming business needs against current capacity, also aided by forecasting and reviewing of future industry trends;
- periodical cost structure reviews in order to identify opportunities, such as renegotiation, outsourcing, capital expenditure (Capex) versus operation expenditures (Opex);
- periodical reports on risk management, aided by forecasting reports and cost/capacity/obsolescence reports.

The overall aim is to add value through the provision of customer-driven forecasts, support and guidance, and effective/efficient/economic linkage between a well-stated business need and the supply of adequate resources.

Agile Procurement to Increase Value for the Customer

The old way of doing business in procurement was based on systems, such as MRP and ERP, and reporting requirements to vendors by telephone, fax, or electronic message. These manual processes and paper are slow and inefficient. They are not acceptable in organizations that aim to be streamlined and to perform pulled by the demand of their customers. With outdated approaches, procurement professionals spend their time extinguishing fires and reacting to persistent problems. They cannot find the time to develop strategic relationships with vendors and implement improved processes that, for example, eliminate the deficiencies of supply.

The correct approach is agile procurement management. According to this approach, the goals include:

- removal of barriers to the free flow of information to/from procurement;
- creation of real-time visibility on material handling;

- transformation of the management of the value network from a push approach to a pull approach, with the production "pulled" by customer demand;
- management by exception, providing buyers and production schedulers proactive alerts in real time only on real exceptions when present in the processes of supply;
- substantial reductions (at the limit zero) in delivery times, especially for critical materials and assemblies;
- avoidance of excesses in consumption forecasts of materials and components;
- collaboration with the organization to define everything that could be outsourced.

Agile procurement adds value by helping the departments involved to:

- synchronize demand and supply along the network of the organization, in order to minimize the risk of insufficient supply even with reduced stock;
- implement a network of production to meet the demand of the whole organization's infrastructure with internal operations and/or outsourcing;
- manage logistics and fulfillment to supply, store, and move products profitably as part of a global network;
- ensure traceability of the supply network to protect customers and the brand. This is to mitigate financial risks and related problems of safety.

The management of agile procurement is not exclusive to organizations that manufacture products. It can be implemented in all organizations that want to simplify processes by eliminating waste and activities that do not add value for the customer and at the same time reduce supply times.

Organizations have a variety of activities in the network of procurement that produce waste in time, money, or stocks. These should be identified and eliminated or reduced. To create agile procurement, the organization must carefully review all activities of the value network and improve them during several cycles.

The actions are therefore as follows:

- Simplification: many organizations have complex procurement operations. Organizations often rely on both buying groups and local vendors. This can lead to longer contracts with vendors and price changes according to location. Organizations engaged in managing with agile procurement aim to reduce their procurement activities so that each vendor has a point of contact, one contract, and offers a single price for all locations. Even management of the procedures for payment of vendors can streamline procurement processes. Organizations using a two-way control, that is, a compliance check in reception, rather than just paying the invoices, can reduce the resources required for the functions of procurement, as well as improving relations with vendors.
- Use of new solutions: in agile procurement, organizations must use new solutions (not only related to new technologies) to improve the processes of procurement. These include e-procurement, that is, purchasing that is as integrated, automated, and inter-connected as possible.
- Revision of internal logistics: organizations wishing to adopt agile practices for procurement should examine invoices for materials, equipment used, and routings of the materials in the process to identify where improvements can be made. They must carefully examine all processes for storing materials and components, such as the receiving, transferring, storing, and withdrawal of goods. The objective is to identify the transactions that do not add value for the customer. These should be eliminated or at least reduced. One area where organizations should aim for continuous improvement is the reduction of unnecessary inventory, even with the help of vendors. By reducing unnecessary inventory, an organization can minimize the space of storage and handling, and thus reduce overall costs.
- Rethinking of external logistics: organizations wishing to implement agile processes often look to their logistics processes to simplify them. In many cases, the organizations remark that their efforts to improve customer satisfaction lead to a reduction of shipments, thanks to their consolidation. For example, in current practices, sometimes the orders from a customer are shipped without consolidating them with other orders, which could save costs, or are shipped by more expensive

Table 4.1 The characteristics of agile procurement

Feature	Traditional procurement	Agile procurement
Vendors	Many	Few
Interactions	Confrontational	Collaborative
Relationship focus	Transactional	Long term
Primary selection criterion	Price	Performance
Contract duration	Short	Medium to long
Prices in the future	Growing	Declining
Replenishment times	Long	Short
Order quantity	Large lots	Small lots
Quality	Extensive inspections	Quality of the supply
Stocks (supplier and customer)	Large lots	Minimum
Flow of information	Unidirectional	Multidirectional
Flexibility	Low	High
Role in product development	Small	Large (collaborative)
Trust	Limited	Wide

modes due to customer request. A careful analysis often leads organizations to understand that they are unnecessarily using a large number of logistics operators when they could reduce the number and consequently reduce overall costs, consolidating sourcing with a few strategic vendors.

In conclusion, the management of agile procurement requires organizations to examine all processes in their value network and identify the areas where they could use fewer resources. The potential benefits from the elimination of waste can be measured in the reduction of money, time, or materials. This improves the competitiveness of the organization and its overall profitability (see Table 4.1).

Approach to Agile Procurement

The ways to implement agile procurement can be classified as follows, in order of increasing effectiveness but also of difficulty (see Fig. 4.1):

- acting on procedures/standards;
- changes in organization, both structural and in persons;
- better planning;

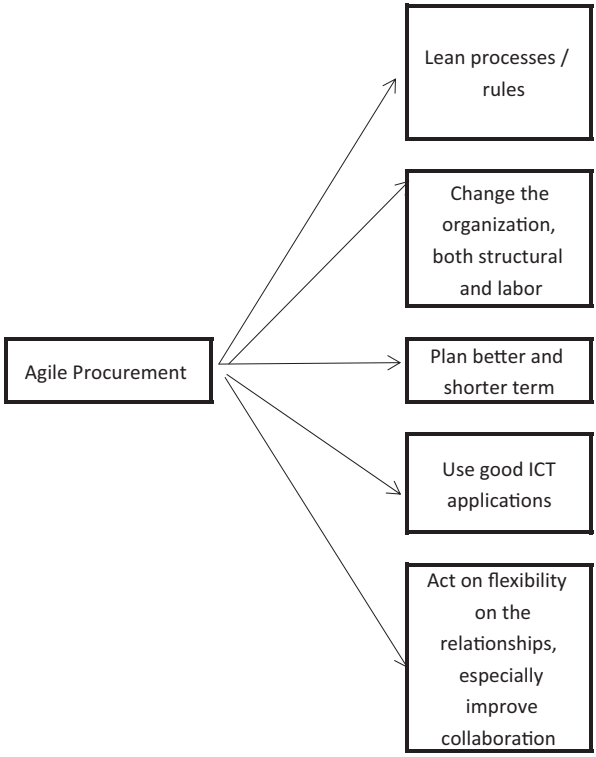

Fig. 4.1 The approach to agile procurement

- using the data and information;
- acting on reports, especially improving collaboration.

The following sections examine each of these means.

Evaluation of the Tools Available to Implement Agility

A number of tools have been developed to manage operations that have an agile and a lean effect on the overall enterprise or just on the procurement organization. They may have been developed for different purposes, yet the traditional tool may have been modified and interpreted in order to provide the agility many organizations strive for. This section briefly discusses a selection of the tools, in order to assess their potential contributions (Table 4.2).

Tesco Plc

Tesco Plc is a well-known brand from the UK in the retail industry.[11] The headquarters are in Hertfordshire, England. It was founded in the year 1919 and since then it has always been setting new success benchmarks for itself. It occupies a good amount of market share in the UK supermarket industry. According to a survey, Tesco occupied 28.5% of the market share for the 12 weeks ending 31 Jan 2015, followed by Asda at 16.2% and Sainsbury at 16.8%.[12]

Tesco has made extensive use of the lean and digitize method and tools, especially in procurement. The results have been very positive: increased market share, increased sales volume, increased productivity, economies of scale, improved brand image, and increased margins.[13] The use of Internet of Things (IoT) solutions has helped the company track products through radio frequency identification (RFID) and barcodes.[14] In this way, it is possible to reduce the lead times that are associated with the sale and distribution of their products. Tesco also uses point-of-sale data to obtain real-time information in order to plan the replenishment system effectively. Tesco uses the "pull" system for value network management and does not use "push" at all.

Cross docking is another facility that is being used by Tesco to ensure quality. Cross docking is a practice in logistics of unloading materials from an incoming semi-trailer truck or railroad car. These materials are then loaded directly into outbound vehicles, with little or no storage in between. This may be done to change the type of conveyance, to sort material intended for different destinations, or to combine material from different origins into transport vehicles (or containers) with the same destination or similar destinations. Cross docking is particularly important for fresh products in the fast moving consumer goods (FMCG) industry.

Tesco ensures customer value procurement at each point. In this way, it can provide very good services, products, and information. Tesco uses flexibility as a major performance objective.[15]

Following the industrial revolution, over the past several decades the value network has undergone a continuous evolution process, spanning material requirements planning (MRP), manufacturing resource planning (MRP II), distribution requirements planning (DRP), lean thinking, vendor managed inventory (VMI), collaborative planning, forecasting and replenishment (CPFR), and business unit-centric planning. These improvements were successful and appropriate as the value networks evolved.

Table 4.2 Effect on the organization and procurement department

Tool	Effect on the organization	Effect on the procurement department
Outsourcing and cloud computing	Rational and strategic outsourcing (and especially the use of cloud computing) can boost productivity. and reorganize investment portfolio towards a better Capex/Opex ratio. The resulting stance is more agile, efficient, focused, and less vulnerable to changes in the environment variables.	Many activities are non-core, low value-adding in the procurement department. They reduce efficiency and increase the workload on resources. Outsourcing can effectively allow the department to focus on high value-adding work, and key activities the function requires.
Lean	The main focus of lean is the reduction of waste in all its forms; this means leaner operations with reductions of stock and increased focus on process improvements.	The pull thinking approach enables the full use of framework agreements, ICT marketplace, and better improvement in the processes, also thanks to the selection of a suitable, reliable, and consolidated vendor base.
Management control	This tool allows an increase in employee empowerment, effectively shortening the approval process and hence reactivity.	Improves information flows between the department and the organization, while the operations can run without direct control and visibility is enhanced.
Vendor consolidation	Pushes a partnership-type relationship with strategic vendors and codevelopment. This allows for a more value-adding collaboration.	Decreases low value-adding work and increases the importance of negotiation. The increased bargaining power allows to some extent a boost not only in effectiveness but also in efficiency. The partnership allows the organization to handle some part of the development of the product on Opex similarly to the way it handles self-produced ones.

(*continued*)

Table 4.2 (continued)

Tool	Effect on the organization	Effect on the procurement department
Digitization and automation	Digitization and automation, coupled with the re-engineering of processes, increases the efficiency, effectiveness, and economics of the processes. At the same time, it improves the manageability and accountability.	The major effects are to increase transactional visibility and amount of spend under management, and to allow for low value-adding work to be automated The wealth of information can be fed to big data analytics in order to create additional benefits.
Big data analytics	Big data analytics requires an effort to re-engineer the process in such a way that it creates a continuous feed of information. It requires adequate infrastructure and resources in order to make use of the data collected and stored, and later to harvest them for the benefit of the organization.	Big data analytics has proved to be of great value in procurement as it has unveiled a number of patterns and opportunities, while being a means of foreseeing shifts in the requirements and market conditions. Effective analytics can greatly help in operations.
Benchmarking	It is an essential activity for agile organizations as it fosters alertness in spotting trends, changes, risks, and opportunities. It is an activity that is often underestimated or just "nice to have," often carried out in a spot way. It is essential that benchmarking reports are produced with a holistic methodology and are effectively employed in decision-making.	Benchmarking is just part of the alertness that agile procurement needs to embrace, in particular the external alertness (vs. internal alertness regarding business needs). It allows procurement to spot opportunity and risks with reference to the kind of business needs that will arise and the kind of resources that the business could use but is not yet aware of.

(*continued*)

Table 4.2 (continued)

Tool	Effect on the organization	Effect on the procurement department
Customer relationship management	This is also a means for alerting the organization of the signals that come before change and building up a buffer of loyalty to reduce the impact of unplanned changes. An agile organization may not mistakenly think that loyalty protects it from change, yet it may hide the effects of change in the short term.	This tool requires the business activities to serve market needs. In an agile organization, efficient CRM is a baseline, as agility requires the organization to be customer driven and to change quickly and accordingly in order to benefit from new requirements.
Knowledge management	The efficient management of knowledge is a key element of an agile enterprise in any industry, but even more so in a labor-intensive service industry that makes intensive use of outsourcing or subcontracting work.	In procurement, knowledge management is an enabler for outsourcing of internal non-commodity functions and activities. Once a third party develops a technology, process, or product, the organization becomes bound to this party.
	Being able to acquire new knowledge and spread it quickly throughout the organization is a major factor in reaction to any change.	An agile procurement department manages the knowledge in order to own it and make use of it extensively, autonomously, and over time.

This book has described agile procurement and the types of changes it requires in the business model of an organization. It is fair to assume that the innovations suggested here will take time to be implemented in a large number of organizations. It is important to imagine how traditional organizations might coexist with agile procurement entities. Actually, the synergies between the two approaches could substantially benefit the organization. This is the approach suggested by several analysts and academics (such as Gartner). It is important to understand how they could coexist.[16]

Traditional procurement is centered on operational excellence, efficiency, eliminating waste, and reducing non-value-added activities. This works well in the linear value network when low demand fluctuation helps ensure smooth production, and a network of local vendors can support short lead times and just-in-time deliveries. However, these assumptions no longer always hold true in today's dynamic and global environment with increased demand and supply volatility.

Stability has given way to agility in business. Current political, environmental, social, and economic events show the shortcomings of being lean and operating only in a traditional procurement model. Value networks are increasingly complex due to increased mergers and acquisitions, the proliferation of product configurations, reduced product life cycles, and market volatility. The outsourcing and globalization culture has resulted in an explosion in the number of value network nodes, creating a multidimensional supply grid that represents a highly diversified and complex network of connection points in terms of physical assets, processes, and stakeholders.[17]

To be able to serve new customers, products, markets, and channels, and at the same time do so in a win–win profitable manner, organizations need the ability to act with agility, responsiveness, and flexibility (what is called in this book agile procurement). Agile procurement complements the lean strategies of operational excellence, efficiency, and waste elimination that are the hallmarks of traditional procurement. Agile procurement also includes the capability to control and manage the impact of variability by establishing appropriate inventory and capacity buffers in the value network to cushion against market volatility. This enables organizations to be more agile and less fragile when faced with unanticipated risks such as natural disasters, currency fluctuations, and geopolitical situations. Capacity and inventory flexibility act as the risk shock absorber at the strategic planning and tactical planning levels.

Gartner defines bimodal as the practice of managing two separate but coherent styles of work: one focused on predictability, the other one on exploration.[18] The traditional mode is optimized for areas that are more predictable and well understood. It focuses on exploiting what is known while renovating the legacy environment into a state that is fit for a digital world. Agile procurement is exploratory, experimenting to solve new problems and optimized for areas of uncertainty.

Adopting a bimodal value network strategy (by combining traditional procurement and agile procurement) allows organizations to deliver a seamless omnichannel experience that accommodates customers' rapidly changing preferences on pricing, delivery options, and service levels.[19] It also allows for the support of financial expectations around higher revenues and margins. The value network strategy must deliver profitability and also the expected service for each segment of the business. Segmentation is the process of grouping a combination of channels, customers, and products that have similar requirements, patterns, and characteristics. This can be achieved by coupling the cost to serve for each segment with the customer value proposition of each segment of the market.

Customer-centricity is at the core of the bimodal value network strategy. For example, agile procurement could be used to serve Tier 1 customers, which demand higher service levels. At the same time, it would be possible to increase agility and responsiveness for the same product, relative to Tier 2 customers. Meanwhile, traditional procurement could be used for Tier 2 customers who want a lower price relative to Tier 1 customers. Therefore, the cost to serve Tier 1 customers (leveraging agile procurement) might be higher and would need to be compensated by a higher selling price.

No matter which approach is used, it is important to align the different procurement processes with the business strategy. If the organization has a business strategy that focuses on innovation and revenue growth, agile procurement, which focuses on innovation, agility, and responsiveness, can support the execution of this strategy by launching new products in a specific location for capturing market share. All the underlying agile procurement value network processes—including demand planning, inventory planning, master planning, allocation planning, order promising, and sales and operations planning (S&OP)—should be aligned.

Best-in-class organizations are making use of the bimodal value network strategy.

A good example is the banking industry, which has been plagued in recent years by increased competition, mounting customer service expectations, profitability challenges, and a growing diversity in channels—such as mobile, online access, fintechs, and so on—with different

needs for these different channels and market segments. A one-size-fits-all traditional procurement value network strategy would focus on operational excellence, efficiency, and eliminating waste alone. This would damage other desirable qualities such as responsiveness, flexibility, and risk management. Such a strategy can quickly turn from a short-term market advantage into a long-term competitive disadvantage. Many financial institutions have launched mobile banking as a parallel and independent operation from the traditional organization. This has also created completely different needs in terms of procurement. The online financial institutions require a completely different kind of procurement that needs to be agile in order to adapt to a changing environment.

The bimodal value network strategy is an organizational initiative that requires a combination of people, process, governance, and best-of-breed solutions. For decades, value network professionals using traditional procurement have been accepted as firefighters, operationally excellent and risk-averse. Moving to a bimodal value network requires a change in the mindset, the organization, and an evaluation based on a complete cross-functional metrics. Agile procurement rewards people who are innovators, strategic thinkers, risk takers, and who take a proactive approach to prevent, rather than react, in issue resolution. Putting the right performance metrics and policies in place that reward the agile procurement process behaviors is key to strengthening this new culture in the organization. Strong executive leadership and the definition of tangible and intangible benefits and goals through top-down and bottom-up communication is critical to making this culture part of the corporate DNA.

Best-of-breed solutions are more and more available. Best-in-class organizations are now leveraging decision-support solutions to enable the bimodal value network strategy. Essentially, they are leveraging the same physical assets to create bimodal virtual value networks that match different value propositions to different clusters with the corresponding costs to serve. As seen from several customer case studies, the bimodal value network strategy has resulted in significant benefits for best-in-class organizations, including increased margins, competitive advantage, market share, higher shareholder value, and faster time to market.[20]

A Tire Manufacturer

The tire replacement business is characterized by short lead times.[21] One tire manufacturer has leveraged agile procurement. It has kept inventory at both its regional distribution center and central distribution center to enable responsiveness and capture market share. This results in increased inventory costs relative to its automotive Original Equipment Manufacturer (OEM) business, which are balanced by higher margins in the tire replacement business. Thanks to higher service levels, it can charge a premium price that more than covers an increased distribution cost. The allocation planning and order promising business processes are also aligned by reserving supply for the different segments, to maintain the necessary service level commitments to each of the two segments.

Zara

Another organization achieving success using the bimodal value network strategy is the Spanish apparel company Zara.[22] Zara has a corporate strategy of getting fashion apparel into stores rapidly. For its fashion-conscious customers, it uses the agile procurement value network strategy, leveraging the more responsive Western European vendors in order to fulfill its corporate strategy. Its Western European vendors are more expensive relative to their Eastern European or Asian counterparts. However, by being receptive to its fashion-conscious customers, the retailer is able to command the necessary premiums that come with fashion items. For staple items with predictable demand, it uses the traditional procurement strategy of partnering with Eastern European or Asian vendors, which have longer lead times but lower costs. Depending on the life cycle stage, customer, and so on, the organization has the ability to move the products from one value network to another. Traditional procurement and agile procurement work in a unified fashion to comply with the business strategy.

Energy Efficiency

Concerns about the availability and cost of energy are increasing. These are set to grow further given the pace of increase in global consumption and reductions in the availability of resources. It is important to use alternative energy and not to forget a very important "source"—the reduction of energy consumption.

From this point of view, the procurement function must do its part in order to add value to the organization. The support of agile procurement in this effort can be very significant. The approach to energy management by the procurement function must also be to become more agile, which means to lean and digitize.[23] It should aim to make the processes more lean and at the same time push for their automation.

Before addressing specific aspects of energy management through agile procurement, it is important to examine in a holistic manner the entire process from beginning to end.

The platform to support an agile procurement management process for optimizing the use of energy must include the following components.

- Data collection: this includes measurement of energy, storing the information gathered, and managing energy use. The benefits are seen at the level of individual entities connected to the system (fuel savings, centralized control, real-time energy availability, and so on). There are benefits in terms of correlation between the various entities belonging to the same energy domain.
- Forecasting: information analysis is used to correlate energy use of different users and to develop forecasts. The aim is to avoid peaks in power consumption, which normally incur financial penalties. These data may also be useful to better manage operations on power exchanges. They allow for better planning of the costs associated with energy budgets in economic and social organizations and administrations.
- Administration and energy trading: the objective here is to manage energy supply contracts and have a useful interface for directly accessing the energy market. Tools of this type can support the decisions of energy managers and improve the overall management activities of the energy supply, and also allow for entering into bilateral agreements with utilities.

The creation and use of these types of methods requires the collaboration of different organizations to develop software modules and devices, according to a plan and shared objectives: smart meters, sensors and actuators, data acquisition systems and conversion protocols (gateways), the application of artificial intelligence (AI) for customer profiling, forecasting of the same, and energy trading.

A certain number of vendors of technology solutions are moving in this direction. Thanks to their support, it is not necessary to develop these solutions (and their expertise) in house—they can be acquired. This is even possible in some cases through systems integrators. In this systems architecture, the data network plays an important role. It must be the collector and the communicator, able to acquire, adapt and aggregate the information, and present it to the organization for managing the energy domain.

Beyond the aspects examined, agile procurement can also act on the direct reduction of energy consumption. Some examples include:

- optimizing the value network and the logistics, especially in terms of transportation outside the organization and movement of the organizations;
- reducing the need to travel with the ability to work and interact remotely;
- optimizing the routes of vehicles of the organization both inside and outside the organization;
- reducing energy consumption connected with the ICT infrastructure. These reductions can be substantial in the data centers as well as in all the peripheral ICT devices. The correct approach is to move toward virtualization and cloud computing. Virtualization allows the organization to reduce its consumption of local devices, focusing on the servers or even moving to cloud computing with the support of external vendors. These may use data centers optimized from the point of view of energy consumption. The cloud computing model offer the possibility of pay-per-use.[24] The organization can pay (and thus consume) in accordance with the energy necessary without having energy-hungry equipment designed for peak consumption.

The Pallet: The Foundations of Ecological Packaging

Unilever and Chep (specializing in providing pooling pallets and containers) have completed an interesting pilot program for ecological packaging in Spain.[25] This project aims at zero emissions of carbon dioxide pallets. Through this program, Unilever—as well as becoming the first organization in the world to use pallets with zero emissions of CO_2—has been able to

offset the annual emissions of carbon dioxide generated by the movement of Chep pallets on Spanish territory (estimated at over 370,000 movements per year). This result has been achieved by choosing Africa as the location for investing its emission credits. In Tanzania, it launched a reforestation project and purchased certified emission credits. In Kenya, there has been an investment in social programs. Compensation is considered a last resort after optimization and efficiency improvements. Through the pooling system promoted by Chep, the organizations are able to reuse the assets on a continuous basis. The consumption of raw materials is reduced. Similarly, Chep's optimized network reduces emissions connected with transportation.

Choosing to transport their products on sustainable pallets, Molino Grassi uses Eur-Epal reconditioned pallets, ensuring quality and traceability to its customers and also types of pallets which are labelled "green".[26] Molino Grassi chose to use green pallets, based on green parameters of environmental sustainability, throughout the supply chain: production, storage, marketing, and product disposal. With these pallets, there is clear communication about:

- the wood used for pallets (from reforestation programs);
- the electricity from renewable sources used in the production;
- the recyclability (the materials used in the pallets are fully recyclable);
- the possibility of energy recovery (excluding the metallic materials, all the other materials can be used in the reduction activities and compensation process of waste-to-energy recovery).[27]

Green Procurement

Green procurement is the process by which an organization acquires supplies in a manner that does not damage the environment. There has been strong trend toward green procurement in public administration (PA) due to its social and community implications. The European Commission defines green public procurement (GPP) as "the approach whereby organizations integrate environmental criteria at all stages of the buying process, encouraging the spread of environmental technologies and the development of environmentally sound products through research and choosing outcomes and solutions that have the least impact on the environment throughout their entire life cycle." This definition is from the *Buying Green* manual prepared for the European Commission.[28]

Green procurement is a voluntary environmental policy tool that aims to encourage the development of a market for products and services with

reduced environmental impact through the lever of public demand. Public authorities that undertake GPP actions are committed both to rationalizing procurement and consumption and to increasing the environmental quality of their supplies and credit facilities.

Private organizations should also push for green procurement in order to:

- reduce environmental impacts, and therefore the relative waste of energy and natural resources;
- improve competitiveness, as green procurement in many cases leads to reduced costs (for example, a reduction in the use of electricity);
- stimulate innovation;
- rationalize expenditures;
- improve the organization's image with its customers and the community in which it operates.

In addition to the statutory financial statements, some organizations annually produce a sustainability report. This is a voluntary commitment. This tool allows the organization to report to every stakeholder the achievements of the organization in contributing to sustainable development. This is not a financial performance report, but it has a reputational effect in terms of transparency.

There are several examples of innovation in the organization value network. For example, Walmart has developed TLC Greenhouse Gas, which aims to reduce the gases that cause the greenhouse effect through the value network. Intercontinental Hotel has engaged its vendors in the sustainable development of food resources in order to reduce costs, improve quality, and support local communities.[29]

Cisalpina Tours Expands Green

Cisalpina Tours is a travel management company.[30] Cisalpina and LifeGate enable their customers to know the CO_2 emissions related to individual transport. The collection of this data is guaranteed to produce comprehensive reporting that is integrated with the business management report already provided to customers. It is fully focused on the reporting and analysis of the overall sustainability of journeys. Awareness of the environmental impact thus becomes the starting point for designing an ecological trip.

The Lean & Green Project in the Netherlands

The Lean & Green project in the Netherlands aims to reduce CO_2 emissions by 20% over a period of five years.[31] It also provides validation by a third party. An example is in the field of energy organizations. The most expensive energy that one of these organizations must provide is to meet unexpected demand during periods of peak consumption. In these cases, the energy vendor may be forced to buy extra energy at a very high cost to support the power grid.

However, if the electricity organizations could analyze trends in their power consumption based on real-time reading, they could offer their customers—in real time—the lowest rates for the week or month. The condition is that customers reduce their consumption during the next few hours after being alerted about peak consumption. Customers would have the chance to save money by reducing their immediate consumption. By enabling customers to make an informed choice and providing an incentive, electricity vendors have the opportunity to moderate peaks in energy consumption.

Green Public Procurement (GPP)

The eco objectives to be achieved and the levers to pursue with Green Public Procurement are summarized in Table 4.3.

Table 4.3 clearly underlines the importance of the role of procurement. Among the sub-projects of GPP is the procurement code, according to which a PA can play a strategic role, contributing, in the conduct of their activities, to the protection of the environment and the promotion of sustainable development according to the principle of the economy and the compliance to a system of competition policy.

Among the many programs arising from GPP, there are also initiatives for an electronic market (marketplace).

Energy Procurement for the Borough of Hillington

One application of the tools presented in this chapter to the London Borough of Hillington in Britain led to interesting benefits:[32]

- reduction in electricity costs of £60,000 a year;
- elimination of 44 tons of coal dispersed into the atmosphere, with anticipation of further savings in the near future.

Table 4.3 Eco goals and levers to achieve them

Areas	Eco goals	Levers
Economical use of resources and energy	• Contribute to generating savings • Promote the use of renewable sources • Promote the use of green fuels	• Contracts to monitor consumption/demand • Auto-production/purchase of energy from renewable resources • Supply of green fuels
Prevention of health damage	• Promote the use of environmentally friendly vehicles • Promote the production of goods and services not containing dangerous substances	• Technical score to reward the possession of ecological certifications (EMAS, Ecolabel or the like) or for the characteristics of products/services not dangerous to health
Reduced production of waste	• Promote recycled products/materials	• Purchase of goods involving use of recycled material
Intelligent waste collection	• Promote waste separation/recyclable materials • Promote valorization of the waste	• Collection and disposal of used assets (e.g., toner)

New Solutions

Several innovative solutions can provide support for green procurement. Some of the most important include:

- cloud computing;
- big data analytics;
- mobility;
- Internet of Things;
- artificial intelligence.

It is possible to analyze how each of these can support green procurement in the sense of allowing the organization to become more environmentally friendly.

Cloud Computing

Cloud computing, using large data centers based on new solutions, allows for savings in electricity. It also results in a substantial reduction of CO_2 emissions.

Big Data Analytics

It is possible to use big data analytics to support green procurement. For example, it can be used to collect, analyze, and integrate the changes in the climate and the time data "extremes" by comparing them with a green supply chain and product data. The aim is to begin a process of utilization of quantitative data to detect, monitor, and support the value network or to introduce more "green vendors."

Mobility

Mobile computing allows for reductions in travel to carry out certain operations and also in procurement, and especially it allows employees to work anywhere, anytime, and without the use of paper. This reduces the handling and consumption of natural resources.

Internet of Things

The IoT can be applied as an intelligent process for using energy through various control devices. It provides an efficient usage pattern for items, whether industrial machinery or household devices, according to user needs. What unifies all these different technologies is their implications for environmental savings. They can deliver these efficiencies discretely, and indeed in a way that provides benefits to those who use them, while respecting the environment and reducing the environmental resources used.

Artificial Intelligence

AI includes the theory and techniques for the development of algorithms that enable machines (typically ICT processors but also any object with a chip, such as smartphones or tablets) to show an ability and/or intelligent activity, at least in specific domains. The sustainability of the software depends on direct effects, which result from programs that perform actions to reduce the consumption of environmental resources, as well as indirect effects on the sustainability of the products incorporating the software. Indirect effects are, for example, the planned obsolescence when a device manufacturer stops providing software updates, making the device useless. To optimize the direct effects, it is necessary to use tools that provide methods for modeling, analyzing, and optimizing energy consumption. The indirect effects are more difficult to evaluate. Their optimization requires a change of economic incentives. However, it is important to optimize both types of effects to provide sustainable software, since the amount of energy consumed during the operation of a device is of the same order of magnitude as the energy used during its production.

Printing

Despite attempts to implement dematerialization, organizations print a large number of documents. New printing devices that use solid inks can greatly lower the consumption of environmental resources. 3D printing (and emerging future technological applications associated with it) is the printing of objects in three dimensions. Additive manufacturing (or 3D printing) is a production mode that uses very different technologies. It allows for the creation of objects (component parts, semi-finished or finished products) by generating and adding successive layers of material. This contrasts with what happens in many traditional production techniques, which are essentially based on "subtraction" from a block of metal (turning, milling, and so on). It is clear that 3D printing reduces the use of resources to produce an object and distrib-

ute it. 3D printing has the potential to have an impact beyond the basic ICT technologies in both custom manufacturing and mainstream. If used properly, these technologies can reduce carbon usage in production and change the paradigm of production, resulting in a highly distributed model for production. These solutions have benefits related to environmental issues in terms of reduced use of materials, use of energy, and transportation costs. They also allow for more effective recycling. By using them, it is much easier to have services for regenerating their materials.

This quick overview shows just how agile green procurement is. The examination proves once again that maximum benefits can be obtained by re-engineering and digitizing processes—what we call the agile method.[33]

Barilla and 3D Printers

Barilla, the world's largest industrial manufacturer of pasta, has launched a 3D pasta printer.[34] This new tool can be used in restaurants, delicatessens, and homes to produce custom-made pasta in a variety of shapes and with a wide selection of ingredients.

The 3D pasta printer is the result of a collaborative project on innovative solutions between Barilla and TNO, the Dutch Research Center (Netherlands Organization for Applied Scientific Research). In 2015, a first prototype using 3D printing solutions was created; it was capable of producing fresh pasta in two minutes, using dough prepared only with durum wheat semolina and water.

This innovation makes it possible to create unique shapes, including geometrical shapes otherwise not obtainable with the traditional solutions used in pasta production. To prepare the pasta it is necessary simply to load the dough cartridges into the machine. It takes only a few minutes, and one chooses the pasta shape one wants. The data are sent to the printer, which materializes ready-to-cook pasta in the desired shape (for example, cubes, moons, roses, and other unusual shapes for pasta).

This solution offers multiple opportunities. Creating personally designed pasta means not only choosing the shape one likes, but also changing the taste, texture, color, and nutritional value, as ingredients such as vegetables, pulses, whole grains, and other types of flour can be used to obtain pasta that is higher in fiber and protein content.

Conclusions

This chapter has underlined the ways that agile procurement can add value to organizations. The value added by procurement should be both toward internal customers and also with respect to external customers. The latter requires procurement to become more and more a business function rather than just a service or support function. It also requires relating to customers in a different way. This is the subject of the next chapter.

One important area in which to add value is in the procurement of energy. This aspect will become more and more relevant in the future.

Notes

1. Nicoletti, B. (2012). *Lean and Digitize: An Integrated Approach to Process Improvement*. Gower Publishing, Farnham, UK.
2. Nicoletti B. (2010). *Gli strumenti del lean and Digitize*, FrancoAngeli, Milano, Italy.
   Miklovič, D. (2008). Q & A: Moving Lean from the Plant to the IT Organization, Part. 1, *Gartner Report*, Nov.
3. Nicoletti B. (1986). *Circoli di Qualita'*, FrancoAngeli, Milano, Italy.
4. Berry, L.L. (1995). *On great service: A model for action*. Simon and Schuster, New York, NY.
   Bertels T. (2003). *Rath and Strong's Six Sigma Leadership Handbook*, John Wiley & Sons, Hoboken, NJ, USA, p. 7–8.
5. Womack, J.P., Jones, D.T., and Roos, D. (1990). *The Machine That Changed The World: The Story of Lean Production*, Free Press, New York, NY.
6. http://www.martinbraun.co.uk/pictures%5CLean_house.jpg, Accessed 11 November 2016.
7. Hence the importance of the recent trend towards contracting multi-skilled resources.
   Bonfiglioli Consulting (2012). *Il Lean-thinking dalla produzione alla progettazione*, FrancoAngeli, Milano, Italy.
   Nicoletti, B. (2010). *Gli strumenti del Lean & Digitize*, FrancoAngeli, Milano, Italy.

8. Stalk, G. Jr. (1988). Time—The Next Source of Competitive Advantage, *Harvard Business Review*. http://www.isixsigma.com/library/content/c030721a.asp, Accessed 25 March 2017.
9. http://www.lean.org/Community/Registered/ArticleDocuments/ASQStoryonQualitySigmaAndLean.pdf, author Dave Nave, page 5 of 6, Accessed 22 April 2016.
10. http://www.isixsigma.com/library/content/c030721a.asp, author: Thomas Bertels
Aggogeri, F., and Gentili, E. (2006): *Lean six sigma: la nuova frontiera per la qualità. La sinergia tra six sigma e lean production per un innovativo metodo di gestione e miglioramento dei processi industriali*, FrancoAngeli, Milano, Italy.
11. https://myassignmenthelp.com/free-samples/total-quality-management-at-tesco, Accessed 1 April 2017.
12. https://www.statista.com/study/31608/tesco-group-in-the-uk-statista-dossier/, Accessed 1 April 2017.
13. Omachonu, V.K., and Ross, J.E. (2004). *Principles of Total Quality Management*, Third Edition, CRC Press. Boca Raton, FL.
14. Nicoletti, B. (2017). *The Future of Fintech*, Palgrave Macmillan, London, UK.
15. Hitt, M.A., Ireland, R.D., and Hoskisson, R.E. (2013). *Strategic Management: Competitiveness*. Cengage Learning, Stamford, CT.
16. Shaikj, S. (2016). Bi-modal Procurement Management, 08 Nov. http://www.supplychaindigital.com/scm/what-bimodal-supply-chain-strategy. Accessed 14 April 2017.
17. Sepehri, M. (2012). A grid-based collaborative supply chain with multi-product multi-period production–distribution. *Enterprise Information Systems*, *6*(1): 115–137.
18. http://www.gartner.com/it-glossary/bimodal/, Accessed 14 April 2017.
19. http://www.brandba.se/blog/2013/5/30/new-character-of-procurement-in-the-on-line-era-lykova, Accessed 24 April 2017.
20. Chick, G., and Handfield, R. (2014). *The Procurement Value Proposition: The Rise of Supply Management*. Kogan Page Publishers, London, UK.
21. See endnote 16.
22. See endnote 16.
23. See endnote 1.
24. Nicoletti, B., (2013). *Cloud Computing and Financial Services*, Palgrave-Macmillan, London, UK (also translated in Chinese).

25. http://thebizloft.com/packaging-ecologico-supply-chain/, Accessed November 14, 2016.
26. http://www.epal-pallets.org/eu-en/, Accessed 02 April 2017.
27. http://ecozema.com/en/link_post/assoscai-associazione-per-lo-sviluppo-della-competitivita-ambientale-di-impresa/, Accessed 02 April 2017.
28. http://ec.europa.eu/environment/gpp/buying_handbook_en.htm, Accessed 20 December 2017.
29. Casemore, S. (2012) http://www.ict4executive.it/executive/approfondimenti/cinque-ragioni-per-integrare-supply-chain-e-social-media_4367215697.htm, Accessed 20 October 2016.
30. http://old.lagenziadiviaggi.it/notizia_standard.php?IDNotizia=167074&IDCategoria=2737, Accessed 02 April 2017.
31. http://www.dcvelocity.com/articles/20170109-lean-and-green-in-the-netherlands/, Accessed 28 February 2017.
32. http://www.cisco.com/web/strategy/government/gov_london_borough_e-govt.html, Accessed 20 September 2016.
33. See endnote 1.
34. http://www.barillagroup.com/en/press-releases/pasta-future-it%E2%80%99s-printed-3d-barilla-previews-its-prototype-cibus-2016, Accessed 24 April 2017.

5

Customer Relationships and Agile Procurement

Introduction

This chapter aims to define a collaborative relationship between the internal customer (the departments) and the procurement function, clearly defining the scope of the procurement activities. Procurement should advocate agility within the organization. This objective resembles a cocreation/dedicated personal assistance way of working.

Relationships with internal customers should be collaborative. Initiatives that foster engagement can support a redefinition of the procurement organization's mission and vision in which other departments participate and provide input.

It is also key to establish a straightforward balance between the support that the procurement organization aims to provide and the effort that the departments should put into the procurement processes. It should be clear that while procurement is working to achieve better processes and savings in the procurement processes, the organization should hold accountable the user departments for respecting budgets and performance level objectives.

Digital transformation refers to the changes associated with the application of digital solutions in all aspects of human society. The digital

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transformation of a specific function or organization implies that digital usages inherently enable new types of innovation and creativity in a particular domain, rather than simply enhancing and supporting the traditional methods. Digital transformation is essentially connected with the use of advanced technologies in support of management. Digital transformation affects all sectors and all functions.

Of the five major trends in solutions (cloud computing, mobile, artificial intelligence, social networks, and big data analytics), the latter, big data analytics, is the most interesting for improving the procurement function both in private companies and in PA. This chapter analyzes this subject.

Big Data Analytics in Procurement

Spending data is traditionally the source that procurement looks at in managing relationships with its internal customers. If the process of spend management is effective, the information is structured and easily computable.

Spending data are a rather small portion of the overall information relevant for procurement. Many procurement decisions need to be informed by using non-traditional, unstructured sources of information.

There are software solutions that provide advanced analytics service. They build an aggregate database using enterprise systems generated data across-the-board. Then they use taxonomic algorithms in order to create a classification. The information is enriched with pattern-seeking algorithms and compared through peer benchmarking. The use of the internal information source is a very important practice, as it is available internally and very often offers unbiased insight on the current internal trends.

Similarly, unstructured economic information may be relevant in global sourcing in order to assess the conditions of a specific procurement, such as the stability of a vendor or of a region, also with reference to price trends and correlation to external factors.

Big data analytics is an interesting solution to support procurement in customer relationships.[1] Hu et al. define big data in a threefold fashion:[2]

An attributive definition:[3]

> Big data technologies describe a new generation of technologies and architectures, designed to economically extract value from very large volumes of a wide variety of data, by enabling high-velocity capture, discovery, and/or analysis.

A comparative definition:[4]

> [Big data are] datasets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyze.

A definition from an architecture point of view:[5]

> Big data is where the data volume, acquisition velocity, or data representation limits the ability to perform effective analysis using traditional relational approaches or requires the use of significant horizontal scaling for efficient processing.

Big data analytics are those analytics that run over a set of data that is: continuously updated, with real-time data gathering and generation, unstructured and fragmented, difficult to structure and unify, in order to generate useful and conveniently ordered information over a four-step cycle (see Fig. 5.1).[6]

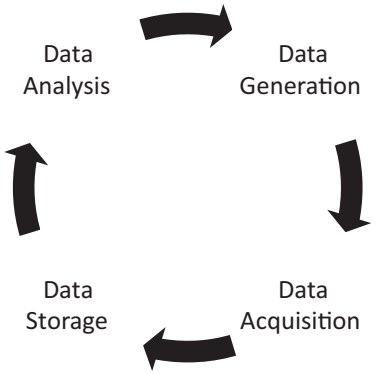

Fig. 5.1 The big data analytics cycle

Data Acquisition in Procurement

A large share of data in procurement is generated internally. It is, therefore, available on the go to the organization. Other information is external and may be inaccessible or costly to gather.

Some information can be accessed through the work of institutions that have a related mission and monitor some indicators through periodic investigations. Very often, the information has to be purchased from specialized organizations or gathered directly.

