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"THE FUTURE OF PROCUREMENT: ADOPTION OF ROBOTIC PROCESS AUTOMATION AND OF RESPONSIBLE PURCHASING PRACTICES"

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Introduction

Supply Chain Management (SCM) is a crucial aspect of each company's business. Being able to build a solid chain, giving strength to each block of it can lead to a competitive advantage for a company. The way these chains have been managed during the history has changed significantly: from the Fordism era, to the advent of Lean Production and Total Quality Management (TQM) and later with the introduction of Digital Technologies, the key factors for a successful Supply Chain diversify themselves following this technological evolution.

In particular, the introduction of Digital Technologies has increased the range of activities that can be done to monitor the efficiency of the supply chain. This new way of controlling and managing Supply Chains through digital technologies enables the generation of Big Data, which can be critical for a competitive chain. Nowadays, the ability to exploit the value of Big Data in the supply structure is fundamental; predict outcomes, automate time consuming processes and leverage on programs or machines that can learn from mistakes are becoming the key drivers of Supply Chain Management but at the same time constitute greenfield for future research.

This new approach to SCM is impacting also procurement function giving it a new and exclusive central role for building organization's competitive advantage.

Procurement is about providing companies with goods and services required for the business to successfully continue. Historically, the Procurement function of companies had always focused its attention of two main basic drivers: price and quality; meaning that companies had searched for the cheapest raw materials that could also satisfy quality criteria. As of today, an efficient sourcing involves also the creation of close and long-term relationship with supplier which may become critical for supply chain overall efficiency.

Procurement has also been impacted by digital technologies, in particular, a growing discussion is involving automation technologies and the possibility to automate time-consuming and paper-based activities, in order to let employees to focus on more value-driven activities.

This possibility takes the name of Robotic Process Automation and is not so far of becoming fully implemented on Procurement. Although some big companies are already adopting it, this implementation is done on a small scale, since they are still trying to get the whole set of competences to drive full automation, moreover, they are trying to exploit the combination of automation technologies and Artificial Intelligence.

Another important driver is shaping the future of the Procurement function. The increasing focus on environmental and social issues are insinuating inside this area and inside the supply chain management. Companies are increasingly focusing their attention on supplier evaluation

and selection upon not only price- and quality- related factors, but also on criteria that belong to the CSR sphere, such as environmental impact, recycling rate of materials, labor conditions and health of workplace, diversity and inclusion among employees. Digital tools enter also here as facilitators for supplier selection and evaluation.

Formally, the thesis will be divided into four chapters. In Chapter 1, a literature review of Supply Chain Management (SCM) is presented and various definitions are given according to different studies. Then the enablement of Big Data inside the supply chain is addressed, stating the possible applications of the technologies that leverage on these data. In the end of the chapter, the Procurement function is analyzed, specifically its changing role and importance inside the supply chain, and room is given for an overlook on the possible future of Procurement shaped by digitalization (such as E-Procurement).

Chapter 2 will focus on Robotic Process Automation (RPA) technology and to its application in Procurement. A possible framework of implementation is also presented. In Chapter 3, some case studies of successful application of E-Procurement and Robotic process automation are presented, showing also its combination with Artificial Intelligence.

Chapter 4 will finally focus on Responsible Procurement. Firstly, the chapter analysed the existing literature on Responsible Procurement, showing the drivers and barriers that can promote or harm its adoption. Subsequently, the chapter presents a framework that indicates the possible *best practices* for a successful Social and Environmental Procurement implementation. A special emphasis has been given to the sustainable evaluation and selection of suppliers, showing how companies are integrating among evaluation and selection criteria, CSR-related aspects, ranging from environmental impact to diversity and inclusion among workforce. Finally, the chapter presents digital tool, developed by the company EcoVadis which allows forms to evaluate end monitor suppliers' achievement upon social and environmental topics (for instance, the obtaining of certifications).

1. Chapter 1 – Supply Chain Overview: Role and Future of Procurement

1.1. Supply Chain and Supply Chain Management: a literature review

The term Supply Chain Management (SCM) has been introduced in the early 80's by Oliver and Webber (1982) and since then it has received a constantly growing interest both from theoretical and practical side. The scope of Supply Chain Management is too broad and has many facets that a single and unique definition has not been found yet.

To start our journey through supply chain management and procurement, the first step is the definition of a supply chain. According to Christopher (1998, p.15) a supply chain (SC) is a "network of organizations that are involved, through upstream and downstream linkages in the different process and activities that produce value in the form of products and services in the hands of the ultimate consumer".

As we can see from this definition all the activities along the supply chain has as ultimate scope to serve the final customer, from the purchase order to the product (or service) delivery.

LaLonde and Masters (1994) proposed that a SC is a set of firms that pass material forward. Similarly, Lamber, Stock and Ellram define a SC as the alignment of firms that brings products or services to market. As stated above, the final customer constitutes and integral part of the entire SC. According to Mentzer et *al.*, a Supply Chain can be defined as a set of two or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer (Mentzer et *al.*, 2001).

Following the definitions above, a SC is comprised by two basic integrated processes: *Production Planning and Inventory Control Process* and *Distribution and Logistics Process* (Figure 1) (Beamon, 1998). Production planning is the management of the entire manufacturing process, extending its functions to raw material scheduling and acquisition, design of the manufacturing process and material handling. Inventory control refers to the management and stocking criteria of raw materials, work in progress and final products. The second fundamental process of a SC is the Distribution and Logistics Process. It explains how final products are

moved from warehouse to the retailer or directly to the end user. This process includes activities like inventory retrieval, transportation and delivery.

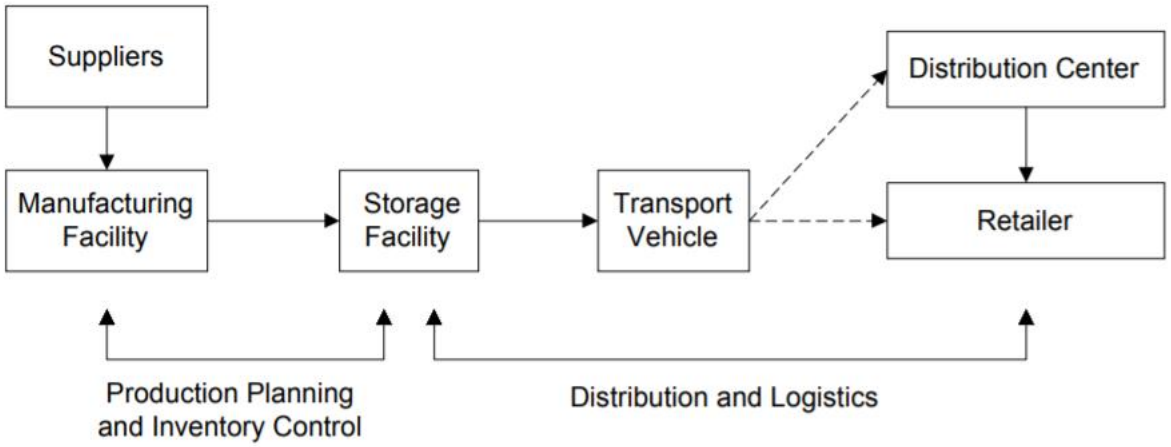


Figure 1. Supply Chain Structure. Source: Beamon, 1998

By means of example, the supply chain process for manufacturing and service industries starts with suppliers, manufacturers, distributors, retailers, service providers, and ends with consumers. The final customer obviously is the focal point of a supply chain as the primary reason of existence of a supply chain. Manufacturing companies attain to a basic supply chain configuration. As shown in the diagram below, the main blocks of a basic supply chain are: suppliers of basic components or packaging; the company itself which manufactures goods, finished goods are then delivered to retailers (think about department stores or hypermarkets, or even online shops for CPG – consumer packaged goods) and finally to the ultimate buyers. Aside from these core activities there are service providers like banking services which are as vital as other blocks of the chain for the SC competitiveness (Figure 2) (Farhan Shahriar, 2014).

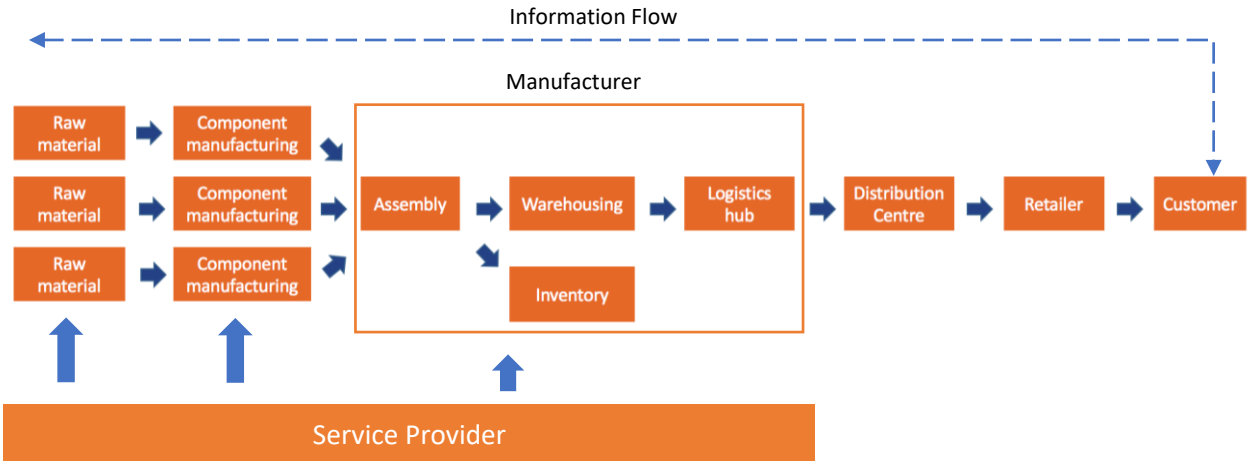


Figure 2. Source: Personal elaboration

The above definitions express the core determinants of a Supply Chain. They investigate the need for a provenance and a destination within which goods flow and accept the approach that

overall Supply Chains start with resources (raw materials), combine several value-adding activities and finish with the transfer of a finished goods to consumers (Janvier-James, 2011). Some other definitions include extra activities inside the SC like sustainabile recycling, financial and reverse information flows and return management, but the core activities that express the flow from one end (suppliers) to the other (customers) remains (Russo et *al.*, 2007;) (Ahi and Searcy, 2013).

1.1.1. Supply Chain building blocks

As described by Stadtler (2005) the primary aim of a SC is to improve competitiveness in the environment in which the company is operating by leading the whole chain in a sustainable and strategic way in order to achieve customer satisfaction. This bigger scope of the SC rests on two building blocks: *integration of organizational units* and *coordination of flows*.

The first pillar includes the *choice of partners*, which is involved in the design of the chain. Basically, the company needs to find the best partners to fit the existing SC and the needs of the customers to be served. Then, since a supply chain can be identified as a *network of organizations* aimed to reach the same goal, the competitive effectiveness lies on the nature of the relationships between these firms (nonetheless some risks must be considered when starting partnerships like risks of leaving the SC for pursuing better market opportunities or being integrated into a takeover). In today's volatile and increasingly digital global business environment, companies need less of a supply chain and more of a supply network—able to move quickly and flexibly and capitalize on new innovations and respond to digital disruption (Accenture, 2018). Finally, the third building block of a SC is the establishment of the *leadership*, would this be financial or hierarchical or polycentric, in which all members of the chain are considered as equal (Stadtler, 2005).

The second pillar of the structure of a SC (coordination of flows), includes the use of *information and communication technologies.* Generally, information- and communication technologies (ICTs) are being introduced in an organization in order to increase operational efficiency, quality, and transparency. Thus, most research focuses on such issues. However, besides these undisputable gains, the introduction of ICTs also leads to substantial changes in the power relationships among all involved actors (Zimmermann and Finger, 2005). The second building block of the coordination pillar is *process orientation.* A business process is a set of value-added activities and tasks that once completed will help reaching organizational goals. Since supply chain is a set of processes (demand planning, procurement, logistics management

etc.) each process and sub-process must be clearly defined as well as measured: approach of continuous improvement, accelerated learning, knowledge teams and all other activities are put in place to design a flawless process and gain a competitive advantage.

The last building block of SC is *advanced planning*. Practically, advanced planning is performed by Advanced Panning Systems (APS) which are software like SAP, Oracle or i2, that, unlike traditional ERP software, are able to find feasible, near optimal plans across the Supply Chain as a whole, while potential bottlenecks are considered explicitly (Stadler and Kilger, 2005). The main focus is on supporting the flow of materials across the chain and the related functions, moreover APS uses optimization and simulation tools to consider supply chain constraints and produce optimal plans (Stadtler, 2005).

The whole chain is constantly supported by other organizational functions and concepts that ranges from organizational theory to logistics, marketing, finance and operations.

1.2. Supply chain management: a research framework

The analysis now moves on to an as questionable as important concept for which literature has put a lot of attention to, but without finding a unique definition: Supply Chain Management.

Supply chain management (SCM) has gained significance as one of the 21st century manufacturing paradigms for improving organizational competitiveness. SCM has been considered as a competitive strategy for integrating suppliers and customers with the objective of improving responsiveness and flexibility of manufacturing organizations (Gunasekaran, 2004). Greater environmental uncertainty, time and quality-based competition and global sourcing are traced among major drivers for such emphasis on Supply chain management. Global souring has increasingly forced companies to look for more efficient ways to organize relationships with their suppliers and coordinate the flows of materials along the chain.

Nowadays, delivering a product without defects and in time to the customer is no longer considered a premium feature but just a qualifying factor for companies. This shifted competition on performance and require firms to build an extremely efficient supply chain grounded on closer relationships with suppliers.

Between theory and practice, some confusion remains about the definition of SCM. Over the last 10 years the perspective of supply chain management focused on purchasing and supply and the one focused on transportation and logistics, have merged into a strategic approach to

operations, material and logistics management, referred to as Supply Chain Management (Tan, Handfield, and Krause, 1998).

Supply chain management has been described as the chain linking each element of the manufacturing and supply processes from raw materials to the final customer, involving all organizations within the chain as a unified virtual business (Scott and Westbrook, 1991). Others (Simchi-Levi, Simchi-Levi and Kaminsky, 2004) define SCM as the process of planning, implementing and controlling the operations of the supply chain in an efficient way. SCM extends its range from all movements and storage of raw materials, work-in-process inventory, and finished goods from the point-of-origin to the point-of-consumption (the final customer). Moreover, SCM also includes coordination and collaboration between partners along the chain; in essence supply chain management includes supply and demand management within and across the company.

From a supplier-oriented definition, SCM focuses on how companies exploit their suppliers' processes and technologies to gain competitive advantage (Farley, 1997) and how to coordinate manufacturing, logistics and material management between companies. When all strategic organizations in the value chain act as a single unified entity, performance is enhanced throughout the system of suppliers (Tan, 2001).

Following this definition of SCM, companies along the chain are considered as a virtual business entity, where the consumer pulls items out the chain instead of the manufacturer pushing them towards the final user.

Another approach of SCM is to consider only strategic suppliers, since a supply chain is a too complex entity to be fully integrates; this leads to another restrictive definition of SCM, given by Houlihan (1985): the integration of the various functional areas within an organization to enhance the flow of goods from *immediate strategic suppliers* through manufacturing and distribution chain to the end user. Another stream of literature, instead, coming from transportation and logistics puts emphasis on the importance of distribution with little consideration of physical transformation of products. The main objective of supply chain management is the distribution of the final products to the end user. This last dimension of supply chain management probably rose due to a logistic trend regarding the importance of logistics management on the 1980s.

By the way there is a difference between the concept of supply chain management and the traditional concept of logistics. Basically, logistics refers to activities that occur within the boundaries of a single organization, whereas managing a supply chain refers to network of companies that work together and coordinate efforts to deliver products (Hugos, 2018). Supply chain management, moreover include all activities of traditional logistics such as procurement,

distribution, maintenance and inventory management and adds marketing, finance, new products development and customer service.

This leads the way to a more holistic definition of supply chain management. According to Hugos (2018): "Supply chain management is the coordination of production, inventory, location, and transportation among the participants in a supply chain to achieve the best mix of responsiveness and efficiency for the market being served". An effective SCM not only requires efficiency at internal operating level, but also requires improvements at customer service level. The lack of a unique definition of SCM is due to the way the concept has been developed. In fact, the concept of supply chain management has been considered from different points of view in different bodies of literature (Croom et *al.*, 2000).

Generally speaking, there is universally confusion among the various definitions of supply chain management: many labels can be found referring both to supply chain and to supply chain management, moreover contrasting approaches has been adopted in defining the term as we can see from Table 1 where some definition of SCM are highlighted.

Table 1.

Authors	*Definitions*
Tan et *al.* (1998)	Supply chain management encompasses materials/supply management from the supply of basic raw materials to final product (and possible recycling and re-use). Supply chain management focuses on how firms utilize their suppliers' processes, technology and capability to enhance competitive advantage. It is a management philosophy that extends traditional intra-enterprise activities by bringing trading partners together with the common goal of optimization and efficiency.
Berry et *al.* (1994)	Supply chain management aims at building trust, exchanging information on market needs, developing new products, and reducing the supplier base to a particular OEM (original equipment manufacturer) so as to release management resources for developing meaningful, long term relationship.

Jones and Riley (1985)	An integrative approach to dealing with the planning and control of the materials #ow from suppliers to end-users.
Saunders (1995)	External Chain is the total chain of exchange from original source of raw material, through the various "rms involved in extracting and processing raw materials, manufacturing, assembling, distributing and retailing to ultimate end customers.
Ellram (1991)	A network of "rms interacting to deliver product or service to the end customer, linking flows from raw material supply to final delivery.
Christopher (1992)	Network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer.
Lee and Billington (1992)	Networks of manufacturing and distribution sites that procure raw materials, transform them into intermediate and finished products and distribute the finished products to customers.
Kopczak (1997)	The set of entities, including suppliers, logistics services providers, manufacturers, distributors and resellers, through which materials, products and information flow.
Lee and Ng (1997)	A network of entities that starts with the suppliers' supplier and ends with the customers' custom the production and delivery of goods and services.
Cooper et *al.* (1997)	Supply chain management is "... an integrative philosophy to manage the total flow of a distribution channel from supplier to the ultimate user".
Williamson, Harrison, and Jordan (2004)	SCM can be defined as 'the management of the interconnection of organizations which relate each other through upstream and downstream linkages between the different processes that produce value in the form of products and services to the ultimate consumer'

Although the general confusion among its definitions, author have developed a universal framework of Supply Chain Management in 2000 (Lambert and Cooper, 2000) and further reconstructed with some changes in 2016. In the next paragraph the building blocks of this framework will be analyzed.

1.2.1. Framework of SCM

In 2000 in the journal of *Industrial Marketing Management* Lambert and Cooper presented a framework of Supply Chain Management based on the idea that companies compete as member of a network of firms (Figure 3). Another framework that is used by companies is the Supply Chain Operations Reference (SCOR) model developed by the Supply Chain Council. Here we will examine the framework developed in 2000 and its further changes made in the new framework developed in 2016.