For the nature of big data analytics, the initial relevant information acquisition for procurement is done through an organization's internal systems. In some cases, there are publicly available databases and sites. These are open for use. It is essential to have the capability to select the appropriate data and use them in a timely, efficient, effective, economic, and ethical way.

Procurement can exploit open data in order to provide more tailored services and estimate risk with greater accuracy.

Organizations need to go beyond simple data collection in procurement. They have to use day-to-day mining operations of real-time data to make better decisions. These may relate to an increase in sales prices due to an increase in the costs of procurement, or recommending whether the organization should produce more of product A or product B to meet revenue targets and margin.

It takes sophisticated solutions to do this. Even more important is the business sense and creative intuition to read the full implications of the data and apply them to various aspects of procurement. According to a survey of procurement leaders, many procurement managers believe that these solutions are significant: 62% of respondents said they plan to increase spending on this tool.[7]

Use of Big Data Analytics in Procurement

Procurement organizations are on the verge of some drastic changes in their characteristics. In more competitive markets, organizations are relying more and more on innovation as a competitive advantage. In

procurement, innovation creates the basis for alliances or partnerships among different financial and non-financial institutions. Procurement organizations need to agree on or extend, for instance, partnerships with entities providing big data analytics and/or technology vendors that can supply and service connected devices that can support other channels. They also need to set up broader partnerships to secure direct access to vendors' data and other valuable information. New players could also take control of these ecosystems—potentially leveraging far more detailed vendor insights than the ones available to the procurement organizations without accessing big data analytics. The long-term result could be lower levels of effectiveness for procurement organizations if they lose control of the relationships with customers. Big data analytics can help in this respect.

In order to analyze in a systematic way the possible support of big data analytics in procurement, it is interesting to consider the various activities in procurement processes:

- Demand analysis and sourcing marketing: choosing the right vendor involves much more than scanning a series of price lists. A correct choice depends on a wide range of factors such as value for money, quality, reliability, and service. The importance of these different factors should be based on the specific organization's priorities and strategy.
- Requests for proposal or similar (RFX) and shortlisting: one of the crucial tasks in procurement is matching demand with supply. Big data analytics can help in finding vendors with successful histories of contracts similar to a current acquisition request.
- Negotiations, assignment, and contractualization: big data analytics can help in getting information on contracts in the market.
- Vendor management and rating: vendor rating is the result of a formal vendor evaluation system. Vendors are given standing, status, or scores according to their attainment of various levels of performance, such as delivery, lead time, quality, price, or some combination of these variables. Big data analytics can help in doing a comparison of the performance of vendors in the market.

- Spend visibility or analysis: this is the process of collecting, cleansing, classifying, and analyzing expenditure data with the purpose of decreasing procurement costs, improving efficiency, and monitoring compliance. It can also be leveraged in other areas of business, such as inventory management, budgeting and planning, and product development. Big data analytics can help in getting data on the performance of other vendors and customers.

Procurement applications of big data analytics require adapting and interfacing traditional models and analysis to the new information available through big data analytics, but shaping both of them to leverage at the highest level.

Table 5.1 summarizes how the Hackett Group describes a number of big data analytics tools in their general use and in particular in the case of the procurement organization.[8]

Critical Success Factors in the Use of Big Data Analytics in Procurement

The use of big data analytics can help in exchanges, spending, and decisions for procurement. This information is massive and heterogeneous—mostly due to different bureaucratic procedures, systems, and formats.

Data quality is an important factor in using big data analytics for procurement. Data is considered of high quality if it correctly represents the real-world construct to which it refers.[9] As data volume increases, the question of internal consistency within data becomes significant, regardless of fitness for use for any particular purpose. The main concern is that organizations using big data analytics might not devote particular care to their accuracy.

Big data analytics updates do not always occur at regular or generally predictable time intervals. Even though the data are made available by the providers, users might be overwhelmed by the size and/or inconsistency of the information.

Table 5.1 Some tools used to support organizations with big data analytics

Area	General business definition	Application in procurement departments
Self-service analytics and reporting	An approach to data analytics that enables business users to access and work with the organization data on a computing device without ICT support. End users create personalized reports and analytical queries using technology tools, accessible via browser, delivered through a portal, profile-based, and/or supported mobile devices.	Develop reports and perform data analysis on spending, supply base, requisition respect, and other spend-related data. Access may include end users, management, or vendors.
Scorecards/performance dashboards	An easy-to-read, ideally one-page, real-time graphical synthesis of current status and historical trends of key performance indicators to enable fast, informed decisions.	Show performance results of the procurement function on a given set of effectiveness, efficiency, and economics metrics.
Predictive modeling	A method that models cause-and-effect relationships between variables based on statistical analysis of these variables. Predictive models are used to simulate different business scenarios (that is, different sets of assumptions for the model variables) to support planning or predicting the most likely business outcomes based on future conditions.	Forecast spending or supply needs based on anticipated changes in the business and pricing based on external factors. Procurement may support value networks on the network design and optimization.

(*continued*)

Table 5.1 (continued)

Area	General business definition	Application in procurement departments
Multidimensional analysis	An analytical method that allows data to be presented along with different dimensions (for instance, sales by region, period, product, demographic) by the end user in a flexible manner within the analytical tool.	May be applied to spend analysis in the form of a "spend cube" showing spending by vendor, geography, category, and departments.
Risk analysis	A method for identifying and assessing factors that may jeopardize the realization of a business goal. This method also helps define preventive measures to reduce the probability that these factors will occur and identify countermeasures to successfully deal with these risk scenarios when they materialize.	Identify business risks related to the supply base. May include geographic risk, price risk, disaster risk, brand risk, compliance risk, or any other factor which the business deems significant.
Data mining	The practice of analyzing large amounts of digitally stored data to find patterns or trends that offer meaningful business insight.	May be applied to spend analysis to better understand spending trends; to vendor management to understand supply performance trends; or to pricing data to understand external pricing trends.
Operational data analytics	This is the so-called Analytics 3.0, where the data available are used through analytical tools to support operational decisions, such as reordering.	May be applied to operational decisions of buyers, who might use this tool to select among potential vendors.

The Metrics

Due to the extensive use of information systems, the availability of data is growing. These data make it possible to produce:

- statistics;
- reports;
- dashboards.

They allow managers to have better visibility of the organization. Big data analytics may require the processing of huge masses of data. Therefore, the algorithms and software make use of advanced informatics, statistics, and mathematics. The best way to analyze data is to show them in a graphical format for ease of interpretation.

Spend visibility is the tool for expenditure analysis. It enables organizations to have access in real-time to complete and consistent data, even if coming from different information systems.

Spend analysis should enable complete, accurate, and consistent visibility of spending on purchases by the organization. The characteristics of spend analysis should be to support improvements in the performance of procurement:

- appropriately classify the data of the real processes of procurement, possibly in real time;
- automate and accelerate the identification of savings opportunities;
- synthesize spending data in a manner consistent with the processes of procurement.

Aeroporti di Roma

Aeroporti di Roma (ADR) is responsible for the management and development of the airport system in Rome.[10] They adopted a platform for spend analysis. This solution allows for full coverage of the consolidated spending, supporting the reporting process. This solution helps to maximize the

opportunities for ADR to rationalize their expenditure with vendors. It supports activities such as:

- review of needs;
- standardization of codes;
- a suite of control of consumption patterns;
- aggregation of volumes;
- planning of purchases.

Spend analysis can support decision-making in setting tactical/strategic policies in procurement. It can provide the tools for complete oversight of the procurement process. Its use can help define and control budgets as well as verify the degree of adoption of model agreements and potential improvements in savings. Experiences in the development of many projects of spend analysis, for large international groups and in different markets, confirm that it can support organizations with a well-established method, and allow them to get the initial benefits in a short time.

Spend analysis should not be confused with business intelligence. Anyone can collect data. Several software tools provide support toward this end. The data itself only offer a glimpse of history. The ability to analyze data supports predictive and prescriptive models. These models in turn can analyze several future scenarios.

A Model for Advanced Analytics in IBM

Some tools are revolutionizing procurement.[11] The use of data resulting from an analysis of the expenditure of the organization to support strategic decisions for the value network is an attractive target. IBM refers to it as "the most intelligent use of the tools of analysis" to transform the processes of procurement. The application of data analysis in all its procurement activities is one of the factors that has helped IBM save $7 per invoice, on an annual cost of about $50 per invoice in 2011.

Open Data

Traditionally, organizations have used big data analytics to increase spend visibility.[12] It could do much more in support of procurement. This section aims to introduce a generalized business model for using big data in

procurement using so-called open data. Open data are data that is held openly and is free to access, use, reuse, redistribute, and so on. There are many sources of open data, for example public administration data, contracts, weather reports, and social networks.

The open data movement for making access to public (and other) information available is relatively new. It is acting as a powerful, emerging force. The overall intention is to make personal, local, regional, national, and international data (and particularly data acquired by PA) available in a form that allows for direct processing using software tools. Such tools make possible, for example, cross tabulation, visualization, mapping, and so on.

Open data can also be used profitably in support of procurement, especially by PAs but also by private organizations. This section analyzes both the release of procurement information as open data and their uses in procurement.

Literature

The literature describing the potential use of open data in procurement is very limited. Almost all of it refers to public procurement.

Some authors have reviewed the international state of the design and implementation of digital services based on open data. They concentrated in particular on those running over open government data (OGD).[13,14] Drawing from a large set of OECD countries, these papers highlight how OGD can become a driver of pervasive change by spurring innovation and promoting efficiency and effectiveness within PAs.

In order to reach this objective, it is necessary to set the appropriate institutional conditions. This requires reforming the status and the norms of civil servants. There is a need to activate a varied and heterogeneous network of agents (including citizens and other external stakeholders), in a process that should become self-governed and sustainable because it is centered on collective learning and feedback.

Nugroho et al. (2015) aimed to promote two waves of policy making.[15] The first wave of policy is focused on stimulating the release of data, while the second wave is aimed at stimulating use. This second wave concentrates on how open data can be used to learn from other policies

and help to improve open data policies. A third wave of open data policy is expected to materialize focusing on realizing benefits from using open data.

Alvarez et al. (2012) described a public procurement information platform that provides a unified pan-European system that exploits the aggregation of tender notices using linking open data and semantic web technologies.[16] This platform requires a step-based method to deal with the requirements of the public procurement sector and the OGD initiative:

1. modeling the unstructured information included in public procurement notices (contracting authorities, organizations, contracts awarded, and so on);
2. enriching that information with the existing product classification systems and the linked data vocabularies;
3. publishing relevant information extracted out of the notices following the linking open data approach;
4. Implementing enhanced services based on advanced algorithms and techniques such as query expansion methods to exploit the information in a semantic way.

Taking into account that public procurement notices contain information such as types of contract, region, duration, total amount, target enterprise, and so on, different methods need to be used to expand user queries in order to ease the access to information and provide a more accurate information retrieval system. Nevertheless, expanded user queries can involve extra time in the process of retrieving notices. That is why several authors outline a performance evaluation to tune up the semantic methods and the generated queries to provide a scalable and time-efficient system. Moreover, this platform is supposed to be especially relevant for small and medium enterprises (SMEs) that, for example, want to tender in the European Union (EU). These platforms ease their access to the information of the notices and foster their participation in cross-border public procurement processes across Europe.

The Open Data Movement

Open data is the school of thought (and its "movement") aiming to address the need of any user, for any reason, to be legally entitled to access and to retrieve data "openly" or freely. The goal of open data can be achieved by law, as in the USA where the information generated by the federal public sector is in the public domain, or by choice of the right holders, through appropriate decisions.[17] The use of open data for any purpose, of course, implies compatibility with the regulations in force (for example, that a list of email addresses will never be used for sending spam). They may provide for a right of attribution to the author or acknowledgment of the source, and possibly the obligation to use the same license of the original dataset for the publication of any modified dataset (so-called "viral" or "copyleft" clause).

Diffusion of Open Data

The open data movement intends to make personal, local, regional, and national data (and particularly publicly acquired data) available in a form that allows for direct processing using software tools such as cross tabulation, visualization, mapping, and so on.[18]

The idea is that public (and other) data, whether collected directly as part of a census or indirectly as a secondary output of other activities (crime or accident statistics, for example, but also social networks or similar), should be available in electronic form and accessible via the Web. There are significant initiatives in this area under way all over the world and as part of a wide variety of not-for-profit initiatives.

A certain number of governments have agreed to commit to moving towards open data as a matter of policy. For example, all the data that the British government collects that are not considered essential to national or public security are moved into the open.[19]

Use of Open Data in Procurement

Procurement organizations should use open data to improve the organization by adding value for customers. Procurement can exploit open data

in order to provide more tailored services and estimate risk with greater accuracy. The innovation can be of many types (see Fig. 5.2).

Worldwide, there are millions of publicly available databases and sites that are open for use. Various companies can tap into the same data. It is essential to have the capability to select the appropriate data and use them in a timely, efficient, effective, economic, and ethical way.

Procurement organizations need to consider possible ecosystems suitable to today's markets. In this model, multiple players collaborate. Collaboration, in the meaning of "working together," is necessary in modern times. It is necessary to work with different vendors, partners, outsourcers, fintech, and so on.

Critical Success Factors in the Use of Open Data in Procurement

The main concern is that organizations making available free open data might not devote particularly care to their accuracy.

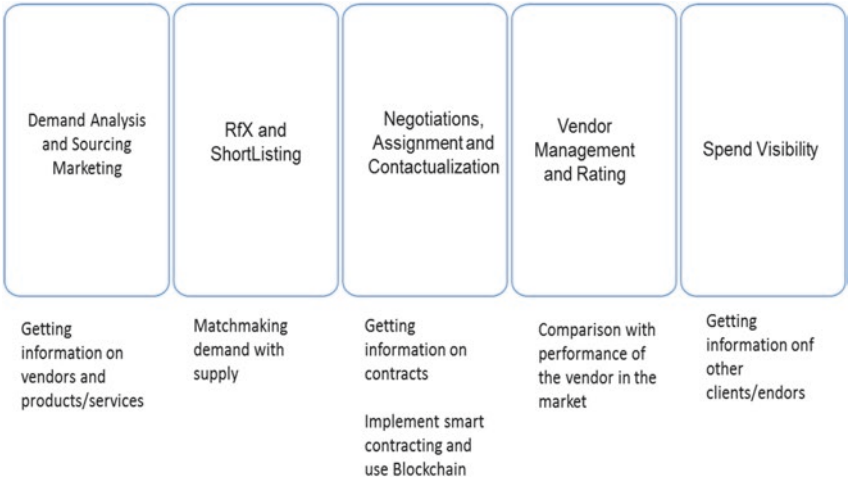

Fig. 5.2 The sourcing process and the use of open data

Open data updates do not always occur at regular or at generally predictable time intervals. Even though the data are made available by the providers, users might be overwhelmed by the size and/or inconsistency of the information they deal with. Vafopoulos et al. (2012) aimed to promote clarity and enhance user awareness regarding public spending in Greece through easily consumed visualization diagrams.[20] Information provision is based on semantic processing of real-time open data provided by the Greek government ('Diavgia') and the Greek Taxation Information System. Secondly, a proposed ontology for public spending in Greece functions at two distinct levels. It checks the validity of the publicly available data accessed by the system, cleaning and reconstructing in parallel false entries. It can also inter-connect the data to existing ontological and data schemes derived from other similar initiatives worldwide and, in addition, core vocabularies.

To use open data in procurement, it is essential to have access to the data but also to be able to process them. This is made possible thanks to linked data. Linked data is a methodology that allows one to aggregate and collect data coming from distributed sources. To make these data accessible on the Web,[21] they must be published under the condition of "open" use. This allows for consulting and navigating (with any means and through deep linking and aggregation).

Open data is to linked data, what the Internet is to the Web. Open data is the infrastructure (or "platform"), of which linked data needs to be able to create the inference network between various data distributed around the Web. Linked data is now a mature solution with great potential. It needs large masses of data linked together to become useful in practice. This is possible with a certain volume of open data. Ideally, open data should already be linked by the same institutions or otherwise made available in a structured way. Linked data can provide a powerful representation of the same, in terms of relationships (links). In this sense, linked data and open data converge and reach their full realization in the approach "linked open data."[22]

Claims have been made about the potential of opening government data to drive service innovation.[23] Little is known about the detailed processes by which hackers create or reshape services out of new releases of public datasets, and the conditions for the move from data release to service inno-

vation. Kuk et al. argued that the utility of open data is accrued through the creation of new artifacts with enhanced performativity transformed by human and material agency.[24] The roles of agency and artifacts in assembling open data are complementary. These authors found that few of the "rapid prototypes" developed through hack day events are maintained or sustained as service innovations beyond those events. Five artifacts provided the value stack of complementarities: cleaned data available through application programming interfaces (API) or bulk downloads, linkable data, shared source code and configuration, source code repositories, and Web technologies. Their findings also suggest that only a few open datasets induce the process of change. Initial contributions are driven by the use values but can only be sustained through an open innovative approach to induce further collaboration within a wider open data community.

Limitations of Open Data

There are a certain number of limitations in the use of open data.[25]

The main difficulty is the fact that there is no central repository from which to select the open data useful to the procurement organization. Each party, be it a central or local government entity or a private association, can determine its own format and its own way to organize data. It is also necessary to govern the process and evaluate the benefits of investing resources and time in using open data. The business case is not easy to prepare, especially on the side of the benefits.

In order to commit to open data, most data sources must be anonymized. That means any personal identifiable information should be masked or scrambled.[26,27] This may become problematic in the long term. As more and more people put their personal data on the Web or on mobile sites, there might be the possibility to rebuild the anonymized parts of the data by comparing the datasets to other sources.

With these precautions in mind, there are many freely available data accessible by procurement organizations. Examples are statistics relating to contracts, vendors, technical specifications, and so on.

Freely available does not mean that they are ready to be used. It is necessary to select, extract, transform, and load them into a private reposi-

tory. This is not an easy task. It requires resources and special skills. We refer to specific literature that deals in detail with this subject.[28]

Open data governance is part of a broader information governance program that formulates policy relating to the optimization, quality, security, compliance, and monetization of open data. It aims to align the objectives of multiple functions involved, such as strategy, marketing, sales, operations, and so on. Organizations need to create and follow appropriate policies and procedures to prevent the misuse of open data, considering regulatory and legal risks when handling social media, geolocation, biometric, and other forms of personal identifiable information. Organizations should define the governance of power users of open data, such as data scientists.[29,30,31]

An open data governance policy should obey the organization's legal and regulatory requirements. This policy might state that an organization may not integrate a customer's personal identifiable information into his or her master data record without respecting the appropriate compliance.

Open data must be profitable for the organization. It is important not to waste resources to use open data if they are not useful in adding value for customers and the procurement organization.

Finally, organizations need to optimize and improve the quality of their open data in the following areas:

- metadata, to build information about inventories of open data;
- data quality management, to cleanse, whenever possible, normalize, and finally manage open data;
- information life cycle management, to archive and sunset open data when it no longer makes sense to retain the massive volumes in internal files.

Benefits of Open Data

The biggest challenge facing procurement organizations is how to operate in an increasingly digital world. Open data can provide a digital support from which procurement organizations can rapidly respond and adapt to a changing marketplace, and add value to their organizations.

The ubiquitous push from governments to release more data publicly has resulted in new UK government and industry bodies being set up to address the use of open data for both citizens and commercial purposes.[32]

The benefits of open data are essentially five, here labeled as the five Vs:

- Value: open data are freely available. Even taking into account the costs of obtaining, analyzing, and processing them, the total costs of operations are decidedly lower than for other types of data.
- Variety: open data are available in different and distant sectors to help in different aspects of procurement processes.
- Velocity: there is no comparison with the slowness of other forms in getting information on environments with respect to digital analysis of existing open data.
- Veracity: all open data normally are connected with some real-life situation, thus open data tend to be relatively reliable.
- Visibility: the data can be shared publicly or selectively.

Experiences in the Use of Open Data

Researchers analyzed the Italian situation through a classification model of open data portals to be able to highlight positive features and issues.[33]

An increasing amount of public procurement data is now being ported to linked data format, in view of its exploitation by government, commercial, and non-profit subjects. A paper shows how to implement a portable matchmaking service that relies solely on the capability of SPARQL 1_1. This is a query language for the Resource Description Framework (RDF) which is a directed, labeled graph data format for representing information in the Web. RDF is often used to represent, among other things, personal information, social networks, metadata about digital artifacts, as well as to provide a means of integration over disparate sources of information.[34] This paper shows how to implement a portable matchmaking service that relies solely on the capability of SPARQL 1_1_ In order to show its effectiveness, the proposed service has been tested and evaluated on the RETized versions of two procurement databases: the European Union's Tenders Electronic Daily and the Czech

public procurement register. This paper evaluated several factors influencing matchmaking accuracy, including score aggregation, query expansion, contribution of additional features obtained from linked data, data quality, and volume.

Despite the potential for extensive energy efficiency, measures are sometimes not adopted due to barriers, such as lack of information.[35] An integrated database of available energy efficiency measures is one step towards overcoming such barriers. To address this, this author presented a database integrating energy efficiency data from Sweden (from the Swedish Energy Agency) and the USA (from the Department of Energy's Industrial Assessment Centers), and published the data on the Web using standardized Web languages and following the principles and best practices of linked data. Additionally, several demonstration interfaces to access the data are provided, in order to show the potential of the result. It integrates data from entirely different sources, making them jointly searchable and reusable. The results show that such data integration is possible, and that the integrated dataset has several benefits for different categories of users, for instance, supporting industry and energy efficiency buyers in overcoming the information barrier for investment in energy efficiency measures, and supporting application developers to integrate easily such data into support tools for energy efficiency assessment.

Gemilo Oy

Gemilo Oy is a software company in Finland that has worked for ways to improve internal communication and work practices in companies and public administration.[36] They developed an application titled Social network developer. The dataset used was the HILMA electronic notification system for notices of public procurement contracts and OpenStreetMap.

The London Fire and Emergency Planning Authority (LFEPA)

The London Datastore is a free and open data-sharing portal where anyone can access data relating to the city.[37] Whether one is a citizen, business owner, researcher, or developer, the site provides over 600 datasets to help understand the city environment and develop solutions to London's problems.

The Local Government Transparency Code 2015 requires the publication of details of every contract, commissioned activity, purchase order, model agreement, and any other legally enforceable agreement with a value that exceeds £5000. The London Fire and Emergency Planning Authority (LFEPA) standing orders (and code of practice on tenders and contracts) provides for tenders for purchases of £10,000 or more in value. This site provides details of all contracts currently in place because of tendering processes. These data are updated quarterly at the end of June, September, December, and March each year.

HM Land Registry Price Paid Data

Her Majesty's Land Registry (HM Land Registry) is responsible for maintaining the Land Register, where more than 24 million "titles" (evidence of land and property ownership) are documented.[38] HM Land Registry began a phased release of its data on property transactions (the Price Paid Dataset) in March 2012. By November 2013, the entire historic record dating back to 1995 had been released. Some traditional players in the property market are already using the data extensively. Additionally, new players are consolidating around the field of technology applied to property management. They are developing digital tools that use HM Land Registry data, often in conjunction with other, proprietary datasets, to bring buying and selling property "out of the Stone Age." The release of these data has also improved data quality.

Collaboration

Teamwork is at the base of any agility approach. In this situation, collaboration is particularly important. The *Oxford Dictionaries* define collaboration as "The action of working with someone to produce something." This subject is relevant, as organizations increasingly require teamwork to function. Procurement amplifies this aspect. Collaboration in procurement implies working together with the internal departments and people outside the organization, including vendors, financial services, logistics, and government departments.

Procurement organizations need to consider possible ecosystems suitable for today's markets. In this model, multiple players collaborate. The

collaboration platform should enable the organization to adopt new forms of collaboration within and outside the organization to support procurement. Current systems in support of procurement, including ERP, MRP, product lifecycle management (PLM), and others, provide access to structured information. They do not allow for the activation of collaborative mechanisms with unstructured "information-based" documents and messages, where people, including vendors, interact, negotiate, decide, and finally execute.

The fundamental difference between a system of procurement process intelligence and all other collaboration platforms is that current collaborative systems are centered on people, whereas the system must allow the organization to center the collaboration on information and documents.

The collaborative platform must be able to integrate structured and unstructured data and provide collaborative capabilities and execution (transactional functionality) that connect the internal actors with partners outside the organization.

The system must provide the following collaboration features:

- automatic workflows that guide buyers in managing the whole work cycle (for instance, the processes of preparing drafts, validation and approval of documents, verification of requirements, and so on);
- instant messaging;
- remarks;
- alerts;
- messaging;
- document exchanges (such as RFX, orders, invoices, and so on);
- joint tasks;
- unified search and semantic information;
- use of mobile devices (chats, SMS, and so on).

Collaboration in forecasting, planning, and replenishment brings a number of benefits.[39] A study by AMR Research showed several benefits of this approach in the case of retail organizations, including:[40]

- improvement of the stock in shops by 2–8%;
- inventory reduction by 10–40%;

- increased sales by 5–20%;
- lower logistics costs by 3–4%.

The same study found benefits for manufacturing organizations including:

- inventory reduction by 10–40%;
- improved supply cycles by 12–30%;
- increased sales by 2–10%;
- improved customer service by 5–10%.

Procurement and e-Collaboration

E-collaboration is the support of collaboration through electronic means. It is related in the case of procurement to operational planning (demand forecasting, inventory management, monitoring, and control) as well as managing the level of new product development, quality management. The ultimate goal is the improvement of the effectiveness of processes through the sharing of knowledge and information. E-collaboration includes all activities of a collaborative nature between customer and vendor, in the planning of production and supply, new product development, and so forth (for example, collaborative planning, forecasting and replenishment, and vendor managed inventory).

The MS Encarta encyclopedia defines e-collaboration as: "working together using electronic means such as the Internet, video conferencing, and wireless devices." E-collaboration has three important aspects:[41]

- sharing and communication through electronic means;
- meeting through electronic means;
- collaborative management tools (such as concurrent engineering, social sourcing, crowdsourcing, and so forth).

ICT development has started to support the third type of e-collaboration. Thanks to the development of communications, the other two aspects are also becoming important. From an application point of view, the complexity is in reverse. Communication using electronic devices does not necessarily

require complex applications. The support of collaborative management, however, tends to be quite complex. A survey in Italy in the field of plant engineering organizations, as part of the ICT section ANIMP (National Association of EPC Industries), highlighted some of the following points.[42]

The use of the functions of e-collaboration is in decreasing order: Communication => Meetings => Management. There are some features in development, especially on automated management tools involving several organizations, be they partners, rather than vendors or logistics or financial services institutions. This is the future of e-collaboration, especially due to the growing availability of extensive networks.

It is important to better understand the main features of the collaboration solutions in procurement. To reach this objective it is useful to break down the process into its elementary logical steps:

- pre-sales support, which requires the sharing of all information—on products, prices, availability of goods, delivery terms. This helps the next stage of issuance of the order;
- order issuance, from its creation, including the configuration phase for complex products, until the confirmation by the vendor of the economic conditions and logistics;
- logistics, equipment of the goods to delivery to the logistics facilities of the customer (or a vendor of logistics services);
- administration and accounting cycle, after invoicing to payment processing, including the activities of accounting reconciliation;
- after-sales support, a set of activities very dependent on the commodity sector, including for example the handling of complaints, the handling of requests for technical support, and the sharing of financial information.

In the case of procurement, the ANIMP survey pointed out the importance of the use of tools for the integration of the order cycle, through the spread of dematerialized processes. In these processes, different actors (internal and external: agents, customers, vendors) interact online. In this way, it is possible to reduce the use of paper documents and read them automatically in the various information systems. This allows for:

- savings in labor costs;
- increased process efficiency;

- reduction in typing errors;
- pursuit of activities with higher benefits.

Stages of e-Collaboration

The phases of the process of e-collaboration are as follows:

- Monitoring and control of the value network provides for the sharing of information (sales figures and availability of production capacity), the definition of metrics for performance evaluation, and reporting of critical issues in the value network (for instance, the depletion of stocks for a given product).
- Collaborative planning management involves collaboration in the process of demand planning, promotions, and inventory management.
- Collaborative management of development and the introduction of new products provides for the sharing of the main technical documents and workflow management of the projects.
- Collaborative management of the processes of communication and marketing provides for cooperation in the research and marketing of the products up to the sharing of the process of engagement and relationship management with customers.

E-collaboration allows for the management of these integrated stages by providing a number of classes of functionality (see Fig. 5.3).

The models of e-collaboration can be described using a matrix with two axes: the technological solution adopted and the degree of support in the operational processes.[43] The results obtained from this matrix can be summarized in the following manner:

- The largest group, with very low growth rates, is undoubtedly made up of organizations that adopt traditional technologies (mainly EDI, or electronic data interchange, but also solutions based on proprietary formats) for the partial integration of the order cycle. This is a solution mainly used in the manufacturing sectors traditionally active in EDI, such as automotive, FMCG (such as grocery), pharmaceuticals, house-

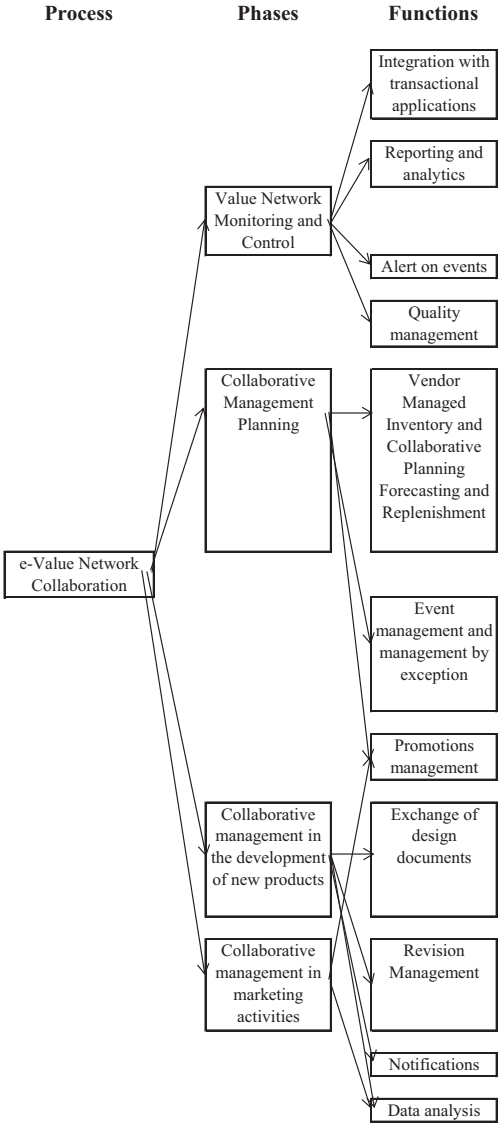

Fig. 5.3 E-collaboration (elaboration of the author on Bertele', U. and Rangone, A. (2004). The B2B in Italy: finalmente parlano di Dati, Associazione Impresa Politecnico, Milano, Italy)

hold appliances, and some service sectors such as tourism, where tools have been available for booking travel services and hospitality with traditional technologies for many years.[44] In many applications, the types of documents exchanged, and thus the coverage of the phases of the order cycle, is very limited. Only a small number of organizations, and only in the case of small value network partners, are using these technologies to completely integrate the order cycle with their customers or vendors.

- Some applications allow for the exchange of transactional data based on technologies from application to application on the Internet, mainly EDI. In recent years, the use of the Internet has risen significantly (by more than 40%). This has happened thanks to a number of projects in the areas of the value network that have used traditional EDI for years (in sectors such as FMCG, pharmaceuticals, and others);
- Transit through the Extranet for e-collaboration has grown by more than 40% in recent years, mainly by virtue of the work of consolidation and development of existing initiatives. There are relatively few major initiatives in this sector, but they are growing mainly thanks to the diffusion of cloud computing.

With the increasing complexity of processes, technologies based on the Web prove more versatile than the traditional technological solutions of communication from application to application. For example, simple processes, such as the order to delivery cycle, can be supported by EDI. Processes that include more activities (such as the entire order cycle, including pre- and post-sales) require more powerful tools and flexibility. They incorporate models of application-to-application interfacing with models from user to application.

Major trends with regard to the future of e-collaboration include:

- increased availability of collaborative processes with improved methods and solutions of social networks;
- the gradual migration from operational solutions to collaborative solutions, as it is easier to develop relationships when only operating in collaborative relationships.

The difficulties of e-collaboration in procurement are related to the need to:

- develop a "sharing" culture. It is not so much a problem of tools as it is a problem of perception of the need and usefulness to operate "in common." It requires a change among people toward a more open culture;
- review processes;
- have an appropriate infrastructure (for example, from the point of view of broadband transmission);
- ensure security, both in terms of access to information that may be confidential, and in terms of transmission (encrypted rather than open);
- justify the use of e-collaboration from the point of view of tangible benefits. The intangible benefits are clear and significant. If the organization intends to use e-collaboration in a generalized way, there will be a need for development and customization, which are expensive and difficult to implement, and in some cases are insufficient on their own to cover the needs of business collaboration. They can be either developed in house or bought as commercial packages or services. In both cases, the costs of sourcing, maintenance, and support do not justify (at least directly) the benefits.

Engineering Product at Avio Aero

Avio Aero is a manufacturer of aircraft engines components.[45,46] In its Rivalta site, Avio has addressed the issue of the percentage of metallurgic defects (White Spot) in forged Trent 500—LP 5th stage.

The initial collection of data showed the presence of metallurgical defects on average over 50% of the raw batch for forging and 25% of the finished batch, with an increasing trend.

By means of statistical tests applied to the data of the vendor, the working team (including the vendor and the customer) identified the parameters necessary for the analysis: temperature relative to the two-step forging and type of furnace. The team determined that it was necessary to decrease the forging temperatures to remove the defect. The changes have been agreed with the customer and validated with many trials. It has been possible to define control charts that can be used to control the temperature influencing the process. By collaborating with third parties, it was possible to reduce defects by 90%.

Benefits of e-Collaboration

The main factor that hinders investments in collaboration solutions is a tendency to underestimate the potential benefits. There is too much emphasis on the costs and complexity of this solution. The difficulty in quantifying the actual benefits of collaboration projects is based on three elements:

- The operational processes (Procure to Pay): the order–delivery–invoicing–payment cycle is usually parceled out into phases under the primary responsibility of many departments (for example, from the vendor side: sales, customer service, logistics, administration and control, finance) and there is no real end-to-end process.
- Another result of fragmentation is that organizations rarely measure the performance of the process (total cost, cycle time from order to payment, total respect of the committed timings, and so forth).
- Projects related to the electronic exchange of documents often arise within individual functions to increase local performance (for instance, to increase staff productivity and reduce the number of stages that require more accuracy in the exchange of information).

With the spread of a culture of process improvements, these difficulties should be overcome.

The benefits, achievable through projects of e-collaboration, belong to three classes:

- increased staff productivity, both in the front office (information on prices and product availability, order tracking, financial statements, complaints, and so on) and in the back office (interaction with information systems, accounting reconciliations, management of non-compliance, and so forth);
- improved accuracy of processes, mainly due to the reduction of manual activities;
- reduction in execution time (or cycle) of processes, by simplifying tasks and the ability to control processes with workflow logic.

The nature and extent of the benefits that it is possible to obtain, however, are closely linked to the cooperation model adopted. The electronic exchange of some isolated documents of the order cycle, such as the order or invoice, usually allows for a very limited achievement of the potential benefits. In this way, organizations can only eliminate some tasks, such as retyping of documents within the information systems, and reduce costs and errors. It is the integration of the entire order–delivery–invoicing–payment cycle, or at least of its main activities, which carries the most significant benefits in improving the performance of the processes, in terms of accuracy, timeliness, and productivity. The electronic exchange of the main documents of the cycle—orders, order confirmations, delivery notes, invoices, payment notices—especially if accompanied by workflow management, allows the organization to keep consistency between the documents themselves and automate reconciliation activities. The latter are usually due to a large proportion of defects in the process performance.

Collaborative solutions can bring significant benefits. Several barriers make it difficult to adopt the processes of e-collaboration. For projects and value-stream execution, the implementation risks are most frequently tied to a reduction in the scope of benefits. In the case of projects of e-collaboration, the negative effects are likely to be felt in the long term, especially with respect to the understanding of the relationships along the process of procurement.

The real obstacle is related to the difficulty of translating the objectives of better cooperation along the procurement processes into real and quantitative objectives for the benefit of the organization. These difficulties are due to cultural factors, but also in some ways objective.

Cultural barriers arise when there is minimal education and preparation of management for adopting collaborative solutions, especially during the first approach to such solutions.

Another barrier of an objective nature is the difficulty of allocating the benefits obtained to the various departments in the procurement network. In this situation, the benefits can hardly be split. It is difficult to make a precise attribution of the improvements to the level of service and the reduction of fixed and working capital. It is also difficult to enter into a culture of collaboration and full sharing of planning. These barriers are

mainly cultural rather than practical, such as the organization and redesign of internal processes and roles.

The primary benefit that a solution of this kind can ensure is the effective and efficient management of the flows of information and materials along the cycle and the ability to develop highly specialized expertise, while at the same time being able to take advantage of the valuable expertise of the different actors along the entire procurement processes.

Value Network Visibility in Piquadro

Piquadro is an organization in the leather sector in Italy.[47] Its manufacturing process uses leathers supplied mainly from Italian tanneries and factories located in China. The semi-finished product is brought to the Piquadro Italian factories to be turned into a finished product and distributed through the direct and indirect channels.

The cycle times of this process are very long. They are measured in months as they involve two continents and considerable handling and transportation between them. There is a need to reduce the cycle times as much as possible and to allow visibility of the whole value network of the skins preparation.

Piquadro has developed an innovative solution with some of its vendors and factories in China. It periodically shares its planned needs with the Chinese vendors. In this way, tanneries can independently launch manufacturing "orders" from Piquadro. The stock remains the property of the tannery until the moment Piquadro withdraws the materials. In this way, it is possible to substantially reduce the average time for fulfillment of the order. At the same time, tanneries are able to make better use of their production capacity.

Thanks to telematics, Piquadro has virtually real-time visibility of the entire value network, despite its complexity.

Social Networks and Crowdsourcing

A very interesting trend is relative to the "sharing economy" in the private sector, with reference to the shared use of goods and services.[48] This can often bring unexpected benefits and radical change in customer behaviors and purchase decisions.

Jeff Howe put forward the following definition of crowdsourcing: organizations assign the missions that should be performed by internal procurement staff to a network of public groups to complete.[49] The public voluntarily participates in mass collaborative activities through ICT. This collaboration is relatively loose.

The use of a private social network in sharing economy dynamics pushes the concept further by aggregating people with a shared need and/or interest.[50] This provides them with a platform to participate in a collective transaction that satisfies the collective need.

Closer to this model is the concept of the group purchasing organization (GPO). In the past, it was questionable whether the GPO paradigm allowed for concrete improvements in agility.[51] Solutions have come a long way to improve the effectiveness, efficiency, and economics of this model. It certainly helps procurement organizations to become more agile.

ABC Consortium

The Asset banking Consortium (ABC) is the consortium active in the procurement for the banks members of the consortium.[52] The consortium is part of the ABI, the national association of Italian banks. ABC has set up a Web marketplace platform which allows for minimum interaction and dematerialization of the procurement documentation. The procurement transactions of the member banks are for the most part automated and standardized accounding to the ABC's regulations.

Thanks to the consortium, the member banks can get lower prices for their purchases and get a better vendor relationship management and scoring.

Social Networks

An interesting case is the use of social networks for collaboration in procurement.[53] A social network connects a set of actors (both individuals and organizations) and creates dyadic ties between those actors. In the field of procurement, social networks provide a model for collaboration between the procurement function, vendors, and users of the purchased products and services.

A social network can support relationships with vendors, allowing the organization to move from a supply relationship to a partnership with mutual benefits.

There are many reasons to integrate social media and procurement organization. Home Depot and Teva Pharmaceuticals have developed integration solutions to improve communications and to build a repository of knowledge.[54]

This trend offers at least five potential benefits:[55]

- It becomes possible to create a knowledge network. Many organizations of all sizes are starting to use Facebook and Twitter to get feedback in real time, both internally (inventory, storage, and procurement) and externally (vendors).[56]
- If an organization needs supply, it can use a social network to contact the vendor at once and provide the specifications, photos, videos, and other relevant information. The dialogue that results allows the organization to keep track of all requests in a single page. For their part, the participants in this social network have access to a single information center. They do not have to waste time looking for emails or visiting other sites. From this point of view, a blog can also be a good solution. Over time, it is expected that the current static vendor portals will be replaced by a more flexible network.
- Balancing the speed of decision-making and the amount of information is another benefit. The speed with which many social media platforms provide video, audio, and documents from a wide network of vendors in real time gives a strong impetus to the process of decision-making. It is necessary to find a correct balance among the relevant information and the speed of the decisions, so as not to be caught up in a hurry, and evaluate the possible consequences.
- The continued demand for information on mobile devices requires instant access to news. Email usually proves insufficient for this task, while social media are better positioned.
- In order for an organization to maintain a competitive advantage its relationships with its vendors must move towards collaboration. The increasing demand for transparency requires close relationships with key vendors. From this point of view, Don Tapscott had already spoken to move from cooperation to the community.[57] Building a community where critical information, and opportunities, can be shared in real time will be one of the solutions for many organizations. Social media platforms provide foundations for these communities.

To do all that is necessary, however, it is necessary to build a platform for innovation. Engaging vendors through social media is one of the best and most agile ways to stimulate innovation in the value network.

Lavazza S.p.A.

When Lavazza started producing machines for making coffee,[58] this new activity required the management and coordination of a more structured activity with respect to its traditional production of coffee. This new activity led to the creation of the machine division. This division is responsible for the entire life cycle of the machines, from the development of new products to the after-sales service.

The development of new product lines occurred in collaboration with vendors. Lavazza created close partnerships with vendors at both the production and distribution phases and in the management of technical services.

The complexity of managing the full cycle of the production and servicing of the machines together with the dynamism of the market of reference have made clear the need for relationships and intense collaboration with vendors. The management of the machine division has developed over time several integration projects in order to make visible the production flow and constantly monitor processes from end to end.

A vendor in the Milan area has been entrusted with the production of a given family of machines. Lavazza and the vendor jointly developed a system for monitoring the production data. It allows the machine division, while being physically distant, to follow in real time the progress of the production lots. The vendor's processes have been integrated with the organization that distributes these machines in Italy. With this seamless integration between vendor and distributor, production batches are launched according to the demand that the distributor must meet. Lavazza has completely outsourced the production but not the production control.

In addition to production data, the system allows for the recording online of all quality control activities. The machine division management can monitor in real time the processes of the vendor. They can check if the processes are experiencing critical issues that require immediate action.

Another project allows for the collection of qualitative information on the market. In this way, drawing together the data on defects in house and in the field, it is possible to have a complete picture of the quality performance of the products and initiate a process of continuous improvement of the production process. This process is based on the real experiences of the customers.

In this case, Lavazza has developed a high level of integration between information systems. It has also created the conditions for a very transparent relationship with vendors. This provides for the adoption of an open book policy for cost analysis. It is possible to adopt shared goals of cost savings, while respecting reasonable margins for vendors.

The organization is acting on its information systems to operationalize even some automation to streamline the administrative processes between the two organizations.

TIM Telecom Italia Group

TIM Telecom Italia has implemented a Vendor Hub.[59] The portal allows current or prospect vendors and TIM Telecom Italia to share useful information and documents in order to develop business opportunities and improve relationships.

It is a closed social network, which so far has been joined by about 2500 vendors. Telecom Italy is using the network to have a continuous and collaborative relationship with its most important vendors.

Mitric S.n.c.

Mitric S.n.c. offers services for the management of internal organizations and the provision of network services.[60] One of the services is offers is called Angkor.

This service combines the concepts of social network and reverse auction. It allows for the management of relations between businesses and the retrieval of information about new contacts through a network of friends.

Web 2.0

Web 2.0 is a term used to indicate a general state of evolution of the Internet and in particular of the World Wide Web.[61] An important aspect of Web 2.0 is the development of tools for mass collaboration through the network. Web 2.0 differs from the initial concept of the Web, retroactively labeled Web 1.0, because it departs from the classic static websites, email, the use of search engines, and a linear navigation. It offers a World Wide Web that is more collaborative, agile, dynamic, and interactive.

Procurement organizations can work collaboratively in the creation and updating of the documentation of procurement. This can ensure consistency in the elements of the procurement documentation and allow for reuse upon request. The best example of this development is in collaborative engineering.[62] In this case, the design process is shared among different actors, which may be located very far from each other and in different organizations.

Other topics of interest in Web 2.0 concern a way of working based on voluntary cooperation and customer management through tools of cus-

tomer relationship management—CRM 2.0.[63] In the latter mode, there is the possibility of customer engagement in the organization of after-sales services through participation in a Web community.[64] In the case of the documentation of procurement, this could apply to the fact that several customers using the product can find similar problems or opportunities for correction. The sharing of experiences would be useful to the entire community of users.

Conclusions

Big data analytics can be of help in better managing the spending of organizations. The use of open data will increase more and more in the future.

It is commonly understood that there will be further developments in customer relationships with reference to procurement. For example, the flexibility and scalability, reduced risk, outsourced administration, and advanced logistics that are possible with the sharing economy provide agility.

The introduction of agile procurement requires a cultural change. In making procurement processes simple, it is also crucial to transfer the benefits to the staff who are required to use them so that success is guaranteed.

Notes

1. Chen, M., Mao, S., and Liu, Y. (2014). Big data: a survey. *Mobile Networks and Applications*, *19*(2): 171–209.
2. Hu, H., Wen, Y., Chua, T.S., and Li, X. (2014). Toward scalable systems for big data analytics: A technology tutorial. *IEEE Access*, *2*: 652–687.
3. IDC Digital Universe Study, sponsored by EMC, June 2011.
4. Manyika, J., et al. (2011) Big data: The next frontier for innovation, competition, and productivity, *Global McKinsey Institute Report*, June.
5. NIST (2015). NIST Big Data Interoperability Model: Volume 1, Definitions, *NIST Special Publication 1500-1*, 16 Sep.
6. See endnote 2.

7. http://procurementheads.com/procurement-leaders-have-their-say-the-impact-of-technology/, Accessed 28 February 2017.
8. Elaboration of the author from Connaughton, P., and Sawchuk, C. (2014). Procurement Analytics in the Era of Big Data: What CPOs Need to Know, *The Hackett Group*.
9. Baskarada, S. (2014). Qualitative case study guidelines. Baškarada, S. (2014). Qualitative case studies guidelines. *The Qualitative Report*, 19(40) 1–25.
10. https://www.bravosolution.com/cms/it/news-events/media-coverage/ufficio-acquisti-gennaio-febbraio-2009, Accessed 20 September 2016.
11. Teague, P. (2012). A Role Model for Advanced Analytics, *Procurement Leaders*, Sep. 10.
12. Morabito, V. (2015). *Big Data and Analytics: Strategic and Organizational Impacts*. Springer, Cham, Switzerland.
13. Ubaldi, B. (2013). Open Government Data: Towards Empirical Analysis of Open Government Data Initiatives, *OECD Working Papers on Public Governance*, No. 22, OECD Publishing, Paris, France.
14. Ubaldi, B. (2015). Open data e la nuova frontiera della fornitura di servizi innovativi. *Prisma Economia-Società-Lavoro*.
15. Nugroho, R.P., Zuiderwijk, A., Janssen, M., and de Jong, M. (2015). A comparison of national open data policies: Lessons learned. *Transforming Government: People, Process and Policy*, 9(3): 286–308.
16. Alvarez, J.M., Labra, J.E., Cifuentes, F., Alor-Hernández, G., Sánchez, C., Luna, J.A.G. (2012). Towards a pan-European e-procurement platform to aggregate, publish and search public procurement notices powered by Linked Open Data: the MOLDEAS approach. *International Journal of Software Engineering and Knowledge Engineering*, 22(03): 365–383.
17. Bizer, C., Heath, T., Ayers, D., Raimond, Y., Interlinking Open Data on the Web in "*The 4th European Semantic Web Conference*", 2007.
18. Gurstein, M.B. (2011). Open Data: Empowering the empowered or effective data use for everyone?. *First Monday*, 16(2).
19. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/78884/Open-Data-Consultation.pdf, Accessed 28 February 2017.
20. Vafopoulos, M.N., Meimaris, M., Papantoniou, A., Anagnostopoulos, I., Alexiou, G., Avraam, I., and Loumos, V. (2012). Public Spending: Interconnecting and Visualizing Greek Public Expenditure Following Linked Open Data Directives. Available at SSRN 2064517.

21. Rizzo, G., Morando, F., and De Martin, J. C. (2009). Open Data: la piattaforma di dati aperti per il Linked Data,. *International Journal on Semantic Web and Information Systems*, 5(3), 1–22.
22. Yu, L. (2011). Linked open data. In *A Developer's Guide to the Semantic Web,* (pp. 409–466). Springer Berlin, Germany.
23. Kuk, G., and Davies, T. (2011). The roles of agency and artifacts in assembling open data complementarities. *Proceedings of the Thirty Second International Conference on Information Systems*, Shanghai, China.
24. See endnote 23.
25. Cole, R.J. (2012). Some observations on the practice of "Open Data" as opposed to its promise, *The Journal of Community Informatics*, 8(2).
26. Kimball, R., and Caserta, J. (2011). *The Data WarehouseETL Toolkit: Practical Techniques for Extracting, Cleaning, Conforming, and Delivering Data*. John Wiley & Sons, Hoboken, NJ.
27. Vassiliadis, P., Simitsis, A., and Skiadopoulos, S. (2002). Conceptual modeling for ETL processes. *Proceedings of the 5th ACM international workshop on Data Warehousing and OLAP*. ACM: 14–21.
28. See endnote 26.
29. Soares, S. (2013). *IBM InfoSphere: A Platform for Big Data Governance and Process Data Governance*. MC Press. Online, LLC, Boise, ID, USA.
30. Davenport, T.H., and Patil, D.J. (2012). Data Scientist. *Harvard Business Review*, 90, 70–76.
31. Profile Sheet Wsp-G3-024 Data Scientist, http://www.skillprofiles.eu/stable/g3/en/profiles/WSP-G3-024.pdf, Accessed 14 April 2016.
32. Bates, J. (2012). "This is what modern deregulation looks like": co-optation and contestation in the shaping of the UK's Open Government Data Initiative. *The Journal of Community Informatics*, 8(2).
33. Tangi, L. (2015). Open government data: la situazione italiana studiata attraverso un modello di classificazione dei portali di pubblicazione dei dati. Quali azioni per una Pubblica Amministrazione più trasparente e vicina ai cittadini?, *Tesi Politecnico di Milano*, Dec., Milano, Italy.
34. Mynarz, J., Svátek, V., and Di Noia, T. (2015). Matchmaking Public Procurement Linked Open Data. In *OTM Confederated International Conferences "On the Move to Meaningful Internet Systems"*. Springer International Publishing, Cham, Switzerland: 405–422.
35. Blomqvist, E., and Thollander. P. (2015). An integrated dataset of energy efficiency measures published as linked open data, *Energy Efficiency*: 1.
36. http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=6758695, Accessed 3 April 2017.

37. https://data.london.gov.uk/, Accessed 3 April 2017.
38. https://www.omidyar.com/sites/default/files/file_archive/insights/Open%20Data_Six%20Stories%20About%20Impact%20in%20the%20UK/OpenData_CaseStudies_Report_complete_DIGITAL_102715.pdf, Accessed 3 April 2017.
39. This approach is shown as Collaborative Planning, Forecasting, and Replenishment (CPFR).
40. AMR Research, Beyond CPFR: Collaboration As of Age, http://web.mit.edu, Accessed 12 October 2017.
41. Rutkowski, A. F., Vogel, D. R., Van Genuchten, M., Bemelmans, T. M., and Favier, M. (2002). E-collaboration: The reality of virtuality. Professional Communication, *IEEE Transactions*, 45(4): 219–230.
42. Animp (2009). *Survey on e-Collaboration*, ANIMP document.
43. Wright, R.J., and Shiner, J.M. (2017). Managing Collaboration in E-Procurement. In *Digital Governance and E-Government Principles Applied to Public Procurement*. IGI Global, Hershey, PA.: 75–98.
44. Fontana, F., Lacchini, M., and Nicoletti, B. (1991). *Casi di Management e Organizzazione*, Giappichelli, Torino, Italy.
45. http://www.docstoc.com/docs/121531208/Il-Miglioramento-in-Avio-Sei-Sigma-e-Lean-Manufacturing, Accessed 22 October 2016.
46. http://dspace.unive.it/handle/10579/4159, Accessed 2 April 2017.
47. Secchi, R. (2012). *Supply chain management e made in Italy: Lezioni da nove casi di eccellenza, EGEA, Milano, Italy.*
48. Habibi, M. R., Davidson, A., and Laroche, M. (2017). What managers should know about the sharing economy. *Business Horizons*, *60*(1): 113–121.
49. Ajzen, I. (1991). The Theory of Planned Behavior Organizational Behavior and Human Decision Processes. *Taylor, S. and Todd, PA (1995) Understanding information technology Usage: A test of competing models, Information Systems Research, June*, *6*(2): 144–176.
50. https://www.pwc.com/us/en/technology/publications/assets/pwc-consumer-intelligence-series-the-sharing-economy.pdf, Accessed 25 April 2017.
51. Cleverley, W.O., and Nutt, P.C. (1984). The effectiveness of group-purchasing organizations. *Health Services Research*, *19*(1): 65.
52. http://www.consorzio-abc.it/, Accessed 03 April 2017.
53. Benkler, Y. (2006). *The wealth of networks: How social production transforms markets and freedom*. Yale University Press, New Haven, CT.

54. Casemore, S. (2012). Social Media and the Coming Supply-Chain Revolution, *CFO.com*, 29 Feb.
55. http://www.ict4executive.it/executive/approfondimenti/cinque-ragioni-per-integrare-supply-chain-e-social-media_4367215697.htm, Accessed 14 November 2016.
56. Heller Baird, C., and Parasnis, G. (2011). From social media to social customer relationship management. *Strategy & Leadership*, 39(5): 30–37.
57. Tapscott, D., and Williams, A.D. (2010). *Macrowikinomics: New solutions for a connected planet*. Penguin, London, UK.
58. See endnote 47.
59. http://www.telecomitalia.com/tit/en/vendorshub.html, Accessed 9 April 2017.
60. http://www.mitric.it, Accessed October 29, 2016.
61. O'Reilly, T. (2009). *What is web 2.0*. O'Reilly Media, Inc., Sebastopoli, CA.
62. Nicoletti, B., (2008). Project Management 2.0, *IPMA Congress*, Roma, Italy, Oct. 10–13.
63. Greenberg, P. (2010). The impact of CRM 2.0 on customer insight. *Journal of Business & Industrial Marketing*, *25*(6): 410–419.
64. Kim, A. J. (2000). *Community building on the web: Secret strategies for successful online communities*. Addison-Wesley Longman Publishing Co., Boston, MA.

6

Processes in Agile Procurement

Introduction

Agile procurement requires the re-engineering of the processes of the organization. In doing so it is necessary to consider all processes and their activities. The objective must be agility, hence leanness of the processes and their digitization.

Procurement involves a series of processes as well as providing support for strategic choices (see Fig. 6.1):

1. It begins with an assessment. In other words, it is necessary to analyze the processes of the organization and understand what to outsource (make, buy, or partner). For most SMEs, the process of buying and managing the network of vendors is entrusted to specialized e-procurement platforms provided by external organizations.[1] Large organizations typically prefer to invest in an internal platform for e-procurement.
2. It continues with the definition of the supply network through a process of searching for new vendors (scouting) and choice of vendors.
3. The next step is the definition of rules and a system of management of the supply network, with solutions for classification and clustering of vendors.

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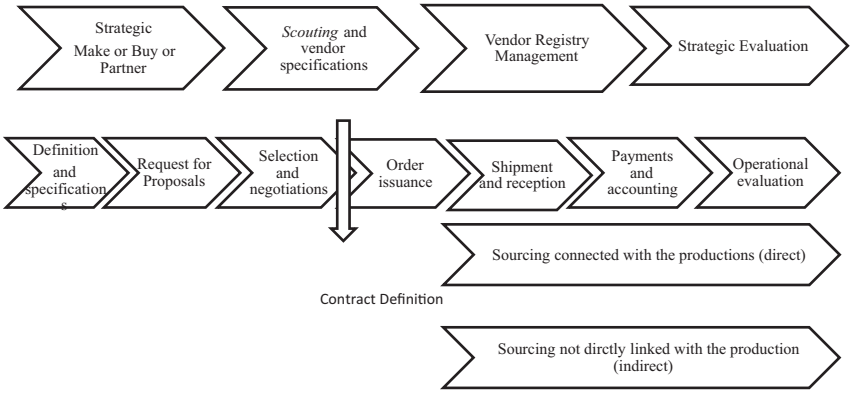

Fig. 6.1 The basic processes of sourcing

4. Finally, the organization needs to make judgments about procurement decisions.

Process business intelligence, analyzed at the end of the chapter, can provide special benefits to the agility of procurement.

Structure and Activities of Procurement Processes

The processes of procurement are complex. They include many activities at three different levels: strategic, tactical, and operational. The overall process is sometimes referred to as P2P (Procure to Pay) or S2P (Source to Pay), to show that it is end to end, from the requirements of internal customers to the final payment for the acquisition of the goods and services.

The goal of the processes of procurement is to ensure the efficient communication of information between users, the staff of the procurement organization, vendors, and the accounting department. Once the information flows to the vendors, the process must ensure an efficient flow of supplies from the vendor to the end user. In parallel there is the financial flow, including orders and vendor invoices up to the administration and accounting. In synthesis, procurement implies three flows:

- informational;
- physical;
- financial.

Procurement processes must be effective, efficient, and economical. They must also comply with an additional "E": they must be ethical, in the sense that there must be an effective control to prevent abuses and ensure compliance with internal regulations and applicable laws.

Many functions are involved in the processes of procurement: engineering, sourcing, logistics, warehousing, operations, quality, finance, administration, and project management. All of these entities must work together according to the procedures and the specific characteristics of the end customer.

Procurement processes include the sourcing process (see Table 6.1). The first stage of this process is the definition of requirements. At that point, the organization needs to decide whether to make, buy, or partner. In other words, for each good or service, it is necessary to decide whether to produce it inside the organization, buy it, or find partners to provide it. If the decision is to buy, buyers with the support of the users should select the vendor and start the negotiation phase. Finally, during and after the delivery, the organization should evaluate the vendor (the so-called vendor rating) in order to create over time a valid set of competent vendors (the vendor register). Such a vendor register can also be created through a specific process of certification or qualification prior to admitting vendors to the tenders.

A clear description of the activities carried out by every single function of the organization in the processes of procurement is important. A study of the activities can highlight areas with low benefits, which can be outsourced or, if possible, eliminated, or reduced substantially.

In the procurement processes, it is useful to distinguish the following main activities:

- issuing an acquisition request (AR);
- choosing a vendor;
- issuing the order;

- receiving the goods or services;
- managing the invoices (controlling, approving, and accounting);
- paying the invoices;
- evaluating the vendor (vendor rating).

Each macro activity can be further broken down into other micro activities (see Table 6.1).

Table 6.1 Procurement processes

Procurement processes	
Requirement	
Micro activities	Need supply
	Formulation of the acquisition request (AR)
	Request approval
	Issue of AR
	Reminders
Sourcing	
Micro activities	Reception of AR
	Request for purchasing
	Negotiation
	Issue of order
	Request for confirmation
	Distribution of copies (administration)
	Storage orders
	Solicitation
Reception	
Micro activities	Reception supplies
	Checks
	Clarifications with suppliers
Finance	
Micro activities	Invoice receipt
	Control and approval
	Possible request for clarifications
	Bills payment
	Invoices archiving
	Any clarification with the banks
Procurement	
Micro activities	Rating of provider (vendor rating)

Strategic Procurement

The initial phase of procurement is a strategic decision by the organization associated with making the activity/product inside the organization, acquiring it, or partnering with a third party. All three cases involve the procurement organization. The first case requires acquiring raw materials and/or components and/or services. The second case requires acquiring complete goods or services. The third case requires finding a partner to work with.

Generally, there is a distinction between the functional and technical specifications and the product specifications:

- The functional and technical specifications of the product allow the organization to segment the vendors in order to define, coordinate, and direct the sourcing policies towards the business objectives.
- The product specifications or specific purchase order refers to all the specifications necessary to select the right vendor, including specifications of quality, logistics, maintenance, legal, ethical, environmental needs, and budget, in line with the policies and strategies of the organization.

For improved organization of the sourcing process, after the definition of the product requirements the procurement management can adopt a portfolio of purchase. The Kraljic model divides the purchases of an organization into four classes in a matrix according to two variables:[2]

- complexity of the market supply (monopolies, barriers to entry, technological innovation);
- importance of the purchases (determined by the value of the product category and the total value to be purchased).

In accordance with this classification, the organization can define the optimal sourcing strategy for each of the four types of components/product classes identified by the matrix. The goal is to maximize the benefits for the organization.

Importance	Supply Risk: LOW	Supply Risk: HIGH
HIGH	**Leverage Purchases** Emphasis on profitability (negotiation, bargaining power, volume, fluid flows) Exploit purchasing power and minimize costs	**Strategic Purchases** Emphasis on long-term availability (guarantee supply, alliances, demand forecasting) Form partnerships
LOW	**Non-critical Purchases** Emphasis on efficiency (irrilevant purchases) Simplify and Digitize	**Bottleneck Purchases** Emphasis on the stability of supplies (guarantee of supply, long-term contracts, safety stocks) Ensure supply

Fig. 6.2 The supply matrix (Kraljic)

The Kraljic matrix defines the following types of procurement items (see Fig. 6.2):[3,4]

- Non-core (non-critical) includes components with a low impact on the organization. They are available in abundance and/or in low-risk markets. For these types of components typically, procurement periodically negotiates a model agreement and then delegates responsibility for purchasing them directly to the business management.
- Those with multiplier effects (leverage) are important components for the organization, but they are available in markets with low risk and plenty on offer. The optimal management of this category of purchases needs to ensure a satisfactory outcome for the organization. For this type of component, organizations tend to make the most of their bargaining power and the abundance of supply with frequent negotiations.
- Components subject to bottlenecks are those with a low impact on the organization in economic terms. For them, the continuity of supply is at risk. The management of these components is aimed at creating relationships in the medium to long term between customers, vendors, or partners to ensure provision, with less emphasis on price.

- Strategic components are important for the organization in terms of both economic impact and the conditions of supply of complex and/or risky markets. In this case, the horizon is the medium to long term, with continuous monitoring of the commercial situation of the market, technical development, evaluation of make, buy, or partner, creation of alternatives, and the development of a stable partnership and full cooperation with the vendor.

Sourcing Marketing

The sourcing process is one of the basic processes of organizations. It changes over time as there are changes in the strategy, the organization and the persons, and as new technologies are introduced. From this point of view, the sourcing marketing mirrors the marketing for sales. The elements that form the basis for efficient management of this function are:

- the search for potential partners and suitable vendors starting from the needs that must be met;
- their qualification and classification;
- the continuous updating of the vendor register.

Issuance of the Acquisition Request

An operating department issues an AR based on:

- planning purchases of raw materials and semi-finished products in accordance with production plans;
- planning purchases of spare parts and technical materials (in accordance with the programs of ordinary and extraordinary maintenance of machinery or products);
- decisions to acquire some services externally.

The AR is sent to the management with the power to approve. Once the request is approved, it is sent to the sourcing department.

The informational input at this stage includes:

- plan or schedule;
- functional specifications:
- technical specifications;
- purchase approval;
- forecast of use according to the plans or customer request.

The output at this stage is:

- the acquisition request.

The acquisition request must contain the following information:

- issuer;
- functional and technical specifications of the goods or services to be acquired;
- quantity and unit of measure;
- date and place of delivery;
- approvals;
- available budget;
- account or class of posting;
- any additional data.

Activities related to this process are:

- checking the needs of the material or services;
- preparing the acquisition request;
- approvals required;
- approvals;
- issue order;
- solicitations.

Research on the Market of the Vendors or Bid

Given the definition of the requirements of the product or service, the buyer can start looking into the vendor market, following a sequential process:

1. definition of the contracting method;
2. qualification of the vendors;
3. analysis of the bids received;
4. selection of the vendor.

The first step is closely related to the concept of procurement risk. This refers to those events that may affect the realization of the supply, and whose presence cannot be forecasted with accuracy. The contracting parties influence it. This aspect of the process involves an appropriate attitude of the contracting parties towards risk, which influences the type of contract. The choice between the different types of potential contracts varies according to the amount of funds the buyer must invest in the terms of contract, and the ways of payment of the contract.

The buyer with the support of the users should prepare a list of potential vendors and rank them in order of preference. Prior to this, the buyer should have sent a Request for Information (RFI) to all potential vendors to gather information on their previous experience. The objective of the RFI is to collect information on the qualifications of the vendors for the order or for that category of orders. This mode allows for making a short list of potential vendors based on the information collected. The buyer can then send a Request for Proposal (RFP) in order to receive offers to compare with each other and to the specifications. Once the bids have been received, the final phase of the selection process begins. This can be done quickly, if the buyer has prepared a technical and commercial evaluation grid of the vendors. The grid should take into account technical, logistical, quality, financial, legal, and pricing aspects. From this point of view, it must consider the total cost of ownership.[5] This approach, developed in 1987 by Gartner, is important. It should take into account the

cost of the purchase of components, installation costs, those of operations, and the cost of disposal of the supply at the end of its economic life.

Vendor Selection

The choice of a vendor is a delicate phase for an organization. There should be a list of approved vendors by sourcing categories and by part number (for items previously purchased). Normally SMEs use public catalogs accessible on the web. For the purchase of important items, vendor selection is strategic. The vendor, in fact, must have the capability to supply the product with the required quality and time, in the necessary quantities, and at competitive prices. There are different strategies for selecting vendors:

- In cases where there is only one possible vendor, there is no choice. This is true in the case of patents, specific technical and/or special raw materials, physical location, and the like.
- More sources of supply involves pursuing the advantage that comes from competition. In this case, it is possible to try to obtain the best price. A tough negotiation would not be beneficial for developing a stable relationship with the vendor.
- Single source means that even if there are multiple vendors, procurement chooses one with which the organization has established long-term agreements or a partnership.

Often the buyer is conditioned to choose a vendor based on reliability, after-sales service, or geographic location. It might also be important to consider:

- better payment terms;
- mutual business;
- willingness to hold stocks for the buyer.

For the selection of vendors it is useful to prepare a vendor assessment grid, weighting the scores based on the most important features.

The bidding phase ends with a proposal for selecting a specific vendor. The document must state the selection criteria and the ranking, underlining the reasons that have been considered. Once the vendor is approved, the buyer should start negotiations with the vendor to define fully the price, terms, and conditions. The assignment may also be awarded to more than one vendor when the preferred policy is to buy from more than one vendor to reduce the risk of being locked in by a vendor or limited by vendor capacity.

The informational input at this phase includes:

- AR;
- catalogs and technical and/or commercial information;
- vendor register;
- assessment of the vendor.

The result of this stage is the identification of the vendor that best meets the requirements of the organization.

Negotiation

Once the vendor has been selected, the next step is to negotiate the contractual terms and conditions. The functional and technical specifications of the supply also influence the decisions on the market conditions and legal and contractual obligations. This is a limitation on the use of standard contracts for sourcing, as available for example on the Web or from organizational associations.

During negotiations it is possible, for particular characteristics of the order, to bargain on the price, the conditions of delivery, and the terms of payment. The criteria should be to ensure mutual benefits. Price is not the only factor to consider when making sourcing decisions. It is effective only when all the other elements are equal. The price has an upper and a lower threshold. The market determines the upper limit; the seller calculates the lower limit based on processing costs, profit expectations, and competition in that specific market/product. The greater the buyer's expertise and bargaining power, the more they can negotiate on the price.

Normally, the final decision should be taken in accordance with the following sequence:

1. send an inquiry to multiple vendors;
2. receive bids;
3. make a comparison based on quality, price, delivery time, and other conditions of supply.

In the case of repetitive purchases, choosing the optimal vendor for each category of products is simpler. The organization knows the potential vendors and already has relationships with the vendor organization or group that owns the organization. In the case of major purchases, it is necessary anyway to negotiate. From the point of view of the buyer, a fixed price for the entire supply is preferable in terms of cost control and budget management.

Other aspects must be taken into account, such as the prices of spare parts when the purchase is relative to equipment or machinery, which includes operations/maintenance costs. The real comparison should be done based on the total cost of ownership (TCO).[6] The buyer should handle with care contracts with foreign vendors due to the presence of foreign supply and exchange risks. In these times, currency exchange rates vary greatly and can significantly affect the TCO.

Contracting

The practice of procurement distinguishes between three main categories of contracts:

- A fixed price contract is an agreement whereby the contractor is paid a fixed price for the supply or project. A fixed price contract is preferable if the purchaser intends to reduce costs and wants to subcontract a simple supply or project where performance is easily verifiable.
- Reimbursement of costs or cost-plus is a contract to reimburse for costs. This is characterized by the willingness of the buyer to pay all costs of production and to pay a contribution for the supervision

and the vendor margin. This type of contract is applicable when it is not possible or very expensive to check contractually the measures of performance and when contractors can affect costs without hurting performance. Cost-plus contracts are used in situations where the work cannot be specified properly, or when the fixed price contract involves a high risk of capital and vendors. Cost-reimbursement contracts are based on a fixed timetable for the work and equipment. The disadvantage of this type of contract is the absence of incentives to undertake cost-cutting or to limit costs by the vendor. The buyer should choose this contract only if the vendor control is cost free or costs less than the adoption of this provision. It is also important that the vendor keeps track of the operations. A maximum price is fixed in the contract and it can be surpassed only by written agreement.

- Between the two extremes of the previous types of contracts, incentive contracts include incentives related to compliance with the objectives and performance improvements. These fixed price contracts plus incentives are appropriate for projects involving complexity and uncertainty. They are used to motivate vendors to perform above the agreed standard. The incentives usually refer not only to organization cost reductions, but also to early completions, higher reliability, and better quality performance. Because of these aspects, contracts at a fixed cost plus incentives are not appropriate in situations where the quality is not verifiable.

The choice of contract type depends on a number of factors, such as:

- completeness of the tender—the absence of fully defined specifications tends to make a fixed price contract unfair;
- available time for the creation of a competitive process, as opposed to starting procurement immediately;
- technical competence—if the job requires special knowledge or skills, a cost-reimbursable contract is probably preferable;
- knowledge of the sector—increased knowledge makes possible agreements that are more precise.

Penalty and Warranty Conditions

Agreements with vendors must ensure quality, timely delivery of products, and service levels. In the case of foreign purchases, the clauses of the contract must reflect the legal system of the country of the buyer, which might differ from that of the country of the vendor. Whichever type of agreement is chosen, there should be contractual provisions that the supplies and their use do not pose any risk with regard to the health or safety of persons, property, the environment, or the respect of the laws in the countries involved in the supply. The agreement should include strict clauses covering the performance of the products or services to be delivered. There should be provisions for penalty or corrective measures in the event that these services are not met. These measures must have legal value. If possible, they should be covered by insurance. Their goal should be to limit damage as much as possible and provide incentives for the vendor to comply with the agreed terms.

Other Terms and Conditions

The agreement with the vendor must take into account the terms and conditions of the sourcing contract, such as:

- quality assurance and safety/security regulations;
- transfer of rights and duties;
- any contract with third parties;
- specific terms of delivery.

Buyers strive to prescribe the conditions of their organization. In practice, a vendor tends to accept an order only if it is based on their own sale conditions. In these situations, some additional negotiations might be necessary and, especially, a closer review of the vendor's contract clauses. There have been attempts to standardize agreements worldwide. Incoterms is an example of these efforts. Such organizations allow the parties to express their agreement quickly, with minimal fuss, and with few problems of language and interpretation.[7]

Commodity prices depend on supply and demand. They can have large fluctuations. In this case, it might be possible to negotiate the currency of payment, the price variation formulas, and so forth.

Order Issuing

Once the proper evaluations and negotiations have been completed, the sourcing department issues a purchase order or a contract. This document is a legal commitment to buy. It is prepared based on the acquisition requests, supply, vendor chosen, and other information. Once accepted by the vendor, the purchase order becomes a legally binding document for the delivery of goods or services as stipulated in the terms and conditions specified in the agreement of purchase. The purchase order execution represents the ultimate expression of the will of the parties.

The mode of delivery of the purchase order may be a fax or a digitally signed and certified document sent via email. Once issued, the purchase order is distributed to all interested parties. Copies are sent to the vendor, the accounting department, the issue's requestor, and the department that receives the supply. Following the issuance of the order, some organizations request an order confirmation from the vendor containing all order data with the agreed prices.

The input data for this activity are:

- data of the selected vendor and supply.

The outputs in this phase are:

- purchase order (PO);
- order confirmation.

Activities related to this process include:

- receiving the acquisition request;
- issuing the order;

- distributing copies of the order;
- updating any internal archive or application;
- storing the order.

Follow-Up of the Order

This phase is relative to the monitoring of progress in the order processing. The objective is to ensure that the delivery dates are respected. The vendor is responsible for the delivery of goods and services ordered according to the agreed time and place, conditions, and service levels. If there are doubts about compliance with the delivery dates, the sourcing department has to take appropriate corrective action in due time to speed up the transportation or use an alternative vendor. The sourcing department is responsible in case of change in the requirements of the provision. The request may change over time, it may be necessary to solicit or delay some items, or to modify other items of the order.

The informational input at this phase includes:

- reminders or variations from the requiring department;
- vendor registry with indication of potential alternative vendors.

The output at this phase is:

- reminder or change in the vendor.

The activities related to this process are:

- sending reminders or notices of change in supply;
- negotiation with an alternative vendor, if necessary.

Administration Management

This phase is the responsibility of the user, procurement, and the accounting departments. Upon receipt of the vendor's invoice, with the support

of the acquiring department, procurement shall verify the congruence of three documents (three-way match):[8]

- the purchase order;
- the acceptance report;
- the invoice.

The same items and the same amounts must appear on all three documents. The prices on the invoice and any discounts should be the same as those on the order. In case of differences, the sourcing department must resolve any issues with the vendor. After verification, the invoice is sent to the accounting department for posting and subsequent administration of the payment authorization. Once they have been paid, invoices must be stored for operational and legal reasons.

The informational inputs at this phase are:

- invoices;
- acceptance reports.

The outputs at this phase are:

- invoices paid and stored;
- accounting posting.

The activities related to this process are:

- receiving invoices (accounting);
- requesting approval (user department);
- examining any clarification (accounting);
- paying the invoices (administration);
- posting (accounting);
- filing of the invoices (administration);
- seeking clarification from vendors and/or banks (sourcing and administration).

Vendor Rating

The final step is among the most important. The role of procurement continues even after the new product has been accepted, or the new service is operating. These activities include:

- documenting and recording the performance of the vendor;
- monitoring the quality of the supply;
- evaluating the work of the vendor from the point of view of its competitiveness and innovation;
- updating the so-called vendor rating.

There are two aspects relative to the vendor rating:

- The first is the "before," or the vendor qualification. It is useful to include the vendor in the vendor registry in order to reduce the lead time of the procurement process.
- The second is the "after," or the supply rating. It is useful to evaluate the performance of the products, service, or vendor periodically.

The second rating requires the updating of information on vendors and their performance. The rating should be based on the following parameters:

- quality of the services provided;
- on-time performance;
- fairness in the pre-contractual stage and in the implementation phase;
- security.

The use of this information management is a major source of value added in the sourcing process. This knowledge of vendor performance can be used in subsequent purchases by setting up a short list of vendors for new supplies in the same category. Vendor rating feeds a virtuous cycle based on knowledge. It helps the organization reduce its vendor base by continuing to work with those vendors who have proven to be (more) valid, based on objective criteria such as excellent vendor ratings.

Improving Processes

The improvement of procurement requires the improvement of all processes related to it. The quality and agility inherent in these processes is normally better than it was in the past. However, this does not mean that the processes cannot be improved, and therefore they still require support interventions. From this point of view, agile procurement can provide many opportunities in terms of functionality that can be improved on and in terms of relevance to the organization. In some cases it is mainly the basic functions that are computerized. The right approach here is to lean and digitize (see an example of the process in the redesign and digitization of transport in the Italian railways (FS) in Fig. 6.3).[9]

In the past, packages to support procurement activities in an integrated way were not available (Table 6.2). Large shippers began to develop their own applications. Today ERP systems are often used to manage the value network. There are commercially available systems to support the specific activities of procurement. For example, several vendors sell systems to support transport with interesting features in terms of relationships with the logistics vendors (see Figs. 6.4 and 6.5).

B&B Italia

B&B Italia S.p.A. is an Italian modern furniture company whose products are sold worldwide.[10] The Busnelli family, who owns and manages the company, founded it in 1966.[11]

In 2008 B&B Italia began shipping the furniture it produces directly to customers. The goal is to reduce the movement of the finished product in order to reduce waste. This organization started to use an external vendor to operate as a warehouse, besides being a manufacturing site for part of the process and a logistics hub. The establishment of this center resulted in a highly successful project. For example, its total cost of operations is the same as for the external logistics vendor despite a double-digit growth in the volumes handled. B&B Italy plans to move forward on this path. The next step would be to outsource the logistics partner as part of the packaging and shipment. In this way, it would be possible to improve the customer service and reduce the costs of handling, storage, and transport of finished products, making them flexible and variable with the volumes managed.

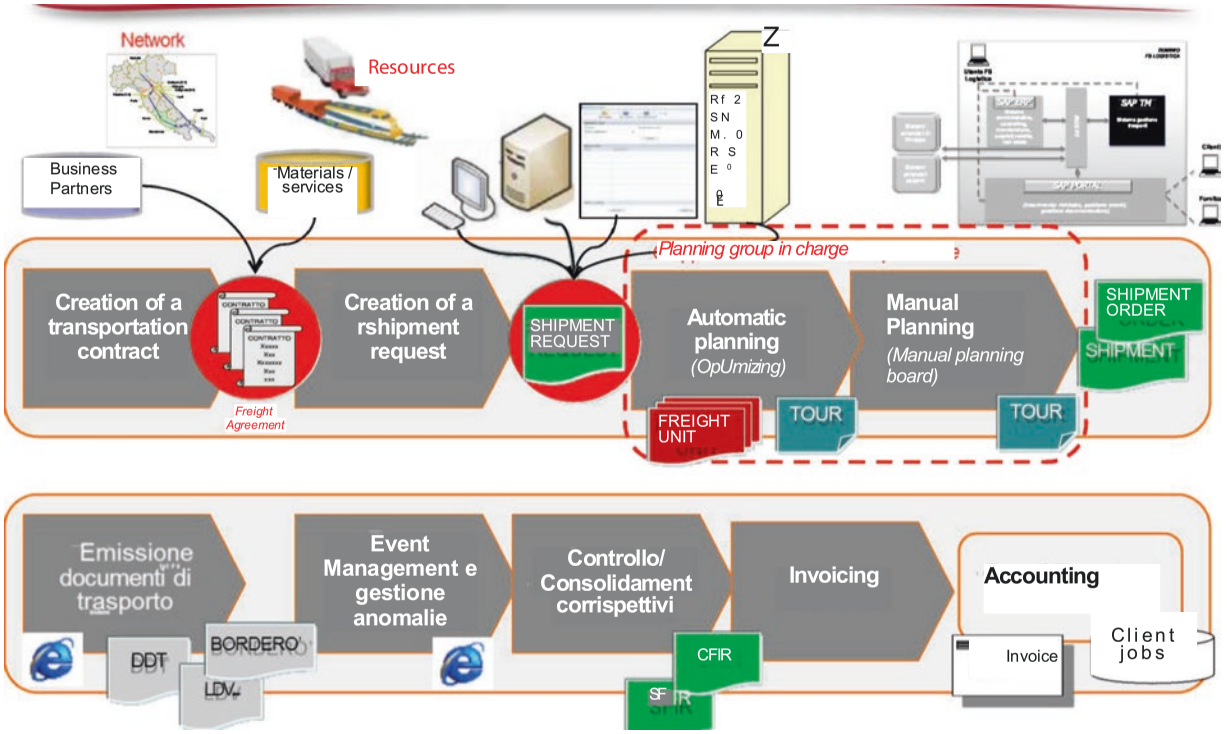

Fig. 6.3 Functionality of a process of transportation. (Musumeci A. (2012), Un caso reale di realizzazione di un Big Data nel Gruppo Ferrovie dello Stato, Big Data Forum, Nov. 21)

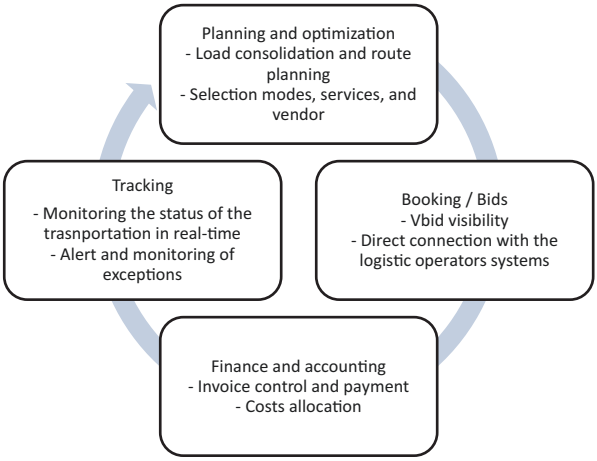

Fig. 6.4 Capabilities and decision-making level

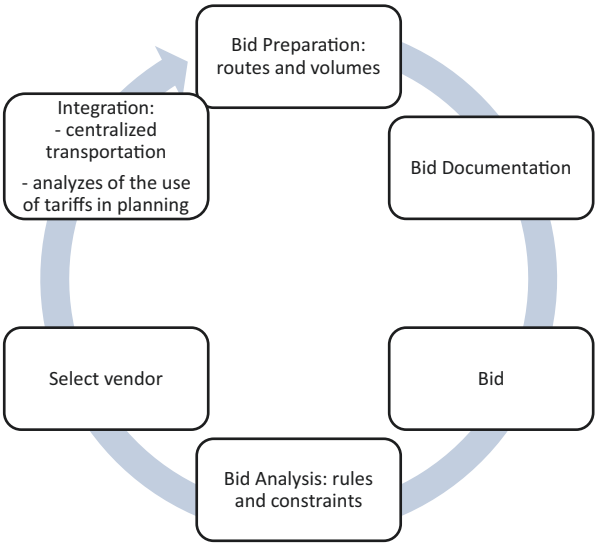

Fig. 6.5 Capabilities of a logistics system in relationships with vendors

Table 6.2 Capabilities and decision-making level

Decision level	% Functionality support
Basic functionalities	
Data	79
Documents	50
Transactions	59
Advanced functionalities	
Coordination and control	40
Decision-making	47
Collaboration	17

The support of the base functionality is essential for the support of the advanced functionality

Procurement Process Intelligence

Today it is essential to maximize the value delivered to the organization by procurement. In the current conditions of volatility, it is difficult to forecast certain variables that can come into play and disrupt programs. It then becomes essential to increase the agility of the organization. To achieve this, it is important to act on the processes and systems. This means:

- modernizing and improving the efficiency of the processes of procurement (online auctions, orders via the Internet);
- optimizing the price/quality, ensuring the quality standard of supplies and ancillary services;
- rationalizing spending on goods and services;
- creating a network of communication with the market of supply.[12]

Many organizations have projects dedicated to improvement. For example, Novartis has a system and process team for the implementation of internal processes and a research group focusing on opportunities in procurement.[13]

This book goes beyond these steps and proposes the implementation of agile procurement. Unlike traditional methods that focus on limited organizational and operational aspects, this approach argues that the transformation project must include two simultaneous stages:

- improvements of the process through, for example, the use of the method of Lean Six Sigma, with the immediate implementation of the aspects that do not require automation, such as new organizational and operational models, elimination of unnecessary activities, and so forth;
- automation of management processes which lend themselves to digitization.