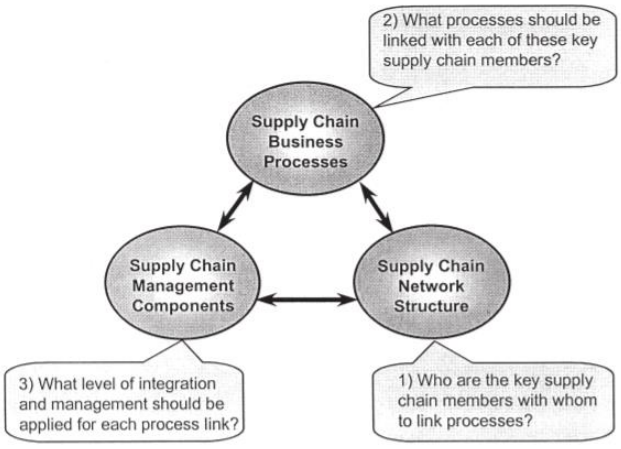


Figure 3 Source: Lambert and Cooper, 2000

As deeply analyzed in the previous paragraphs the definition of supply chain management has mainly been developed under logistic management literature, but this orientation of logistics and SCM as silos create much confusion for managers and academics. Therefore, a definition has been provided by the authors of the SCM framework that changes the focus from single functions to the management of business processes across companies to create competitive advantage (Lambert and Enz, 2017):

"Supply chain management is the integration of key business processes from end user through original suppliers that provides, products, services and information that add value for customers and other stakeholders".

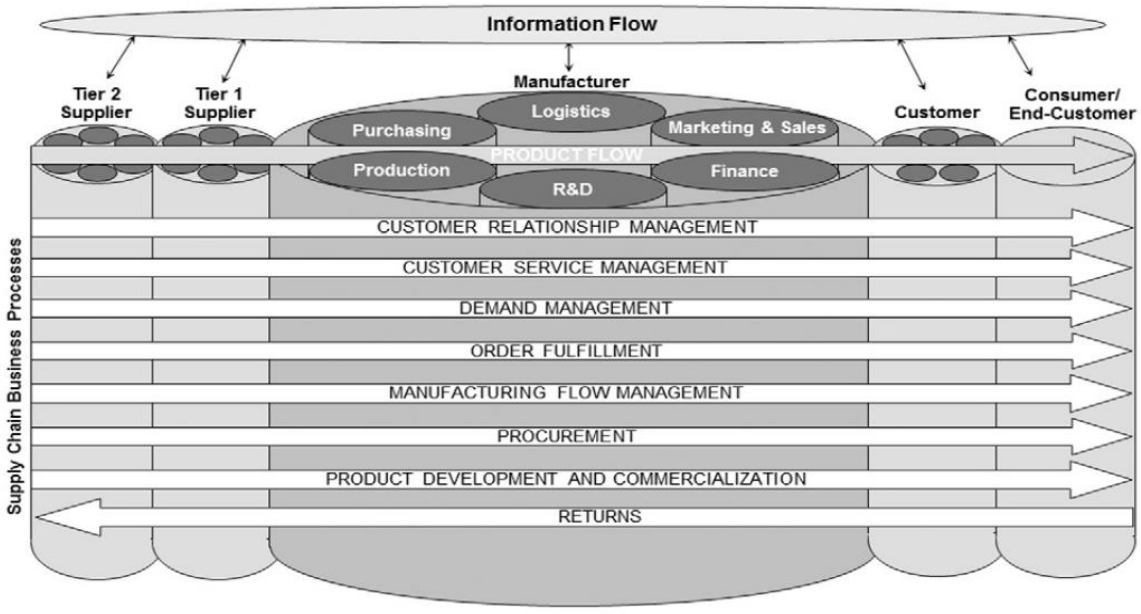
The supply chain management framework is characterized by three interrelated elements: the *first* is the *supply chain network structure* which involves the identification of the key supply chain members with whom to link processes. The second element is made of *supply chain business processes* in order to identify which key processes must be implemented with each key partner. In Figure 4 are shown the eight key processes of SCM, mainly they are: customer relationship management, customer service management, demand management, order fulfillment, manufacturing flow management, procurement, product development and commercialization and returns.

The third one indicates the *supply chain management components* mainly identified as planning and control, work structure, organization structure, product flow facility structure, information flow facility structure, management methods, power and leadership structure, risk and reward structure, and culture and attitude (Figure 4).

Supply Chain Network Structure

All firms participate in a supply chain, at different level and with different roles, different number of supplier and customer served. How these many actors need to be managed? More precisely. How do the relationships along the chain need to be managed? Not all relationships are equal in the chain, and not all of them need to be closely coordinated and integrated ad not all of them needs the same management attention. The article of Lambert and Cooper suggested three aspects of a supply chain network structure to be considered: (1) the members of the supply chain, including all the firms with whom the main company interacts with directly or indirectly. Here all firms involved in the supply chain are considered: the primary members that

Figure 4. Source: Lambert and Cooper, 2000



carry out value-added activities in a determined business process and the supporting members, which basically provide resources or assets to primary members (i.e. banks lending money to a retailer); (2) the dimensions of the network, that depends on the *horizontal dimension,* the *vertical dimension* and the position of the main company within the end points of the chain. Simply, the horizontal structure refers to the number of tiers. The vertical structure depends on the number of suppliers and customers within each tier. Finally, the company can position itself closer to the source of raw material or closer to the end customer; and (3) the different types of process links across the chain.

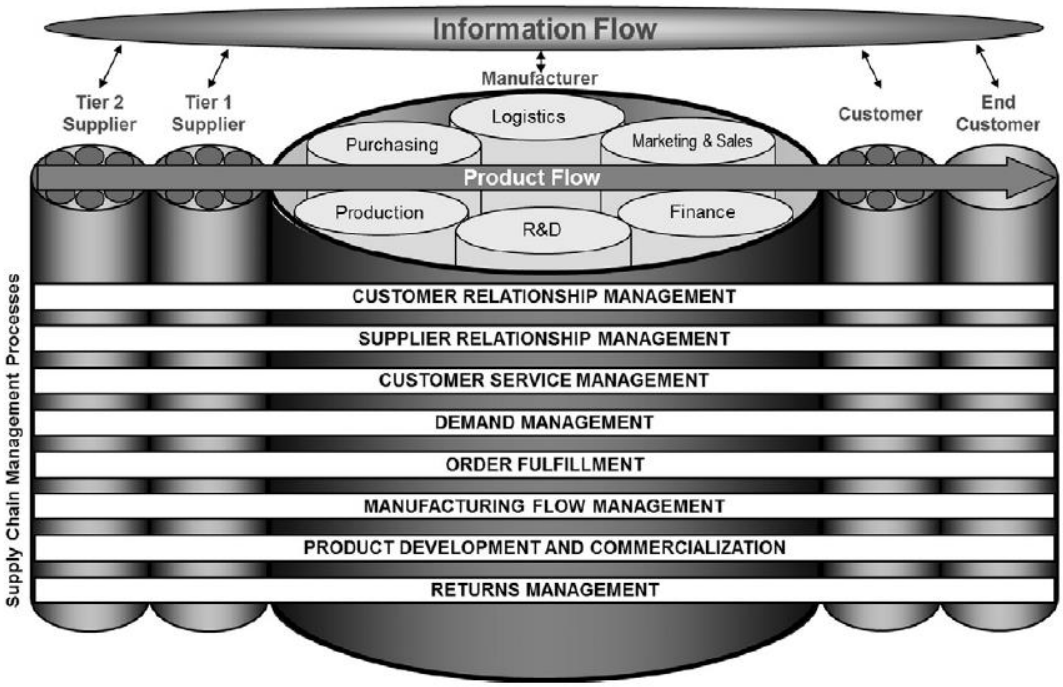
Supply Chain Business Processes

SCM is about focusing into key supply chain processes rather than individual functions, for this to be successful, information flow is required, maintaining the customer as the primary focus of the whole process. Optimizing the product flow therefor cannot be accomplished without implementing a process-orientation to the supply chain.

As far as our analysis is concerned only the procurement process would be deeply looked at to see how the concept has changed within the framework elaborated in 2000 and the new one of 2016.

In 2000's SCM framework, procurement is viewed under the lens of a strategic alliance with suppliers with which develop growth plans and support new product development. These alliances are intended to be of a long term and established with a core group of suppliers focused on the same goal of the focal company. Moreover, as already stated, the flow of information

Figure 5. Lambert and Enz, 2017



between suppliers and the main company is crucial for competitive advantage: information exchange prevent wasting on the negotiating side of purchasing and allow to focus more on manage the relationship with each supplier.

In the framework developed in 2016 the supply chain management has been addressed as supplier relationship management (SRM). One direct impact on a company's competitiveness is its capability to align strategic customer relationship management processes with supplier relationship management processes, and both of these with the management of collaborations and joint ventures with third parties (Piercy, 2009).

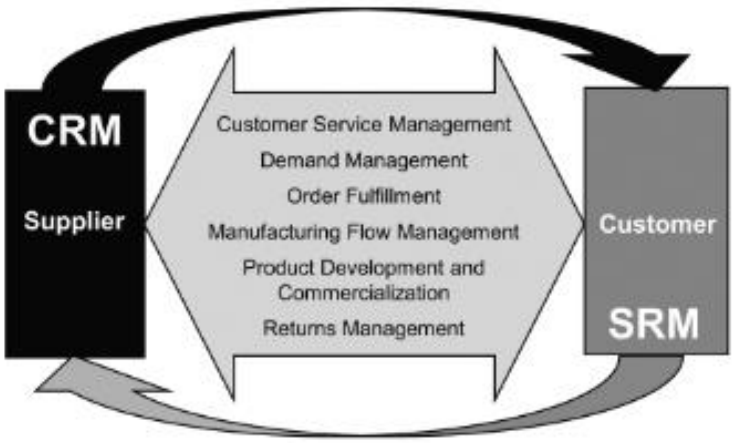


Figure 6. New Framework of SCM. Lambert and Enz, 2017

The new framework of SCM has underwent some refinement during the years (Figure 5), arrows were dropped, two processes has been renamed, namely the procurement process was changed into *supplier relationship management* and returns was changed into returns management.

The procurement process deals now on how relationships with supplier needs to be developed and maintained. As in 2000, close relationships are built with small subset of suppliers based on the value they provide, and more traditional relationships are kept over time. Supplier relationship management represent an opportunity to build on strategic sourcing and traditional procurement activities. It deals with establishing partnerships with key suppliers in order to innovate (new product/service development), reduce costs and co-create value for a long-term collaboration. This key process can be viewed as a macro-level business process (Lambert and Schwieterman, 2012): not only is one of the eight processes of the framework of SCM, but also along with customer relationship management provide the critical links throughout the supply chain (Figure 6).