To achieve this in the case of agile procurement, it is important to adopt a model of business process intelligence, also referred to as procurement process intelligence. This is an innovative approach focused on measuring and managing the procurement processes.

The term procurement intelligence refers to an investigation process, in both micro and macro terms, of procurement.[14] It is also a market research activity leveraging a range of quantitative and qualitative tools, creating forecasts, running simulations, and statistical modeling. The outcome is a structured and clear understanding of matters such as categories to monitor, demand criticalities, vendor evaluation, risks related to the value networks and market analysis, cost projection, and other aspects. The objective is to assess dynamically the fit of the procurement processes to the organizational strategy.

In brief, procurement intelligence is the group of activities that provides well-structured and timely information in order to support and challenge procurement decisions and make procurement more agile. Atkinson (2007) reported an increasing enterprise demand for procurement intelligence, a trend that has been strengthened by the turbulent economic environment.[15]

Traditional business intelligence (BI) has strategic importance within procurement. The ability to manage and make optimal use of information assets is key to defining successful strategies and improving their competitiveness. The analysis of the data obtained using BI solutions, however, is not sufficient. In order to improve their performance organizations should:

- discover trends;
- hypothesize about possible scenarios;
- make operational decisions based on detailed information provided;

- act accordingly and coordinate with all institutions and persons involved;
- check the effects of the possible actions to be undertaken.

Traditional BI allows for making decisions consciously and quickly. It increases the capacity of response to the emergence of critical situations. The use of advanced analysis, made possible by BI, allows an organization to act quickly upon the occurrence of a critical condition and to prevent inefficiencies.

In an article in the *Harvard Business Review*, Tom Davenport presented a model of the development of analytics over time:[16]

- Analytics 1.0 is business intelligence before big data analytics. It was mainly devoted to analyzing small internal problems since the amount of data available was small.
- Analytics 2.0 was a step forward thanks to the rise of big data analytics. It can be used for predictive analytics as well as historical analysis.
- A new wave is Analytics 3.0. It applies powerful data gathering and analysis methods to an organization's operations and to its offerings. It thus embeds data smartness into the products and services that customers buy.

A quotation from Tom Davenport is interesting:[17]

> The most important trait of the Analytics 3.0 is that not only online companies but virtually any type of companies in any industry, can participate on in the given economy.

Procurement process intelligence is business intelligence in the approach of Analytics 3.0 focused on the optimal management of procurement processes. It has a major innovative aspect. The traditional approach of business intelligence is essentially aimed at analyzing information, and in some cases allow simulations (what-if analysis). In the case of procurement process intelligence, the process also provides for the possible direct action on the same through:

- expert systems;
- appropriate actions;
- the use of collaborative tools.

The emphasis is therefore on systems that can act in continuity (real time) and take direct action, in a sequence, quickly and focused on the process. Thanks to the rapid implementation of this approach, its ease of use, high flexibility, and the peculiarities of the process, it must be possible to:

- increase the level of responsiveness;
- identify and analyze critical indicators in real time;
- make decisions at all levels of the organization.

The development of procurement process intelligence should include the following steps:

1. define the objectives to be achieved;
2. record activities: this means to examine in depth the processes, identifying a beginning and an end, its repetition in time and run, with the support of tools;
3. define an architecture solution for procurement business intelligence to adopt;
4. make transparent the process of procurement in order to know immediately the progress of improvements;
5. process the data and produce statistics, taking into consideration a set of activities and giving a summary over one or more dimensions (time, quantity, time distribution, resource, quality, and anomalies);
6. compare data for measuring changes, transposing the statistical measure in a structured form that is visual and easily interpretable (pie, bar chart, table, graph, and so on) with comparison over time;
7. analysis of expenditure: this represents the fundamental "ingredient" for success. The contribution to the visibility of the process is critical, so much so that it is sometimes referred to as spend visibility;
8. actively check and continuously monitor the performance of processes, organizations, or functions and signal when they fall below the set thresholds.

Such solutions help the organization to increase the value that the procurement function brings to the customer.

Improving processes is essential for transforming the procurement organization from an "order issuing factory" to a function that adds value to the organization through the vendors. In some organizations (such as Schneider Electric), it has been possible in some cases to save up to 60% by using these processes.[18] Bayer in this respect has used interesting approaches to optimize travel expenses.[19] Carlson Wagon Lits has provided ICT tools that allowed Bayer to optimize expenses in this area by analyzing the characteristics of business journeys. This analysis supported the definition of more precise rules for corporate travel.

The main components of procurement process intelligence include:

- forecasting;
- procurement strategizing in accordance with and in support of the organizational strategy;
- planning;
- budgeting;
- collaborating;
- executing;
- monitoring;
- spending analysis.

The following sections describe the most important components of procurement process intelligence.

Forecasting, Procurement Strategy, Planning, and Budgeting

In order to integrate procurement forecasting, strategy, planning, and budgeting in a single solution with business intelligence, it is important to have a collaborative platform that can provide the same analytical and planning tools. It is therefore important to design and implement processes and systems to support and facilitate rigorously and flexibly all planning processes (long, medium, and short term) that the organization intends to adopt and put under control in procurement.

The first stage in developing procurement agility takes into consideration what and how many products to produce, and what, if any, parts or components should be produced at which plants or outsourced to capable vendors.[20] These strategic decisions regarding production must also focus on capacity, quality, and volume of goods, keeping in mind that customer demand and satisfaction must be met.

The modules of forecasting, strategy, planning, and budgeting must support collaborative management of scenarios and other features. Their goals are to analyze the consequences of the decisions in order to:

- share future results;
- simulate alternative hypotheses;
- prepare and validate a focused schedule.

These forms must be completed by a component of performance management. It must underpin the processes of planning, both strategic and operational, the procurement in line with the needs of the organization.

The platform needs to support in an innovative way the following activities while providing a unique flexibility due to native integration with business intelligence tools:

- flow forecasting;
- strategic and operational planning;
- economic and financial planning;
- budgeting;
- simulating the consequences of possible choices;
- managing profitability and costs;
- producing dashboards on synthetic process activities.

The solution must be flexible. It should:

- adapt to the needs of planning and control required by procurement;
- provide a workflow designed to make the organization strong and consistent with the process of collecting data and approving the decisions to be taken.

The body of procurement using modes of operation of the process must be able to:

- communicate the organization's strategy;
- implement and monitor its performance;
- have an "influence" at all organizational levels necessary to ensure that what is planned is then effectively executed.

Execution

With support on the processes execution, the system should allow procurement to integrate information, decisions, and actions. It is necessary to move from collaborative decisions to their effective implementation (for example, the issuance of an order) with a single mouse click and directly in the assay system the same information that generated the decision. This requires:

- integrating processes by monitoring in real time all procurement key performance indicators (KPI), namely the critical variables under observation, and correlating them, thus generating intelligence;
- using intelligence inherent in the system to manage unplanned events collaboratively, providing all the actors of the extended organization the optimal indications to follow in order to maximize the critical indicators of performance defined for that specific process;
- closing the circle by running or triggering the actions necessary to implement the decisions taken by the procurement staff or by the system itself.

Collaboration, Monitoring, and Spending Analysis

The functionality of the procurement process intelligence system must provide all analyses typical in procurement, from spending on each vendor to on time delivery. They should also make it possible to assign scores to vendors based on the quality of their supply. This allows for increasing the bargaining power of the organization, since it is possible to define a procurement

strategy based on the vendors. These systems offer valuable support in containing spending on goods and services. KPIs simplify the analysis by allowing for a synthetic vision of the status and trends in procurement.

Analytics can be used to support business process intelligence. This section concentrates on a specific type of analytics: operational analytics. It supports the operations of business process intelligence to improve the agility of the operational processes.

Operational analytics in its simplest terms is analytics done on the fly as part of the operational business processes. By way of contrast, investigative analytics is done at the speed of research, not the speed of operational business processes. There are border cases in this version of the dichotomy, such as when the analytics is highly urgent yet otherwise investigative in nature. Operational analytics is becoming interesting also because it can be made thanks to technology of in memory database.[21]

Operational analytics includes but is not limited to (and some of these overlap):

- planning:
  - segmentation of demand information flow;
  - value network synchronization;
  - dynamic detailed scheduling and sequencing;
  - right-sourcing;
  - end-to-end fuel management;
  - automated risk analysis;
- inventory management:
  - end-to-end product supply improvement;
  - stockless value network;
  - real-time replenishment;
- control:
  - monitoring of logistics and operators;
  - online conflict alerting;

- digital integration of point of sale (POS) data;
- following customer interactions;
- in general, much of what might be called "next best action."

The result should be a digitized work supply. In other words, it makes more and more sense to replace the investment in inventory with investments in data.

The objective is to implement the following cycle:

- enterprise automation to help in planning, with:
  - transport management systems;
  - asset management systems;
  - imaging;
- mobile to get actual data in real time:
  - electronic on-board recorder (EOBR);
  - engine data
  - Global Positioning System (GPS);
- analytics to improve:
  - big data;
  - business intelligence;
  - predictive analytics;
  - operational analytics.

The main objective of operational analytics is to arrive at a digital customer-centric value network. By improving visibility, it is possible to move in successive steps:[22]

- lagging: monthly planning driven by shipment;
- common: monthly planning with mid-period adjustments;
- leading: weekly planning driven by integrated demand signals (as done, for example, by Zara, the Spanish apparel retailer);[23]
- excelling: real-time adjustments ("sensing and responding").

R.J. Reynolds's use of operational analytics has allowed for arriving at a segmented agile value network for new product introduction.[24] This allows for proactive management of the procurement risks by implementing exceptions-based planning and sustaining the fill rate targets for products.

Operational analytics is strongly connected to the lean and digitize approach.[25] To improve a process, reduce cycle times, and cut waste requires essentially "knowing" the process and especially measuring it. This means essentially having data and facts on the process. On the other hand, with modern systems and sensors, the amount of data available is huge, hence the need to combine in a synergic way the leaning of the processes with their digitization. Once the process is known, it is essential to manage it within seconds. This requires moving from business intelligence to business process intelligence: from analyzing the data to managing the processes.

The objective of operational analytics is a digital value network that makes it possible to reach agility though visibility and velocity out of volume and variety.

These systems must support the rationalization of expenditure for goods and services in the organization using advanced statistical analysis tools capable of supporting the achievement of cost savings and optimizing the service levels, with capabilities to:

- interface with the electronic market for the purchase of goods and services, such as electronic catalogues, online auctions, and marketplaces, to compare the procurement of traditional and new technologies;
- view the process network of procurement to create measurable benefits in terms of quality of purchases, recovery of resources for other value-added activities, and internal customer satisfaction;
- know the potential of the organization's vendors and of the procurement professionals;
- analyze the time series of expenditure.

A solution for procurement process intelligence must offer real decision support, not just provide a magnified view of the information assets of the organization. It should also provide a way to maximize the return from its utilization through integrated collaborative mechanisms.

The systems for procurement process intelligence should provide the opportunity for all the people and the departments involved to make collaborative decisions based on the information and to propagate the decisions within the processes.

Technology

From the technological point of view, the procurement process intelligence system should be an integrated platform. It should use a single development environment, unified security management, and description of the processes and their management. It should allow for conducting and supporting the activities of analysis, planning, knowledge sharing, and process execution, using a collaborative environment. This integration allows for driving the execution of decisions, optimizing them, and, above all, considering the overall goals at every stage of the decision-making process.

Available technologies and packages have integrated powerful analytical engines in a collaborative environment. They can produce dashboards, reports, evaluation grids, and alert signals with rapid execution times. They are able to activate, when necessary, modes of collaborative work requiring the sharing of information.

Procedures and Standards

It is important to avoid the use of processes that are not well described and not standardized in order to achieve agile procurement.

The standardization of processes enables the uninterrupted movement of a product through the value network. The continuous flow is enabled from the point of view of the value that each activity in the flow brings to the customer. This means that the processes of reporting must show how each activity adds value for the customer. The steps in this direction have to push activities to become foolproof. Some ways to facilitate this include:[26]

- make it easy to do things right and difficult to do things wrong;
- introduce visual controls that are easy to read;
- use devices coupled with sensors or barcodes;

- improve rotations in the warehouses:
- use Lean Six Sigma and Statistical Process Control;
- standardize repetitive processes on the basis of ISO standards;
- exchange data electronically and online;
- determine in advance how best to perform each task;
- map processes with visual methods;
- correct any activity that results in the "re-": rework, unnecessary readjustments, returns, or similar;
- arrange jobs with the techniques of the five S tools.[27]

Support from Consultants

A consultant specializing in the field of agile procurement can help to:

- define plans to introduce agile procurement;
- help create portals for collaboration with vendors;
- provide training on procurement processes;
- train internal and external users and vendors;
- manage organizational reviews.

A consultant can help in particular in benchmarking. A consultant can bring the experiences acquired from consulting with others who have used agile approaches and learning from their mistakes. One organization reduced delivery times of vendors by 70% in 90 days.[28] Another reduced stocks along the process by 25%, increasing productivity by 700%. A third organization reduced cycle times from 60 days to five days and sold a warehouse. Following the practice in order to implement their innovations, a consultant can help an organization achieve excellence in the field of agile procurement in a relatively short time.

Conclusions

In pursuing agile procurement, it is necessary to take into consideration the three Ps: processes, platforms, and people. This chapter has analyzed processes and how to make them more agile. The following chapters

analyze the other two Ps: platforms and people. The human element is important beyond process automation and management in projects of agile procurement. In the future, with increasing processes of re-engineering and automation, it will be important to take care with the role of people. This is the subject of the next chapter.

Notes

1. Neef, D. (2001). E-Procurement: From strategy to implementation. London, UK: FT press.
2. Kraljic, P. (1983). Sourcing must become Supply Management, *Harvard Business Review*.
3. http://it.wikipedia.org/wiki/Matrice_di_Kraljic, Accessed 23 September 2016.
4. Gelderman, C.J., and Van Weele, A.J. (2003). Handling measurement issues and strategic directions in Kraljic portfolio's sourcing model, *Journal of Sourcing and Supply Management*, 9: 207–213.
5. http://www.gartner.com/it-glossary/total-cost-of-ownership-tco, Accessed 14 August 2017.
6. Ellram, L.M. (2002). Total cost of ownership. In *Handbuch Industrielles Beschaffungsmanagement*. Gabler Verlag, Wiesbaden, Germany: 659–671.
7. http://www.iccwbo.org/products-and-services/trade-facilitation/incoterms-2010/, Accessed 22 September 2016.
8. http://www.accountingcoach.com/blog/what-is-three-way-match, Accessed 28 February 2017.
9. Musumeci, A. (2012). Un caso reale di realizzazione di un Big Data nel Gruppo Ferrovie dello Stato, *Big Data Forum*, 21 Nov.
10. Secchi, R. (2012). *Supply chain management e made in Italy: Lezioni da nove casi di eccellenza,* EGEA, Milano, Italy.
11. http://www.bebitalia.com/en, Accessed 9 April 2017.
12. Luccini, S., and John, G. (2010). *Could not be easier, nothing more difficult*, Fausto Cub Ed., Milano, Italy.
13. Breault, G., and Rashed, S. (2014). Reshaping Buyer/Seller Relationships to Create More Value, http://www.pharmoutsourcing.com/Featured-Articles/169169-Reshaping-Buyer-Seller-Relationships-to-Create-More-Value/, Accessed 16 January 2017.

14. Cretton, L. (2010). Viewpoint: Learn to love procurement, *International Journal of Market Research*, 52(1): 9–10.
15. Atkinson, B. (2007). How to get the most value from e-procurement tools. *Manufacturing Business Technology*, *25*: 12–13.
16. Davenport, T.H. (2013). Analytics 3.0, *Harvard Business Review*. 91(12): 64–72.
17. See endnote 14.
18. Schneider Electric (2011). *Business Intelligence*, White Paper, March.
19. Nicoletti, B., (2013). *Lean Procurement*, FrancoAngeli, Milano, Italy.
20. Palladino, A.P. (2010). Zara and Benetton: Comparison of two business models, https://upcommons.upc.edu/handle/2099.1/9620, Accessed 28 February 2017.
21. Some of the interesting technologies in this respect include Sap Hana and Oracle In-memory.
22. Nicoletti, B. (2014). Using Operational Analytics to Achieve a Digitized, Visible Supply Chain. *Inbound Logistics*, Feb.
23. Kaipia, R., Korhonen, H., and Hartiala, H. (2006). Planning nervousness in a demand supply network: an empirical study. *The International Journal of Logistics Management*, *17*(1): 95–113.
24. See endnote 20.
25. Nicoletti, B. (2012). *Lean and Digitize: An Integrated Approach to Process Improvement*. Gower Publishing, Farnham, UK.
26. See endnote 23.
27. Callahan, C.D., and Roberts, T.S. (2017). Performance Measurement and Operations Improvement Using Lean Six Sigma. In *Practical Psychology in Medical Rehabilitation*. Springer International Publishing, New York, NY: 569–573.
28. Nicoletti, B. (2013). *Lean Procurement*, FrancoAngeli, Milano, Italy.

7

Resources and Agile Procurement

Introduction

Agility is introduced in response to dynamic and turbulent markets and customer demand.[1] It directly affects the value network of the organization and is one of the reasons that concepts such as the agile value network have emerged. The need to decrease lead times and be flexible in today's manufacturing has introduced the involvement of vendors in the process as crucial to the ability to attain high levels of customer satisfaction.[2]

The two concepts inherent in most of the 12 attributes of an agile firm are speed and flexibility.[3] Although the speed and flexibility of the value network affect a firm's agility, agile manufacturing is still an important part of it.

This chapter analyzes the management of resources in an agile procurement organization. Agility is based on leaning and digitizing. Therefore, it requires human resources with strong digital competences. They must be digitally enabled (connected, online, real time). There should be multiskilled buyers (through job rotation and enrichment) who continuously develop their functional, intercultural, leadership, and/or management

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capabilities through flexible e-learning systems, and spend part of their time on innovation.[4]

The agile structure should be a twofold (or bimodal) organization (that is, one organization managing the legacy business and one networked/shadow organization supporting the digital transformation initiatives).[5] The agile organization should be a flat organization with no or reduced hierarchy, and "accountability" and "responsibility" assigned to each one of the employees.[6]

Due to the peculiarities of each sector, this chapter considers the resources in different sectors. Each section starts with a description of the specific features of the sector considered, followed by an examination of the application of agile procurement in the sector.

Key Resources

In identifying the key resources in an agile procurement organization, it is essential to recall the most important assets used. In particular, while procurement involves a large number of physical assets, financial assets, even intellectual properties, these have only a contingent role in the procurement core activities.

On the other hand, the key resources are undoubtedly the human resources and the organizational knowledge. An effective procurement organization is bound to carry out complex optimization processes in order to come up with simple and agile processes capable of adapting to change and to hedge the organization against uncertainty.

An effective procurement organization needs to be forward-looking. It should be very much aware of the industry and its subtle, more or less visible trends in order to react in a timely manner. In this, the persons working in procurement can be supported by advanced systems. In particular, digitization has introduced digital platforms that are now inseparable from any procurement activity. They often represent a competitive advantage or, if poorly managed, a major bottleneck.

To a certain extent, an agile organization should aim to fully integrate the more traditional key resources with these physical assets that digitization is pushing forward as new key resources.

Best Buy

Agile procurement implies lean human resource (HR) management.[7] Gary Hamel,[8] a management guru, argues that there is a need for the following changes in the management of organizations:

- the leader must be a social architect;
- the organization must be a productive ecosystem;
- managers must be facilitators.

This change is not a heresy. It is about delivering the final blow to Fordism via HR management. Enhancing human capital and creating an organization of knowledge competencies is to give up the idea that there is only one person that can affect behavior, change attitudes, and address the challenges towards the best performance of the organization. There is a need for facilitators. This is a field of creative forces for each working team. It has huge cooperative potential, scarcely used until now.

On the other side, the idea that involving staff, increasing their commitment, and making the work environment participative is something that already exists. It only needs to be brought to light. The thread that creates innovation is tied at one end to creativity, and at the other end to motivation. Working well means to work in the community. This certainly requires profound changes in the organization, but it is worth pursuing.

The effectiveness of these ideas is demonstrated by the experience of Best Buy, a group specializing in the distribution of consumer electronics. The organization was part of an initiative (Blue Shirt Nation) to develop new marketing approaches. This initiative is based on favoring employees to provide ideas for improvements. The result was that 20,000 persons (out of 150,000 employees) registered over a period of a few months to contribute their ideas.

This is free innovation. Similarly, the Italian government received 100,000 suggestions relating to its initiative for a spending review.[9]

Key Activities

The key procurement activities are quite complex to assess in a detailed way. As a support function, procurement mostly undertakes problem-solving activities in which complex optimization tasks are required.

In many cases, the procurement function is required to comply with business needs that demand a different approach. Even if a number of

activities carried out by the procurement organization may fall into the category of platform usage activities, these are not key activities.

Hence, the procurement organization may aim to maintain a very lean shape, concentrating on problem-solving activities, leveraging the strategically key human resources, and making use of platforms.

The platforms are needed, but outsourcing the necessary development and maintenance work is inevitable in the search for efficiency and leanness.

Agile Procurement in Manufacturing

Manufacturing organizations and processes are subject everywhere to increasing pressure from competition, especially from Asian countries. This scenario requires the identification and adoption of all possible means to grow in effectiveness, efficiency, economy, and ethics in terms of the processes of procurement, moving from a product perspective to a customer-centric perspective.

This section focuses particularly on the component of logistics in the procurement of manufacturing sectors.

Agile procurement can help organizations consolidate and maintain market position through solutions and professional services that optimize process performance. It can provide support in particular in:

- analysis of the trends of supply markets, also in low-cost countries: these can be developed on request, with market research aimed at finding new opportunities to supply internationally. Actions should focus on the organizations referenced that can satisfy even the highest demand levels;
- search for new vendors that comply with requirements: agile procurement can help in the management of outsourced activities aimed at scouting for vendors by the buyer, including collection of compliance requirements, buyer's identification of the target, first contact, and analysis of the information collected. The methods and tools of agile procurement allow organizations to search by category of expenditure, according to specific needs;

- management of the negotiation process: agile procurement is also based on the development of a platform for e-sourcing that can be used by organizations to manage the process for the negotiation of any goods/services, including facilities and investments. Organizations should also rely on the support of procurement professionals with expertise in the management of different categories of expenditure. These experts should be able to drive the dynamics of negotiations to achieve the best market conditions, in compliance with quality and timing requirements;
- sharing and exchange of knowledge on cross-functional projects and shopping experiences: the platform for e-sourcing allows the different structures of the organization involved in the procurement process (procurement department, technical department, and other establishments) to share, regardless of the location, structured information about vendors, experiences, and needs of procurement. It allows organizations to interact and to prepare, in a collaborative manner, documents and contract negotiations;
- efficiency of the process of the procurement cycle: agile procurement helps to develop and/or install systems for the management of orders via electronic catalog. The introduction of these applications increases the level of compliance, drastically reducing the time and costs of process execution;
- optimization of inventory management: through operations analysis and rationalization, the reclassification of codes for the disposal of surplus, managed with the support of enabling technologies (electronic catalog, auction sales, and so on);
- reduction in working capital: the systematic use of electronic catalogues with regard to products available in stock favors a bigger rotation of the same, and the identification of surplus and obsolete items, resulting in the optimization of the working capital.

In the evolution of the market, the main change is to move the focus from the product to the customers: their requests, but especially their needs. (Fig. 7.1). Porter's value chain clearly shows that these two aspects are essential to add "value" to the product (Fig. 7.2).[10]

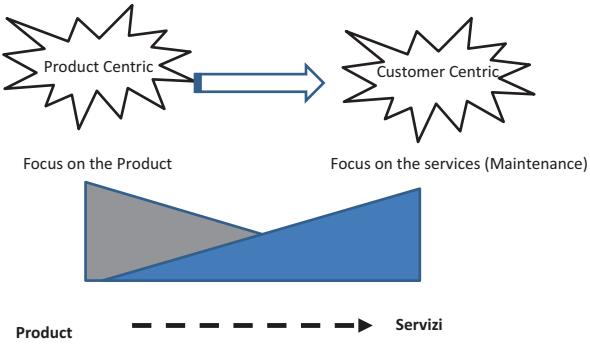

Fig. 7.1 From a product perspective to a customer perspective

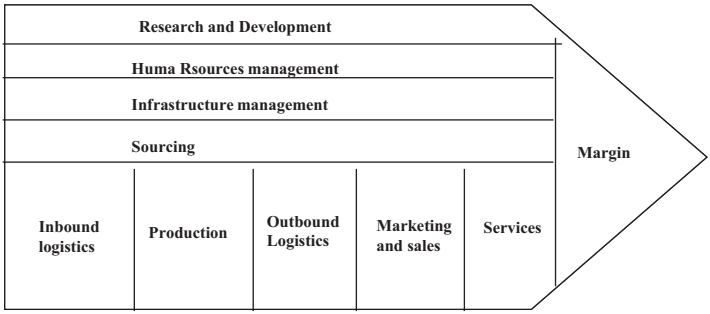

Fig. 7.2 Porter's value chain

Logistics

The customer buys a product to meet his or her needs. These are not limited to the characteristics of the product, but also include requirements for delivery on time and the use of the product over time. There is therefore a need and an opportunity for organizations to better assess their logistics services as a fundamental element of procurement, especially in the case of manufacturing services.

In Italy, it is estimated that the logistics industry, as a system of services for the organization of production lines, inventory management, warehouse systems, and distribution of products, currently has a total value of about 188 billion euros. It can provide a return on investment of up to

50%. In the system of manufacturing organizations, the average impact of costs for logistics is estimated at 7.3% of the total costs of the organization. This rises to 9.8% for smaller firms (20–49 employees).[11]

By structuring the production lines based on the criteria of efficiency, logistics can probably be considered an advanced function, besides being a new business segment, in which specific professionals can find employment.

When it comes to industrial logistics, the term "industrial" stresses that the perspective is that of the manufacturer and/or vendor of the product rather than the customer. The evaluation of the logistics industry by organizations supplying products has been modest in the past. The concern of organizers for the quality of logistics services such as customer satisfaction also leads to the redevelopment of the logistic services and its resources. They represent one of the major elements of this philosophy. Then, slowly but irreversibly, quality is changing the function and weight of logistics services. They have become of major importance, both for customers, whose increasing dependence on e-commerce and machines, apparatuses, and systems has accentuated the need to guarantee timely delivery, and for manufacturers and/or vendors, for whom the phase of the logistics services industry is a necessary aspect. Corresponding to these changes in the environment, the logistics industry is evolving. It is a complex function from the management point of view. The logistics industry currently is subject to a range of stimuli, including:

- changes in technology (electronics, new materials, and so on);
- increasingly fierce competition;
- a push towards reduction of lot sizes and just-in-time deliveries.

In these conditions, it is important to:

- keep in mind a number of aspects, to ensure the effectiveness, efficiency, and economy of industrial logistics;
- carefully analyze the changes in the organization needed to meet the new challenges;
- educate the human resources to exploit the new opportunities and be creative in fostering agility in procurement.

Development of Agile Procurement in Logistics

Objectives

The use of information systems for logistics has three basic objectives:

- increase the effectiveness of logistics processes in meeting the objectives of organizations;
- improve efficiency, increase productivity, and thereby reduce the need for resources;
- increase the margins of the service, helping reduce costs; this brings benefits to both logistics operators and their customers.

There is a need to improve these aspects. Research carried out by the group OTM SIG clearly illustrates these opportunities:[12] it found that 92% of customers believe that the ICT skills of the resources of their logistic vendors are a fundamental element in their offer of services, while 30% felt that innovation in ICT among their logistics vendors also increased the in-house use of ICT in the processes and operations internal to their organization. Only 32% of customers surveyed said the computer technology skills of their logistics vendors were satisfactory.

Some examples of waste within logistics services, mainly connected with the 3Ps—people, processes, and platforms—include:

- excessive wait times;
- spare time and poor loadings;
- modest loads compared to vehicle capacity;
- poor infrastructure use;
- unnecessary administrative burdens;
- excessive stocks in process.

Cardinal Health

Cardinal Health is a leading distributor of healthcare products.[13] It distributes $103 million of products annually. The organization handles a quarter of all prescriptions every day in the USA and delivers to 60,000 sites a day.

Over the past 30 years, the percentage of US GDP devoted to logistics costs has decreased, from 17.9% in 1980 to 8.3% in 2011. This is a testimonial to how smart organizations have managed to reduce waste in the supply chain. At the same time, healthcare costs in the USA rose from 9.0% of GDP to 17.6%.

Cardinal Health has started its lean journey as part of an initiative to improve collaboration in the health value network, with the aim of achieving zero errors, zero waste, and zero lost revenue. This initiative involved thousands of kaizen events and brought the error rate down by 30% in three years.

The next step was to extend the scope of Lean Six Sigma to the partners of the value network of Cardinal. The organization worked closely with key partners of the value network by organizing Lean Six Sigma workshops to learn from them, educate employees/partners, and train them in problem solving.

A concrete example of this improvement is the reduction of waste that Cardinal has managed with the help of its partners. For example, a customer used to order a specific medicine several times a day. An examination of this purchasing process revealed that the customer typically would order seven pieces a day. However, the products to be delivered were pulled from boxes that contained ten items. This raised the obvious question of why not buy a whole box at a time, instead of buying them individually.

To achieve these objectives it is vital to bring the right people together in the same meeting room. It is important that healthcare workers do not experience shortages of medicines. Cardinal focuses on availability, visibility, and responsiveness. The organization uses predictive analytics, powered by transactional information from vendors, to increase the speed of communication from the producer to the end customer.

Services

Services are very important for the economy, and their importance is growing. For example, services account for over 80% of GDP in the USA and are expanding rapidly worldwide.[14] Even within manufacturing organizations, it is common to have Selling, General, and Administrative expenses (SG&A) between 50 and 100% of the manufacturing costs.[15] These indirect costs are associated with support functions and services, including design, marketing, sales, finance, information systems, administration, legal, and human resources.

The improvement of cost efficiency can play a key role in service organizations obtaining new customers and markets. From this point of view, there is considerable room for potential improvements, especially in

services. Historically, the manufacturing world has been the first to adopt "scientific" (to use Taylor's term) models of organization. A study by Booz Allen supports this statement.[16] The research points out that in the USA, the gap between the performance of organizations that provide financial services and the performance of manufacturing organizations has grown in recent years. In 1970, the performance of the two sectors was very similar. By 2000, manufacturing organizations had achieved 60% higher productivity than organizations belonging to the financial sector.

The increase in the number and complexity of processes may result in the duplication of processes and data redundancy as part of information systems. To manage and make the most of the benefits obtained by the diversification of and growth in the catchment area, an organization must be able to manage the complexity of the processes and the solutions related to them. The challenge lies in the creation and adoption of a new model to manage customers, processes, and systems that can be obtained through the application of agile procurement.

ICT is not simply a support for the automation of management and the management of data and transactions. It must have a strategic role in:

- addressing;
- adapting;
- supporting;
- accelerating and simplifying the new management model and the operation of the service organizations.

Before discussing the specifics of using agile procurement in service organizations, it is important to first define and categorize services.

Characteristics of Services

The services have characteristics significantly different from those of the physical products of other types of organizations such as manufacturing.[17]

- Product: it is perishable, intangible, not storable, hard to standardize, and often not easily structured.

- Distribution: there is often physical interaction and real-time employees between the provision of services and customers.
- Rating: the evaluation of the service provided is mostly subjective, lacking the materiality of the product.
- Production: in service, there are a variety of operations, not all easily controlled, competing at the time of each service.
- Interdependence: service delivery involves interdependence with other bodies and persons and considerable availability of access to product information and resources available within the organization.
- Compliance: service is heavily impacted by government regulations and national and international laws and regulations of the European Union and data privacy.

These aspects are mentioned in order to emphasize the desirability of devoting attention to the specific characteristics of services in the case of an initiative of agile procurement.

Service Classifications

It is possible to imagine different classifications in the case of services. The first classification distinguishes between services for sale and those not for sale. Another classification refers to the specific sectors to which services are offered. In fact, these classifications do not help much in terms of management. Indeed, they can contribute to a sense of diversity among organizations which is not useful in identifying the most suitable means of agile procurement. From this point of view, it seems appropriate to distinguish between organizations depending on two fundamental factors:

- contact with the customer in providing the service;
- degree of customization of the service.

In terms of the first factor, a possible classification of services can be based on the extent of contact with the customer in the delivery of the service. The "contact" is defined as the physical presence of the customer

at the place where the organization delivers its services. The extent of the "contact" can be broadly defined as the percentage of time spent by the customer in the area of service delivery compared to the total time of service delivery.

From the point of view of the way in which services are delivered, they can be based predominantly on people or on the equipment/installations. For example, in the case of functional services connected with air transportation, they can be based on airplanes, which are controlled by more or less specialized operators.

Considering the two characteristics, there are four possible placements according to the grid shown in Fig. 7.3. Figure 7.4 provides some examples of possible classifications of certain services in an air transportation organization.

The proposed scheme highlights a number of aspects:

- Organizations fall across a continuum, rather than strictly within any of the four classes.
- A specific organization can provide a suite of services that correspond to multiple classes.

In recent years, the service sector has undergone a remarkable transformation. The biggest challenge, given the current market conditions, is

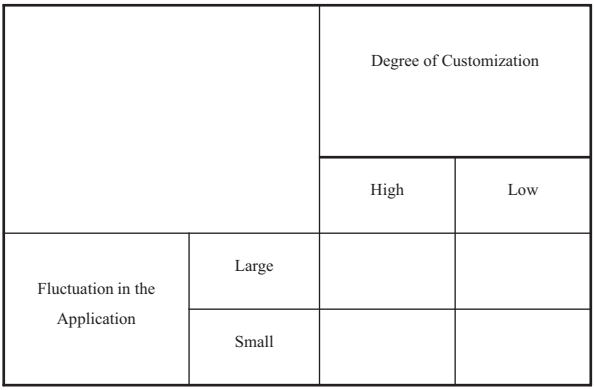

Fig. 7.3 A model for the classification of services

		Degree of Customization	
		High	Bass
Fluctuation in the Application	Large	First Class Catering	Economy Class Catering
	Hold	Scheduled Flight	Revenue Accounting

Fig. 7.4 Examples of services in the case of a transportation organization

the growth in sales at such a rate as to recover all investments in innovation, definitely proven in the early stages of technological innovation.

The points to watch in such a situation are:

- market saturation;
- local and global competition;
- satisfaction and customer experience services;
- effective management of the customer base.

These factors are reflected directly in the economic and financial accounts.

There are many elements of similarity between the organizations belonging to each of the classes indicated previously. In particular, one can identify a number of indicators that accurately characterize the current issues:

- operating margins (down);
- cash flow (negative);
- growth in debt;
- asset management;
- investment (there is difficulty in recovering resources to cope with the need to invest substantial time).

These indicators can identify the need to address these problems of the sector:

- strengthening the customer relationship and experience: improvement through possible strategies for the business of the area devoted to customer relations and market channels;
- eliminating technological barriers: promoting the expansion of an architecture that allows for the implementation of new services at low cost and effective interaction between all available business channels;
- developing new services and business models: it is necessary to invest in a structure that is able to support the testing and launch of new processes and technologies. They must be able to offer potential new revenue sources and to facilitate the implementation of new business models;
- Consolidating and automating all structures of the organization: it would be necessary to reconfigure the organizational structure to eliminate redundancies in different lines and focus only on those considered strategic for the organization.

Agile Procurement in the Services Sector

There are several uses for agile procurement in the processes of direct and indirect supply of products with the support of EDI or Internet-based systems. Many organizations are turning increasingly to the adoption of other tools of e-procurement. Typically, the industry-leading organizations invest in e-procurement for heterogeneous goods, contracts for civil works, facility management services, purchases of ICT, network services, and in some cases consultancy.

Frequently service organizations invest in e-catalog, with the intention of offering more categories of products by exploiting the window effect of this tool and enjoying, in fact, a significant increase in business transactions.

The following sections examine in detail the development of agile procurement in three areas:

- telecommunications;
- retail;
- travel.

Agile Procurement in Telecommunications

The telecommunications market has been characterized in recent years by strong dynamics of liberalization and globalization. There are new means for comparison between operators, both consolidated and emerging. In parallel, the industry is marked by an acceleration in the processes of technological innovation, making some new and increasingly integrated telecommunications services available to users. Developments related to the Internet have accelerated a gradual convergence and encouraged interaction between organizations from different sectors (ICT, audiovisual, telecommunications, and so on).

The increasing mergers, acquisitions, and alliances among operators confirm the trend to seek synergies between different skills to support the market. These synergies are important in a world with rapid technological obsolescence. They require an increasingly holistic and innovative approach.

In the search for effectiveness, efficiency, flexibility, and streamlining of processes, including in procurement, a determining factor is the maintenance of market position. Many leading organizations in these sectors, at an international level, are realizing the objectives of increased efficiency in procurement by supporting the development of projects that include:

- analysis of the trends of supply markets, even in low-cost countries: it is possible to develop, on demand, market research aimed at finding new opportunities for supply at the international level. These initiatives are focused on the organizations referenced and can satisfy even the most demanding requirements;
- development of projects and custom sourcing: a leading operator has integrated its ICT systems with high-development, support performance solutions for managing dynamic trading online;
- analysis and rationalization of expenditure and procurement processes in high strategic supply for the sector. It is possible to renegotiate interventions such as for instance on infrastructural works for the laying of optical fiber, on performing a re-layout of call centers from the functional point of view, do maintenance of the sites, working for radio coverage of tunnels, or building new uses of the networks;
- analysis and rationalization of purchases of indirect goods and services (telephone services, business trips, logistics services, office furniture,

and so on): the best organizations in the field have focused, according to the specific needs of customers, the improvement of processes ranging from standardization of specifications and procurement procedures, to support projects of centralization, rationalization of the vendor, and redefinition of procurement strategies. The results confirm the possibility of obtaining significant savings also in expenditure items that are not strategic but have a large impact on the budget;
- analysis and optimization of procurement marketing of goods and services: experience confirms that this item of expenditure, particularly important for the telecommunications sector, can be managed through process improvement online. In this way, it is possible to increase efficiency and optimize costs;
- support for the organization and implementation of online trading: this approach provides assistance in all phases of the negotiation process in terms of expertise and training in the use of Web-based methods of procurement.

Agile Procurement in Retail

The world of retail is changing radically in terms of innovation, variation, and critical aspects of the modern world. In this situation, it is essential to re-engineer processes to reflect changing conditions. Procurement, intended as the management of the value network of the organization from inception to delivery of the final product, cannot innovate quickly. The processes must be changed to make them more streamlined and automated to suit the dynamic situations in which organizations find themselves. One way to achieve this is through the leanness and automation of agile procurement.

The 2009 report of the Observatory in digital innovation in retail of the Politecnico di Milano, Italy, showed that 69% of those responsible for production and logistics believe that the contribution of automation is relevant for organizations in the retail sector, and as many as 93% said it will be even more relevant in the future.[18] In the past, ICT provided support especially from the standpoint of administration and production planning. It may be interesting to examine also the innovative ways in

which agile procurement can provide support to the optimization of processes and their automation in the retail world. For example, it is possible to search for vendors via the Web. In this way, it is possible to adapt to rapid changes in the characteristics of vendors: from the collection of compliance requirements by the buyer to the identification of the target, from the first contact to the exchange of documents and analysis of the information collected.

The analysis and re-engineering of processes that relate to procurement should start with mapping especially operations, to identify inefficiencies and areas of optimization and start a program of renewal.

The introduction of agile procurement in retail requires particular attention to change management from the implementation phase and roll out of new processes to full utilization and continuous improvements. It must take into account the presence and real-time interaction of the customer in retail processes. Changes must also be made to the personnel who in these cases are in direct contact with the customer.

Agile Procurement Management for Business Travel

The costs of travel and accommodation for business purposes are growing. On average, they are already at a high level: it has been estimated that they represent between 8% and 12% of the budget of an organization.[19] There are several reasons for this growth, including:

- rising unit costs of travel;
- globalization, which requires frequent contacts with remote partners not only on the phone, but also in person;
- outsourcing, leading to relationships with geographically distant vendors.

This situation requires improvement in the management of these expenses, especially the human resources—not to cut these costs, but to make them add higher value.

The correct approach is to make the processes leaner and to automate them at the same time.[20] Thanks to a series of developments, support for

the management of these expenses can become more effective, efficient, and economical.

The support of agile procurement can be provided:

- before a specific trip;
- during a trip;
- after traveling.

Much has been made of the activities prior to a trip. The computer reservation system (CRS) provides considerable support to the processes in travel agencies to which the reservations and ticketing of an organization are normally outsourced.[21] New approaches allow the organizations to improve on this. There are solutions available today that allow for self-service management of the trip booking by staff. This speeds up the processes since it reduces or eliminates dependency on an outside agency. These systems are programmed not to allow reservations that are not compliant with the organization's policies.

The support of agile procurement is very important during the journey. In this case, the use of a smartphone allows the traveler to take into account the changes that often take place with respect to a planned trip. The process can allow for the accounting of actual expenses almost in real time thanks to the use of mobile devices. This provides many benefits in comparison with keeping a large number of paper receipts. The use of credit cards greatly facilitates corporate payment processes and their final balance. In the past, this option was only available to large organizations. Today there are many vendors of customized corporate cards, even for organizations with a small number of employees.

The most interesting developments are taking place at the level of calculation and analysis of the costs of travel. The developments are several and very interesting. For example, there are systems that allow the organization to analyze the final data of the travel costs (big data analytics). They allow for extracting a lot of information regarding critical KPIs, including:

- monitoring of compliance with the policies for corporate travelers;
- centrally managing expenses for travel (as opposed to individual decisions);
- processing costs of a trip report.

These parameters are used to compare organizations with respect to best practices with effective benchmarking.

In order to move in this direction, it is necessary to make an extensive review of business needs and define a plan of action:

- The first step is to define a strategy.
- Given this strategy, the actions to implement it need to be defined.
- The actions should improve the processes of the organization.
- It is necessary to define media, processes, and solutions, to support as previously defined.
- It is important to educate employees to use the new applications available and not look for shortcuts to try to be non-compliant.

A good example of these applications is the process in the Travel & Living (T&L) of the medical division of GE. This allows the individual employee to book, track, and report on business travel. The organization then is able to use systems analytics to analyze the travel expenses.

Financial institutions that issue Visa cards with the corporate Visa scheme offer a similar process. Particularly powerful is the system that allows for analyzing the costs of travel and related expenses.

Conclusions

Agile procurement brings several benefits to the management of organizations. The only limit is the imagination of those who work to improve the processes and automate the organizations. Agile procurement can be of great help to the world of both manufacturing and service organizations.

The speed and complexity of business continues to accelerate. This forces procurement professionals to adapt to new market conditions and react to new opportunities while maintaining discipline and efficiency. Agile organizations have an advantage as enterprises become more reliant upon the relationships and events that exist beyond their walls. Agility and innovation will start to define market leaders over the next decade. The versatility and general capacity of the chief procurement officer

(CPO) to support non-traditional roles and responsibilities will play an increasingly important role in how far he or she succeeds and advances.[22]

Agile procurement can provide considerable support in controlling costs. The next chapter covers this issue.

Notes

1. Prater, E., Biehl, M., and Smith, M.A. (2001). International supply chain: Tradeoffs between flexibility and uncertainty, *International Journal of Operations & Production Management*, 21(5/6): 823–839.
2. Power, D.J., Sohal, A.S., and Rahman, S.U. (2001). Critical success factors in agile supply chain management-An empirical study. *International journal of physical distribution & logistics management*, *31*(4): 247–265.
3. See endnote 1.
4. http://www.adlittle.com/downloads/tx_adlreports/ADL__Future__of__Procurement__4.0.pdf, Accessed 25 March 2017.
5. Kotter, J.P. (2014). *XLR8 Accelerate*. Harvard Business Review Press, Cambridge, MA.
6. http://www.adlittle.com/downloads/tx_adlreports/ADL__Future__of__Procurement__4.0.pdf, Accessed 25 July 2017.
7. Gaeta, F. (2012). La sfida ambiziosa dell'ufficio che si fa comunità, http://www.ilsole24ore.com/art/economia/2011-12-13/sfida-ambiziosa-ufficio-comunita-165138.shtml?uuid=Aa8h2xTE&fromSearch, Accessed 23 September 2016.
8. Hamel, G., and Ruben, P. (2000). *Leading the revolution* (Vol. 286). Harvard Business School Press, Cambridge, MA.
9. http://ec.europa.eu/economy_finance/events/2014/20140211-meeting/documents/sessioni2goretti_en.pdf, Accessed 9 April 2017.
10. Porter, M.E., and Millar, V.E. (1985). How information gives you competitive advantage, *Harvard Business Review*, July–Aug.:149–152.
11. Nicoletti, B. (2009). Miglioramento dei Processi di Logistica e Costruzione, *Atti del Convegno Annuale della Sezione Informatica dell'ANIMP*, Genova, 23 Apr.
12. http://www.otmconference.com/, Accessed 22 September 2016.
13. Blanchard, D. (2012). Supply Chain and Logistics: Lean Six Sigma Keeps Cardinal's Supply chain Healthy, Collaborating with its vendors and customers helps keep Cardinal vital products in stock, *IndustryWeek*,

Oct. 17, http://www.industryweek.com/supply-chain/supply-chain-and-logistics-lean-six-sigma-keeps-cardinals-supply-chain-healthy, Accessed November 13, 2016.
14. http://www.focus-economics.com/countries/united-states, Accessed 28 February 2017.
15. Dudick, D.S. (1987). Why SG&A Doesn't Always Work, *Harvard Business Review*, Jan.
16. www.boozallen.com/media/file/121159.pdf, Accessed 22 October 2016.
17. Nicoletti, B. (1979). Aziende di servizio: opportunità e problemi, *Sviluppo e Organizzazione*, 10(56), Nov.–Dec: 19–32.
18. http://www.osservatori.net/ict_nel_fashion_Retail/rapporti/rapporto/journal_content/56_INSTANCE_0HsI/10402/685194m, Accessed 26 September 2016.
19. https://www.vdr-service.de/fileadmin/der-verband/fachmedien/geschaeftsreiseanalyse/vdr_btr2016.pdf, Accessed 24 April 2017.
20. Nicoletti, B. (2012). *Lean and Digitize: An Integrated Approach to Process Improvement*. Gower Publishing, Farnham, UK.
21. CRS, or a computer reservation system, is the electronic distribution of travel services via telematics systems, primarily to travel agents. These have spread from the end of the 80<AU: Pls clarify, do you mean since the 1980s?> first in the USA and then in Europe.
22. http://cporising.com/2016/12/27/best-of-2016-the-state-of-the-chief-procurement-officer-in-2016-hypothesis/, Accessed 4 March 2017.

8

Costs and Agile Procurement

Introduction

The need to satisfy, and possibly delight, customers is increasingly influencing organizations to offer:

- lower and lower prices;
- high quality;
- more options and faster and secure deliveries.

Changes in demand have led to a series of adjustments by organizations that have forced them toward the management of complex and expensive processes. The increase in costs, the price war competition, and the purchasing power of customers have undermined the profitability of many organizations. To survive and grow, an organization must make profound changes in its management approach and culture.

Agile management is a philosophy, a method, and a set of tools and techniques. It allows an organization to orient its processes toward the customer, eliminating activities that do not generate benefits for the product/services. Agile procurement allows for faster production at lower cost and of higher quality. One of the ways to become more agile is to

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become leaner, especially from the point of view of cost, and to digitize these leaner processes.

This chapter first describes lean thinking in general, introducing the concepts and the basic tools. It then describes the five principles of lean thinking (value, value network, flow, pull, and perfection) and related tools (value network mapping, just-in-time, autonomation, SIPOC, and kanban).

The second part of the chapter introduces the method of Lean Six Sigma, a synthesis of lean thinking and Six Sigma.[1]

The final part of this chapter analyzes a growing opportunity for procurement and vendors alike to become more agile also from a financial point of view: procurement finance.

Cost Structure

When discussing procurement, one of the main topics on the table is the way costs are addressed. This issue can be discussed in two ways: in terms of procurement, and in terms of the overall enterprise. The two aspects often overlap, as the principles behind them are the same.

Procurement is an organization that carries out key activities that are high value-adding and problem-solving focused. It should have a value-driven cost structure. In this scenario, an agile procurement organization should separate out non-core activities and possibly outsource or distribute them to the business.

In particular, a number of non-core procurement activities, such as invoicing and legal, may be outsourced and purchased from specialized enterprises. These enterprises can both offer efficient use of specialized resources and ensure consistency in results and scalability that shield the organization from external changes (both quantitative and qualitative).

On the whole, organizations pursuing agile procurement need to maintain a high standard of service while shifting the structure of costs towards a more Opex-oriented stance. The same can be seen as a viable aim for procurement as a department. In order to increase agility, its cost structure should become leaner.

For all these reasons, this chapter examines lean thinking and its applications to procurement.

Lean Thinking

The economic crisis, the reduction of geopolitical barriers, the subsequent entry of new competitors such as China and India, and the more than proportional increase in supply over demand are all factors that have introduced strong competition into markets.

In general, organizations have applied a pricing policy based on costs incurred. They have followed the classic formula:

- The cost of production/distribution plus the profit should be equal to the selling price to the final customer of the product/service (cost + profit = price).

The dynamics of the market have shifted power to customers, making their purchasing power much stronger. It is now the customer and the competition (the market as a whole) that decide the price and quality of products and services that customers want to buy. The new logical pricing schema becomes:

- The selling price, decided by the market, minus the cost of production/distribution determines the price (price – cost = margin).

It is no longer acceptable to raise prices to cover issues of efficiency, effectiveness, economy, and ethics of the organization. To ensure margins for the organization, it is essential to increase quality while at the same time reduce drastically:

- the cycle times;
- the costs.

Both can be reduced by eliminating all types of waste, defined as anything that does not add value for the customer.

The customer determines the value added. The quality is for the customer. Waste is measured with respect to the needs of the customer. The satisfaction must be of the customer. The customer must be seen not only as the end user of the product or service, but also as the department

immediately downstream in the production cycle (the internal customer), and cascading, following the value network, to the end user.

To optimize the processes it is necessary to investigate the needs of internal and external customers to understand which activities are not adding value and therefore make the product/service less attractive, or simply more expensive.

Principles of Lean Thinking

The following sections analyze the five principles of lean thinking along with its main tools (Fig. 8.1).[2]

Define the Value (VALUE)

The first principle in lean thinking is the definition of value. The value is what the customer wants to obtain from the purchase of a product or a service in terms of functionality, quality, price, and delivery times.

Any product or service is composed of components to achieve a certain purpose. All of these characteristics determine the technical content, which is all the more valid as "fitness to use" for what it was designed for.

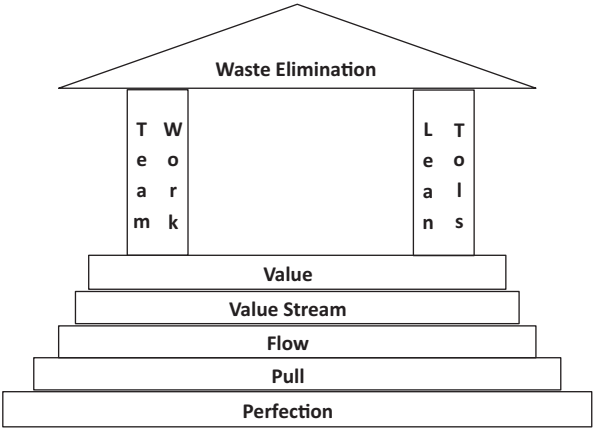

Fig. 8.1 The structure of lean thinking

Apart from these technical aspects, there are the costs necessary to make the product or deliver the service. It is possible to define the value as "affinity between use and cost." To express the value in a different way, it is possible to think of the relationship between the cost attributable to the essential functions required by the customer in the product or service according to its purpose and the cost effectiveness. In other words, the value can be thought as the ratio of the cost that the customer would pay for that product or service and its total cost.

It is possible to replace the term "use" with the term "function" to better reflect the goals of the organization.

When one talks in terms of function, it is necessary not to be influenced by the current design, but to try to rebuild everything from scratch. At the end of the analysis of the product or service, taking into account its functions and the customer's point of view, often many existing features in the product or service can be considered unnecessary or unimportant for the customer (secondary functions versus primary functions). These should be eliminated. In fact, these features only add additional costs. They do not increase the value for the customer. However, all functions defined as necessary despite being unimportant for the customer, such as accounting, must be retained for legal or regulatory reasons.

Once all primary and secondary functions have been defined, it is necessary to understand their costs. The goal of lean thinking is to maximize the value of the service of a product or service or process through the complete elimination, or at least the substantial reduction, of the costs associated with unnecessary functions and the maximization of the content of the necessary functions.

The identification of functions facilitates the action of cost reduction.

One can also say that lean thinking searches, in a particular product or service, for the primary functions for which it was designed and the secondary functions that are necessary in order to improve it both from the technical and the organizational points of view. This concept is important because it leads to the search for the "why" of the functions of a product, service, or activity. It is an analysis of the functions of the product provided or the service delivered.

Primary functions are characterized by the fact that the level of appreciation of the function is unique. This type of function is satisfied only if

the function is 100% available. For example, the primary function of packaging for perishable food goods is to "maintain the vacuum." This can only be implemented if the possibility of infiltration of air is completely excluded. There is no different level of achievement. Therefore, one can conclude that in this case the minimum and maximum levels of this function are equal.

A product or service can have more than one basic function. For example, a "wardrobe packaging" has the primary function of "containing clothes." It must be satisfied in one way, uniquely valid. There may be other secondary functions to characterize the packaging. These other functions could be "the transportation" and "allow the reuse."

The costs associated with the value can be divided into:

- direct costs associated with the purchase price or the cost directly linked to the product or service;
- indirect costs of poor performance, which include costs not directly associated with the product or service;
- operating costs of the product, which relate to the administration, monitoring, and governance necessary for delivery of the product or service.

The analysis of the ratio function/cost can identify the value of each product.

There are different meanings of value in terms of possible value for customers.

- The utility value includes all the performance requirements that are necessary for the customer to use the product. The utility value of a car is to be able to move from one place to another quickly and independently. Such value can vary greatly from person to person. It is very high for a commercial account, for which the car is indispensable. The value of the transport is less for persons who only use the car occasionally, and for pleasure. Generally, this value does not change very much from one model of a car to another. Both a small and a large car are able to perform almost with an equal value. But if one considers other factors such as "reputational" or "sports performance," or "safety,"

there would be a complete change in the evaluation of cars because other features become important and the primary function of transport becomes secondary.

- The value of reputation is all the technical and aesthetic characteristics that do not affect the utility but attribute to the product a higher value. A car that is not mass produced has the same utility value as a mass produced car of the same size. The improved estimation can be a greater incentive to purchase it.
- The aesthetic value is different from the reputational value since it derives simply from the beauty of the product. The car can be embellished with decorations and finishes, or at least, with a special body, mounted on a standard chassis. This is an example of aesthetic value. The utility and performance value of the same car is standard, but the appearance of the product is improved.
- The value of trade measures the qualities and properties that will be sufficiently attractive to other people in the future and allow the product owner to resell the product or carry out an exchange. For instance, the value of a used car varies over time with a rate inversely proportional to its size.
- The economic value of a product or service corresponds to the sum of the various costs required to buy, operate, and dismiss it (TCO).[3]

There are many other values derived from the functions that the product or service examined must satisfy. For brevity, they are not described in this book.

To get the right balance between cost and value, the latter must be assessed both qualitatively and quantitatively in all its aspects. This serves to verify that the utility value is always equal to or higher than the cost, and that other values do not have a significant impact on the cost.

The approach to the value in lean thinking is very simple, almost elementary, and based on common sense. At the same time, it is an accurate and extremely systematic method. It makes use of all forms of organization and motivation to achieve the goal of having products or services that add value for customers.

Every action of improvement of the product and, consequently, of the process, must necessarily start with an analysis of what the end customer

wants (the so-called voice of customer). It then goes back along the value network, tracing back all the operational process and/or regulatory aspects.

The difficulties that may be encountered include the precise understanding of customer value. It is necessary to identify with the customer the value of the product or servive (Voice of the Customer), understand the customer needs and translate them into the environment in which the customer is operating. A common myth is that if a process is carried out in a certain way, it means that the specific modus operandi is excellent. It is believed therefore that the only levers for improvement may be changes to the pricing policy, customization of the product surface, shipment, or assistance.

In fact, the waste is in every action, every gesture, and every activity that does not generate benefits for the customer:

- product defects due to errors in design, purchasing, or production;
- excess inventory caused by incorrect assessments of need;
- unnecessary movements;
- loss of time resulting from the incorrect design of products and processes or errors in computing capacity;
- production of unnecessary items unsolicited, explicitly or implicitly, by the customer.

The key points of the principle of value are as follows:

- The improvement process starts with the definition of value.
- The voice of the customer defines the value: use, quality, price, and time.
- The improvement is achieved by change.
- Anything that does not add value is a waste (called *muda*, in Japanese and in lean thinking).
- There are several types of waste which must be eliminated or drastically reduced.
- It is necessary to counter resistance to change.

Identify the Value Network (VALUE NETWORK)

The first principle of lean thinking, the definition of value, leads to the analysis and understanding of the needs of customers using the product or service. The second principle is the identification of the value network. This allows for an understanding of how the internal processes (including procurement activities/vendors) add value for the customer.

Process mapping of each product family includes analysis of:

- the sequence of activities to design the product;
- the flow of information, from the customer orders, to the planning of the work, the supply of the orders, and the delivery of the product;
- the administration of the invoicing of the product and related acceptance and accounting actions.

In the case of services, the flow is similar but affects activities rather than physical elements. The activities can be:

- value added (contribute to customer satisfaction or, better, delight);
- no value added but necessary (do not contribute to customer satisfaction but cannot be completely eliminated because they represent an operational constraint or regulation);
- no value added and not necessary (they are part of the waste or *muda*). These can then be eliminated immediately or through a project.

The purpose of mapping activities is to get a detailed picture of the flow of work and information. This is important to start the analysis of waste. Waste is highlighted by comparing the value required by the customer and the flow of material and information generated in the process sequence.

Mapping of the As-Is process, the current state map, is made using a tool called value stream mapping (VSM).

Key points of the second principle are:

- mapping each process relative to the families of products under consideration;

- mapping the flow of materials and information in the process: the current state map, or As Is, using tools such as VSM;
- analysis of the As-Is;
- identification of value-added activities;
- identification and elimination of waste.

Assure a Continuous Flow (FLOW)

Once the customer value has been defined, the process has been mapped, the value network has been defined, and the preliminary activities that provide no benefit and are not necessary have been selected, the next step is to make the flow as continuous as possible. The process must be designed in order to consolidate and edit its activities so that they can form a continuous flow of materials and information in order to:

- eliminate waiting times, scrap, and down time during and between productive activities;
- reduce batches;
- reduce queues, inventories, and work in process (WIP).

The flow should strive to be continuous, starting with raw materials or components that are transformed into finished products which are delivered to the end customer. A fully continuous flow is difficult to achieve, especially for production with low volume and high mix. The objective is to focus on the realization of an ordered rhythm of production, a leveling of the load, and the implementation of a continuous flow wherever possible.

Improvement actions in this phase are to reduce set-up times by implementing techniques such as the single minute exchange of die (SMED) and shifting from mass production to cell production through the redesign of the layout and the identification of new machinery that is smaller and multifunctional.[4]

To make the flow continuous, the logistical and technical redesign of the process is not enough. The entire process must be redesigned and the work revisited, and the product itself might even need to be reconsidered. It is crucial to involve the operators at this stage because they have to

change their mentality and their approach to work. They must have an overview of the process and be able to perform more tasks and functions in a more efficient way.[5]

The key points of the third principle are as follows:

- The flow is continuous if there is no waiting time, scrapping, non-productivity, batch queues, stocks (warehouses), or other waste.
- The process is redesigned in order to make the flow as continuous as possible.
- The layout and machinery are redesigned (set-up times, size, and multifunctionality).
- Tools such as SMED, cells, and similar are used.

Make Sure that the Flow Is Pulled (PULL)

The first three principles of lean thinking allow for the definition of value, identification of the value network, and the creation and running of the operational flow as continuously as possible. The objective is to eliminate waste and obstacles that do not add value for the customer. The next step is represented by the fourth principle: to ensure that the flow is pulled by the customer. To achieve this, it is necessary to design, plan, and carry out exactly what the customer wants, when he or she wants it. It is necessary to try to avoid forecasting sales and to produce only what the customer requires. This means making sure that the customer "pulls" the product, rather than the organization "pushing" often unwanted products to customers.[6]

The elimination of waste allows for faster production by decreasing the cycle time by as much as ten times compared to the initial situation.[7] The creation of cells and speeding up the machinery set-up facilitate the variation in the products produced (for single units or very small batches) and the load balancing of the stream.

This principle requires that work is not scheduled based on sales forecasts. The product should be produced only after the order has been received from the customer. The goal is the alignment of the workflow with final demand. To accomplish this, it is useful to move to a production

in cells using kanban badges to activate the production and leveling the workload using Heijunka.[8]

The key points of the fourth principle are as follows:

- The customer should pull the production:
  - moving production from push to pull;
  - from scheduling based on forecasts to customer jobs programming.
- Production and demand should be aligned.
- Tools such as kanban and heijunka should be used.

Search for Perfection (PERFECTION)

The fifth and final principle, the search for perfection, stresses continuous process improvement. Perfection does not exist. For this reason, there is always something to improve, to refine, or to review. Waste will continue to exist, as will efforts to reduce it.

The rule must be: to observe, to think, to evaluate … and to simplify, simplify, and simplify.

The key points of the fifth principle are as follows:

- Perfection does not exist.
- There are always some elements to be improved.
- Improvement should be continuous.
- Streamlining should be ongoing.

Elimination of Waste

The cornerstone of lean thinking is the total elimination of waste (*muda* in Japanese), or of all the activities that do not add value to the product from the point of view of the end customer. Waste in organizations is caused mainly by:

- problems of organization and management of space and production times;

- non-essential activities;
- lack of method and attention to detail;
- inadequate equipment;
- low quality of supplies and defects;
- incorrect understanding of the needs of customers;
- continuation of old practices that are no longer necessary.

The lean thinking method specifies seven types of waste that either decrease customer satisfaction or do not add value for the end customer:

- overproduction: wasted material, time, labor, goods, and money;
- defects: wasted material, time, and money;
- unnecessary transport: unnecessary transportation of raw materials, components, semi-finished and finished products;
- manual movements: unnecessary actions of operators during their work;
- delays/waiting: waiting time for operators due to delays in the arrival of materials, defects/failures, and business start-up of machines and so forth;
- stocks, for example along the process (WIP): materials and components used to overcome problems of load balancing along the production cycle;
- un-needed spaces in the workplace.

Some researchers highlight a further type of waste, that of human resources (under-utilization of human capital), of energy, or of other types of resources (including financial ones).

Kaizen

Kaizen, or continuous improvement, is a change in the way of seeing the organization's processes (*Kai* = change, *Zen* = good: change in the way of looking for the better). The kaizen method destabilizes the status quo. It encourages all members of the team to generate and share ideas for improvement, which are then achievable with less resistance. The natural resistance to change is converted into energy to implement change.

The kaizen plan involves short-, medium-, and long-term planning (seven, 30, and 90 days) of implementation activities and regular reviews of the progress of a lean project. The sequence of the improvement activities agreed during meetings of the improvement team is determined, and the tasks and responsibilities associated with each activity (design, procurement, construction, testing, and production launch of new components/applications/interfaces, and so forth) are assigned during the planning and timing of the revisions or the allocation of the budget.

Based on the difficulty of implementation of the solutions agreed to in the preparation of the initiative, the team defines the terms and conditions of the improvement actions. The more complex the intervention is, the more time will be included in the kaizen plan and the more progress reviews of the operation, in agreement with an agile approach.

Kaizen also works with a tool called 5S. Its goal is to reduce waste and help improve the workplace. The key components of this tool are shown in Table 8.1.[9]

Table 8.1 The 5S tools

Japanese term	English translation	Description
Seiri	Sort	Examine the workplace with the aim of eliminating materials and tools that are not used. Bring order
Seiton	Set, straighten, store	Organize the remaining items. A place for everything and everything in its place
Seiso	Shine, sanitize, scrub, sweep	Establish a cleaning routine, which includes an initial cleaning as well as continuous cleaning, with commissioning activities in order daily
Seketsu	Standardize	Ensure that best practices become part of the regular work of the workplace. Establish standard processes
Shitsuke	Sustain, self-discipline	Revisit the first four Ss on a continuous basis to ensure that there is no clearance, but on the contrary, there is continuous improvement

Tools of Lean Thinking

Lean thinking tools support improvements in processes and the elimination of the costs of suboptimal solutions (such as keeping stocks, which demonstrates the inability to forecast, or batch processing that compensates for the fixed cost of tooling set-up of the machines).

To eliminate this waste, it is important to level the production using the Heijunka tool.[10] This can be done by applying a series of tools:

- value stream mapping to identify the flow and waste in the process;
- just-in-time to reduce stocks;
- autonomation to implement intelligent automation;
- SIPOC to provide a high-level view of the process;
- kanban to ensure that the flow is pulled by the customer.

The following sections provide details of these tools.
Please refer to specialized texts for other methods such as:[11]

- Takt Time and Heijunka: slide the flow and make sure it is pulled by the customer, obtaining at the same time a load leveling through the definition of a production rate;
- Kano diagrams, Quality Function Deployment (QFD), Value Stream Mapping (VSM), analysis Value Added/Non Value Added (VA/NVA):[12] these tools support the definition of the needs of the customer and help identify waste;
- Single Minute Exchange of Dies (SMED), Program Evaluation and Review Technique (PERT), just-in-time (JIT), total productive maintenance (TPM) for compression of the cycle time and set-up times.
- Jidoka.

Value Stream Mapping

VSM is a tool used for process mapping.[13] The flow diagram that results from the application of this tool has the purpose of identifying the flow of materials and information. This helps in spotting waste at the very beginning of an improvement project. This book would prefer the

expression "value network mapping," since complex networks increasingly are replacing streams in processes. The mapping of the value network supports improvements and streamlining of the flows in the pursuit of agile procurement.

Value network mapping:

- provides a common language on the value and the processes;
- clarifies the current situation and opportunities for improvement;
- binds the process information on the flow of materials;
- represents the starting point for every action to improve the value network.

The mapping takes place in three distinct phases:

- identification of product families on which to conduct the investigation;
- mapping the current flows of the procurement processes;
- mapping the future flows showing the improvements.

The mapping is followed by two further phases:

- definition of the plan to implement the new flows;
- revision of the cycle for continuous improvement.

Identification of Product Families

The mapping should refer to a product or family of products. Different products are part of the same family if they undergo similar treatments during operational processes. To assign a product to a family, it is convenient to observe the first stages downstream because the products are different. At the beginning of the process, the treatment is similar for products within the family. It is useful to focus on families, rather than considering all products at the same time, to avoid confusion and to direct attention and efforts at one problem at a time.

It is important to select a product (or product family) with a large potential impact in terms of economic improvements and customer satisfaction and no negative influence on the production of the remaining items.

Stream Mapping of the Current Procurement Processes

The map of the current flows of the procurement processes is called As-Is, or the current state map. It is a snapshot of the initial flows of the processes of the families of a product selected for improvement. For correct mapping, it is useful for the team to follow these guidelines:

- observe the activities;
- determine the timing of the activities directly, not relying on standard times;
- start from the customer orders and trace the process up to the supply of raw materials or components or the beginning of the process of delivery;
- draw the actual processes, not as they should be in theory based on obsolete documentation;
- do not go into too many details but observe the macro activities, especially at the beginning of the mapping process.

The steps to follow for the design of the current state map, including a data report for a proper understanding of the As-Is process (value added and potential waste), are the following:

1. Record the customer requirements: define the value perceived by the end customer or the department in the downstream operating cycle—the Voice of the Customer (VoC).
2. Draw the basic processes: define the processes in which the material flow is continuous.
3. Measure the relevant data for each continuous flow process: the EPE (Every Part Every: the time between the production of two successive batches), starting time (time in seconds to set up the machine), reliability, lot size, number of resources engaged in the process, percentage of waste, and type of packaging costs.
4. Record the number of stocks in the warehouse or in process, where the continuous flow is interrupted.

5. Record the transportation outside the organization: products, raw materials and components from vendors, and the internal movement within the organization of the material and the work in progress.
6. Adjust the flow of information from forecasts to daily orders: if the organization uses an MRP system for programming operations, this must be noted since it denotes a "push" approach.
7. Compute the draw times, which allows for calculating the total cycle time of the process and time to value, and the difference: time wasted in actions that do not add value to the product.

The most important index is the ratio between the total cycle time of each operation and the total cycle time of the process.

Future Stream Mapping with the Definition of Improvements

Once the design of the As-Is process is completed, it is necessary to redesign the new process, the mapping of the To-Be or the future state map. It is necessary to remove the highest number of possible causes of waste identified in the previous phase.

The goal of the future state map is to trace a process that produces only what is required in terms of quantity, mix, and timing, to a high quality, variability, and at low cost, without waste.

To achieve a streamlined process it is important to follow these guidelines:

- Procure and produce by following the Group technology: the Group technology is the relationship between the work time available per turn (the difference between the time of total turn and non-working periods, in seconds) and the number of products (or results) required by the customer per turn. The resulting number represents how many seconds elapse between two requests for product. To operate following the Group technology means to synchronize the procurement and the production with the demand. Parameters to consider are the TPM and the set-up times (SMED).

- Implement continuous flow where possible: continuous flow means the immediate acquisition and passage of a part being machined from one process to another, one at a time, with no queues, waiting, stops, intermediate storing, or excessive movements. Streaming can be introduced for those phases that start and have short lead times similar to the Group technology. When it is possible to combine multiple processes into one continuous flow process, the process boxes in the To-Be are combined into a single process box. It is also important in this case to consider the possibility of problems of reliability and set-up, in addition to design changes of the machines and logistics.
- Where the continuous flow cannot be extended upstream, it is not possible to implement streaming. In this case it is necessary to work in batches. The program should not be based on forecasts. The customer, internal or external, should pull the operations. In this case the expression "supermarket" is used to indicate an area for (internal or external) customers to pick up what they need. These withdrawals, using kanban cardboards, authorize the process upstream team to produce or reorder the products just to restore the stock in the supermarket. This method is based on the real supermarket customer requests (make to order—MTO) and thus avoids using an MRP based on production according to forecasts (make to stock—MTS).
- Programming operations of a single process must involve only the process pacemaker. The pacemaker is the process that dictates the pace of operations upstream (following the Group technology). Downstream, the process must be a continuous flow. There can be no supermarket because this would cause problems syncing with the pacemaker.
- Level the mix of operations and the batch production (value of EPE high). If not levelled they would cause the Forrester effect,[14] and consequently:
  - problems of excess inventory;
  - higher crossing times;
  - negative effects on customer satisfaction.
- Leveling the mix allows the pacemaker to respond more nimbly to changes in demand. It reduces stocks and improves the throughput

time. For example, with a production at pacemakers of two products (product A and product B), if previously the series production consisted of the sequence AAAAAAAAAABBBBB, through leveling of the production mix, the sequence becomes AABAABAABAABAA. The leveling of the production mix provides an answer to the problems of reliability and start-up.

- Level the volume: the problems arising from non-leveling volumes are similar to those for improper leveling mix: lots of high production, inventories, and excessive lead times. To maintain high flexibility of response to the customer, the volume must be leveled out by withdrawing small quantities of products to the process pacemaker. The pitch measures leveling, which corresponds to the Group technology multiplied by the number of pieces removed. Leveling the mix and volumes can be implemented through the Heijunka: a cardboard that is near the leveling process pacemaker, formed by a series of cardboards for kanban. The process can be easily automated. These cardboards have coordinates to indicate the pitch of the columns and rows for the type of product and the target cell. At each pitch are picked up at the respective kanban to treat a predetermined quantity of a specific product or purchase it.
- Treat each type of product at each interval pitch upstream of the pacemaker to minimize stocks and consequently improve the ability to respond to changes in demand. To operate in this way, it is essential to have very high reliability and very short start-up times of the machinery.

Just-in-Time (JIT)

JIT is one of two pillars of the Toyota Production System (together with autonomation) and is one of the basic tools of lean thinking. The JIT approach drastically reduces the need for stocks by making available the materials and the components at the right time and in the correct quantity and mix, being "pulled" by the customer (either internal or external to the organization).

JIT includes a set of tools that allows for sliding the workflow with the following objectives:

- eliminating the stocks;
- making available the materials, components, or documentation at the right time, in the right place, and in the correct volume and business mix;
- meeting the deadlines and quality required by the customer.

The application of JIT requires centralized management of vendors. It is necessary to negotiate with them for the delivery of products or the provision of services to their customers at the time of request. It is necessary, for example, to negotiate the provision of the semi-finished products in the right volumes and mix for assembly, as well as the raw materials for the transformations. The production is not "pushed" to the customer. It is the customer (external or internal) that "pulls" the offer.

Responding to the times and demands of customers implies the elimination of inventory (raw materials, WIP, semi-finished or finished products). Using traditional methods, it would be impossible to respect these rules. Procurement orders are traditionally done in large lots, calculated based on the balance between order costs and holding costs (Economic Order Quantity—EOQ).[15]

Improving quality and eliminating the costs of conservation (stocks) involves an objective of smaller lots, actually moving towards the lot of one unit. Producing with a batch of one unit involves renegotiating with vendors and minimizing times through the redesign of manufacturing processes and equipment according to the SMED method.[16]

Reducing set-up times and production lots brings a number of direct and indirect benefits:

- Possibility of controlling less inventory: the absence of stocks of raw materials in inventory eliminates the cost and time of controlling materials.
- Waste reduction: eliminating stocks and WIP makes the problems of quality and cycle time immediately visible and consequently they can be solved.
- Improved quality: when there is no safety stock, to keep the process operating blocks, the vendor feels driven to meet deadlines and compliance directives. The work is thus more accurate.
- Increased sense of responsibility and motivation: the responsibilities of vendors and operators are increased in the pursuit of continuous

improvement. In addition, each issue also involves the workers downstream. This increases cohesion and team spirit.
- Reduction of indirect labor: reduced inventories imply less storage and less labor management.
- High productivity: the items listed so far enhance productivity, eliminate waste and delay, and decrease the cycle times of the supply process.
- Best response to the market: the decrease in production times allows for more rapid changes of volume and mix.

Autonomation (Jidoka)

Autonomation is the second pillar of the Toyota Production System. It essentially means intelligent automation, or the transfer of intellectual work to the machines. Intelligent automation blocks production immediately in case of anomalies detected automatically through sensor devices and reported with sound and light warnings (*Andon*). The objective of the blockage is to detect as soon as possible the cause of the error, its origin, and responsibility for it (eventually of the vendor). The blockage can be done either automatically or manually. The process can resume only when the problem is resolved.

Introducing software for the detection of defects (such as the number of orders not treated properly, in the case of a sector purchase) makes possible the separation between the operators and the machines. It allows the first to perform other tasks (sequential multiprocessing activities) and equips the second with "smart" features that make the machines more autonomous.

Shigeo Shingo identifies six stages of separation between man and machine and positions autonomation at the fifth stage:[17]

- first stage—manual work: the employee, for example, issues the orders manually;
- second stage—manual feed and automatic machining: entering the order in the workstation and its processing is performed by the computer driving the machine;
- third stage—automatic feeding and automatic processing: the employee identifies abnormal conditions, resolves them, and implements the solutions;

- fourth stage—semi-automatic order processing: this is highly automated (with automatic reorders). The operator identifies only abnormal situations and their solutions;
- fifth stage—processing and automatic detection of abnormal conditions: the person simply finds solutions to these conditions (autonomation);
- sixth stage—automation of all stages, including resolution of the exceptions (known as straight-through processing, or STP).

Autonomation also means trying to prevent possible errors through a priori analysis, not only detecting and eliminating the causes retrospectively. The tool that tries to eliminate problems before they occur is known as Poka-Yoke (or error proofing in English). Preventing problems allows for sliding the flow without unnecessary blockages caused by problems already solved in the past.

SIPOC

SIPOC is an acronym derived from the English words:

- supplier (vendor);
- input (data, materials, documents, and so on);
- process;
- output (data, materials, documents, and so on);
- customer.

This information is very useful in any project to affect quality. The project team can usually collect it in a short time.

The SIPOC provides a snapshot of the process from start to finish. It is the linchpin of the macro phase of definition and measurement of an agile procurement project.

In fact, a much more interesting approach would be COPIS—starting with the customer and going back upstream in the process to the vendors (similar to kanban).

Another alternative is to start with the process. When the relevant steps of the process have been defined, it is possible to move to the

definition of the output and the customer. Finally, the work can be completed with the inputs from the vendors.

Prior to the start of the application of SIPOC, it is necessary to define:

- customers: those who pay for the product or service provided;
- input(s): acquisition requests, orders, and any data relevant for the completion of the process in question;
- vendors.

After scoring the SIPOC (or COPIS) chart, it is possible to start looking into each item. In this way, it is possible to interpret the information and document every step of the tool (see also Fig. 8.2):

- Process: this step is necessary to define the purpose of the process. It is necessary to define exactly the beginning and the end of the process. This stage can reveal any possible redundancies, a vicious cycle, or waste and movements without benefit on which to start working to increase the efficiency of the process. This work is of great help in the process of definition of agile procurement.
- Output: this step involves examining in depth the measurement of the process. The information obtained can be used to verify of the objectives set out above. The outputs obtained may also form the basis of discussion for possible negotiations with the customers.

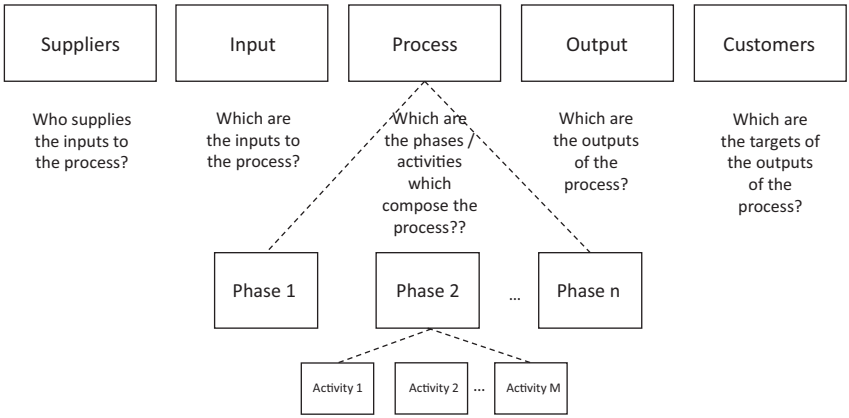

Fig. 8.2 The SIPOC

- Customers: this step of the work is an excellent exercise to determine the VOC. This phase is crucial to identify those involved in defining the monitoring of parameters that are critical to quality (CTQ). This step allows for selecting the right people to be included in the working team, especially when it comes to internal customers.
- Input: this phase should be considered as a miniature diagram of Ishikawa.[18] It is the step to identify the causes of the failure to meet the performance required from the process.
- Suppliers: in this step, it is necessary to think of vendors as real stakeholders in the process of improvement. In many improvement projects, in fact, it turns out that the root cause of a problem is related in some ways to the supplies.

Kanban

Kanban is the tool that allows for the support and smooth flow of information and materials in a process. The concept is relatively simple. An operational department should start to process the quantities that are communicated by the downstream department (the internal customer) according to a cardboard (*Kanban* in Japanese), which is delivered by the department upstream (the "cardboard" kanban is now becoming an electronic message). Kanban is a specific tool for information control and the ordering of the production and transportation of materials between manufacturing and services processes. It allows for synchronizing the procurement processes between upstream and downstream. It facilitates the flow of pull and JIT, in contrast to the just-in-case (push), which is the typical technique based on programming upstream of each individual process.

The kanban system forces the upstream process to produce only the output needed by the downstream processes, at the right time, and in the right quantities. The system is based on the supermarket, which is the area where the customers (downstream processes) "buy" products.

A kanban cardboard includes the information useful to the upstream department, such as (see Fig. 8.3):

- name of the part;
- its part number;

From:	Product Information	To:
Name Vendor - Process	Code	Name Client - Process
Code	Description	Kanban code / Issuing Date
Location	Reorder quantity	Location

Fig. 8.3 Typical kanban

- process in question;
- lot size to be delivered;
- where to deliver supplies.

The kanban can signal production (in-process for the continuous stream or for batch production) or procurement (inter-process for internal operations, the vendor for external operations). In particular, the types of kanban are:

- in-process: signaling the need to produce an article or a small amount (ideally one unit), used when the flow is continuous;
- signal: signaling the need to produce a batch of relatively large dimensions, used in conjunction with the supermarket to drive upstream processes and allow them to make the fitting; generally costly in terms of time;
- inter-process: for handling/withdrawal, used to signal the need to move items from the supermarket and upstream process in the facility;
- vendor: for procurement, used for the handling of material from outside of the site/of the organization in accordance with the vendors. It indicates the cycle of the kanban, in other words, the type of product to be supplied, the quantity, and the frequency of delivery.

Generally, the different types of kanban are used in combination.
The rules of the kanban are simple and clear:

- The activities are pulled from the downstream activities in the processes.
- The upstream processes produce only the units necessary for the downstream processes.

- It is not possible to put something into production without having first received a production kanban. It is necessary to produce the amount of product shown on the cardboard.

The aim of kanban is to:

- prevent overproduction;
- control production visually;
- eliminate schedules based on forecasts;
- be a useful tool for continuous improvement. In fact, thanks to kanban, it is possible to reduce:
  - WIP stocks;
  - changes;
  - total cycle time of the process.

The ultimate goal of lean thinking is to eliminate the kanban as well. This would be possible only with a single continuous flow of supply, from raw materials to finished products to the end customer.

Human Contribution to Lean Thinking

Lean thinking is a model that simplifies the organization and the way people work. It must involve the entire organization. It requires considerable effort to overcome resistance to change. The primary goal is customer satisfaction achieved through the elimination of waste and activities that do not add value. The profitability of the organization is an important goal, but it derives from the customer's satisfaction. The lean organization must strive for perfection, even knowing that it will never reached. It must pursue continuous improvement. The team should not care about competition, since the aim is perfection.