Strategically, relationships should be managed by reviewing marketing, manufacturing and sourcing strategies in order to identify critical supplier to achieve ongoing competitive advantages; identify criteria for segmenting suppliers (like simply profitability or more complex

indicators like supplier's technology capability and compatibility); developing metrics to measure profitability of suppliers and how their profitability impacts on company's one.
Operationally speaking suppliers are segmented and improvement opportunities with each supplier are identified and agreements on commitment, continuous improvements and communication are reached (so-called product and service agreements - PSA).
Supplier relationship management is really about relationships management. The supply chain is then managed relationship-by-relationship, therefore is critical for a company to be able to measure the performance of each firms involved along with the capability to manager customer relationships.

1.3. Supply Chain and Big Data

In the following paragraphs the thesis describes the importance of Big Data inside Suppl Chains and the possible applications in this field. In the first one, a brief introduction to what are Big Data and what technologies data are enabling will be presented.

1.3.1. Big Data Overview

Big data are characterized firstly (as the name suggests) by their big volume, they appear without a defined structure and with heterogeneous features. Mainly Big Data have three fundamental features:

- *Volume*
- *Variety*
- *Speed*

Volume
Big Data are generated by users surfing the web, by sensors, bank transactions, financial agreements or also social media: all these sources generate a huge amount of data that are impossible to manage with normal databases.
The volume of these data is more or less equivalent to billions of terabytes and to deal with such an amount of data companies must rely on open source solutions that allow advanced computing capabilities and a big storage capacity.

Variety

The absence of a format and a fixed structure is the second characteristic of Big Data. Not only data are of various formats but also, they may come from different sources: machines, sensors or other users.

Speed

It's the speed at which data are generated and collected (Yin and Kaynak, 2015).

Moreover, Big Data allow to manage firms' own data shifting the attention of management in creating ad hoc processes that organize, analyze and adjust them in order for the final user to have in its dashboard the final output. Two more features are also relevant when considering Big Data:

- *Veracity*

  Veracity is often defined as the quality or trustworthiness of the collected data. Considering the accuracy of the collected data and analyzing it is important. Thus, when it comes to Big Data, quality is always preferred over quantity. To focus on quality, it is important to set metrics around the type of data that is collected and its sources;
- *Value*

  Acquiring datasets of the Big Data scale involves substantial investment. Value of a dataset can be determined by estimating the insights that can be generated from the dataset post-analytics.

What are then the data sources? Where does this enormous amount of data came from? We have already named a few, but more specifically they are:

- Traditional systems (enterprise software, CRM, ERP);
- Social Media
- IOT (Internet of Things);
- DCS (Distributed Control System);
- Medical devices or scientific machines;
- Devices that traces human characteristics (from buying behavior, to steps, heart beat rate etc.);

All data coming from these sources needed to be stored, codified in some cases and understood.

This is getting more and more difficult to manage for companies because of the continuous expansion in volume of data, but data driven insights and decision making is getting a lot of attention from companies and new technologies that allow them to analyze data are becoming nowadays more widespread. Thanks to this increasing and rapid accumulation of data, new knowledge is coming into firms' hands to improve strategic decision-making and planning. Actually, data are fundamental not only because of the large amount of information they carry, but also because they allow to extract this information and take decisions, where these would be further taken autonomously. Companies are therefore investing lots of resources on Big Data and Analytics (BDA), since missing this opportunity generate no value, regardless the amount of data. Gaining organizational success thanks to data requires not only a solid technological infrastructure but also data analysts, data knowledge but also an understanding on how the BDA translates information in competitive advantage and strategic value.

Big companies are already collecting Big Data and exploit its analysis to support decision-making as part of routine procedure; contrary SME (Small and Medium Enterprises), are adding more and more data to top management decisions (Y. Wang, Kung, and Byrd, 2018).

Enabling the use of data as a core element of the strategy of a company it is for sure not a straightforward process. In order to better analyze data and improve decisional processes (in this case regarding Supply Chain), three different level of analytics and so of analysis must be point out. *Prescriptive Analytics* deals with optimization and testing and finds application data from processes such as Manufacturing, Logistics, Transportation and Warehousing along with newly introduced processes such as Cyber Physical Systems in the Industry 4.0 trend. *Predictive Analytics* makes predictions about unknown future events using statistics, modelling, machine learning to analyze current data and make predictions about future, it finds strong applications in procurement, risk assessment, risk management, forecasting. *Descriptive Analytics* has the widest scope in terms of number of processes covered in a system. Descriptive analytics examines state of art of a business situation and finds application in development of effective and summarizing reports on raw data that makes human interpretation easier (Awwad et *al.* 2018).

These analytics methods support, as stated above, decision-making and overall performance, allowing companies a new look at competitive environment highlighting potential inconsistencies or opportunities.

1.3.2. Who uses Big Data today?

Nowadays Big Data are used in every field. Each company can exploit its advantages. Not only marketing function may use them, as some may believe, but all functions inside the firm. Big data are used intensively for example by banks, public sector, manufacturing companies, retail and politics. Banks have been the first to take advantage from Big Data: banks have access directly to historical data regarding customers' spending patterns, from the salary to saving account and preferred transaction channels. Banks can segment their customer base for cross-selling purposes and prevent frauds.

The public sector can use Big Data too, to improve public services and road systems or even prevent criminality. Manufacturing companies can benefit from wider span of activities thanks to data: waste reduction, quality management and preventive maintenance are only some of the possible outcomes of a data-driven manufacturing system. Retail industry is affected as well. Knowing customer preferences and create a customized offering ready to change as customer expectations, allow retail companies to implement better sourcing strategies. Finally, politics take advantage from Big Data to forecast elections results or predict market trends.

1.3.3. Future of Big Data

Big Data is taking off. Although for many companies analytics is still an open question, for high performers analytics is the answer, because they have a distinctive approach to data that contributes to measurable gains. Those companies with stronger Big Data commitment result in higher overall performance (Accenture, 2015).

In this paragraph, the trace of the next frontier of Big Data is presented and further (in this chapter) would be addressed the possible application in Supply Chain and later (cfr.1.5.) into Procurement function. The main technologies that Big Data can enhance are IoT (Internet of Things), Machine Learning and RPA (Robotic Process Automation). As far as our analysis in concerned, Machine Learning and RPA would be deeply analyzed here and in the next chapter, since their involvement in Procurement is very strong.

Machine Learning

One possible application of Big Data is Machine Learning. According to an article of "The Economist" data are the most valuable resource and to discover their real potential, companies are increasingly turning on Machine Learning. Machine Learning (ML) has been defined as the science of getting computers to learn and act like humans do, and improve their learning over time in autonomous way, by "feeding them data".

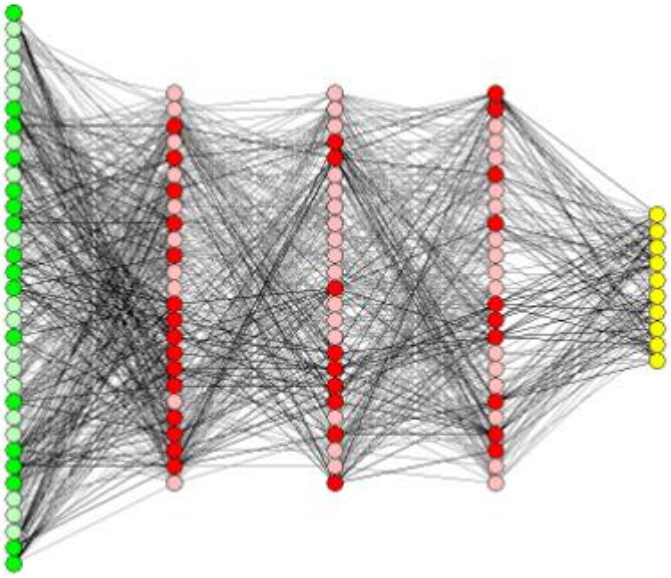


Figure 7. Machine Learning Structure. Deloitte, 2017

Dr. Yoshua Bengio from University of Montréal defined machine learning as part of research on artificial intelligence, seeking to provide knowledge to computers through data and observations by interacting with the world. This acquired knowledge allows computers to correctly generalize to new settings. Basically, ML is implemented via algorithms, which are typically grouped by their *learning style*, like supervised or unsupervised learning, and *similarity in form* (classification, regression, decision tree, deep learning or clustering). Regardless their style or similarity, each algorithm is made of a *Representation*, which is basically the language that a computer can understand (logistic regressions, decision trees, neural networks or graphical models); an *Evaluation*, an objective to be achieved like accuracy or cost/utility and an *Optimization*, mainly a search method such as combinatorial optimization or continuous optimization. Graphically ML may appear like Figure 7 and 8.

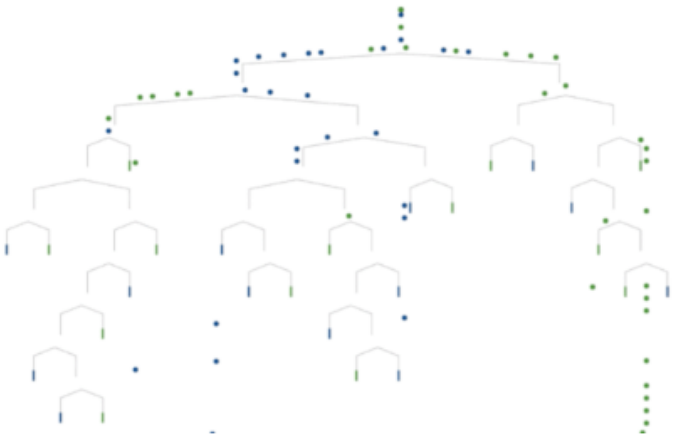


Figure 8. Machine Learning Structure. Source: Deloitte

Without going too deeply into technical details, Machine Learning drive business towards tangible business values but only if implemented. Companies are struggling to deploy ML in real business environment, because they actually struggle to use it, even if hardware, processing and power storage is increasingly developing.