The application of the method and techniques of lean thinking requires the involvement, after appropriate training, of all the personnel of the organization. The lean concepts are simple in theory but not easy to apply in everyday life. For this reason, it is necessary to work to change the cultural approach of the personnel in the direction of continuous improvements.

Change must start with top management. It is necessary to create a sense of urgency and interest among all staff through a communication plan and incentives. People must change their mindset in order to face the challenge of continuous improvement.

The tools used are different, but most are essentially based on the work of an improvement team. This is definitely the best way to utilize creative criticism and to reach, in an integrated way, the optimization of the value network. Lean thinking has to involve many functions. No proposal is valid if it does not come from the team. Possible changes are only those approved by the team.

Lean Six Sigma

A further development of quality management is the Lean Six Sigma method. This makes it possible to deal with problems with two methods and two sets of different and complementary tools. There are two components of the method:

- Six Sigma focuses on reducing variability and on the consequent improvement of the process following the DMAIC approach through the use of statistical tools.[19]
- The lean approach, guided by the five principles of lean thinking, focuses on eliminating waste and ensuring the continuous improvement of the workflow and the shortening of cycle times.

Reducing cycle times and at the same time decreasing defects (which in turn allows for the reduction of times of control, rework, and similar) is essential in a situation in which delivery times are becoming an important aspect of competition.[20]

The main differences between lean and Six Sigma and the effects obtained from their implementation are summarized in Table 8.2.[21,22]

Characteristics of Lean Six Sigma

The integrated approach to Lean Six Sigma begins with the mapping process. The value stream map allows for viewing the As-Is and the flow

Table 8.2 Lean and Six Sigma characteristics

Characteristics	Lean	Six Sigma
Target	Cycle time improvement. Process improvement	Elimination of defects and variability
Applicability	Initially manufacturing then all processes	All processes
Project selection	Driven by the Value network map	Various approaches
Project duration	From one week to three months	From two to six months
Structure	Ad hoc	Dedicated resources as facilitators (the belt)
Training	Learning by doing/no formal training	Learning by doing/formal training and extended throughout the organization
Primary effect	Reduction in the cycle time/elimination of waste	Reduction in defects and variation/process resulting uniform
Byproduct	The resulting processes are uniform	Reduction in cycle times

of the current value, and for designing the To-Be, or the future state to be reached. Mapping allows for the drawing up of a project plan (or kaizen plan). The plan should define the action plans to bridge the gap between the As-Is and the To-Be and achieve their goals. The kaizen plan consists of a list of improvement projects. These projects can be accomplished through the application of Lean and/or Six Sigma.

The lean projects focus on the problems typical of the operations, such as measures to reduce the start-up time, the creation of cells, and the leveling of the workload. They can be completed in a short time, without the use of analysis tools.

The Six Sigma projects cover every type of process. They are useful in dealing with problems that are more difficult to resolve, using advanced tools of statistics and problem-solving. They tend to have a longer duration than the lean projects.

The Lean Six Sigma projects use the positive characteristics of both approaches. They define and accelerate the process of improvement to create flow and eliminate process variability.

Interventions can be lean or Six Sigma. If the interventions are lean, the main goals are to speed up the workflow, decrease boot times, level the workload, connect vendors, and apply TPM, through the five

principles of the lean thinking method. If the interventions are Six Sigma, the goal is to reduce the variability using a DMAIC or DMADV approach, depending on the objectives set out.

Benefits of Lean Six Sigma

The synergistic effect achieved with the application of the Lean Six Sigma method allows for making the results visible and obvious in terms of:

- lower costs;
- increased profitability;
- leanness, acceleration, and flexibility of processes;
- effective response to customer requests;
- increased quality of product/process and customer satisfaction.

The combined effect of high quality and high cycle speed brings many benefits. Less production time means a rapid response to the changing demands of customers and therefore the opportunity for higher revenues. A high level of quality of the product means greater customer satisfaction and, at the same time, a significant reduction in service costs.[23]

Leagile

Combined Approach: Lean and Agile

At the beginning of the 2000s,[24] academics and practitioners analyzed the combination of the agile and lean approaches for leveraging the benefits of both methods in a balanced manner.

Agile management and the lean method are complementary. In order to be agile, it is necessary to be lean. On the other hand, it is necessary to be agile in order to be lean.

There are some areas in which the lean and agile methods differ:

- In order to be agile, it is better not to push too much on leanness. In other words, to be agile it is necessary to have some reserves of resources available in order to be able to change rapidly.

- If an organization strictly applies the Lean Six Sigma approach, that organization will structure the improvement projects in DMAIC (define, measure, analyze, improve, and control) for continuous improvement or in DMADV (define, measure, analyze, develop, and verify) for drastic process improvement. Both structures tend to lead to projects managed in the traditional ways (waterfall: one activity of the project after another) rather than agile (with the projects devided in smaller subprojects (called springs) .

Naylor et al. coined the term "leagile" to refer to hybrids of the lean and agile approaches.[25] It was later systemized by Mason Jones Naylot and Towill[26] Building on the concept of the blended strategy set forth by Naylor, Naim and Berry.[27] Christopher and Towill identified distinct types of hybrids.[28]

It is important to combine leagile with digitization.[29]

Leagile Model

While lean management emphasizes the pursuit of process efficiency—generating the greatest outcome from the least input through the minimization of waste—agility refers to an effective and flexible accommodation of unique customer demands.[30] Naylor, Naim, and Berry suggest that an agile organization "[uses] market knowledge and a virtual corporation to exploit profitable opportunities in a volatile marketplace."[31] Instead of relying on speculative notions of what might be demanded, the quantity of demand, and the location of that demand, agility employs a "wait-and-see" approach to demand. There is no commitment to deliver products until the demand becomes known. Therefore, while lean management typically calls for make-to-stock replenishment driven by short-term forecasts, agile value networks employ make-to-order provisions, producing only what has already been sold or committed in the marketplace.

Leagile is a hybrid of lean and agile methods. However, this can take one of several forms:[32]

- use of make-to-action: lean strategies for large volume, stable demand products and make-to-order agile strategies for everything else. This approach embraces the Pareto (80/20) rule, recognizing that 80% of a company's revenue is generated from 20% of products;

- having flexible production capacity to meet peak demands or unexpected demands from the end customer;
- use of decoupling strategies, in which the components of the basic products are made based on demand forecasts. The product is assembled or finally configured only when a firm order by the end customer has been received.

The last approach seems particularly interesting and is the subject of this section of the book. It requires a change with respect to the traditional lean or agile approach. It is based on accommodating diverse needs efficiently. Many refer to such an approach as mass customization. This indicates the creation of something new each time through an organization's own creative process to satisfy each specific customer.[33,34]

In the case of manufacturing, the decoupling point strategy could be obtained with the creation of a strategic inventory. It is possible to set up a staging area (an inventory) in some generic or modular form. The final assembly or configuration is then completed when the precise customer requirement is known. An example is the customized personal computer by Dell.[35] This concept of "postponement" is increasingly being used by organizations in a range of industries.[36] As shown in Fig. 8.4, by using the concept of postponement, an organization may use the lean method up to the decoupling point and agile methods beyond it.[37] Organizations such as Hewlett-Packard have successfully employed such strategies to

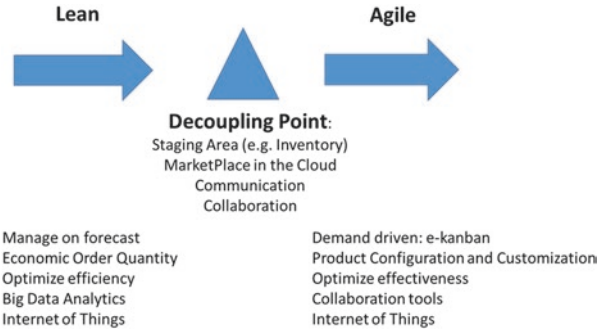

Fig. 8.4 A leagile approach based on decoupling (elaboration of the author from Christopher and Towill)

enable products to be localized much closer in time to actual demand.[38] However, as Pagh and Cooper pointed out, satisfying customer demand may require particular combinations of postponed manufacture and postponed logistics.[39] A parallel concept to the material decoupling point described above is that of the immaterial information decoupling point.[40]

In order to evaluate the benefits of the different possible strategies—only lean, only agile, or leagile—a paper by Goldsby, Griffis, and Roath examined three broad KPIs of value network performance:[41]

- The expected level of customer service attainable by each model. A common measure of service is average order-to-ship time. This metric captures both on-hand inventory availability and backorder response time.
- The measure of enterprise-wide inventory captures the speculative nature of the value network. More inventory in various levels of completion in different locations translates into larger inventory holdings and higher inventory carrying costs.
- The enterprise-wide total cost is an exploratory dimension. It consists of the focal company's costs of material acquisition, inbound logistics, manufacturing, and outbound logistics. Inbound and outbound logistics include the costs of transportation, warehousing, and inventory carrying costs.

Leagile and Digitize Method

The leagile model for the improvement of processes comprises several stages. To be successful, the leagile approach must adopt a process that this paper describes as "the seven Ds": define, decouple, design, develop, digitize, deploy, and diffuse. It is essential to apply this method and its tools in a strong partnership between the sectors of the organization involved, quality and support departments (such as ICT, finance, and operations).[42] Stakeholders from all parties need to be aligned in setting up and staffing the improvement project team. Perhaps more importantly, the organization must treat the initial application of the leagile

and digitize method as the beginning of an iterative cycle that generates continuous improvement and leads to a change in the culture of the organization. A "problem" or "challenge" should not trigger process improvement efforts. It should be a substantial part of the organizational culture.

It is important to blend process improvement and ICT. Based on research and experience, one can profitably use leagile and digitize in improving processes. The leagile and digitize method can be summarized as follows. It can be divided into seven stages and 29 steps, as described below and as illustrated in Fig. 8.5. At the end of each stage there must be tollgates, where the project needs to be checked by the improvement initiative steering committee.

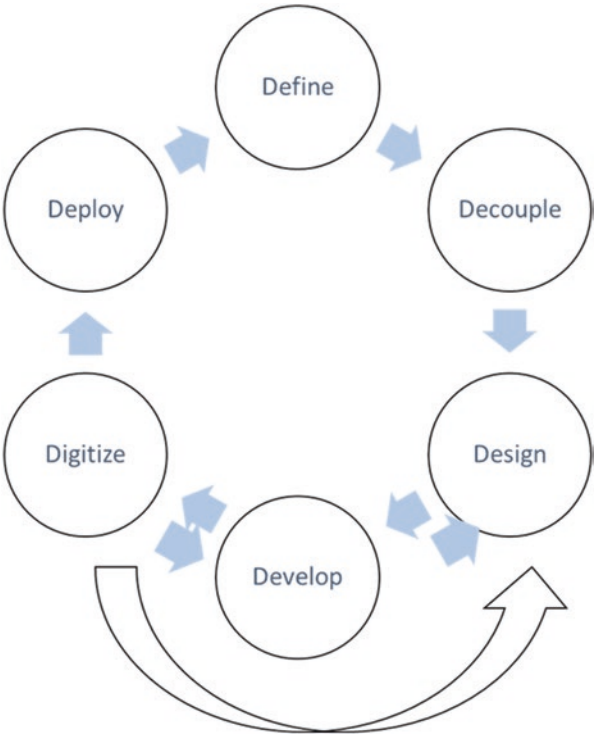

Fig. 8.5 The method of leagile and digitize

Stage 1: Define

In this stage, the environment is defined to set the ground for the process improvement.

- Context: identify the needs or the requests of the customers, shareholders, and employees, and the challenges of competitors and respect for compliance (for instance, legislation and regulations).
- Culture: detect the culture of the organization, of the community, and of the nation in which the organization is located.
- Vision: tackle the problems of effectiveness, efficiency, economy, and quality of process improvement.
- Strategy: define the possible content of the process improvement.
- Kick-off: launch the project during a special meeting and notify all the stakeholders.
- Governance: define how to manage the initiative and set up the team.
- Voice of the customer: listen to the VoC associated with the potential process improvements and verify it.

Stage 2: Decoupling

In this stage, new ideas are explored for potential development into a process, product, organization, or business model.

- Splitting of the value network: set up lean operations in the production of generic, semi-finished products, and agile accommodation in the customization process.
- Selection: find and evaluate a process improvement to potentially develop or adopt.
- Metrics: translate the process improvement and the VoC into CTQ factors.
- As-Is: map the existing situation in terms of products, processes, organization, or business models.

Stage 3: Design

In this stage, the model and the sequence of activities are defined.

- Lean and agile: define how to innovate with the support of the team in workshops and meetings.
- Kaizen plan: define the improvement intervention plan.
- Architecture design: define the rules, policies, and process structure of the potential process improvement.

Stage 4: Develop
In this stage, an idea is developed into a usable process improvement.

- Build: construct the chosen solutions.
- Packaging: surround the core technology with complementary products and services that together form a solution that can be effectively used for a given purpose by a target adopter.
- Configure: decide which technology features will be used, whether they will be used as is or with adaptations, how the technology will be integrated with other technologies the organization already has in place, how related organizational elements (for instance, structures, processes) will be changed, and how the organization will absorb and make use of the technology.
- Change management: manage the changes.

Stage 5: Digitize
In this stage, automation is applied at the highest possible level of the redesigned processes in a distinct way for the lean and agile part of the value network.

- Implementation: implement the digitized applications.
- Test: unit tests, system tests, integration tests and user acceptance tests should all be conducted.

Stage 6: Deploy
In this stage, the process improvement is implemented and the ancillary activities are performed.

- Deploy: implement the chosen solution.
- Document: issue the documents related to the process improvement.

- Verify: control the improvements.
- Internal and external benefits: assess the benefits, both external (i.e., take notice of customers, shareholders, and employees satisfaction) and internal (i.e., assess the profitability, market share, and internal improvements related to the new process).
- Lessons learned: learn from the initiative.
- Celebration: acknowledge the team's work.

Stage 7: Diffusion

In this stage, it is necessary to assemble and arrange the resources necessary to (1) persuade and enable a population of organizations or individuals to adopt and use the process improvement and (2) to diffuse or spread it across a population of potential users.

- Assimilation: individuals and other units absorb the process improvement into their daily routines and the work life of the firm.
- Appropriation includes tasks such as managing intellectual property and the ecosystem of complementary products and services so that profits are protected from vendors, customers, and imitators.
- Transformation of the technology and the organization makes it possible to take advantage of the new opportunities brought about by the process improvement; transformations can also happen at the market and societal levels.

Stages 3, 4, and 5 should be done with an agile approach in several cycles, or "springs" in the terminology of agile innovation.[43] An agile approach is a development method based on iterative and incremental development, where requirements and solutions evolve through collaboration between self-organizing, cross-functional teams.[44] It promotes adaptive planning, evolutionary development and delivery, and a time-boxed iterative approach, and it encourages rapid and flexible responses to change. It is a conceptual model promoting tight interactions throughout the development cycle.

Many tools can be used in conjunction with the process described. They can come from the tools used in lean, Six Sigma, agile management, and digitization. This section of the book does not consider them since they are well covered in many publications.

Leagile e-Procurement

The method of leagile and digitize can be used in a beneficial way to improve procurement. This is obtained with the simultaneous use of process improvement and e-procurement. E-procurement is the electronic tendering and procurement of goods and services.[45] Organizations implement some forms of e-procurement on the Web. They search for benefits such as a wider choice of vendors. This is expected to lead to lower costs, better quality, improved delivery, shorter lead and cycle times, and reduced total cost of ownership. For instance, tendering specifications are downloaded by the vendors themselves rather than mailed by post. Electronic negotiation and contracting, and possibly collaborative work in specification, can further enhance time and cost savings and convenience. For vendors, the benefits are in being able to access more tendering opportunities on a global scale, lower cost of submitting a tender, and possibly tendering in parts, which may be better suited to smaller enterprises, or collaborative tendering (if the e-procurement site supports such forms of collaboration). The main source of increased margins until now has been the reduction of costs (automated tender processing, more cost-effective offers, and so on).[46]

The benefits connected with e-procurement can be substantial. Public procurement accounts for more than 16% of GDP. It has not yet made full use of innovative models and tools to streamline value networks, increase transparency and speed, and reduce administrative costs and contract prices. E-procurement can bring significant savings when used in public and private procurement. Such a process of change requires a new management culture and new tools. Several authors have analyzed the key lines of change to be pursued. They have shown that e-procurement, and especially e-tendering, are the appropriate tools to implement such changes because they, in connection with business process intelligence, can support significant improvements to cope with the strategic and tactical challenges of procurement.

The application of e-procurement in combination with leagile requires flexibility. Chang et al. underlined the importance of flexible e-procurement systems.[47] Their paper explores and presents the inter-relationships

between e-procurement research during this period and the changes and focus on the domains and characteristics considered important. Flexibility is highlighted as a key factor when considering which marketplace platforms to use—providing an opportunity for firms to increase overall performance and better facilitate inter-organizational relationships and transactions.

E-procurement should be viewed as an enabling mechanism to make the process of procurement more efficient in terms of cost, time, and achievement of value for money.[48] Because existing procurement practices and procedures may contradict the goals and objectives of the new initiative, the implementation of e-procurement will require the re-engineering of existing procurement processes.[49] Birks, C., et al. noted that roles and responsibilities might change substantially with the new process, requiring staff to adapt accordingly.[50]

The high degree of re-engineering of the process is positively associated with the practices and processes implementation perspective of an e-Procurement initiative.[51]

All these papers underline the importance of using a flexible process improvement method in e-procurement initiatives.

In order to use all these new solutions, it is necessary to adopt an advanced architecture. This is based on cloud computing, and in particular the software as a service (SaaS) mode. This solution ensures proper connections between the organization, the customers, the vendors, and the partners, anytime, anywhere, and from any device.

The correct implementation of leagile and digitize procurement combines process improvement and automation using the method described previously.

The usefulness of this approach has been demonstrated in the field at many organizations. Quite often attempts to use this approach do not give due importance to the improvement of the processes and especially to the people who have to use them. The introduction of lean procurement requires a cultural change. In order to make procurement processes simpler and more immediate to manage, it is essential to transfer the benefits to the staff that need to use them, so that success is guaranteed.

E-procurement is a substantial enabler of a leagile value network. Four components in particular are essential to make the leagile approach successful. They can be referred to as the four Cs:[52]

- cloud computing;
- communication that is increasingly mobile;
- comprehension, meaning how to improve the knowledge of the organizations through tools referred to as big data and analytics;
- collaboration, also through so-called social networks.

Each of these components is a strong change agent in the processes of procurement:

- Cloud computing is the use of computing resources accessed through networks and with payment for services provided based on use. Its impact on procurement is significant since it opens up new horizons for accessing computing resources. Cloud computing provides a distributed computing platform that makes interactions between the decoupled components of the value network and the sales channels easier and more feasible.
- Communication pushes towards working anywhere, anytime, on any device. The decoupled approach makes communication among the distinct components of the value network, its vendors, and its sales channels essential. Mobile technology, such as the Internet of Things, allows for the collection of data all along the value network, also making communication between the different components of the value network much easier.
- Comprehension of the organization, through tools such as big data analytics, supports procurement in a way that was not possible in the past, thanks to the increasing availability of a large amount of data and documentation. In order to function effectively and efficiently, big data analytics should be used as an essential tool for better forecasting, by making use of the increased amount of data available, in part thanks to sensors.
- New collaboration tools make it possible to develop integration along the value stream. Since the leagile approach involves splitting procurement

and production, collaboration becomes essential in order to increase the efficiency, effectiveness, and economics of the operations.

Procurement Finance

Procurement is characterized by three flows (Fig. 8.6):

- physical flows of material and products;
- information flows of documents;
- financial flows from procure to pay.

The information flows synchronize the physical flows with the financial flows. Organizations must be able to communicate with vendors, distributors, and customers. In parallel, they must also manage their relationships with banks and other financial institutions. The diversity of financial communications between an organization, its vendors, and various financial institutions in different countries gives rise to a wide range of transactions and services. These include cash management services of reconciliation, delivery of bank statements, routing and execution of orders, and connected flow of funds.

As a result, there is a need to integrate the different areas of procurement, operational and financial, connected to each other, both inside and outside the organization, through an environment of multienterprise collaboration.

Combining financial and physical procurement is a challenging and complex project. Organizations are forced to comply with regulations in some countries, such as the EU legislation on e-invoicing.[53] All

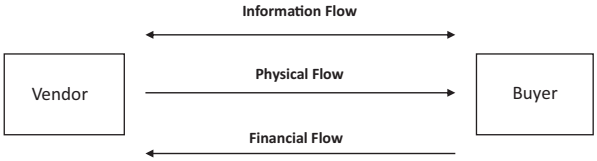

Fig. 8.6 The three flows in procurement

organizations operating in Europe must also comply with the legislation in force in each country.

In order to optimize the processes and realize savings, it is possible to implement e-invoicing within a business community. This eliminates (or at least reduces) manual and paper-based processes. Electronic invoicing has to be integrated with the systems and processes within the organizations. They must comply with the storage, retrieval, and removal regulations in each country.

Financial excellence requires efficient financial transactions. In the absence of effective financial management processes that are optimized and designed to reduce costs and limit the demand for resources, it is difficult to achieve such increasingly challenging business goals. Manual processes in financial procurement cannot help an organization's productivity.

The problem is not only with the efficiency of the processes. The processes and systems must optimize and improve the accuracy of financial processes.[54] They should help, for instance, with reporting cycles and the management of accounts receivable, monitoring and managing expenditures at the organizational level, and the achievement of economies of scale by enabling shared services.

It must be possible to:

- optimize closing financial cycles by improving automation and collaboration in order to reduce the time of closing of the fiscal or legal periods;
- increase the productivity of the financial management, also allowing organizations to conduct international operations with fewer resources, while maintaining, at the same time, control of the costs;
- automate the processes of accounts receivable, billing, computation of cash flows, reconciliation of cash, and the improvement of cycle times for completing orders.

Financial management solutions must provide the basis for the automation of critical processes in financial management, including sales, sourcing, and vendor and financial institutions management. They must provide the flexibility to configure processes according to best practices.

Some surveys show that roughly 75% of working capital is tied up in procurement.[55] It is not common in the value networks, such as apparel or durables, to have cash-to-cash cycles of six months or more. Working capital inefficiencies are combined with cross-border risks related to exchange and interest rate movements. They tend to increase the cost of goods and reduce service levels.

Characteristics of Procurement Finance

Supply chain finance (SCF), or procurement finance as it is generalized in this book, refers to the use of short-term credit to balance and finance working capital across the buyer–seller–organization system. In this way, it aims to minimize the aggregate value network cost, that is, the base value of the network costs plus the cost of money. Procurement finance works in such a way that buyers can keep their long payment terms and simultaneously ensures that vendors are paid quickly and with certainty (through letters of credit and guarantees).[56] Procurement finance refers to risk management practices and transactions that facilitate the purchase of, and payment for, goods and services, especially internationally. Examples include the exchange of purchase orders and invoices, the management of liquidity, the financing of the working capital finance, and making payments, if necessary taking into account several currencies (Fig. 8.7).[57]

The providers of procurement finance resources, information, and components are internal corporate functions, vendors, or external partners, for instance:

- collaborating trading partners;
- corporate treasuries;
- banks, fintech,[58] and insurance providers;
- business process outsourcers or services;
- B2B integration networks;
- e-invoicing and e-business service providers;
- market analysts and advisers;
- government, global, or regional institutions.

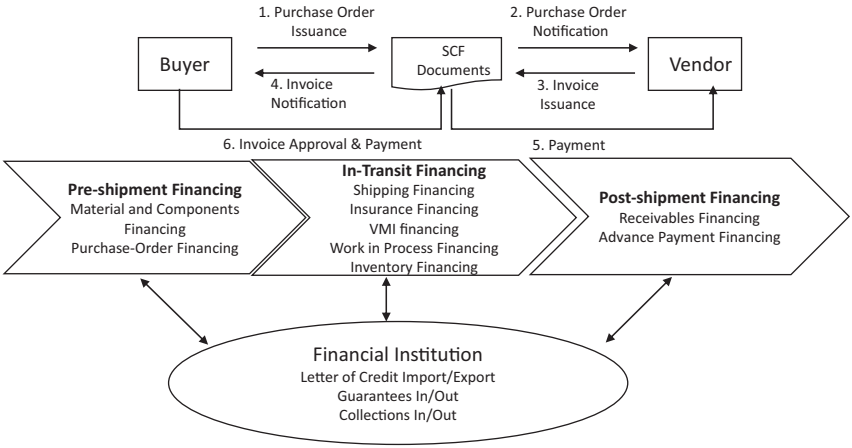

Fig. 8.7 Procurement finance model

Procurement finance is becoming more important in addressing the requirements of open account trading and the increasingly globalized and inter-related value networks. The roles of physical and financial value networks are highly inter-related. It is also becoming more complex due to the trend towards servitization: the provision of products and related services.[59,60]

The key risk indicators (KRIs) of procurement finance are:[61]

- trading partner financial stability;
- buyer default;
- vendor default;
- cash flow and liquidity;
- financial impact of demand volatility;
- exchange and interest rate risk;
- availability of finance, credit, or guarantees.
- payment assurance;
- payment execution and performance;
- fraud and errors.

Procurement finance works on interest rate arbitrage between a creditworthy buyer and a less well-established seller. The finance institution

purchases the seller's accounts receivable at a discount, securing cash against the buyer's credit. The discount assessed on the seller's invoice amount, minus the risk premium, constitutes the financial institution's profit. Typical procurement finance spreads range from around 20 to 500 basis points.[62]

Compared to the traditional letters of credit or guarantees, procurement finance encompasses new trade finance tools. It is a field that is still under development and improving. Procurement finance includes advance payments, reverse financing, payables financing, factoring, and dynamic discounting.[63] The money may flow from the buyer's treasury, a bank with an active transaction banking practice, or a trade finance fintech start-up.[64]

Procurement finance is becoming increasingly important due to:[65,66]

- increased globalization and complexity in the value network management;
- accelerated growth in open account trading and reduced use of classical procurement finance tools;
- automation as technology is leveraged to improve physical and financial value network processes;
- focus on working capital management and the need to manage costs at all levels;
- the fact that business processes increasingly run across organizational and geographical boundaries, increasing risks and requiring greater collaboration:
  - internally between sales, marketing, procurement, operations, treasury, and receivables and payables management;
  - externally among buyers, vendors, financial institutions, and solution providers;
- greater demand for standards and standardization as a platform for competition;
- demand for transparency and visibility. This is driving buyers, vendors, and financial institutions to achieve automation and better tracking of physical and financial flows for management and compliance reasons.

The inter-relationship between the physical and financial value networks can be clarified by referencing process maps that show:

– the components of the physical value network;
– the components of the combined physical and financial value network;
– the events in the physical and financial value networks that represent opportunities for financial institutions and solution providers to introduce financial value network products, services, and solutions.

The challenge for providers of financial procurement solutions is to recognize the key components of procurement finance to include that will support the physical value network.

To better understand the role of financial institutions in procurement finance, the opportunities and solutions can be classified as follows:

- value network automation;
- working capital management;
- trade and procurement finance;
- risk mitigation;
- business intelligence and big data analytics.

These categories overlap, for example, trade and value network finance with risk mitigation.

In the past, procurement finance has focused on a single value network (between a buyer and a seller) in order to show the components and inter-relationships in physical and financial value networks. In reality, the actual transaction flow between a buyer and a vendor likely consists of multiple parties meshed together in a value network.

Physical and financial value networks are very much linked. They are becoming ever more integrated, automated, and characterized by collaboration among all parties involved. Several points along the physical value network create opportunities for financial institutions to offer procurement finance solutions. They can support and facilitate the physical value network.

Buyers, vendors, and providers of procurement finance solutions should move beyond a silo view of the traditional supply chain. They

should take a holistic approach in order to fully understand and act upon the opportunities.[67]

Big Data Analytics and Agile Procurement

Big data analytics can contribute to making procurement finance agile. With reference to procurement logics, for any purchase there is a financial outcome in the form of some outward financial flows, at given times, for given amounts, and through an established invoicing process. These outcomes are relative to vendors, but also to financial institutions, shippers, customs, and other stakeholders.

Big data analytics' contribution to the finance functions is its capability to aggregate raw spend data and investigate them in order to draw useful insights from them.

An interesting example of the opportunities that can be exploited and the value that can be extracted is in cash flow management (CFM). Organizations that are multinational and collaborate with a number of vendors around the world often struggle with CFM evaluation.

An excess of liquidity can be a big waste. Running out of cash can be even more problematic for an organization's rating and reputation, as the customers may suffer. Financial institutions can provide cash in case of liquidity shortcomings, but this flexibility comes at a huge cost. Careful CFM may become a way to run a business that is agile, which means lean and digitized. To be effective, CFM needs to be supported by reliable analytics and continuously fed with relevant information.

Big data analytics is able to identify and structure relevant data from raw information databases, and even open data, providing forecasts of the cash needs of an organization with reference to its portfolio of vendors, the structure of contracts, the payment policies, and more.

The benefits of big data analytics include the possibility of using what-if analysis. Thanks to this solution, characteristics of the organization's dynamics (for instance, lead times in payment days) can be analyzed in order to quantify the potential improvements in profitability, balancing the cost/income scenario with the financial inflow/outflow scenario.

Monitoring

Managing this delicate process becomes less complex if the procurement staff can use specific monitoring tools. Analysis expenditure systems enable organizations to analyze spending and data on vendors, as well as key performance parameters. In this way, it is possible to control the volumes purchased. It is also possible to evaluate their breakdown by entity or expenditure category. This should allow for checking variances from the budget and the objectives of the organization. This solution should be on top of the management system, allowing for turning data into information, information into decisions, and decisions into actions in order to keep track of and better manage all activities in the procurement processes.

Agrifac

Agrifac is a B2B producer of agricultural equipment (sugar beet harvesters and sprayers) for a niche market. It delivers solutions to its customers in the form of custom-made equipment of high quality and excellent after-sales services (maintenance, spare parts provision, and so on). The "4E for growers" concept is about efficiency, economy, ergonomics, and ecology, all of which are value drivers for Agrifac and its customers.[68]

Agrifac is investing in improving its procurement financing.[69] Most certainly, the real world of Agrifac cannot in fact be described in a theoretical model. Some of the theoretical features can be observed as well in this case study. The necessary pre-conditions for Agrifac's take-off are now at an operational stage, to share information about the sales forecast from the focal company (Agrifac)with its Tier 1 and Tier 2 vendors in the supply chain, using the TradeCloud platform.[70] Therefore, inventories in the supply chain have a tendency to be lower at the Tier 1 and Tier 2 vendors and at Agrifac. The next steps to be implemented are the workflow of invoices, as well as the confirmation process of invoices. These steps will result in the reduction of the payment period between:

- Tier 2 and Tier 1;
- Tier 1 and the focal company (Agrifac).

Conclusions

This chapter has presented powerful methods and tools for managing process improvements to add value for customers and the organization with cost reductions. An agile procurement team should be able to use them in profitable ways.

The second part of the chapter has underlined the importance of procurement finance to better manage the financial flows for vendors, buyers, and indeed financial institutions.

Revenue estimations and costs should always be coupled. This subject is covered in the second volume of this book.

Notes

1. Nicoletti, B. (2012). *The Methodology of Lean and Digitize*, Gower Press, Farnham, UK.
2. http://www.martinbraun.co.uk/pictures%5CLean_house.jpg, Accessed 11 November 2016.
3. Ellram, L.M. (2002). Total cost of ownership. In *Handbuch Industrielles Beschaffungsmanagement*. Gabler Verlag, Wiesbaden, Germany: 659–671.
4. See endnote 1.
5. Hence the importance of the recent trend towards contracts for multi-skill resources as well.
6. Bonfiglioli, R. (2016). *Pensare snello. Lean-thinking alla maniera italiana. Costruiamo l'impresa competitiva (più produttività-minori sprechi) 5 nuovi casi italiani di successo,* FrancoAngeli, Milano, Italy.
7. Dennis, P. (2016). *Lean Production simplified: A plain-language guide to the world's most powerful production system*. CRC Press, Boca Raton, FL.
8. See endnote 1.
9. Miklovič, D. (2008). Q & A: Moving lean from the Plant to the IT Organization, Part. 1 *Gartner Report*, Nov.
10. Leanmath.Com (2015). Heijunka cycle. http://leanmath.com/blog/2013/12/11/heijunkacycle, Accessed 22 April 2017.
11. Nicoletti, B. (2010). *Gli Strumenti del Lean and Digitize*, FrancoAngeli, Milano, Italy.

12. Nicoletti, B., (2012), *Lean and Digitize: An Integrated Approach to Process Improvement*. Gower Publishing, Farnham, UK. ISBN-10: 1409441946.
13. This section is a reworking of the concepts in the book: Rother, M., and Shook, J. (2009), *Learning to see. Mapping the value network to create value and eliminate waste*, The Lean Enterprise Institute, Cambridge, MA.
14. The Forrester effect, also called the whip effect, is defined in Wikipedia as a distribution channel phenomenon in which forecasts create supply chain inefficiencies. It refers to increasing variations in inventory in response to variations in the customer demand as one moves further up the supply chain:

    Symptoms of the Forrester found by Hau Lee and Corey Billington (Lee, H. L., and Billington, C. (1992). Managing supply chain inventory: pitfalls and opportunities. *Sloan management review*, *33*(3): 65 are:

    - an excessive level of stocks, especially upstream of the production chain;
    - ineffectiveness of frequent or constant sales forecasts;
    - sudden changes in demand for capacity (which is sometimes insufficient and sometimes excessive);
    - frequent backlogs;
    - frequent changes to production plans.

    It is not necessary that all these symptons be present. One or fewer are sufficient.
15. Nicoletti, B. (1974). Gestione scorte, Part 3 *The Organization of Production*, Academy, Roma, Italy.
16. Nicoletti, B. (2012). *Lean and Digitize: An Integrated Approach to Process Improvement*. Gower Publishing, Farnham, UK.
17. Shingo, S. (1991). *Il Sistema di Produzione giapponese Toyota dal punto di vista dell'Industrial Engineering*, FrancoAngeli, Milano.
18. See endnote 15.
19. See endnote 15.
20. Time—The Next Source of Competitive Advantage, Harvard Business Review, July 1988.
21. Bertels, T. http://www.isixsigma.com/library/content/c030721a.asp, Accessed 20 October 2016.
22. http: //www.lean.org/Community/Registered/ArticleDocuments/ASQStoryonQualitySigmaAndLean.pdf, author Dave Nave, page 5 of 6, Accessed 20 October 2016.

23. Aggogeri, F., and Gentili, E. (2006). *Lean six sigma: la nuova frontiera per la qualità. La sinergia tra six sigma e lean production per un innovativo metodo di gestione e miglioramento dei processi industriali*, FrancoAngeli, Milano, Italy: 18–19.
24. Mason-Jones, R., Naylor, B., and Towill, D.R. (2000). Lean, agile or leagile? Matching your supply chain to the marketplace. *International Journal of Production Research*, *38*(17): 4061–4070.
25. Naylor, B.J., Naim, M.M., and Berry, D. (1997). Leagility: Integrating the Lean and Agile Manufacturing Paradigms in the Total Supply Chain, *MASTS working paper No. 47*.
26. Mason-Jones, R., Naylor, B., and Denis, R.T. (2000). Engineering the leagile supply chain. *International Journal of Agile Management Systems, 2*(1): 54–61.
27. Naylor, B.J., Naim, M.M., and Berry, D. (1999). Leagility: Integrating the lean and agile manufacturing paradigms in the total supply chain. *International Journal of Production Economics, 62*(1): 107–118.
28. Christopher, M., and Towill, D. (2001). An integrated model for the design of agile supply chains. *International Journal of Physical Distribution Logistics, 31*(4): 235–246.
29. See endnote 15.
30. Christopher, M. (2000). The agile supply chain-competing in volatile markets. *Industrial Marketing Management, 29*(1): 37–44.
31. See endnote 24.
32. Goldsby, T.J., Griffis, S.E., and Roath, A.S. (2006). Modeling Lean, Agile and Leagile Supply Chain Strategies. *Journal of Business Logistics, 27*(1): 57–80.
33. Feitzinger, E., and Lee, H.L. (1997). Mass Customization at Hewlett-Packard: The Power of Postponement, *Harvard Business Review,* 75(1): 116–121.
34. Barlow, J. (1999). From Craft Production to Mass Customisation. Innovation Requirements for the UK Housebuilding Industry. *Housing Studies, 14*(1), 23–42.
35. See endnote 29.
36. Van Hoek, R.I. (1998). "Measuring the unmeasurable"-measuring and improving performance in the supply chain. *Supply Chain Management: An International Journal*, *3*(4): 187–192.
37. See endnote 27.

38. See endnote 32.
39. Pagh, J. D., and Cooper, M.C. (1998). Supply Chain Postponement and Speculation Strategies: How to Choose the Right Strategy, *Journal of Business Logistics,* 19(2): 13–33.
40. Mason-Jones, R., and Towill, D.R. (1999). Total cycle time compression and the agile supply chain. *International Journal of Production Economics*, *62*(1): 61–73.
41. See endnote 31.
42. See endnote 1.
43. Ma, M., and Morris, L. (2017). The Agile Innovation Sprint. *International Management Review*, *13*(1): 92.
44. Socha, D., Folsom, T.C., and Justice, J. (2013). Applying Agile Software Principles and Practices for Fast Automotive Development. In *Proceedings of the FISITA 2012 World Automotive Congress*: 1033–1045.
45. Timmers, P. (1998). Business models for electronic markets, *Electronic markets*, *8*(2): 3–8.
46. See endnote 44.
47. Chang, H.H., and Wong, K.H. (2010). Adoption of e-procurement and participation of e-marketplace on firm performance: Trust as a moderator, *Information Management,* 475(6): 262–270.
48. ECOM Group (2002). *e-Procurement in the UK Public Sector: A Guide to Developments and Best Practices,* A CIPFA e-Government Forum Report. London, UK, Feb.
49. Kpmg (2001). *University of California Office of the President System-Wide E-Procurement Assessment and Strategy Recommendation.* Berkeley, CA.
50. Birks, C., Bond, S., and Radford, M. (2001). *Guide to e-Procurement in the Public Sector: Cutting through the Hype.* London, UK: Office of Government Commerce, HMSO.
51. Vaidya, K., Sajeev, A.S.M., and Callender, G. (2006). Critical Factors That Influence E-Procurement Implementation Success in the Public Sector, *Journal Of Public Procurement,* 613: 70–99
52. Nicoletti, B. (2013). *Cloud Computing and Financial Services,* Palgrave-Macmillan, London, UK.
53. Directive 2001/115/Ec. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:015:0024:0028:EN:PDF, Accessed 24 April 2017.
54. Navatte, P., and Bironneau, L. (2017). La mise en place d'un marché interne du capital au sein de la chaîne logistique: un nouveau défi. *Logistique & Management*: 1–11.

55. http://www.sdcexec.com/article/12247812/supply-chain-finance-on-the-blockchain-enables-network-collaboration, Accessed 3 March 2017.
56. Templar, S., Findlay, C., & Hofmann, E. (2016). *Financing the End-to-end Supply Chain: A Reference Guide to Supply Chain Finance*. Kogan Page Publishers, London, UK.
57. Adapted by the author from More, D., and Basu. P. (2013). Challenges of Supply Chain Finance, *Business Process Management Journal*, 19(4): 624–647.
58. Nicoletti, B. (2017). *The Future of Fintech*, Palgrave-Macmillan, London, UK.
59. Lodefalk, M. (2017). Servicification of firms and trade policy implications. *World Trade Review*, *16*(01): 59–83.
60. Kowalkowski, C., Gebauer, H., Kamp, B., and Parry, G. (2017). Servitization and deservitization: Overview, concepts, and definitions. *Industrial Marketing Management*.
61. Recor, J., and Xu, H. (2017). GRC Technology Fundamentals. In *Commercial Banking Risk Management* (pp. 333-392). Palgrave Macmillan US, New York, NY.
62. https://issuu.com/supplydemandchainfoodlogistics/docs/sdc0916, Accessed 20 April 2017.
63. When the buyer's cash is used to finance the vendor, the practice is called dynamic discounting. Functionally it is the same as procurement finance.
64. http://www.sdcexec.com/article/12247812/supply-chain-finance-on-the-blockchain-enables-network-collaboration, Accessed 20 April 2017.
65. Christopher, M. (2005). *Logistics and supply chain management: creating value-adding networks*. Pearson Education, London, UK.
66. Lysons, K., and Farrington, B. (2006). *Purchasing and supply chain management*. Pearson Education, London, UK.
67. Bryant, C., and Camerinelli, E. (2014). *Supply Chain Finance: EBA European market guide*, European Banking Association, Paris, France.
68. Agrifac (2014). *Agrifac*. Opgeroepen op September 30, 2014, van Agrifac: http://www.agrifac.com/, Accessed 09 April 2017.
69. Jansen, J. (2016). Supply Chain Finance. *Vestnik (Chelyabisnsk State University)*.
70. http://www.tradecloud1.com/en/active-suppliers-on-the-supply-chain-platform, Accessed 9 April 2017.

9

Conclusions for the Agile Procurement Processes

This volume focuses on a number of characteristics that define the very basics of the agile model. This model has been placed in the context of procurement, outlining the meaning that this has acquired in the theory and practice of organizational management.

This volume has gone through an exemplification of the major transformation that the procurement function is experiencing. This has followed a business model in order to be exhaustive. For a long time, procurement has been considered purely a support function within an organization. Well-managed procurement can be a substantial component of the organization, contributing to its value added for customers and the organization.