A key impediment to the adoption of ML, however, is how to trust a particular model or algorithm, and the ability to explain the conceptual soundness and accuracy of such techniques is a significant challenge, not only because the tools are so new, but also because there is an inevitable "black box" nature to some of the more powerful ML approaches such as deep learning (Accenture, 2017).

Before being able to use effectively ML, a company needs solid foundations in data management and their analysis. An example can be the adoption of cloud technology, that allows companies to acquire, elaborate and analyze data in an easy and convenient way. Although ML may seem too much to handle for a company, it isn't.

If successful, an interesting facet of ML is predictive analysis, which allows forecasting on determined topics thanks to historical data. Gas and car companies are using ML to find new source of renewable energy and predict machine faults. Healthcare firms are using ML to obtain data from wearable devices; finance services companies are adopting newer approaches based on Machine Learning to model financial and non-financial risk (fraud detection), or to regulate a financial portfolio to risk tolerance of a user.

Machine Learning can be implemented also to increase the flexibility of a supply chain to offer new products and evaluate supplier decisions.

RPA

Here a brief explanation of what is RPA (Robotic Process Automation) is given as it would be deeply addressed at the beginning of the second chapter where the links between RPA and

Procurement will be presented.

Robotic process automation (RPA) is a technology that allows to configure a software, or a bot through structured inputs aimed at automating a business process. With an RPA tool, companies can automate routine ruled-based processes, enabling users to devote more time at better serving customers. RPA tools process transactions, manipulate data, trigger responses and communicate with other digital systems; their activities can range from an automatic e-mail response, to deployment of hundreds of bots to automate tasks in an ERP system.

Briefly, since work areas are surrounded by repetitive and time-consuming processes, RPA thinks differently how processes are solutioned, delivered and managed. RPA empowers business advisors, workers and judgement-based role staff by removing the repetitive tasks and allowing them to spend more time on business processes more consumer-centric.

Among its benefits, RPA can lead to a 40% reduction in average handling/cycle time and a reduction of processing costs from 30 to 80% (Accenture, 2016).

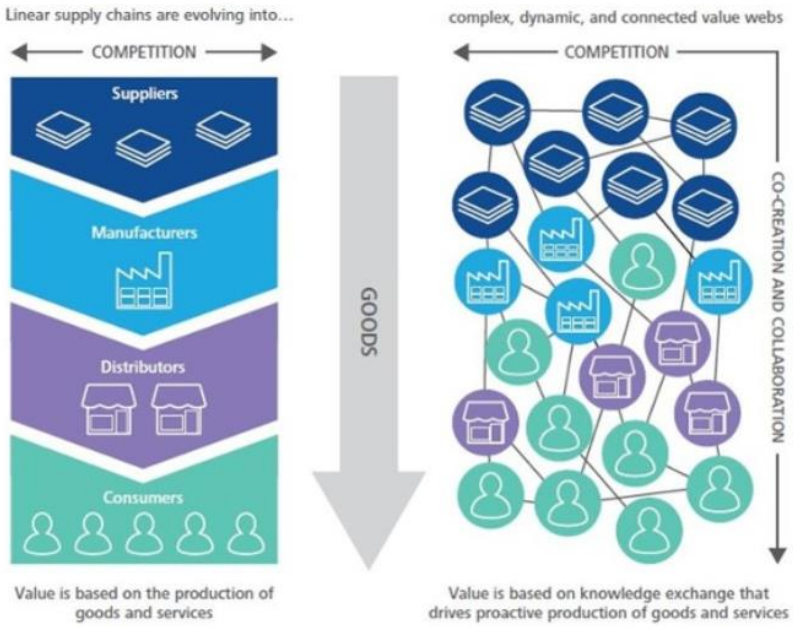
To conclude this brief presentation of RPA, it is important to recognize that if properly implemented, automation technologies enable a scalable, responsive and flexible workforce which is extremely important in today's competitive digital environment (Accenture, 2016).

1.3.4. Importance of Big Data in Supply Chain

How much important are Big Data in Supply Chain? Currently, the majority of information on material flow is traced and generated by data. Traditional ERP systems are considered a bottleneck for modern enterprises (especially manufacturers) since they are based on structured data and aren't able to meet today's SC challenges. Supplier see themselves competing on speed, quality, time and accuracy. To face this new competitive environment, they need a level of understanding, collection and analysis of unstructured data not possible with SCM and ERP systems.

Big Data are changing the way supplier networks are formed and grow over time. The final objective of supplier networks become not transactions anymore but creating and share valuable knowledge thanks to insights obtained through data. The evolution of this network is presented in this graphic developed by Deloitte (Figure 9): Big Data can be implemented into demand forecasting capabilities of companies, as well as in business planning and supplier management capabilities. Moreover, the integration of data into a SC system is considered one the most disruptive technologies to be prioritized in a data-driven organizational change.

Figure 9. Big Data enabled Network. Source: Deloitte



Within all these benefits, an Accenture research shows that although 97% of SC executives interviewed report having and understanding of how Big Data analytics can benefits their supply chain, only 17% stated having already implemented analytics in one SC functions. The study shows also that the adoption of Big data into SC functions is not coordinated through global supply chains, underlining the fact that still some "confusion" remains about which are the key capabilities for success, even though companies are reported to be making big investments on analytics capabilities (Accenture, 2014).

What companies actually need is firstly and enterprise-wide strategy that must include the usage of Big Data to drive business and secondly as the next step, a supply chain-specific strategy (not only oriented on single processes).

Overall, there are mainly two possible approaches in applying Big Data: data can be either implemented to focus on current business needs or can be used for new product development and enlarge value proposition (Vanauer, 2015). By the way, significant challenges derive from the fact that SC processes generated great amount of complex and unstructured data to be managed and analysed. Complexity is given by material in information flow across the companies and between companies and other supply chains, therefore being able to manage this complexity would guarantee a competitive advantage. Additionally, information flow is no longer linear: the sequence supplier-buyer-customer may not reflect the real situation on many supply chains, where now information flow is more like a continuous exchange of data (Awwad et *al.*, 2018).

Among Big Data application in a cross-functional contest, Sanders (2016) identifies four main areas of application for Big Data. These areas are marketing, operations, logistics and sourcing.

Marketing gains the most value from data focusing on customer behaviour and price strategies. Operations analytics involve productivity and quality optimization, facility layout and workforce monitoring; logistics analytics optimize inventory and resource allocation, identify optimal distribution location and minimize transportation costs. Finally, sourcing implementation of analytics improve supplier negotiation and evaluating sourcing channels. Other authors like Benabdellah et *al.* (2016), report plausible applications of Big Data analytics in some of SC processes:

Table 2

Processes	Opportunities
Planification	i) Risk evaluation and resilience planning; ii) Reduce the risk of infrastructure investments and contracted external capacities; iii) Enabling the monitoring of performance, as well as improving planning and management functions.
Supplying	i) Reduce storage capacity and distribution; ii) Enabling more supplier networks that focus on knowledge collaboration as the value- add over just completing transactions; iii) Achieve granular levels on aggregated procurement patterns.
Production	i) Market intelligence for small and medium-sized enterprises; ii) The largest clusters of data are related to an automated sensing capability, connectivity and intelligence to material handling and packaging systems applications evolved; iii) Getting back a real time capacity availability and providing a quicker response and vendor managed

	inventory.
Distribution	i) Optimal routing; ii) Real-time route optimization; address verification; crowd-based pick- up and delivery; environmental intelligence; iii) Improve Supply Chain traceability; iv) Real-time optimization of delivery routes; v) Estimated lead times based on traffic conditions, weather variables, real time marginal cost for different channels; vi) Optimize logistics activities thanks to costs reduction, improved customer satisfaction and supply chain performance; vii) Optimize manufacturing processes, shop-floor management and manufacturing logistics: reduce lead times and minimize costs and delays, as well as process interruptions:
Return	i) Reduction in driver turnover, driver assignment, using sentiment data analysis; ii) Customer loyalty management; Continuous service improvement and product innovation; iii) Benefits for the government (e.g., urban planning) and companies (e.g., localized advertising, optimized routing); iv) Creating an integrated view of customer interactions and operational performance, ensuring satisfaction of both sender and recipient;

	v) Technology has made it more feasible than ever to access and understand customer data, as Big Data enables sensing of social behaviour; vi) Access and understand customer data, as Big Data enables sensing of social behaviour; vii) Know customers' perceptions of offered products and services and discover their unobservable characteristics

After having seen some of the possible application of Big Data into the Supply Chain environment, in the next section the Procurement function would be analyse deeply, with particular attention to e-procurement and possible future development of this core function especially looking to RPA applications.

1.4. Procurement: Role evolution and Future

This section is going to present the role of Procurement in the Supply Chain Management, highlighting how this role has increased its importance in recent years. Subsequently, the section undergoes through the shift from a traditional Procurement to an E-Procurement (an online-based procurement), indicating the features of an E-Procurement system. Finally, it will briefly present the future of Procurement function beyond the online-based procurement, towards the integration of latest technologies.

1.4.1. Framing Procurement into SCM

After having analyzed the frameworks of SCM with a particular focus on procurement, now we will take a closer look on the role of procurement into the supply chain management.
The role of procurement within supply chain has shifted from being merely transactional to a more strategic role and of core importance, dealing with cooperative alliances and supply chain

network management. Macro-economic changes like technological advances, changes in consumer patterns, web-based platforms, increased process outsourcing have all been influencing factors for the shift of the role of procurement (from transaction to relationship management) (Tassabehji and Moorhouse, 2008).

Procurement plays a critical role in organization's management by being responsible for purchasing specific resources from the external environment which are required by internal operations. This business function is not only accountable for planning, implementing, evaluating and controlling purchasing decisions but also, as stated above is responsible for managing supplier's relationships (Szwejczewski, Lemke, and Goffin, 2005).

Moreover, procurement has been addressed within the SC perspective as a boundary spanning function, that looks at both ends of a firm (Castaldi, Kate, et *al.* 2011): it helps achieving supply chain resilience, defined as a company's an ability to absorb disruptions and enabling the supply chain met work to initial conditions faster with a positive impact on performance.

Procurement management is extremely important not only because it supports delivery of finished goods, but also for organization's competitive advantage, playing a crucial role for an effective supply chain management as it relates to sourcing of materials and represents one of the major costs sustained by companies (Suvittawat, 2017). Studies (Azambuja, Ponticelli, and O'Brien, 2014) shows that the maturity of the procurement business function has a positive impact on supply chain management performance.

Nowadays, as far as digital technologies evolution is concerned, the opportunities to improve procurement performance and value-contribution increases exponentially. Enabling digital technologies into procurement would boost efficiency and reduce both risks and costs, but more importantly it is becoming a competitive necessity. Within companies, this will for sure take time since technologies like AI (Artificial Intelligence) take long time to be adopted inside organizations; it will take money since digitally transforming the procurement function requires a big initial investment not only in latest technologies but also in developing people's skills. Departing from the traditional concept of procurement takes quite a big effort in what the company should do to make digital procurement a reality (Accenture, 2017).

Regarding digital procurement and, in particular, procurement automation, a dedicated section would be presented later on in this chapter. Now the analysis of the supply chain will continue, exploring the impact of technologies enabled by big data into supply chain environment.

Here a deep investigation on Procurement would be made. This function would be the core topic of the case studies that would be presented in the second chapter. Firstly, the thesis presents a literature framework to better identify a definition of Procurement and its core building blocks; then the work will focus on e-procurement which is basically the sourcing

process assisted by cloud platforms. In the subsequent sections the thesis tries to identify which is the future of procurement ad which are the technologies enabling it.

1.4.2. Procurement: role evolution

The procurement function has evolved over time from an operational order-taking task of sourcing goods and services to a strategic corporate function that can lead to a competitive advantage.

Many factors influenced the evolution of the role of procurement into SCM. Globalization and technological advance can be named as the most relevant. Others are surely the constantly changing customer preferences, a shift towards outsourcing and an increasing interest for corporate social responsibilities and diversity and inclusion.

As a result of all these external pressures, more product and development responsibilities are shifted towards a smaller group of suppliers; this smaller base has become strategically important (Andersen and Rask, 2003).

Technological evolution that lead to ERP systems (which we recall not being enough to exploit fully the technological advance) and E-procurement (that would be address later on) contributed to automatization of paper-based activities, allowing a stronger focus on relationships management, advanced planning or more customer-centric activities departing from traditional procurement models.

However, a survey conducted in 2008 upon 18 procurement managers and senior managers identify their perception of Procurement function inside organization and the changes required to its role. The survey showed that for some managers procurement is an “unnecessary step” in the process of securing the goods or services required, or it is mainly focused on lowering down and bidding on prices. Others instead recognize the strategic nature of procurement, although still struggle to communicate its value inside companies. A head of procurement interviewed stated that if the its role would be more involved at the starting of decision-making process the chance to get better deals and on time delivery would be better. Concerning procurement role changes required inside companies, the interviewed managers recognize that the role of this function has not changed much over time though “the basics never change” (Tassabehji and Moorhouse, 2008).

An article by McKinsey (2007) confirms how the role of procurement has changed over decades. Years and years of globalization has fuelled competition, so executives of large companies have opened eyes on strategic benefits of an intelligent use of procurement. Among its benefits, procurement can leverage competitiveness of supply chains, improve time to

market and product development and reduce overall sourcing costs. Several CPO (Chief Procurement Officers) pointed out that the role of procurement has not changed much beyond its borders; however some purchasing organizations have gained cost reduction and use insights from procurement in other company's functions, manufacturing and administrative primary, others are leveraging a larger supplier base to boost innovation especially in new product development, moreover they are putting efforts on aligning purchasing strategy with the corporate strategic goals.

Today that digital technologies are enabling more flexible supply chains; the procurement function is facing an ongoing transformation thanks to the application of these technologies. The impact of this function is becoming more strategic: sourcing is becoming more predictive, some procurement activities are becoming automated freeing time and commitment on supplier relationship management (Deloitte, 2017). This would be a photograph of procurement today.

Procurement today require having a digital strategy in place: last year companies have started moving towards Big Data Analytics, Machine Learning, Artificial Intelligence and Robotic Process Automation, however, as stated in numerous surveys by research institutes and consulting companies, only one third of companies that believed in the true potential of such technologies have effectively applied them. One thing is recognizing the potential of a technology, another one is to choose the right infrastructure, invest the proper amount of money and align everything with long term strategy.

Collaboration with suppliers has remain a central factor for today's procurement. Buyers cannot communicate only over price, suppliers need to be involved in more strategic decisions in initial phases and guarantee them more visibility of the whole steps in the procurement cycle in order to reduce risks and therefore better evaluate performance of all suppliers. Moreover, the need of transparency still remains along the whole chain. Not only is required legal transparency: with social media rapid diffusion, ethics and compliance are a major concern for today's companies.

Finally, Artificial Intelligence will not remain just a trend nowadays, it will undertake many processes and tasks with minimal or no human intervention. These are some of the goal's procurement function is achieving at the moment. By the end of the chapter, a dedicated section will analyse the further evolution of Procurement function in the years to come. To start the journey towards procurement future, the next section will address the concept of E-Procurement and put it in comparison with standard Procurement.

1.4.3. From Procurement to E-Procurement

As stated in previous sections, Procurement is an integral part of Supply Chain Management. Companies are increasing investments into sourcing processes for raw material and services, so an efficient and lean procurement can lead to a competitive advantage for companies. Since traditional procurement activities may be characterized by repetitive tasks and paper-based work, an e-procurement platform can overcome these and become a necessity for a company to survive.

Online procurement (e-procurement) has been identified as the "… most important element of e-business operational excellence for large corporations" (Barua and Konana, 2001). An e-procurement technology is defined as any kind of technology that allows the acquisition of goods or services by a commercial or government organization over the internet. Among e-procurement technologies are e-procurement software, B2B auctions, B2B market exchanges and purchasing consortia, all focuses on automating workflows, identifying new online sourcing opportunities (and leverage them) and optimizing spending power (Davila et *al.* 2003). E-procurement systems allows buyers and suppliers to foresee and release proper offers for services and products. It is a valid alternative to traditional procurement processes, and it is definitely more advantageous. Advantages of e-procurement provide among those already cited:

- Reduction of sourcing time;
- Increased visibility;
- Huge increase in market size both for buyers and suppliers;
- Safety of information flow between users, which is often not guaranteed by traditional methods;
- Prevent incorrect behaviours;
- Reduction of total costs (since the complexity of each activity involved is reduced);
- Shorter order fulfilment cycle time;
- Significant improvement in project management and team collaboration across supply chains;
- Increase technological collaboration and planning with business partners.

Compared to e-procurement, traditional procurement activities were paper- and conversation-based, usually with procurement officers contacting long-term and well-known suppliers and purchasing at fixed prices. These basic activities include:

- *Requisitioning*: this is the initial input and comes from the firm, it is an identification of a need. More formally, it is a document that identifies the needs to order a specified good or service, its quantity and the timeframe;
- *Supplier sourcing*: as soon as the company defines what good or service need, the next step is to find a supplier. There are several ways to contact a reach a supplier (bid, direct contract, etc.), but generally a company sends an RFI (request for information), which is basically a request for more information about a good or a service. The requestor chooses both the good and the supplier;
- *RFP (request for proposal)*: once the item and the supplier have been identified, and RFD is sent to the supplier and once received back with an indication of price of the item, the contract can be stipulated;
- *Catalogue Management*: once a vendor has been selected, it is inserted into a catalogue with other supplies so that the company do not have to bid on price again and select another supplier;
- *Spend Data Management*: this activity allows the company to monito all spending with a determined supplier;
- *Negotiation*: basically, is the bidding activity over price and volumes;
- *Purchase Order (PO)*: is an official document issued by a buyer committing to pay the seller for the sale of products or services with indication of agreed types, quantities and prices;
- *Delivery*: is the actual physical transportation of the good;
- *Contracting*: in this phase falls all the post sales activities like the confirm that the goods has been received and the possible delivery dispute;
- *E-invoicing*: in this stage the invoice is created. When the supplier is aware that the good has been correctly received as agreed, it proceed with the invoicing. As soon as the invoice reaches the buyer it is controlled and if no mistakes are detected (i.e. wrong indication of bank details), the buyer must deliver the payment.
- *Inventory*: this is like a real warehouse for invoices. The storage can be physical or either digital like a cloud storage.

These traditional procurement methods involve requests for proposals made by phone, by ordinary e-mail or by face to face meetings with suppliers. Within the past twenty years, companies have used e-mails and Excel spreadsheets to manage contracts with suppliers, however these methods are notoriously inefficient due to the lack of transparency and visibility over current and past requests. Contrary, e-procurement instruments made standard

procurement methods more efficient cutting out steps: buyers save time, management can easily access data from a central repository and see the whole process results based on past data, suppliers can complete orders within minutes anywhere in the world.

E-procurement instruments involve electronic purchasing made by an EDI (Electronic Data Interchange) or ERP (Enterprise Resource Planning), latest smart procurement methods are nowadays cloud-based. Known as SaaS (Software as a service), these solutions tend to have a shorter evaluation time since it is not necessary to install a dedicated software and the whole sourcing process may require few hours or days.

Given the huge advantages of e-procurement with respect to traditional procurement activities, the reasons why companies may adopt an electronic procurement system can be related to efficiency and compliance. The shift towards an e-procurement system is needed firstly for efficiency reasons. E-procurement wold lean up processes: companies will gain a better supervision, a cycle time reduction of request for information and proposals and an increase of events (orders) with suppliers. The second reason is compliance. Firms with clear and transparent processes find highly convenient moving towards e-procurement processes; compliance of e-procurement systems ensure accuracy in requisitioning, invoicing and payments, compared to orders placed outside and e-procurement solution which are liable to errors and require more resources during payment and invoices (Brandon-Jones, 2009). Contractual compliance allows aggregation (into catalogues) when there are multiple requisitions for the same supplier, since it creates opportunities for price negotiations (Croom and Brandon-Jones, 2005).