The findings of this exercise outline innovation as the major driver in procurement. Secondary drivers are changes in the management of relationships with vendors, changes in the way of producing and of managing procurement, reflecting the radical changes in the environment, and especially process improvements.

This volume defines a model for process improvement. The model provides a logical and holistic sequence for the rationalization and digitization of procurement processes: streamline them and, at the same time, digitize the management of procurement, with benefits for the end

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customer and the organization. The latter point is part of the second volume of this book. With this approach, it is possible to avoid including in the information and automated solutions all the waste in the existing processes that could be the cause of ineffectiveness, inefficiencies, and diseconomies of the procurement processes.

This volume outlines a realistic agile business model for procurement organizations for identifying the desirable outcomes in each of its processes. In so doing, this book utilizes the Business Model Canvas. The resulting model has been matched with a number of viable management tools. These tools, if properly tuned and implemented, may substantially improve enterprise agility.

The findings point to the need for an organization to move to an agile enterprise business model also in its procurement organization. Organizations may improve their agility through greater use of solutions as an analytics aid, in particular in identifying opportunities, patterns, and trends. This is arguably a challenge that all organizations are facing.

By using the model described in this book, an organization may integrate agile procurement in its development programs in order to finalize them towards agility in a more direct way. Currently agility is viewed as a collateral effect of initiatives that point mainly in the direction of achieving savings. Actually, agility is a way to add value for customers and the organization.

The approach presented in this book is an example of a method for improving processes to make procurement agile by leaning and digitizing them. On this basis, and with a focus on the model of agile procurement, it is possible to synthesize one aspect resulting from the research:

Proposition: In the context of procurement, accepting a non-optimized process is counterproductive.

A corollary to this proposition is: In the context of procurement, it is necessary to use a sequence of implementations that provide an improved quality of service and the streamlining of the process by eliminating any waste.

Glossary

Account Receivable a legally enforceable claim for payment held by a business entity against its customer for goods supplied or services rendered in execution of the customer's order, and recorded on the balance sheet. Such claims generally take the form of invoices raised by a business and delivered to the customer for payment within an agreed time frame.

Advance payment a payment made in advance of a prescribed event such as a due date or a contract commencement.

Agility a metric to measure how quickly a solution responds as the customer's resource load scales, allocating additional resources to the activity.

Algorithms an essential part of modern advanced applications. They are used for a range of tasks from recommending books, movies, and music to automating investments online. In stock markets, algorithms are plugged directly into an electronic market and trading happens without any human intervention. They suggest where the most money can be made faster and more accurately than any human being, according to the BBC.[1] Pedro Domingos offers a simple definition: "An algorithm is a sequence of instructions telling a computer what to do."[2] He goes on to explain that algorithms are reducible to three logical operations: AND, OR, and NOT. While these operations can be

These definitions are of necessity synthetic and therefore not necessarilyvery accurate. Please refer to the text for a fuller presentation. This glossary includes only selected terms, with the purpose of providing rapidclarification for readers during the course of their reading this book.

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linked together in complex ways, at their core algorithms are built out of a relatively simple rationale.

Analyze the third phase of DMAIC. In it, the details of the process are analyzed to identify opportunities for improvement.

Andon meaning 'lantern' in Japanese, it refers to the technical management of notifications of errors and downtime typical of devices related to autonomation. In general, it consists of a luminous sign and a system of audible alarms (sirens) operated automatically or by pressing a button placed in the vicinity of the workstation.

App short for application—a program or piece of software, especially as downloaded by a user into a mobile device.

Application a software program that uses basic software, middleware, and network environments to achieve a specific function related to the purposes of the organization.

Application Programming Interfaces (API) a specification for the interfaces used by software components to communicate with each other. The specifications include a set of requirements that define how two pieces of software can interact with each other. It allows for moving data between applications. An API may include specifications for routines, data structures, object classes, and variables. These are important because they enable other programmers to use components of existing software, allowing for faster and more reliable software development. This is a major component of the fintech movement.

Audit the process by which financial records, business processes, and information systems are independently verified by an internal or external auditor.

Audit and Compliance It is the ability to collect, audit, and verify compliance information.

Authentication the verification of the identity of a user by a system or service.

Authorization the procedure to check whether a customer or another person inside or outside the organization has the right to do a certain action, for instance, to transfer funds or access sensitive data.

Automation the automated handling of services or goods. It is also the percentage of requests to the vendor handled without any human intervention.

Autonomation the second pillar of the Toyota Production System. Intelligent Automation essentially means transfer of intellectual work to machines.

Availability the metric that measures the percentage, usually calculated on a regular (such as monthly) basis, and net of planned or unplanned service downtimes of service coverage.

Bank a regulated financial institution licensed to receive deposits and undertake a range of activities such as commercial, retail and investment banking.

Belt the "belts" are the members of the working teams for Six Sigma projects, experts in the method and facilitators of its application.

Benchmarking the comparison of processes and/or measures to other processes and/or measures implemented by well-organized entities, or to a large number of them.

Big Data an all-encompassing term for any collection of data sets so relatively large and complex that it becomes difficult to process them using traditional data processing applications. Big data have the five V characteristics—volume, velocity, variety, veracity, and value.

Black Belt a term used to describe a level of expertise. The Black Belt can help or direct a group that applies the Six Sigma method and other process improvement initiatives. A typical Black Belt must have successfully completed a number of training courses and at least one major project. Some organizations have a process of official registration. It is a full-time position.

Business Intelligence (BI) a broad category of applications and technologies for gathering, storing, and analyzing, retrieving, and providing access to data to help users make better organization decisions. BI applications include the activities of decision support systems, querying and reporting, online analytical processing, statistical analysis, forecasting, and data mining. Analytics has generalized and extended BI.

Business Model Canvas a strategic management and entrepreneurial tool. It allows for describing, designing, challenging, inventing, and pivoting a business model.

Business Process Management (BPM) the management of processes in order to improve them substantially.

Business Process Outsourcing or Business Process Optimization (BPO) the outsourcing of business processes in order to optimize them.

Business Process Re-engineering the re-engineering of business processes in order to improve them drastically.

Business to Business (B2B) refers to organizations that relate to other organizations, rather than to customers.

Business-to-Consumer (B2C) indicates the solutions from an organization to the consumer.

Buy-Back Agreement or Guarantee an agreement between a purchaser and a seller in which the seller agrees to repurchase goods or property from the purchaser if a certain event occurs within a specified period. The buy-back price is usu-

ally set out in the agreement. It is specifically used in the context of distributor finance, a term defined herein.

Buyer in the context of supply chain finance, a buyer is a corporate entity procuring goods and services, issuing orders, and making payments to the vendors, which form its supply chain.

Change Agents figures considered benchmarks within the project team. They have the task of introducing, motivating and supporting change within the organization. Their two essential tasks are to identify priorities that characterize the different areas, giving reasons for the choices made and organizing the necessary technical support, and to speed up the implementation of agile procurement, in order to avoid unnecessary extensions in the use of resources.

Cloud a metaphor for a global network or synthetic for cloud computing. Initially, it referred to the telephone network. It now refers to the Internet.

Cloud Computing a computing capability that provides convenient and on-demand network access to a shared pool of configurable computing resources. These resources can be rapidly provisioned and released with minimal management effort or vendor interaction. Cloud computing has six essential characteristics: pay-per-use, self-service, broad network access, resource pooling, rapid elasticity, and measured service. In general terms, cloud computing enables three possible modes: infrastructure as a service (IaaS), platform as a service (PaaS), software as a service (SaaS), and business process as a service (BPaaS). It can be public, private, or hybrid.

Committee Agile and Digitize See Steering Committee.

Commodity a raw material, for instance, foodstuffs, metal ore or refined product, crude oil or oil product, for which there are normally liquid markets and which represent attractive collateral for the provision of finance.

Common Causes system features which may depend on the material, the staff, or the design. They are constant and predictable. To eliminate them it is necessary to change the system itself.

Companion Application an application associated with a payment application to increase functionality (for example, personal code management or transaction logs). The installer of the payment application decides to provide the companion application.

Compliance the respect for the internal and external compulsory rules of the organization.

Consensus Mechanism a mechanism that allows computers to agree regularly on how to update the database, after which the modifications they have settled on are rendered unchangeable with the help of complex cryptography.

Consent the strategy of making a decision based on conviction and approval by all the members, who undertake to support the decision.

Consumption-based Pricing Model a pricing model in which the vendor charges its customers based on the number of services the customer consumes, rather than on a time and material-based fee. For example, a cloud storage vendor might charge per gigabyte of information stored.

Control the last phase of DMAIC in which solutions, once implemented, present characteristics which make improvements sustainable.

Corporate Performance Management (CPM) the information system for the management of key business metrics.

Country Risk a collection of risks associated with investing in or creating exposure to a particular country. These risks include political risk, exchange rate risk, economic risk, sovereign risk, and transfer risk, which is the risk of funds being frozen for external transfer by government action. Country risk varies from one country to another.

Credit Rating an evaluation of the creditworthiness of a debtor, a business, or a government, but not individual customers. The evaluation is made by a credit rating agency of the debtor's ability to pay back the debt (both short term and long term) and the likelihood of default. A rating is usually reflected in a grading range such as AAA to B.

Credit Risk the risk that a borrower or obligor might default on any type of debt or contractual obligation by failing to make required payments

Crisis a situation formally declared a service interruption, or the deterioration of one or more critical or systemically important processes because of incidents or disasters.

Critical Path Method CPM) a tool for planning and control of projects through a network method.

Critical to Customer (CTC) a critical feature for the customer, determined through the Voice of the Customer. It can have a direct impact on the customer's delight.

Critical to Quality (CTQ) a critical aspect of the quality. It is an element of a process that impacts directly on the quality perceived by the customer; the attributes of a product that the customer considers more important are the starting point for process improvement. These are quality parameters that mainly affect the realization of the product organization.

Crowdfunding the practice of funding a project or venture by raising money from a large number of people. This takes place most often via online platforms. It can also happen through mail-order subscriptions, benefit events, and other methods. Equity crowdfunding is the process whereby people (the

"crowd") invest in an early-stage unlisted organization or initiative in exchange for shares in that organization. A shareholder has partial ownership of an organization and stands to profit should the organization do well. The opposite is also true, so if the organization fails investors can lose some, or all, of their investment. Seedrs is an example of an equity-based crowdfunding platform in the UK.[3] Debt-based crowdfunding is when people lend to an organization. The lenders earn a rate of return based on the interest charged on the loan. Typically, loans are secured against an asset, which provides the investors with some protections should the borrower fail to repay. Donation-based crowdfunding is when people donate money to a project. In return, backers may receive token rewards that increase in prestige as the size of the donation increases; for small sums, the funder may receive nothing at all. There are two types of crowdfunding: rewards-based crowdfunding and equity-based crowdfunding. The first relates to platforms like Kickstarter or Indiegogo, where start-ups raise pledges and in return offer buy-in incentives for anything they produce. Equity crowdfunding is a more recent phenomenon where pledgers are actually investors that receive a small share in the business in return for their contributions.

Customer the person who pays for the product, service, or activity. This is not necessarily the user of the product, service, or activity. It can be external or internal to the organization. In the latter case, unless there is a system of interior "prices," the internal customer does not pay for the product, the service, or the activity but uses it. Customers should be seen as the reason for the existence of the process and not just because of the process of the receptors. In this book, it refers to the customer. It could be either external or internal to the organization. In some cases, the word "customer" indicates the access device. In this latter meaning, there is always in this book a specification (such as a thin customer). Legally it is the contracting authority of the contract.

Customer Relationship Management (CRM) the information system to manage relationships with customers. It is a tool that can manage the life cycle of the customer, the acquisition of new customers, increased customer relationships, and the customer loyalty based on the relationships with the organization. It lowers transaction costs between customers and the organization and integrates the processes of customer management.

Customer Value Proposition the benefits a product or service holds for a customer; the reasons why a customer might buy that product or service.

Cycle Time this term can be used in different situations. The cycle time suggests the time it takes for a product/service to go from its beginning stage to delivery. In the case of a manufacturing organization, in production the cycle time is the time that elapses between the arrival of the raw materials and payment for the finished product. If the cycle time instead is evaluated from the point of view of the end customer, it can be defined as the total time the customer must wait to receive a product/service after having ordered it.

Data Collection the process of collecting data to generate information that can be used to make decisions. In the case of manual data collection, they are used the so-called check sheets are used to collect information and provide for their initial classification.

Data Governance and Compliance defines who is responsible for what, and the policies and procedures that persons or groups need to follow. Data governance requires governing the organization's own infrastructure and the infrastructure that the organization does not totally control. Data governance has two key components: understanding compliance and risk, and organization performance goals.

Data Source a database of personal information used by identity verification/identity proofing services to validate an identity. Examples of data sources include credit bureau records, government records, property files, customer marketing data, and telephone/utility records.

Database or Data Set a collection of data, usually from a common source and assembled for a particular business or another purpose. The term is used generally to define data that could historically have been brought together in a document, but in an automated process is transmitted as a data set. Under the rules of the BPO, data sets must be matched prior to a payment obligation becoming due.

Defect lack of fulfillment of customer expectations by a process or service.

Defects to Million Opportunities (DPMO) where opportunity means a chance of non-compliance and failure in the output of the process with a few specifics unmet. By this calculation, one can make quick assessments of the dispersion and process variability.

Define the first phase of DMAIC in which problems, opportunities, and customer needs are defined by the working group.

Define, Discover, Develop, and Demonstrate (DDDD) a structured method for innovation.

Define, Measure, Analyze, Develop, and Verify (DMADV) the Six Sigma Method for drastic improvement of processes.

Define, Measure, Analyze, Improve, and Control (DMAIC) the Six Sigma method for continuous process improvement. This structured process eliminates unproductive steps, focusing on new measurements and applying solutions for improvement.

Disruptive Innovation an innovation that completely changes the way people do something (for example, Amazon vs. in-store shopping). It describes innovations that improve products or services in unexpected ways and change both the way things are done and the market. The smartphone is an example of a disruptive solution. It has the potential to change completely the way in which users connect to ICT services.

Distributor a person or entity that supplies goods on a wholesale basis to retail outlets or organizations. It may be a manufacturing entity, an arm of a manufacturing entity, or an independent entity.

Distributor Finance an SCF technique defined herein in which a finance provider provides financing for a distributor of a large manufacturer to cover the holding of goods for resale and to bridge the liquidity gap until the receipt of funds from receivables following the sale of goods to a retailer or end customer.

Documentary Trade Finance a term that covers a large element of the traditional trade finance market relating to tools such as Documentary Credits, Documentary Collections and Guarantees, which are usually governed by rules published by the International Chamber of Commerce (ICC) (for example, UCP 60 for Letters of Credit (or later version) or URC 522 for Collections or URDG 758 for Guarantees). Although not SCF techniques in their own right, these tools can be incorporated into SCF transactions or used alongside SCF techniques.

Dynamic Discounting describes a number of methods through which early payment discounts on invoices awaiting payment are offered to sellers and funded by the buyer. The service is dynamic in the sense that the earlier the payment, the higher the discount.

Ecosystem Participants a set of organizations or individuals that can work together in order to gain synergies.

Electronic Data Interchange (EDI) the computer-to-computer exchange of business documents in a standard electronic format between business partners.

Electronic Invoicing or e-Invoicing the exchange of the invoice document between a seller and a buyer wholly in an integrated electronic format or data set. Traditionally, invoicing, like any heavily paper-based process, is manually intensive and is prone to human error, resulting in increased costs and processing life cycles for organizations.

Enterprise Content Management (ECM) the management of all content (data, unstructured documents, email, voice, video, and so on).

Enterprise Resource Planning (ERP) the extension of the Manufacturing Resource Planning II to the remaining functions in the organization, such as engineering, finance, and personnel administration and management. It consists of a software package with a single data model that facilitates the horizontal and vertical integration of all inter-organizational processes, improves process efficiency, and monitors processes through special key performance indicators (KPIs) according to quality, economic values, service levels, and timeliness. Some components of an ERP are accounting, industrial accounting, payroll, sourcing, warehouse management, production, project control, sales, distribution, and facility maintenance.

E-procurement (Electronic Procurement) a tool for managing the cycle shop with the integration of vendors B2B (Business to Business). It integrates the procurement process, reduces transaction costs for buyers, and simplifies workflows for sellers with access to the market. E-procurement indicates the set of technologies, processes, operations, and organizational procedures for the acquisition of goods and services online through the opportunities offered by the development of the Internet and electronic commerce.

Facilitator a person who helps a group achieve its full potential, through the identification and removal of barriers. He/she leads the group to achieve its mission.

Factoring an SCF technique defined herein as a form of receivables purchase, in which sellers of goods and services sell their receivables (represented by outstanding invoices) at a discount to a finance provider (commonly known as the "factor"). A key differentiator of factoring is that usually the finance provider becomes responsible for managing the debtor portfolio and collecting the payment of the underlying receivables.

Finance Provider a bank, financial institution, or other regulated or non-regulated provider of finance and related services, specifically herein in the context of value network finance

Financial Institution (FI) a provider of financial services in the broad sense, usually referring to banks and other regulated entities such as insurance companies, investment dealers, and trust companies. It includes, by definition, a range of non-bank financial institutions. These are the institutions that handle financial transactions and are normally the place where people deposit their money or get credit. It is a tradeable asset of any kind: either cash, evidence of an ownership interest in an entity, or a contractual right to receive or deliver cash

or another financial tool. In forfeiting, rights under the financial tool are normally independent of the underlying transaction that gave rise to the financial tool, since they rely on the legal obligations created by the legal status of the financial tool itself.

Financial Procurement the chain of financial processes, risk and liquidity management decisions, events, and activities that provide financial support to the physical value network.

Flow the progressive implementation of operations from the beginning of the process until the release of the result. According to one of the principles of Lean Thinking, the flow is such that it must proceed "forward," that is, toward the customer (internal or external), and proceed without interruptions. It should be ensured that all activities create value "to flow" without interruption from beginning to end so that there are no waiting times, idling or waste during a step or between phases.

Flowchart a diagram or map of a process that uses symbols (for activities, decision points, and other events) in a horizontal sequence to show what actually happens in a process or in the design of a new process.

Geolocation the process or technique of identifying the geographical location of a person or device by means of digital information processed via the internet or GSM.

Global Systems for Mobile Communications (GSM) a standard for digital mobile phones. It is in use with 80% of the global mobile market.

Governance refers to the controls and processes that ensure the effectiveness, efficiency, and economics of a sector. The sector might refer to the entire organization or to an organizational unit, a process, or data.

Green Belt may be the facilitator in a group project. As a participant, a Green Belt helps the group to which it belongs implement methods of improvement in an effective manner so that they can improve the way in which the job is done. It is a part-time position.

Guarantee any signed undertaking, however named or described, provided for payment (by the guarantor) on presentation of a complying demand. Guarantees may also be subject to internationally recognized rules of practice issued by the ICC URDG 758. Guarantees, both financial and performance-related, issued by finance providers form an important category of traditional trade finance techniques. More generally, a guarantee is a promise to take responsibility for another party's financial obligations, if that party cannot meet its obligations. The party assuming this responsibility is called the guarantor.

Heijunka a box in the leveling of production, used in the vicinity of pacemakers and other manufacturing cells. The Heijunka allows organizations to level production, balancing the workload of the cells and minimizing fluctuations in supply.

Histogram a graphical tool to show with bars the distribution of a variable. It is one of the seven tools of quality control.

Human-to-Human (H2H) a relationship from person to person.

Human-to-System (H2S) a relationship from person to system.

Identity verification the identification of individuals using their physiological and behavioral characteristics to establish a mapping, from a person's online identity to their real life identity.

Improve the fourth phase of DMAIC, in which ideas and solutions are generated and implemented.

Improvement Team See Project Team.

Incident any event that is not part of the standard operation of a service and that causes or may cause an interruption to, or a reduction in, the quality of that service.

Information and Communication Technology (ICT) the combination of computers, storage, network, applications, and so on that provides integrated computer-based services.

In-Process Kanban a kanban signaling of production of an article or a small amount (a maximum of a pitch), used where the flow is continuous.

Input a resource introduced into the system or consumed in its operation that helps in getting a result or output.

Instant Messaging (IM) a protocol for communicating between two parties using text-based chat through IP-based customers.

Integration the process of combining components or systems into an integrated entity.

Interaction Design (IxD) a customer-led design method for improving the interaction between customers and systems.

Internet of Things a development of the Internet in which non-human objects have network connectivity, allowing them to send and receive data. The IoT has the ability to record, receive, and send data. This covers internet-connected vehicles, devices, switches, sensors, and everything in between. It is based on using the Internet to communicate between objects, machines, and any other inanimate things.

Internet Protocol (IP) the primary protocol for transmitting data or information over the Internet.

Interoperability the ability of systems to operate in multiple environments.

Interprocess Kanban a kanban for handling/withdrawal. It is used to signal the need to move the items from supermarket and process upstream, inside the plant.

Inventory Finance-borrowing Base a variation of loans and advances against inventory defined herein, whereby the amount of finance is made available against a calculated market value of the goods (which could be of more than one type) being financed less a margin, which will vary according to the quantity or quality of the goods.

Inventory Finance-Repo a variation of inventory finance defined herein, whereby the finance provider enters into a sale and repurchase agreement for the goods being financed.

Inventory Turnover a ratio showing how many times an organization's inventory is used or sold and replaced over a period of time. The days in the period can then be divided by the inventory turnover formula to calculate the days it takes to sell the inventory on hand. It is calculated as consumption or sales divided by average inventory.

Invoice a document, or electronic version of a document, addressed by a vendor of goods and services to a buyer recording and describing a transaction for the supply of goods and services, requesting payment by a specified due date, and setting out any applicable taxes to be collected and remitted to a tax authority.

iOS the Apple mobile operating system for the iPhone, iPod touch, iPad, Apple television, and similar devices.

Kaizen the Japanese term to indicate continuous improvement. It is also used to indicate the seminars for suggesting and implementing improvements in a lean initiative.

Kanban a tool that allows for the flow of information and materials as part of a process. The concept is relatively simple. A production department must be activated to produce the quantities that are communicated by the next department downstream according to a card (precisely the Kanban in Japanese), which is delivered by the department downstream.

Key Performance Indicators or Key Process Indicators (KPI) the metrics (or measures) used within corporations to measure the performance of one department against another with respect to revenue, sales lead conversion, costs, customer support, and so on.

Lead Time the time taken by a piece (a part, the transaction of a product or a service) to move through a whole series of processes linked to a value network, from beginning to end. It also includes time not in process, such as queuing.

Lean and Digitize the method used to make processes lean and automated at the same time, wherever necessary. It aims to make the process automated and streamlined. The method presented in this volume, based on the first review of the process to make it lean and then in the automation where necessary.

Lean Production an organizational and management model that achieves a structure in which the main objective is the optimization of the production system, in terms of the speed of the process and eliminating waste. It involves the application of improvements and standardization, and many other concepts and tools to improve the quality, cost, or time of production. Many of the lessons learned in lean manufacturing can be applied to the operation of lean services.

Lean Six Sigma (LSS) a complete, flexible, and highly structured method aimed at achieving, maintaining, and increasing customer value.

Loan making money available to another party in exchange for future repayment of the principal amount plus interest or other finance charges. A loan may be for a specific, one-time amount or can be available as a variable credit line or overdraft up to a specified ceiling amount. It is also possible to make loans of actual real and financial assets.

Management Process a method to optimize the organization as a system, determining which processes need improvement and/or control, defining priorities, and providing leadership to initiate and support efforts to improve processes.

Marketing defined by the American Marketing Association (AMA) as the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, partners, and society.[4]

Material Requirements Planning (MRP) a computer application that automatically provides the timing and amount related to purchases and production. The outputs of these packages are obtained by analyzing the input data (cycle times, BOM, inventory situation, political shuffle, and so on) from one or more databases.

Measure the second phase of DMAIC, in which the specific key measurements and the way to collect data are defined.

Metrics an index of the performance of an organization that wants to indicate whether or not a goal is reached.

Mission the way to proceed toward the vision.

Mobile Device includes smartphones, feature phones, and tablet computers. The term "mobile device" is also used interchangeably with "mobile handset" or "handset."

MRP II a successor of manufacturing and materials resource planning (MRP). The MRP II with respect to the base MRP adds a scheduler module for the calculation of production capacity and the leveling of workloads.

National Institute of Standards and Technology (NIST) a US Department of Commerce agency that promotes the effective and secure use of cloud computing within organizations.

Norms an alternative to the word standardization.

Order to Cash Cycle represents the process steps and the time interval between receipt of an order, the manufacturing or fulfillment process, delivery, and the receipt of cash from the customer.

Organization in this book, a company, public institution (either central or local), department, or non-profit organization.

Output the result of product or system processes. It can be a product or a service. It is the result produced by a system or process. The final output is normally a product, a service, or an initiative.

Outsourcing defines an operation whereby an organization relies on an outside vendor for the management of a specific process or activity already operational within the organization (usually non-core assets such as the purchase of indirect materials, administrative management, and so forth). It is the acquisition from an external vendor of products or services that currently result from direct production activities and internal management organization.

Pacemaker the process that dictates the pace of operations upstream (following the Group technology).

Pareto Principle a principle arguing that the 20% that few "vital" elements justify the 80% of the consequences than many "trivial". The economist Vilfredo Pareto introduced it. Joseph Juran popularized it.[5]

Party any entity that becomes engaged in a financial or commercial transaction, whether a natural or legal person such as a company, corporation, financial institution, unincorporated business, government organization, or not-for-profit entity.

Payment a means of settlement for a commercial or other obligation, such as an electronic credit transfer, direct debit, credit or debit card payment, wire transfer, automated clearinghouse payment (ACH), check, or cash. The payment is completed when the creditor receives the funds.

Personal Productivity Software software used for processing individual standards (for instance, WinZip, Adobe, MS Office, Google Apps, MS Project, and so on).

Physical Procurement a term used to describe the totality of the organizations, systems, people, activities, information, and resources involved in moving a product or service from vendor to buyer.

Platform a business processing capability embedded in an information technology system and its surrounding management.

Poka-Yoke a terms that means "fail safe." It describes the design selections for devices, machines, or parts assembly that allow self-inspection even before the production process is in operation.

Policy a general term for an operating procedure.

Problem the cause of an incident. Incidents that cannot be resolved due to the lack of an available solution, as well as repeated incidents related to a known issue ("known problem/error"), pass through the process of problem management. A workaround could remediate the problem, before finding the root causes and resolving them.

Process a set of inter-related activities that transform a set of inputs on one or more results. Sometimes the process is identified with a system. It would be correct to regard it as a component of a system.

Process Control the act of getting and keeping a stable process. In fact, stability is not always a natural state for any process.

Process Improvement a continuous effort to learn the causes and effects in a process in order to reduce complexity and variations and reduce times. The process gets better by removing the incorrect causes. Through the redesign of a process, it is possible to reduce the variations in common causes.

Process Management a method used to optimize the organization as a system, determine which processes need to be improved and/or controlled, define priorities, and encourage leadership to initiate and sustain process improvement efforts. It manages the information obtained in these processes.

Process of Continuous Improvement a structured approach that improves the overall performance of the organization by using methods appropriate to its problems. Its scope may be the quality or social responsibility of the business. Continuous improvement is called Kaizen in Japanese.

Process Owner literally, the master of the process. This person has responsibility for the whole process and communicates the objectives of the process, optimizes its performance in the context of the whole system, and guides efforts to improve it. It is not a common organizational figure and must be closely coordinated with the heads of the departments involved in the process.

Procure to Pay Cycle or Process (P2P) represents the process steps and time interval between procurement, the issue of a purchase order, delivery of goods and services, receipt of invoice, and payment to the vendor.

Procurement in this book, it refers to the initiation, design, development, acquisition, and logistics of goods and services for the organization. Procurement

generalizes further management of the value network, also including strategic aspects and outside the organization.

Procurement Transaction sets out descriptions, quantities, prices, discounts, payment terms, date of performance or shipment, and other associated terms and conditions, and identifies a specific vendor. It is used to control the purchasing of products and services from external vendors. When accepted by the seller, it forms the basis of a contract binding on both parties. It is also called an order.

Program a set of projects with similar objectives. An example is the improvement of systems installed at different subsidiaries of the same group.

Program Evaluation and Review Technique (PERT) a tool for planning and control of projects based on a network of activities.

Project Charter a description of the problem, defining the objectives and planning of the main activities of the project. It is a document that sets out the model, specifications, and plans for an improvement project. It includes definitions, issues and objectives, constraints and assumptions, roles, and preliminary plan. Periodic reviews by the sponsor guarantee the alignment with business strategies.

Project Teams groups consisting of people from the same sector or, better, from different fields working for a certain period of time to improve the process.

Purchase Order a buyer-generated document or data set that authorizes a purchase.

Quality a concept not easily defined, because there are several variants, at times specified by an adjective or specification added to the name. In general, one can say that the quality is profitable customer satisfaction for the organization. There are many variations of the concept of quality, sometimes determined by an adjective or specifications. In general, quality is customer satisfaction in a way that is profitable for the organization.

Quality Assurance the set of planned and systematic actions necessary to provide adequate confidence that a product or service meets certain quality requirements.

Quality Function Deployment (QFD) refers to a set of disciplines, based on a deep understanding of the needs and desires of customers. It is used to accelerate the development of major projects and new products or services. It is based on many hierarchical matrices.

Receivable the amount due from a debtor or obligor to a creditor. This includes, but is more extensive than, trade-related account receivables. For instance, it covers the amount due under a negotiable tool.

Reporting consists of supplying and updating representative data and indicators whose degree of detail tends to vary depending on the person or organization for whom or for which they are intended. For the purposes of sustainable development, tools such as the GRI (Global Reporting Initiative) enable a standardized method to be agreed on at the international level. In a certain number of countries, there are laws that require that all organizations beyond a certain size publish a Corporate Social Responsibility or "sustainability" report.

SaaS an acronym for Software as a Service. It is one of the ways to use cloud computing, based on using the software as a service offered by a third party on their computers.

Service Vendor an organization such as a bank, a telecommunication organization, or a merchant that provides services to be integrated, for instance, with mobile payments.

Sharing Economy an economic model based on sharing, swapping, trading, or renting products and services, enabling access or use over ownership. It is reinventing not just what is consumed but how it is consumed. It is an economic model in which individuals are able to borrow or rent temporarily assets owned by someone else. The sharing economy model is becoming popular when the price of a particular asset is high and the asset is not fully utilized all the time.

Short Message Service (SMS) a system of communicating by short messages over a mobile telephone network. It can be rather secure if encrypted.

Sigma (σ) the eighteenth letter of the Greek alphabet. In statistical theory, it is connected with variance. It is a metric based on the number of defects that occur per million opportunities.

Signal Kanban a kanban signaling production of a batch of relatively large dimensions. It is used in conjunction with the supermarket to drive upstream processes and allow them to make the fitting, generally costly in terms of time.

Single Minute Exchange of Die (SMED) a tool used in the Toyota Production System.

Six Sigma a method and a performance goal. The method is a structured approach to continuous process improvement. The goal is a measure of the performance of a process defined as the number of defects per million opportunities. It is a philosophy and a performance objective. It is a structured method for the continuous improvement of processes. The objective is a measure of process performance defined in terms of defects, with 3.4 defective parts per million opportunities.

Software as a Service (SaaS) a software distribution model in which applications are hosted by a vendor or service vendor and made available to customers over a network, typically the Internet. Many fintech start-ups use this software distribution model. It refers to applications hosted by a vendor on the cloud. The users can access them online for a subscription fee, as opposed to users buying a software license outright in a hard format like a tape or a CD. SaaS is a common tool utilized by start-ups. A vendor sells the service of hosting applications on a cloud for users to access online.

Sponsor a person in the organization that sponsors the project, having the necessary authority and power. It is normally a member of the executive. Important to the success of the project.

Stable Process a process that is predictable since it is subject to change controllability. It is also the property of being in statistical control.

Stakeholder an individual, group, or organization that is likely to be affected, directly or indirectly, by an activity, a program, or a particular arrangement of an organization. Stakeholders include all those groups that participate or are otherwise involved in its economic life (employees, customers, vendors, shareholders), those who observe the organization (unions, non-governmental organizations), and those that it affects either directly or indirectly (civil society, local authorities, and so on).

Standards indications of voluntary standardization.

Statistical Process Control (SPC) a method by which a process is studied and the variations reduced over time. The resulting data is analyzed to identify the causes of changes. People with knowledge of the process work to identify and reduce the recurrence of the unpredictable causes and understand and reduce foreseeable changes.

Steering Committee also referred to as the committee of agile procurement. It includes representatives of the executive, the project leader, and the facilitators who meet regularly. Its main responsibilities are management of the efforts of the improvement process, assessment of the needs and oversight of the support and training within its area of responsibility, communication of progress to all stakeholders, and direction of the efforts.

Streaming a situation in which a number of sequential processes are balanced, allowing the material or the information to flow continuously from one station to another without delays. It is an efficient way to produce repeatedly a specific product or service.

Supplier Input Process Output Customer (SIPOC) a page that synthetizes a view of the process, customers and vendors, measures, and performance. It presents an explanation of the possible sources of variation.

Supply Chain Finance (SCF) defined as the use of financing and risk mitigation practices and techniques to optimize the management of the working capital and liquidity invested in supply chain processes and transactions. SCF is typically applied to open account trade and is triggered by supply chain events. Visibility of underlying trade flows by the finance provider(s) is a necessary component of such financing arrangements, which can be enabled by a platform.

System defined by Deming as "A network of interacting components that cooperate to achieve the objectives of the system."[6] It is the organization which includes customers, vendors, and the flow of materials and information.

Tablet a general-purpose computer contained within a single panel, with a touchscreen as the input device.

Takt Time is the pace of production of products assigned to a cell.

Telematics denotes the synergy between telecommunications and informatics, indicated in this volume as ICT.

Throughput a metric of how quickly the service responds.

Time to Market in the process of development of new products, the time that elapses between the first phase of the concept of the new product and the launch on the market.

Total Cost Management (TCM) a business philosophy of managing the entire organization resources and the activities that consume those resources. Managing costs in a TCM approach means focusing on the activities and the events, the circumstances, or the conditions that cause or drive these cost-consuming activities.

Total Cost of Ownership (TCO) a metric that takes into account the costs throughout the life cycle of a solution. Typically, it includes procurement costs, installation, testing, maintenance, use, and disposal at the end of the useful life.

Total Quality Control (TQC) a method for total quality control.

Total Quality Management (TQM) a method for total quality management.

Toyota Production System (TPS) the production system introduced by Toyota, which later evolved into lean thinking.

Trade Finance a "super-category" or umbrella term used by finance providers to describe their business lines, organizational units, and activities. Trade finance is usually used as a generic term for a range of traditional trade finance techniques and evolving SCF techniques.

Transaction the action of executing a function or an application. An example of a transaction is the execution of the purchase at the point of sale and the processing of authorization and clearing messages.

Trust the ability for two parties to define a trust relationship with formal authentication of the two parties.

UNI EN 28402 the ISO standards on quality—Terminology.

UNI EN ISO 9000 the ISO standards concerning the conduct of an organization and the quality assurance (or guarantee) quality. Criteria for selection and use.

UNI EN ISO 9001 the ISO standards on quality management systems. Criteria for insurance (or guarantee) of quality in the design, development, production, installation and service.

UNI EN ISO 9002 the ISO standards on quality management systems. Criteria for insurance (or guarantee) in the implementation of quality and service.

UNI EN ISO 9003 the ISO standards on quality management systems. Criteria for insurance (or guarantee) quality controls and final tests.

UNI EN ISO 9004 the ISO criteria concerning the conduct of an organization for quality and quality management systems of the organization.

Usability Testing (UT) the method of testing how users interact with a system, product, or interface through observation.

Validation a method to provide specific personal information to prove ownership of the identity for the purpose of identity verification.

Value defined by the end user. Conceptually, it is the relationship between benefits and cost/damage of a product or service, expressed in terms of a product/service able to meet his/her needs at a given price and at a given time. It is also possible to talk about the value perceived by the customer as all the features of the product/service that the customer deems necessary and valuable. Any activity that consumes resources (including time) and does not create value is a waste (Muda in Japanese).

Value Analysis a technical organization that allows for alternatives and solutions to enhance customer value.

Value Engineering value analysis applied to the design.

Value Network a set of activities required to design, order, manufacture, and supply (or provide in the case of a service) a given product. These activities cover the entire path of the product/service from organization to end customer. Objective analysis of the value network is to classify tasks into categories. The supply chain can be seen as the sequence of activities that brings value to the customer (and indirectly to the organization).

Value Network Mapping the identification and subsequent graphical representation of all the activities that are performed in the value network for a product/service or a family of products/services.

Variance in statistics, the average of the squared deviations. It is a dispersion index.

Variations changes in the quantity or time value between cases caused by acts and not predictable.

Vendor a person or organization that provides goods or services for use by the process that is designed.

Vendor Kanban a Kanban handling/withdrawal. It is used for the handling of the material from the outside of the site/s of the organization in accordance with the management vendors. Indicates the cycle of the Kanban, in other words, the type of product to be supplied, the quantity and frequency of delivery.

Vendor Managed Inventory (VMI) a family of business models in which the buyer of a product (business) provides certain information to a (supply chain) vendor of that product and the vendor takes full responsibility for maintaining an agreed inventory of the material, usually at the buyer's consumption location (such as a store). It is analogous to the holding of consignment stock.

Vision the expression of what would represent success for the organization. The goal is to produce a mental image to strive for in order to make sure the organization produces creative tensions between the current reality and the vision. For the value to be shared by the entire organization requires a lot of time. Mission is the manner in which the organization must make progress towards the vision. It is an expression of what would represent a success for the organization. The Vision's objective is to produce a mental image for generating creative tensions between the current reality and the future of the organization. In order to be valuable, the whole organization should know and accept it. This requires many efforts and much patience. The mission is the way to proceed toward the vision.

Voice of the Customer (VoC) the customer's voice, or the voice of the citizen in the case of public organizations.

Web 2.0 includes the Web applications that facilitate interactive information sharing, inter-operability, user-centered design, and collaboration on the World Wide Web.

Working Capital the financial resources invested by a business in financing its current trading operations, usually expressed as the difference between current assets (receivables, inventory, and operating cash balances) and current liabilities (payables and short-term debt).

Yellow Belt a figure that participates in a project by joining and supporting the Working Group. It is a part-time position.

Bibliography

Abdi, F., Shavarini, S., & Hoseini, S. (2006). Glean Lean: How to Use Lean Approach in Services Industries? *Journal Service Research, 6*(Special issue), 191–206.

About, Y., Hsu, T., & Yang, W. (2005). *Building Ontological Knowledge Bases for Sharing Knowledge in Digital Archive*. Proceedings of the 2005 International Conference on Machine Learning, Cybernetics.

Achanga, P., Shehab, E., Roy, R., & Nelder, G. (2006). Critical Success Factors for Lean Implementation Within SMEs. *Journal of Manufacturing Technology Management, 17*(4), 460–471.

Ackermann, T., Widjaja, T., Benlian, A., & Buxmann, P. (2012). *Perceived IT Security Risks of Cloud Computing: Conceptualization and Scale Development*. Proceedings of the 33rd International Conference on Infornation Systems. Orlando.

Adolph, S., Tisch, M., & Metternich, J. (2014). Challenges and Approaches to Competency Development for Future Production. *Journal of International Scientific Publications—Educational Alternatives, 12*(8), 1001–1010.

Aggogeri, F., & Gentili, E. (2006). *Lean six sigma: la nuova frontiera per la qualità. La sinergia tra six sigma e lean production per un innovativo metodo di gestione e miglioramento dei processi industriali*. Milano: FrancoAngeli.

Aghamanoukjan, A., Buber, R., & Meyer, M. (2009). Qualitative Interviews. In Buber, R. & Holzmüller, H. (Eds.), *Qualitative Marktforschung. Konzepte—Methoden—Analysen* (Vol. 2, pp. 415–436). Wiesbaden: Gabler.

B. Nicoletti, *Agile Procurement*, DOI 10.1007/978-3-319-61082-5

Albano, G., & Sparro, M. (2008). A simple Model of Model Agreements: Competition and Efficiency. *Journal of Public Procurement, 8*, 356–378.

Albrecht, C., Dean, D., & Hansen, J. (2005). Marketplace, Technology Standards for B2B e-Commerce: Progress, Challenges, the State of the Art. *Information, Management, 42*(6), 865–875.

Alvarez, J. M., Labra, J. E., Cifuentes, F., Alor-Hernández, G., Sánchez, C., & Luna, J. A. G. (2012). Towards a pan-European e-Procurement Platform to Aggregate, Publish and Search Public Procurement Notices Powered by Linked Open Data: The MOLDEAS Approach. *International Journal of Software Engineering and Knowledge Engineering, 22*(03), 365–383.

Anonymous. (2001). The Manifesto for Agile Software Development. http://agilemanifesto.org/, Accessed 25 March 2017.

Anonymous. (2008). Third-Party Logistics, OTM-SIG, 2008, 50.

Arjan, J., & Weele, V. (2010). *Purchasing and Supply Chain Management. Analysis, Strategy, Planning and Practice* (5th ed.). Stamford, CT: Cengage Learning.

Arksey, H., & O'Malley, L. (2005). Scoping Studies: Towards a Methodological Model. *International Journal of Social Research Methodology, 8*(1), 19–32.

Arthur, J. (2006). *Lean Six Sigma Demystified*. New York: McGraw-Hill.

Aslanbas, M. (2014). Emporias Survey Agile procurement: Significance and Future Challenges for the Logistical Integration of Vendors. In *Emporias Management Consulting* (pp. 10–14). Quarterly 3/2014, Emporias. Munich.

Atkinson, W. (2007). MeadWestvaco Leverages Market Intelligence for Procurement. *Purchasing, 136*(11), 18–19.