By implementing more intuitive and flexible e-procurement solutions based on cloud platforms companies can improve compliance by reducing management expense and saving costs. Mainly firms can improve visibility and data management, improve and optimize RFP process.

1.4.4. Features of E-Procurement

From a conceptual point of view, e-procurement solutions do what tendering was doing before the internet, it helps companies source products or services at a lower cost, while ensuring that those inputs meet certain technical expectations.

Let’s look now at the main features of e-procurement solutions:

- *Indent Management*: is a solution in e-procurement processes. It allows for online ordering, complete tracking and management of goods, services, resources ordered and in stock or out of stock items. It is the workflow involved in the preparation of tenders.

It allows users also to purchase questions, placing orders and material management. Indent management systems generates invoices and maintains documents received by suppliers;

- *Creation of an RFX*: RFX encompasses the entire formal request process and can include, RFI (Request for Information), RFP (Request for Proposals), RFB (Request for Bids), RFQ (Request for Quotations). The emission of an RFX is a complex process and its complexity is determined by the requirement asked by the company, the number of suppliers that have been qualified, the expected competition among them, and costs of missed opportunities with other suppliers;
- *Offer Presentation*: suppliers competing for supplying goods or services register themselves into the online platform and display their offers that demonstrates their technical and commercial characteristics;
- *Offers Evaluation*: once offers have been sent correctly, suppliers are deeply examined. Selected suppliers are then invited to join online auction.
- *Online Auction*: the e-auction enables the shortlisted bids to be ranked using automatic evaluation methods. Therefore, only quantifiable elements that can be expressed in numbers entered into a specific formula (i.e. price and quality parameters);
- *Supplier Selection*: after the e-auction, according to the requirements of the company, one or more suppliers are chosen, and the purchasing order is evaded. This stage ends the procurement process.;
- *Supplier Management and Support*: this is an additional stage that companies must insert in their e-procurement cycle in order to catalogue all suppliers and keep trace of all transactions (events) occurred and, most importantly, support them in all stages of submission of a bid or receipt of an RFI or registration problems.

With the objective of gaining maximum value from procurement function, companies are moving towards strategic sourcing, defined as that function that aim at satisfying company needs with through a proactive and planned market analysis and supplier selection. Another hard block for firms is the huge cost for initial implementation of cloud solutions and licenses, in addition to the intense personnel training. However, the increasing availability of cloud solution allows also small and medium enterprises to take advantage of e-procurement systems, but the pace of technological advance is so fast that these instruments are no longer enough.

E-procurement sites, platforms, trading hubs do not come along without some disadvantages. First of all, e-procurement solutions create a gap between buyers and suppliers' expectation on how these systems affects them. On one side, buyers that adopts e-procurement become increasingly supplier-dependent (also due to the increasing adoption of JIT practices) due to

their continuous involvement in company's activities; on the other side, suppliers may be reluctant to rely on multiple online websites/platforms when they deal with different suppliers. This would imply also costs associated to training and risk of releasing sensible data; suppliers may sustain costs related to organizational restructuring associated to technical changes. Another main disadvantage is the lack of standards within the industry. Basically, there were multiple providers of e-procurement and uncertainty on which of them will survive still remains (Ageshin, 2001).

Today keeping up with customers' expectations and need for real-time actions is a challenge for procurement. However, the possibility to implement a real-time e-procurement infrastructure, along with data analysis and interconnections may advance procurement to the "speed of now" experience just like shoppers do in B2C e-commerce. Havin such technological power at hands will strengthen relationship with key stakeholders and contribute to business' success.

E-procurement solutions are included in the so-called Procurement and Supply Cycle which will be analysed in the next section.

1.5. Future of Procurement

Few corporate functions have evolved more dramatically than procurement. This function helped businesses optimize its purchasing spend while becoming more and more efficient and contributes as much as – or more than – other business functions to profitability, corporate growth and competitive advantage. Starting from 2007, procurement function was mainly focused on cost saving. Just four year later, in 2011, procurement was required to evolve in its approach: not exclusively focused on cost savings, but also on quality, sustainability, risk management and innovation.

In last 7-8 years, procurement has become even more efficient. The typical procurement organization's operating cost is approximately 0.8 percent of enterprises overall spending down from 1 percent on 2007 (Enterprise Value Targeting, Accenture 2015). Some other industries perform even better with a spending from 0.5 to 0.7 percent. In the next several years, the value creation of procurement would not come only from cost reduction and savings but will also help companies to differentiate strategically. Purchasing would be evaluated with increasingly advanced measures, closely related to company's strategy and financial indicators (Accenture, 2015).

One of the fundamental aspects of procurement efficiency is that of a creation of a virtually integrated company, based on closed relationships with a restricted group of strategic suppliers,

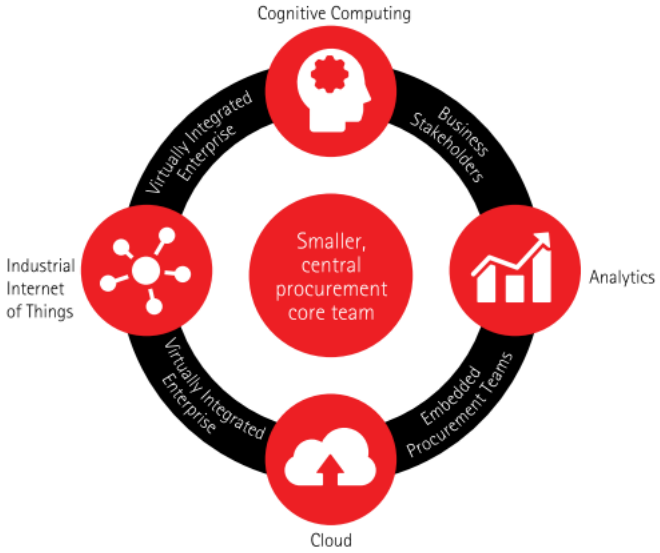
that allows a bigger strategic advantage for both buyer and supplier with respect to the past. In this strategic view, the boundary between buyers and supplier is destined to become more blurred inside the company. The new relationship would be increasingly improved thanks to technology, leading companies involved through virtual integration.

One of the objectives of Supplier Relationship management is to leverage on supplier capabilities through early involvement in innovation and product and process development. This form of collaboration will have critical impact on innovation since supplier would be relied on as one of the major sources of new ideas. Achieving mutually beneficial partnerships with suppliers can be a great way for this function to drive positive change, according to a research conducted by Wax Digital (E-Procurement Software provider) called Procurement Innovation Pathway, where 100 senior procurement professionals have been interviewed).

Moreover, a new way of managing procurement is expected to be implemented, because this function will evolve inside an environment made of professionals that will spend most of their time addressing business issues while applying procurement knowledge.

This new procurement structure will require new roles, new skills with a bigger strategic focus in order to generate greater value (Figure 10). The enablers of this new vision of procurement are *four* main digital technologies. The first one is *Cloud Computing*. Cloud computing would be the foundation of the digital strategy of procurement. It would be characterized by greater usability, making employees more productive and engaged; it will provide access to new content the company can use to make procurement activities easier. The second enabling technology is *Real-time Analytics* along with *Industrial Internet of Things (IIoT)*.

Figure 10. Procurement Structure. Source: Accenture, 2015



These two technologies would provide new insights that can improve the decision-making process, as well as helping identify opportunities. The last one is *Cognitive Systems*. These systems will be integrated inside procurement and would perform not only transactional activities (help desks or back office tasks), but also more strategic ones. Cognitive procurement simply means the application of cognitive computing (i.e. data mining, pattern recognition, natural language processing) to some of procurement's functions respectively predicting market prices and analysing contracts.

Not only these technologies will allow procurement function to continuously be more efficient but will also help the company take better decisions thanks the more availability of data. Data-driven procurement puts under discussion its fundamental procedure that have shaped it throughout the years.

1.5.1. The virtually integrated company

Int the next five to seven ears, few key strategic suppliers are meant to be part of a close bound between them and the focal company, with a relevant role on company's growth. Suppliers would be treated as part of the company, in particular impacting on product design and development process.

Virtual integration represents the substitution of ownership with partnership by integrating a set of suppliers through information technology (IT) for tighter supply-chain collaboration (Wang, Tai, and Wei, 2006). By becoming a virtually integrated company, a firm release the ownership of assets and processes in favour of a portfolio of key smaller companies. In a not so distant future, suppliers will be seen as opening physical shops inside buyers' structures (i.e. Starbucks cafés inside Target stores), so that items can be purchased directly without the need of releasing a Purchase Order.

The virtually integrated company would not be necessarily limited to strategic suppliers, since other entities can be part of it like Universities, Procurement Institutes or companies that produces complementary products. In the upcoming future, the access of a company's ecosystem will be managed entirely by digital technologies: strategic suppliers will be connected to the central company by Virtual Supplier Rooms (a virtual collaboration room, made by an app, that allows a company to interact virtually with suppliers, work on innovation projects and share ideas that may also provide uncharted suppliers with a communication tool to start a collaboration with the firm), to mutually exchange crucial information.

Generally, collaborative innovation between suppliers and buyers is the key for companies to

survive in today's competitive environment. To be effective though, both ends of the chain must be aware that this innovation process would benefit both, so there must be no obstacle on ideas sharing. It is not a straight forward task to accomplish inside the company, however a company must overcome these internal barriers before synergically interact with external suppliers.
To fully implement the strategy transparency becomes a key factor because it creates a high level of trust between buyers and suppliers. No secrets are allowed, this means that both ends must be as clear as possible on strategies, plans and imitation. Technology will be a crucial factor for transparency since each party would access information about:

- Inventory level;
- Production capacity;
- Production plant information (flows, layouts, time);
- Delivery status;

Although at the moment no integrated software is able to provide all such information, the only solutions are customized which by the way are supposed to change over time to amore integrated one.
In the upcoming future the "ideal" procurement function will focus its attention on strategic differentiation with procurement professionals surrounded by advanced technologies. No longer a supportive function but a decisional core that contributes to the competitive advantage of the whole Supply Chain.
In the next paragraphs the impact of all 4 enabling technologies for the future of procurement would be considered one by one.