Atzori, M. (2015). Tecnologia blockchain e governance decentralizzata: lo Stato è ancora necessario? *SSRN*.

Ayers, J. B. (2000). *Handbook of Supply Chain Management*. Boca Raton, FL: CRC Press.

Bales, F. (2005). *The Goldmine—A Novel of Lean Turnaround*. Cambridge, MA: Lean Enterprise Institute.

Ballou, R. H., Gilbert, S. M., & Mukherjee, A. (2000). New Managerial Challenges from Supply Chain Opportunities. *Industrial Marketing Management, 29*, 7–18.

Batran, A., Erben, A., Schulz, R., & Sperl, F. (2017). *Procurement 4.0: A Survival Guide in a Digital, Disruptive World*. Frankfurt am Main: Campus Verlag.

Bank for International Settlements. (2012). *BIS Communications, Basel III: A Global Regulatory Model for More Resilient Banks and Banking Systems.*

Barnhart, T. M. (2012). *Creating a Lean R and D System*. New York: Productivity Press.

Bartezzaghi, E., & Ronchi, S. (2002). *The Role of the Internet in Customer-Vendor Relationships: The Integration-Efforts Ratio, the Emergence of Collaborative Markets*. Proceedings of the 9th International Conference of EUROMA: Operations Management, the New Economy. Copenhagen, Denmark, June 2–4.

Bartezzaghi, E., & Ronchi, S. (2003). Internet Supporting the Sourcing Process: Lessons from Four Case Studies. *Integrated Manufacturing Systems, 14*(8), 632–641.

Bartezzaghi, E., & Ronchi, S. (2004). A Portfolio Approach in the e-Purchasing of Materials. *European Journal of Purchasing, Supply Management, 10*, 117–126.

Bartezzaghi, E., & Ronchi, S. (2005). E-sourcing in a Buyer-Seller-Operator Perspective: Benefits, Criticalities. *Production Planning, Control, 16*(4), 405–412.

Baškarada, S., & Koronios, A. (2014). A Critical Success Factors Model for Information Quality Management. *Information Systems Management, 31*(4), 1–20.

Basu, R. (2008). *Implementing Six Sigma, Lean: A Practical Guide to Tools, Techniques*. Oxford: Butterworth-Heinemann.

Bates, J. (2012). This is what Modern Deregulation Looks Like: Co-Optation and Contestation in the Shaping of the UK's Open Government Data Initiative. *The Journal of Community Informatics, 8*(2). Available at: http://ci-journal.net/index.php/ciej/article/view/845/916. Retrieved on 13 August 2017.

Baudin, M. (2005). *Lean Logistics: The Nuts and Bolts of Delivering Materials and Goods*. New York: Productivity Press.

Beaumont, N. (2009). Guest Editorial. *Journal Management Manufacturing Technology, 20*(6), 787.

Berman, B. (2012). 3-D Printing: The New Industrial Revolution. *Business Horizons, 55*(2), 155–162.

BERR. (2008). Supporting Innovation in Services. *Department for Business, Enterprise and Regulatory Reform*. London, UK.

Bizer, C., Heath, T., Ayers, D., & Raimond, Y. (2007). Interlinking Open Data on the Web in The 4th European Semantic Web Conference.

Blomqvist, E., & Thollander, P. (2015). An Integrated Dataset of Energy Efficiency Measures Published as Linked Open Data. *Energy Efficiency, 8*(6), 1125–1147.

BMBF (Bundesministerium für Bildung und Forschung). (2015). *Zukunftsprojekt Industrie 4.0*. Retrieved August 12, 2016, from http://www.bmbf.de/de/9072.php

Bogaschewsky, R. (2015, March 24). *State of the Art und Trends in e-Procurement.* Proceedings of the 6th BME e-Lösungstage. Düsseldorf, Germany. Retrieved March 25, 2017, from http://www.cfsm.de/fileadmin/Downloads/E-Procurement/e_ltage_2015.pdf

Boiko, B. (2002). *Content Management Bible*. Canoga Park, CA: Hungry Minds.

Bolstorff, P., & Rosenbaum, R. G. (2007). *Supply Chain Excellence: A Handbook for Dramatic Improvement Using the SCOR Model*. New York: Amacom.

Booth, C. (2010). *Strategic Procurement*. London: Kogan Page.

Borders, A. L., Johnston, W. J., & Rigdon, E. E. (2001). Beyond the Dyad: Electronic Commerce Network Perspectives in Industrial Marketing Management. *Industrial Marketing Management, 30*(2), 199–205.

Borhanazad, A., & Tran, M. (2012). KTH Industrial Engineering and Management Industrial Management. *Improved Sourcing Flexibility Through Strategic Procurement.*

Bortolotti, T., Romano, P., & Nicoletti, B. (2010). Lean First, Then Automate: An Integrated Model for Process Improvement in Pure Service-Providing Companies. *Advances in Production Management Systems* 2010, (Best Paper Award) (pp. 579–586). Berlin: Springer.

Brenner, W., & Wenger, R. (Eds.). (2007). *Elektronische Beschaffung: Stand und Entwicklungstendenzen*. Berlin: Springer.

Brettel, M., Friederichsen, N., Keller, M., & Rosenberg, M. (2014). How Virtualization, Decentralization and Network Building Change the Manufacturing Landscape: An Industry 4.0 Perspective. *International Journal of Science, Engineering and Technology, 8*(1), 37–44.

Brynjolfsson, E., & Smith, J. (2000). Frictionless Commerce? A Comparison of the Internet, Conventional Retailers. *Management Science, 46*(4), 563–585.

Carr, N. G. (2000, January–February). Hypermediation: Commerce as Clickstream. *Harvard Business Review*.

Chaffey, D. (2009). *E-business and e-Commerce Management: Strategy, Implementation and Practice*. Upper Saddle River, NJ: Prentice Hall and Pearson Education.

Chesebro, R. (2015). *A Contract That Manages Itself: The Time Has Arrived*. Ft Belvoir, VA: Defense Acquisition Univ.

Chiarini, et al. (2006). Revolution Lean. *Trade Business, 5*, 34–41.

Chopra, S., Dougan, D., & Taylor, G. (2001). B2B e-Commerce Opportunities. *Supply Chain Management Review*, May-June, 50–58.

Chopra, S., & Meindl, P. (2007). *Supply Chain Management: Strategy, Planning and Operation*. Upper Saddle River, NJ: Pearson Prentice Hall.

Chopra, S., & Meindl, P. (2012). *Supply Chain Management Strategy, Planning, Operation* (5th ed.). London: Prentice Hall.

Christensen, C. (2013). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Cambridge, MA: Harvard Business Review Press.

Christopher, M., & Towill, D. (2001). An Integrated Model for the Design of Agile Supply Chains. *International Journal of Physical Distribution Logistics, 31*(4), 235–246.

Cimorelli, S. (2004). *Kanban for the Supply Chain: Fundamental Practices for Manufacturing Management* (Vol. 1, p. 244). New York: Productivity Press.

Clarke, I., & Flaherty, T. (2003). Web-Based B2B Portals. *Industrial Marketing Management, 32*(1), 15–23.

Cohen, S., & Roussel, J. (2004). *Strategic Supply Chain Management*. New York: McGraw-Hill.

Cole, R. J. (2012). Some Observations on the Practice of "Open Data" as Opposed to its Promise. *The Journal of Community Informatics, 8*(2). Available at: Available at: http://ci-journal.net/index.php/ciej/article/view/920/917. Retrieved on 13 August 2017.

Conboy, K., & Fitzgerald, B. (2004). Toward a Conceptual Model of Agile Methods: A Study of Agility in Different Disciplines. In Proceedings of the 2004 ACM Workshop on Interdisciplinary Software Engineering Research, 37–44. Newport Beach, CA.

Connaughton, P., & Sawchuk, C. (2014). *Procurement Analytics in the Era of Big Data: What CPOs Need to Know*. Miami, FL: The Hackett Group White Paper. Miami, FL: The Hackett Group

Corbin, J., & Strauss, A. C. (2015). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques* (4th ed.). Newbury Park, CA: Sage Publication.

Cousins, P., Lamming, R., Lawson, B., & Squire, B. (2008). *Strategic Supply Management-Principles, Theories and Practice*. Upper Saddle River, NJ: Prentice Hall Harlow.

Cox, A. (2004). The Art of the Possible: Relationship Management in Power Regimes and Supply Chains. *Supply Chain Management: An International Journal, 9*(5), 346–356.

Croom, S. R. (2000, Winter). The Impact of Web-Based Procurement on the Management of Operating Resources Supply. *The Journal of Supply Chain Management, 36*(4), 4–13.

Davenport, T. H., & Beck, C. J. (2001). *The Attention Economy: Understanding the New Currency of Business*. Boston: Harvard Business School Press.

Davenport, T. H., & Patil, D. J. (2012). Data Scientist. *Harvard Business Review, 90*, 70–76.

Davila, A., Gupta, M., & Palmer, R. (2003). Moving Procurement Systems to the Internet: The Adoption, Use of e-Procurement Technology Models. *European Management Journal, 21*(1), 11–23.

Delfmann, W., & Klaas-Wissing, T. (2007). *Strategic Supply Chain Design. Theory, Concepts and Applications*. Cologne: Kölner Wissenschaftsverlag.

Deloitte Analytics (2012). Open Growth. Stimulating Demand for Open Data in the UK. *A Briefing from Deloitte Analytics*, 1–9.

Dimitri, N., Piga, G., & Spagnolo, G. (2006). *Handbook of Procurement*. Cambridge, MA: Cambridge University Press.

Dolcemascolo, D. (2006). *Improving the Extended Supply Chain*. New York: Productivity Press.

Dospinescu, O., Fotache, D., Munteanu, B. A., & Hurbean, L. (2008). Mobile Enterprise Resource Planning: New Technology Horizons. *Communications of the IBIMA, 1*(11), 91–97.

Drath, R., & Horch, A. (2014). Industrie 4.0: Hit or Hype? *Industrial Electronics Magazine, IEEE, 8*(2), 56–58.

Dubois, A., & Araujo, L. (2007). Case Research in Purchasing and Supply Management: Opportunities and Challenges. *Journal of Purchasing and Supply Management, 13*(3), 170–181.

ECB. (2014). *2014 ECB Banking Structures Report*. Frankfurt am Main: European Central Bank.

Emiliani, M. L., Stec, D., Grasso, L., & Stodder, J. (2003). *Better Thinking, Better Results: Using the Power of Lean as a Total Business Solution*. Kensington, CT: The CLBM.

Eriksson, E. (2010). Improving Construction Supply Chain Collaboration, Performance: A Lean Construction Pilot Project, Supply Chain Management. *An International Review, 15*(5), 394–403.

Essig, M. (2006). Electronic Procurement—Konzeption und Anwendung. In J. Zentes (Ed.), *Handbuch Handel* (pp. 735–758). Wiesbaden: Gabler.

Essig, M., & Arnold, U. (2001). Electronic Procurement in Supply Chain Management: An Information Economics-Based Analysis of Electronic Markets. *Journal of Supply Chain Management, 37*(4), 43–49.

Ernst & Young (2014). Global Banking and Capital Markets Center. *EY Global Consumer Banking Survey*.

Feldmann, C. (2015). Ohne den Einkauf findet Industrie 4.0 nicht statt. http://www.bme.de/ohne-den-einkauf-findet-industrie-40-nicht-statt-969/, Accessed 20 March 2017.

Ferrari, E. (2004, October). Supply Chain Management and e-Procurement: In Fact, Legend. *Logistics Management*.

Flinchbaugh, J., & Carlino, A. (2006). *The Hitchhiker's Guide to Lean: Lessons from the Road*. Dearborn, MI: EMS.

Fretty, P. (2014). Merging Crowdsourcing with Big Data Analytics. Retrieved April 16, 2016, from http://www.iee.ch/etech/2014/etech_0314/ind-1.htm

Garimella, K. K. (2006). *The Power of Process*. Tampa, FL: Meghan-Kiffer Press.

Gebauer, J., Shaw, M. J., & Zhao, K. (2003). The efficacy of mobile e-procurement: A pilot study. In *Proceedings of the 36th Annual Hawaii International Conference on System Sciences*, HICSS 2003 [1174386] Institute of Electrical and Electronics Engineers Inc. DOI:10.1109/HICSS.2003.1174386

George, M. L. (2002). *Lean Six Sigma: Combining Six Sigma Quality with Lean Speed*. New York: McGraw-Hill.

Giessmann, et al. (2012). Mobile Enterprise Applications—Current State and Future Directions. In *Proceedings of the 2012 45th Hawaii International Conference on System Sciences*, Jan. 4, 1363–1372 doi:10.1109/HICSS.2012.435

Gunasekaran, A., Tirtiroglou, E., & Wolstencroft, V. (2002). An Investigation Into the Application of Agile Manufacturing in an Aerospace Company. *Technovation, 22*(7), 405–415. Elsevier.

Gur, Y., Lu, L., & Weintraub, G. Y. (2015). *Model Agreements in Procurement: An Auction Model and Design Recommendations*. New York: Columbia University.

Gurstein, M. B. (2011). Open Data: Empowering the Empowered or Effective Data Use for Everyone? *First Monday*, 16(2). Available at: http://firstmonday.org/ojs/index.php/fm/article/view/3316/2764. Accessed: 13 August 2017. doi:http://dx.doi.org/10.5210/fm.v16i2.3316.

Harrison, A., & van Hoek, R. (2008). *Logistic Management and Strategy, Competing Trough the Supply Chain* (3rd ed.). Upper Saddle River, NJ: Prentice Hall Harlow.

Hartley, J., Lane, L., & Hong, Y. (2004). An Exploration of the Adoption of e-Auctions in Supply Management. *IEEE Transactions on Engineering Management, 51*(2), 153–161.

Henke, M., & Schulte, A. T. (2015). Einkauf und die 4. Industrielle Revolution. *Beschaffung Aktuell, 62*(3), 20–21.

Hines, P., Holweg, M., & Rich, N. (2004). Learning to Evolve: A Review of Contemporary Lean Thinking. *International Journal of Operations and Production Management, 24*(10), 994–1011.

Hino, S. (2006). *Inside the Mind of Toyota*. New York: Productivity Press.
Hobbs, D. (2004). Lean Manufacturing Implementation: A Complete Execution Manual for Any Size Manufacturer. *CPIM*.
Hodgkinson, D. (2001). *Public Authority Procurement Strategy*. London: Thomas Telford.
Homer, G. M., Thompson, D. R., & Deacon, M. (2002). A Distributed Document Management System. *Computer and Control Engineering Journal, 13*(6), 315–318.
Hu, H., Wen, Y., Chua, T. S., & Li, X. (2014). Toward Scalable Systems for Big Data Analytics: A Technology Tutorial. *IEEE Access, 2*, 652–687.
Hugos, M. H. (2002). *Essentials of Supply Chain Management*. West Sussex: Wiley.
Husby, P. (2009). *Fix Your Supply Chains*. New York: Productivity Press.
Ilyas, R. M., Shankar, R., & Banwet, D. K. (2008). Creating Flex-Lean-Agile Supply Chain by Outsourcing: An ISM-Based Interventional Roadmap. *Business Process Management Journal, 14*(3), 338–389.
Jap, S. (2000). Going Going Gone. *Harvard Business Review*, 78(60), 50.
Jeston, J., & Nelis, J. (2006). *Business Process Management*. Amsterdam: Elsevier Science BV.
Jung, H., Chen, F. F., & Jeong, B. (Eds.). (2007). *Trends in Supply Chain Design and Management, Technologies and Methodologies Part 2*. London: Springer.
Kagermann, H. (2014). Chancen von Industrie 4.0 nutzen. In T Bauernhansl, M Ten Hompel, and B. Vogel-Heuser (Eds.), *Industrie 4.0 in Produktion. Automatisierung und Logistik* (pp. 603–614). Wiesbaden: Springer.
Kahl, S. J., & Berquist, T. P. (2000, September/October). A Primer on the Internet Supply. *Chain Supply Chain Management Review*, 40–48.
Kalakota, R. (2000, July/August). Next-Generation B2B Solutions. *Supply Chain Management Review, 4*(3)74-79.
Kalakota, R., & Robinson, M. (2000). *e-Business 2.0: Roadmap for Success*. New York: Addison-Wesley Information Technology.
Kane, G. C., Palmer, D., Phillips, A. N., & Kiron, D. (2015). Is Your Business Ready for a Digital Future? *MIT Sloan Management Review, 56*(4), 37–44.
Kaplan, S., & Sawhney, M. (2000, May–June). E-hubs: The New B2B Marketplaces. *Harvard Business Review*, 97–103.
Kerber, B., & Dreckshage, B. J. (2011). *Lean Supply Chain Management Essentials: A Model for Materials Managers*. New York: Productivity Press.
Kim, J., & Shunk, D. (2004). Matching Indirect Procurement Process with Different B2B e-Procurement Systems. *Computers in Industry, 53*(2), 153–164.

Kimball, R., & Caserta, J. (2011). *The Data Warehouse ETL Toolkit: Practical Techniques for Extracting, Cleaning, Conforming, and Delivering Data*. Hoboken, NJ: Wiley.

Kitchin, R. (2014). *The Data Revolution: Big Data, Open Data, Data Infrastructures and Their Consequences*. Los Angeles: Sage.

Kollmann, T. (2011). *E-Business: Grundlagen elektronischer Geschäftsprozesse in der Net Economy*. Wiesbaden: Gabler.

Koppelmann, U. (2007). Internet und Beschaffung. In W. Brenner & R. Wenger (Eds.), *Elektronische Beschaffung: Stand und Entwicklungstendenzen* (pp. 23–38). Berlin: Springer.

Kovatsch, M., Mayer, S., & Ostermaier, B. (2012). *Moving Application Logic from the Firmware to the Cloud: Towards the Thin Server Architecture for the Internet of Things*. Proceedings of the Innovative Mobile and Internet Services and Ubiquitous Computing (IMIS). Sixth International Conference, IEEE, pp. 751–756.

KPMG. (2012). *Financial Services, MiFID Matters—Assessing The Wider Agenda*. KPMG.

KPMG. (2014a). 2014 Banking Industry Survey, http://www.kpmginfo.com/industryoutlooksurveys/2014/pdfs/KPMGBankingIndustrySurvey_072414.pdf, Accessed 15 August 2017.

KPMG. (2014b). High Impact Procurement Operating Models. https://www.slideshare.net/KPMG_US/pom-slide-share, Accessed 15 August 2017.

Kraljic, P. (1983). Purchasing Must Become Supply Management. *Harvard Business Review, 61*, 109–117.

Krüeger, M. W., & Dix, M. (2014). Analysis of Cloud Business Models for the Industrial B2B Market. *IT Convergence Practice INPRA, 2*(2), 12–20.

Kuglin F. A., & Rosenbaum, B. (2001). *The Supply Chain Network @ Internet Speed* (p. 246). New York: Amacom.

Kuhn, A., & Hellingrath, B. (2002). *Supply Chain Management: Optimierte Zusammenarbeit in der Wertschöpfungskette*. Berlin: Springer.

Kuk, G., & Davies, T. (2011). *The Roles of Agency and Artifacts in Assembling Open Data Complementarities*. Proceedings of the Thirty Second International Conference on Information Systems. Shanghai, China

Kyokai, H. R. (1990). *The Improvement Engine*. Tokyo: Nippon Kogyo Shinbun.

Lambert, D. M., & Cooper, M. C. (2000). Issues in Supply Chain Management. *Industrial Marketing Management, 29*, 65–83.

Larsen, T., Kotzab, H., & Grieger, M. (2003). Electronic Marketplaces, Supply Chain Relationships. *Industrial Marketing Management, 32*(3), 199–210.

Lasi, H., Fettke, P., Kemper, H. G., Feld, T., & Hoffmann, M. (2014). Industry 4.0. *Business and Information Systems Engineering, 6*(4), 239–242.

Lawrenz, O., Hildebrand, K., Nenninger, M., & Hillek, T. (2013). *Supply Chain Management: Konzepte, Erfahrungsberichte und Strategien auf dem Wfor example, zu digitalen Wertschöpfungsnetzen*. Berlin: Springer.

Lee, J., Kao, H. A., & Yang, S. (2013). Service Innovation and Smart Analytics for Industry 4.0 and Big Data Environment. *Procedia CIRP, 16*, 3–8.

Levitt, J. (2005). *Complete Guide to Predictive, Preventive Maintenance*. New York: Industrial Press. 207 CD.

Liker, J. (2004). *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer*. New York: McGraw-Hill.

Liker, J. K., & Meier, D. (2006). *The Toyota Way Fieldbook*. New York: McGraw-Hill.

Liker, J., et al. (2008). *Toyota Culture: The Heart, Soul of the Toyota Way*. New York: McGraw-Hill.

Louis, R. S. (2006). *Custom Kanban*. New York: Productivity Press.

Lovelock, C., & Gummesson, E. (2004). Whither Services Marketing? In Search of a New Paradigm, Fresh Perspectives. *Journal Service Research, 7*(1), 20–41.

Lupi, C. (2007). Una intervista a Bernardo Nicoletti: Lean Six Sigma: un percorso di successo. *Sistemi & Impresa*, No. 4, Mag.

Lysons, K., & Farrington, B. (2016). *Procurement and Supply Chain Management*. London: Pearson Higher Ed.

McCue, C., & Roman, A. V. (2012). E-Procurement: Myth or Reality. *Journal of Public Procurement, 12*(2), 221–248.

McKinsey and Co. (2012). Banking on Customer Centricity: Transforming Banks into Customer-Centric Organizations. *EMEA Banking Practice.*

Marchand, D. (Ed.). (2000). *Competing with Information*. Chichester: Wiley.

Marino, B., & Juels, A. (2016). Setting Standards for Altering and Undoing Smart Contracts. In *International Symposium on Rules and Rule Markup Languages for the Semantic Web* (pp. 151–166). Cham: Springer International Publishing.

Mariotto, C., & Verdier, M. (2015). *Bank of Finland, Innovation and Competition in Internet and Mobile Banking: An Industrial Organization Perspective*. Bank of Finland Research Discussion Paper.

Martin, C. (2005). *Supply Chain Management, Creating Value with Logistics*. Upper Saddle River: Pearson Education.

Martin, J. W. (2007). *Lean Six Sigma for Supply Chain Management*. New York: McGraw-Hill.

Mason-Jones, R., Naylor, B., & Towill, D. R. (2000). Lean, Agile or Leagile? Matching Your Supply Chain to the Marketplace. *International Journal of Production Research, 38*(17), 4061–4070.

Mell, P., & Grance, T. (2011). *The NIST Definition of Cloud Computing*. Gaithersburg: NIST Special Publication.

Menges, M., Roubanov, D., & Ernst, J. (2014). Produktionsplanung und-steuerung (PPS). In M. Eigner, D. Roubanov, & R. Zafirov (Eds.), *Modellbasierte virtuelle Produktentwicklung* (pp. 301–326). Berlin: Springer.

Messe, H. Industrie 4.0 muss sich erst beweisen. Retrieved August 15, 2016, from http://www.handelsblatt.com/unternehmen/industrie/hannover-messe-industrie-4-0-muss-sich-erst-beweisen/8044930.html

Monczka, R., et al. (2009). *Purchasing and Supply Chain Management*. Andover: Cengage Learning EMEA.

Morabito, V. (2015). *Big Data and Analytics: Strategic and Organizational Impacts*. Cham: Springer.

Mouritsen, J., & Hansen, A. (2006). *Contemporary Issues in Management Accounting*. books.google.com

Myerson, P. (2012). *Lean Supply Chain and Logistics Management*. New York: McGraw-Hill.

Mynarz, J., Svátek, V., & Di Noia, T. (2015). Matchmaking Public Procurement Linked Open Data. In *OTM Confederated International Conferences: On the Move to Meaningful Internet Systems* (pp. 405–422). Cham: Springer International Publishing.

Nakano, R. (2002). *Web Content Management: A Collaborative Approach*. Boston: Addison-Wesley.

Nekolar, A. P. (2013). *e-Procurement: Euphorie und Realität*. Berlin: Springer.

Nicoletti, B. (2001). *Assistenza Tecnica: Total Quality* (2nd ed.). Milano: FrancoAngeli.

Nicoletti, B. (2006). Nuovo Pignone, l'Arte di fondere il Lean Management e Six Sigma. *Computerworld Italy, 6*, 1–2.

Nicoletti, B. (2008a, February 29). The Lean Branch. *Fintech 2008*, Singapore.

Nicoletti, B. (2008b). Unified Content Management. *Sistemi e Automazione, 4*(April), 38–43.

Nicoletti, B. (2010a). Il Miglioramento dei Processi dell'Assistenza Tecnica con il Lean and Digitize. *Manutenzione Tecnica e Management,* no. 10, 22–23.

Nicoletti, B. (2010c). *La metodologia del Lean and Digitize Per una organizzazione eccellente*. Milano: FrancoAngeli.

Nicoletti, B. (2010b). *Gli Strumenti del Lean and Digitize*. Milano: FrancoAngeli.

Nicoletti, B. (2012a). *Lean Procurement*. Milano: FrancoAngeli.
Nicoletti, B. (2012b). *Lean and Digitize: An Integrated Approach to Process Improvement*. Farnham: Gower Publishing.
Nicoletti, B. (2015). ll rinnovamento del Procurement. *The Procurement Magazine*.
Nugroho, R. P., Zuiderwijk, A., Janssen, M., & de Jong, M. (2015). A Comparison of National Open Data Policies: Lessons Learned. *Transforming Government: People, Process and Policy, 9*(3), 286–308.
Ohno, T. (1988). *The Toyota Production System*. New York: Productivity Press.
Ølnes, S. (2015). Beyond Bitcoin-Public Sector Innovation Using the Bitcoin Blockchain Technology. In *Norsk konferanse for organisasjoners bruk av IT, 23*(1), 1–11.
O'Riain, S., Curry, E., & Harth, A. (2012). XBRL and Open Data for Global Financial Ecosystems: A Linked Data Approach. *International Journal of Accounting Information Systems, 13*(2), 141–162.
Osterwalder, A., & Pigneur, Y. (2010). *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. Chichester: Wiley.
Patton, M. Q. (2002). *Qualitative Research and Evaluation Methods* (3rd ed.). Thousand Oaks: Sage Publications.
Patty, R. M., & Denton, M. A. (2010). *The End of Project Overruns: Lean, Beyond for Engineering, Procurement*. Boca Raton, FL: Universal Publishers.
Perkin, N., & Abraham, P. (2017). *Building the Agile Business Through Digital Transformation*. London: Kogan Page Publishers.
Perugini, M. L., & Dal Checco, P. (2015). Introduzione agli Smart Contract (Introduction to Smart Contract). *Available at SSRN 2729545*.
Picot, A., Reichwald, R., & Wigand, R. T. (2001). *Die Grenzenlose Unternehmung: Information, Organization und Management* (4th ed.). Wiesbaden: Gabler.
Platform I4.0. Von smarten Objekten und Maschinen. Retrieved August 24, 2016, from http://www.plattform-i40.de/
Plenert, G. J. (2007). *Reinventing Lean*. Burlington, MA: Elesevier.
Poirier, C. C., & Bauer, M. J. (2000). *e-Supply Chain*. San Francisco: Berrett-Koehler.
Poppendieck, M., & Poppendieck, T. (2003). *Lean Software Development: An Agile Toolkit*. Boston: Addison Wesley.
Porter, M. (1979). How Competitive Forces Shape Strategy. *Harvard Business Review*, 102–117.
Posada, J., Toro, C., Barandiaran, I., Oyarzun, D., Stricker, D., de Amicis, R., et al. (2015). Visual Computing as a Key Enabling Technology for Industrie 4.0 and Industrial Internet. *IEEE Computer Graphics and Applications, 35*(2), 26–40.

Profile Sheet Wsp-G3-024 Data Scientist. Retrieved April, 2016, from http://www.skillprofiles.eu/stable/g3/en/profiles/WSP-G3-024.pdf

Puschmann, T., & Alt, R. (2005). Successful Use of e-Procurement in Supply Chains. *Supply Chain Management, 10*(2), 122–133.

Harris, R., & Rother, M. (2001). *Creating Continuous Flow, An Action Guide for Managers, Engineers, Production Associates*. Cambridge, MA: The Lean Enterprise Institute.

Rizzo, G., Morando, F., & De Martin, J. C. (2009). Open Data: la piattaforma di dati aperti per il Linked Data. *International Journal on Semantic Web and Information Systems, 5*(3), 1–22.

Rockley, A., Kostur, P., & Manning, S. (2003). *Managing Enterprise Content: A Unified Content Strategy*. Harlow: New Riders Publishing.

Roggenhofer, S. (2008). Banking on Lean. *McKinsey Report*. http://www.mckinsey.com/App_Media/Reports/Financial_Services/Banking_On_Lean_For_A_Competitive_Edge.pdf

Roland Berger, R. (2011). *Purchasing-Excellence-Studie*. Munich: Roland Berger.

Ronchi, S., Brun, A., Golini, R., & Fan, X. (2010). What is the Value of an IT e-Procurement System? *Journal of Purchasing and Supply Management, 16*(2), 131–140.

Ross, D. F. (2011). *Introduction to Supply Chain Management Technologies*. Boca Raton, FL: CRC Press and Taylor and Francis Group.

Rother, M., & Harris, R. (2006). *Creating Continuous Flow: An Action Guide for Managers, Engineers, Production Managers*. Cambridge, MA: The Lean Enterprise Institute.

Rother, M., & Shook, (2009). *Learning to See. Mapping the Supply Chain to Create Value and Eliminate Waste*. Cambridge, MA: The Lean Enterprise Institute.

Russell, J., & Cohn, R. (2012). *e-Procurement*, Ltd. Book on Demand.

Sabraz Nawaz, S., Pulasinghe, K., & Thelijjagoda, S. (2015). Mobile Office and its Implications for ERP Systems: A Review of Literature. *International Journal of Advanced Research in Computer Science and Software Engineering, 5*(5), 12–16.

Saggau, B. (2007). *Organization elektronischer Beschaffung. Entwurf eines transaktionskostentheoretischen Beschreibungs-und Erklärungsrahmens*. Wiesbaden: Deutscher Universitäts-Verlag.

Sarkar, D. (2007). *Lean for Service Organizations, Offices—A Holistic Approach for Operational Excellence*. Milwaukee, WI: ASQ Press.

Savarese, A. (2007, October). Una Intervista con Bernardo Nicoletti, CIO GE Oil and Gas. *Data Manager.*

Schadler, T., Yates, S., Wang, N., & Sharma, A. (2013). Mobile Workforce Adoption Trends. *Forrester Research.*

Scherrer-Rathje, M., Boyle, T. A., & Deflorin, P. (2009). *Lean, Take Two! Reflections from the Second Attempt at Lean Implementation*. Bloomington, IN: Kelly School of Business.

Schlick, J., Stephan, P., Loskyll, M., & Lappe, D. (2014). Industrie 4.0 in der praktischen Anwendung. In T. Bauernhansl, M. ten Hompel, & B. Vogel-Heuser (Eds.), *Industrie 4.0 in Produktion, Automatisierung und Logistik: Anwendung—Technologien—Migration* (pp. 57–84). Wiesbaden: Springer.

Schmidt, R., Möhring, M., Härting, R. C., Reichstein, C., Neumaier, P., & Jozinovic, P. (2015). Industry 4.0: Potentials for Creating Smart Products: Empirical Research Results. In W. Abramowicz (Ed.), *Business Information Systems* (pp. 16–27). Wiesbaden: Springer.

Schniederjans, M. J., Schniederjans, D. G., & Schniederjans, A. M. (2009). *Topics in Lean Supply Chain Management*. Hackensack, NJ: World Scientific Press.

Schuh, G., Potente, T., Wesch-Potente, C., Weber, A. R., & Prote, J. P. (2014). *Collaboration Mechanisms to increase Productivity in the Context of Industrie 4.0*. Proceedings 19th Robust Manufacturing Conference. CIRP, Bremen Germany, pp. 51–56.

Secchi, R. (2012). *Supply Chain Management e Made in Italy: Lezioni da nove casi di eccellenza*. Milano: EGEA.

Semprini. (2008). The Lean Production in Micro. *SME*. Retrieved March 25, 2017, from www.eccellere.com

Sendler, U. (2013). Industrie 4.0: Beherrschung der industriellen Komplexität mit SysLM (Systems Lifecycle Management). In U. Sendler (Ed.), *Industrie 4.0: Beherrschung der industriellen Komplexität mit Sys LM* (p. 120). Berlin; Heidelberg: Springer-Vieweg.

Shah, R., & Ward, P. T. (2003). Lean Manufacturing: Context, Practice Bundles, Performance. *Journal of Operations Management, 21*, 129–149.

Shohua, D., et al. (2008). Implementing Best Practices, Pipeline. *Gas Technology*, 26–33.

Smalley, S. (2004). *Creating Level Pull, A Lean Production-System Improvement Guide for Production-Control, Operations,, Engineering Professionals*. Cambridge, MA: The Lean Enterprise Institute.

Smith, H., & Fingar, P. (2003). *Business Process Management, The Third Wave*. Tampa, FL: Meghan-Kiffer.

Smith, S., & Wheeler, J. (2002). *Managing the Customer Experience: Turning customers*. Harlow: Pearson Education.

Smith, V. C., Goel, S., & Gulhane, T. (2009). *Enabling Profitable Growth Through Procurement: Transforming the Sourcing and Procurement Organization*. ASUG/SAP.

Soares, S. (2013). *IBM InfoSphere: A Platform for Big Data Governance and Process Data Governance*. Boise, ID: MC Press.Online, LLC.

Stadtler, H., & Kilger, C. (Eds.). (2008). *Supply Chain Management*. Wiesbaden: Springer.

Sundermann, F. (2013). Einkauf 40: Einsparungen durch Zusammenarbeit von Einkauf und Technik. *Pool4Tool, 11*, 24–28.

Tangi, L. (2015, December). Open Government Data: la situazione italiana studiata attraverso un modello di classificazione dei portali di pubblicazione dei dati. Quali azioni per una Pubblica Amministrazione più trasparente e vicina ai cittadini? Milano: Tesi Politecnico di Milano.

TenHompel, M., & Henke, M. (2014). Logistik 4.0. In T. Bauernhansl, M. T. Hompel, & B. Vogel-Heuser (Eds.), *Industrie 4.0 in Produktion. Automatisierung und Logistik* (pp. 615–624). Wiesbaden: Springer.

Ubaldi, B. (2013). *Open Government Data: Towards Empirical Analysis of Open Government Data Initiatives*. OECD Working Papers on Public Governance, No. 22. OECD Publishing, Paris.

Ubaldi, B. (2015). Open data e la nuova frontiera della fornitura di servizi innovativi. *Prisma Economia-Società-Lavoro*.

Uday, M., & Chon, G. (2004). Applying Lean Manufacturing Principles to Information Intensive Services. *International Journal of Services Managment and Technology, 5*(5–6), 488–506.

Ukalkar, S. (2000). *Strategic Procurement Management for Competitive Advantage* (p. 291). Oxford: Oxford University Press.

Vafopoulos, M. N., Meimaris, M., Papantoniou, A., Anagnostopoulos, I., Alexiou, G., Avraam, I., et al. (2012). Public Spending: Interconnecting and Visualizing Greek Public Expenditure Following Linked Open Data Directives. *Available at SSRN 2064517*.

van Weele, A. J. (2010). *Purchasing and Supply Chain Management. Analysis, Strategy, Planning and Practice* (5th ed.). Andover: Cengage.

Various Authors. (2007). *Integrated Rath and Strong's Six Sigma Pocket Guide*. Lexington, MA: Rath and Strong.

Vassiliadis, P., Simitsis, A., & Skiadopoulos, S. (2002). *Conceptual Modeling for ETL Processes*. Proceedings of the 5th ACM International Workshop on Data Warehousing and OLAP. ACM, pp. 14–21.

Vatalaro, J. C., & Taylor, R. E. (2005). *Implementing a Mixed Model Kanban System: The Lean Replenishment Pull for Production*. New York: Productivity Press.

Vincel, J. P. (2004). *Lean Supply Chain Management: A Handbook for Strategic Procurement*. New York: Productivity Press.

Volarevic, M., Strasberger, V., & Pacelat, E. (2000). *A Philosophy of the Electronic Document Management*. Proceedings of the 22nd International Conference Information Technology Interfaces, pp. 141–146.

Voss, C., Tsikriktis, N., & Frohlich, M. (2002). Case Research in Operations Management. *International Journal of Operations and Production Management, 22*(2), 195–219.

Walker, D., & Hampson, K. (Eds.). (2003). *Procurement Strategies*. Oxford: Blackwell Publishing.

Wang, S., Wan, J., Li, D., & Zhang, C. (2015). Implementing Smart Factory of Industrie 4.0: An Outlook. *International Journal of Distributed Sensor Networks. ePublication*, Article ID 681806.

Wannenwetsch, H. (2005). *Vernetztes Supply Chain Management: SCM-Integration über die gesamte Wertschöpfungskette*. Berlin: Springer.

Wannenwetsch, H., & Nicolai, S. (2004). *eSupply-Chain-Management: Grundlagen, Strategien, Praxisanwendungen*. Wiesbaden: Gabler.

Ward, A. C. (2007). *Lean Product, Process Development*. Cambridge, MA: Lean Enterprise Institute.

Wilson, M. M. J., & Ram, N. R. (2009). Enabling Lean Sourcing: A Consolidation Model for Small-, Medium-Sized Enterprises. *Manufacturing Journal Management Technology, 20*(6), 817–833.

Wincel, J. P. (2003). *Lean Supply Chain Management: A Handbook for Strategic Procurement*. New York: Productivity Press.

Wisner, J. D., Leong, K., & Tan, K. C. (2006). *Principles of Supply Chain Management, A Balanced Approach*. Stamford, CT: Thomson Learning.

Wisner, J. D., Tan, K.-C., & Leong, G. K. (2015). *Principles of Supply Chain Management: A Balanced Approach*. Boston: Cengage.

Womack, J. P., & Jones, D. T. (2009). *Seeing the Whole. Mapping the Extended Supply Chain*. Cambridge, MA: Lean Enterprise Institute.

Worley, J. M., & Doolen, T. L. (2006). The Role of Communication, Management Support for a Lean Manufacturing Implementation. *Management Decision, 44*(2), 228–245.

Yu, L. (2011). Linked open data. In *A Developer's Guide to the Semantic Web* (pp. 409–466). Berlin; Heidelberg: Springer.

Websites

leanforum.se/boktorget.asp
leanforum.se/boktorget_anmalan.asp
searchmanufacturingerp.techtarget.com/news
www.3isite.com
www.aberdeen.com
www.altimate.ca
www.asslogistica.it
www.assomoda.it
www.benetton.com
www.bernardonicoletti.com
www.bershka.com
www.cameramoda.it
www.canon.it
www.chaseperformance.com
www.cnipa.it
www.consult.it
www.con-way.com
www.cscmp.org
www.cscmp.org
www.dcvelocity.com
www.dylog.it
www.eccellere.com
www.esisinc.com
www.fujutsu.com
www.georgia-associates.com
www.gformula.com
www.hem.com
www.hp.it
www.ibm.it
www.idtech.it
www.ieee.com
www.iged.it
www.ilsole24ore.com
www.ilsole24ore.it
www.impind.de.unifi.it

www.impresaestesa.it
www.impresaprogetto.it
www.inditex.com
www.industryweek.com
www.isixsigma.com
www.istitute-of-logistics.org.uk
www.iungo.it
www.laserfiche.com
www.leancenter.it
www.leancompany.it
www.leanmanufacturing.it
www.logility.com
www.ltdmgmt.com
www.managementstudyguide.com
www.massimodutti.com
www.mckinseyquarterly.com
www.microsoft.com
www.microsoft.it
www.novell.com
www.ohio-state.edu/index.php
www.openwork.it
www.optimialelectronics.com
www.organizzazioniaziendali.it/index.asp
www.oysho.com
www.panorama.it
www.pullandbear.com
www.qualityi.it
www.queoconsulting.it
www.qurius.it
www.reggiani.it
www.ryder.com
www.sas.com
www.sciencedirect.com
www.scmr.com
www.scodanibbio.com/site/access/homeaccess/65.html
www.sistemamodaitalia.it
www.stradivarius.com
www.supply-chain.org

www.toshiba.it
www.tso.it
www.unifi.it
www.unioncamere.it
www.unitec.it
www.uterque.es
www.xerox.it
www.zara.com
www.zarahome.com
www.zenshare.it
www.Leandigitize.com
searchstorage.techtarget.com/podcast/Understanding-stripped-down-hyperscale-storage-for-big-data-use-cases
cloudmate.com/about
data.gov.uk/
openparliament.ca/
www.cloudmate.com
www.data.com
www.freedomdefined.org/Definition
www.leandigitize.com
www.opendefinition.org
www.skillprofiles.eu

Notes

1. http://www.bbc.com/news/technology-14841018, Accessed 30 July 2016.
2. Domingos, P. (2015). *The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World*. Basic Books, New York, NY.
3. https://www.seedr.cc/, Accessed 25 April 2017.
4. https://www.ama.org/AboutAMA/Pages/Definition-of-Marketing.aspx, Accessed 20 December 2017.
5. Dixit, U.S., Hazarika, M., and Davim, J.P. (2017). Emergence of Production and Industrial Engineering. In *A Brief History of Mechanical Engineering*. Springer International Publishing, New York, NY: 127–146.
6. Deming, W.E., and Edwards, D.W. (1982). *Quality, Productivity, and Competitive Position* (Vol. 183). Cambridge, MA: Massachusetts Institute of Technology, Center for advanced engineering study.

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[1] Note: Page numbers followed by 'n' refer to foot notes.

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