1.5.2. Cloud Computing

Many industry leaders are predicting a shift towards procurement and supply chain departments as a whole moving away from complex ERP-built reporting tools to new "app"-driven user interfaces and cloud-based analytical platforms which let users purchase from enterprise app stores. Cloud computing technologies facilitate information sharing along global supply chains within people from different companies. They are more powerful than customized solutions and may outsource maintenance to providers.
Cloud computing is definitely one of the most important trends that will influence the procurement in the next years. This technology enables access to new and powerful contents and insights based on precise analysis, as well as new ways to connect and collaborate deeply with supply network. Those that already implement cloud technologies benefit from lower costs, standardization of basic processes and rapid access to new functionalities.

Nevertheless, a cloud-based solution comes with its own challenges like maintain security of data and finding employees with new skills. Among these new skills, technical skills are the most important, for example supply risk management expertise including managing volatility and risks due to the huge number of transactions occurring with suppliers. Data analysis and modelling are also required skills. Being able to extract large amounts of data and critically analyse them help facing ever-changing scenarios developing proper solutions.

As may be understood, within the next three to five years, turning procurement on a cloud platform may not be a distinctive feature anymore; a new way to exploit cloud technologies must be found. So, what could be the new source of competitive advantage when each player is implementing cloud-based platforms, standardized technologies and best practices?

According to a research made by Accenture (2015), usability is considered the next floor for building competitive advantage. In particular, enhanced usability goes along with providing users with right content, right data and in the right time.

1.5.3. Industrial Internet of Things

IoT based technologies allow procurement professionals to access rapidly to huge amounts of data, track orders, request a contract, approve requests and track invoices, gain visibility in their spend analysis and keep an eye on their consumers' changing patterns. Technically a significant part for example product can be linked to a "box" made of sensors that can "feel" vibrations, heat, humidity or other similar variables. If some parameters are overcome, or for example, if the component broke down, it sends automatically a replacement order. Since it is connected to the internet, this device can take actions on behalf of the particular component. Imagine applying these kinds of devices into each or most of the components of a final product? Imagine the huge amount of data that can be ready in company's hands.

Big Data, as already stated in a SC context, are collected and then analysed in order to extract relevant information for taking key decisions, not only from procurement personnel. The more the "things" connect one another and all to the Internet, the more they are going to transform each business function.

Unfortunately, last 20 years have not seen a radical evolution of how procurement process is conducted, except from implementation of e-procurement systems. Today that IoT is closer to reality than ever companies must rethink processes from scratch, they must think on the opportunities that can get by re-designing the whole sourcing process with the lens of IoT.

The key issue however with data is that companies are already dealing with huge amount of

data, see for examples data lakes, what critical is instead to train in a sense machined to deliver the exact output the user needs. Basically, a company does not need the same information every day, but when it needs it really needs it. As a matter of example, a driver does not need the exact data on oil pressure, but when something stops working the driver really needs that information. The issue is for the company of understand what the business issue is to solve and what data can be used and combined with other data to solve it.

1.5.4. Analytics

In the last 10 years the use of analytics has increased inside corporate functions, however procurement has been left apart in order to focus on more consumer-centric activities. In the upcoming future, as already stated, the landscape of procurement will change dramatically. More and more companies are trying to obtain significant info from the sourcing activities and new figures born inside organizations as Chief of Procurement Officer (CPO). This role today requires a more data-driven approach.

Because it is at the intersection of business and technology, analysis is critical to providing the type of information needed by procurement professionals. This is the reason why for example knowledge about descriptive analytics (analysis of past data) must be at the hand of those in charge of procurement, in order to respond consistently and be prepared to future changes on the environment (predictive analysis). Applied professionals must have both analytical skills and business and management understandings; same for data scientist. Build this set of skills require consistent investments on time and efforts and it would be difficult for a single person to acquire both or to be willing to acquire analytical or business knowledge. There are several skill sets required today about analytics. Some examples of skill sets are, knowledge about methods of estimation and sampling, application of qualitative and quantitative methods for forecasting, optimization methods and so on (Waller and Fawcett, 2013).

Analytics are an extremely valuable resource. The implementation of analytics in procurement can help companies merge price information of raw materials to better structure contracts; determine price risks and items availability and anticipate the impact of these risks in core business; help better analyse and evaluate the performance of a supplier; create personalized software that perform purchasing of raw material autonomously. In the following 5 to 7 seven yeas companies are expected to keep data clean, which means collect data that usually came in an unstructured way and structure them for a better evaluation.

When a company relies only on internal systems to collect data, its analysis capabilities are limited, whenever IoT is implemented, since it attains from external sources of data, sourcing

opportunities can expand enormously. These new sources can range from cloud-based platforms to social media.

Grouping these analyses into a dashboard and making it easier for business stakeholders and procurement professionals will become a key competitive differentiator. Big Data analysis in this way could help procurement to more effectively manage supplier risk and solve specific problems. Concepts not widely spread among organizations today.

From a technology standpoint, the future trend is clearly towards ever-greater automation to support more robust analysis. For descriptive analysis, which relies heavily on transactional data, this means allowing programs to effectively manage (and optimize) the processing of routine analysis. For more complex predictive analysis, which involves the emergence of "cognitive engines" that can make better decisions and learn from their experiences.

However, even with the right data and technology, companies still need the human element to generate value from analysis.

1.5.5. Procurement Automation

Procurement automation systems go far beyond simple automation of standardised tasks, not only make them easier and efficient but also free up space for more strategic activities. These new instruments are based on cognitive computing, one of the latest technological trends, which aim at making computers as operatives as humans, creating smarter IT solutions capable of perceive, analyse and take decisions.

If properly integrated with business expertise, these technologies can lead to a variety of features. They include intelligent virtual agents (software that exhibits human qualities and communicates to assist and carry out business processes); automatic question response systems (which provide a new type of interface and a vast body of knowledge); and machine learning applications (for system optimization, automatic trend detection, anomaly detection). It is likely that this scenario will develop over the next 5-7 years when procurement organisations begin to embrace cognitive computing.

Currently, technology processes data and information in an incredibly fast way, making existing processes more efficient and less costly, and provides decision-makers with the information they need to make better decisions. In the future, cognitive tools will play an empowering role, naturally interacting with humans, for example, using existing natural language and data without people having to reformat data in machine language. These tools will process data and information to recommend to a decision-maker a particular course of action, which the tools

consider "best" on the basis of all available information.

How far are we from technology involvement in decision making process? And how fast would it be? These are still open questions at the moment, but the time frame seems not too long. Self-driving cars, just to take an example, constantly collect and analyse data to give the best possible output decreasing dramatically the percentage of errors. As well as for self-driving cars, procurement would be managed by smart systems with possibilities for monitoring the process of creating a purchase requisition, find suitable suppliers, create cost and price models, improve compliance, evaluate suppliers' performance, improve inbound and outbound logistics and orders, reports and catalogue management.

Advantages of automation (cognitive computing) are more than evident, though not fully implemented in today's companies but with an enormous potenti*al*. It is important not to forget, however, how much the human supervision and control will still be needed.

The next chapter begins where the first one left, Procurement automation and in particular RPA (Robotic Process Automation) will be part of the analysis and case studies will follow.

2. Chapter 2. Procurement Automation: RPA (Robotic Process Automation)

2.1. What is Robotic Process Automation (RPA)?

One the first glimpse of Robotic Process Automation can be found in Fejrst and Slaby (2012) where it is described as a technological replacement of human worker with the aim of automating structured tasks in a fast and cost-efficient way. (Fersht & Slaby, 2012).

It is very important to state that Robotic Process Automation (RPA) as may seems, does not refer to physical robots replacing humans inside factories. RPA is a software-based solution, it refers to sophisticated software that allow automation of processes based on rules without constant human supervision. A complete and more formal definition of RPA is given by Aguirre and Rodriguez (2017) where this technology is described as a "software-based solution" that "automates rules-based business processes that involve routine tasks, structured data and deterministic outcomes" (Figueroa-García, et *al*., 2017).

This technology aims at deploying robots (called simply bots) that manipulates already-implemented software of CRM, ERP, help desks, etc. in the same way a human can do, but with less execution time. One bot, practically, equals one software license. For the execution of processes, employees currently spend much of their time working on ERP systems, CRM software, spreadsheets and similar and executing quite repetitive activities: extracting data, copy them into spreadsheets, execute formulas, moving huge amounts of data from one software to another one, often creating duplications of the same.

RPA has been around during the last few years, it has escalated quickly in most industries and more and more technologically-advanced are looking towards it. But how "new" is the concept of RPA? Where does it came from?

After the advent of Industrial Revolution and subsequently of the assembly line, the term "workflow automation" started to spread around the 1990s. Around this decade, factories saw computerization of assembly lines that further led to management information systems took place. This stage of development saw also the advent of Total Quality Management (TQM) and continuous process improvement methods, where companies looked at improving business processes.

This increased focus onward processes is called Business Process Management (BPM). BPM is a way of looking and controlling processes in an effective way; it is rather an approach then

a technology: it monitors how processes runs and how can be improved over time. It involves standardizing processes across the company, continuous change and improvement and assessing ownership to these processes. Each department of the company is responsible for collecting raw data and information and analyze them in order to find better ways to manage them.

From the concepts of Business Process Automation, companies (especially tech companies) started looking to Business Process Automation. Mainly after 2000, the introduction of software inside companies allows companies to "delegate" some easy and standardized procedures to this software, like database management for example.

BPM is more a holistic approach to optimize and automate business processes from one end t the other, from where they begin to where they finish. Contrary RPA is an enabling technology of a BPM approach. Where RPA allows the creation of bots for automation of rule-based activities, BPM gives employees (also non-technical employees) the possibility to identify a new process discipline that not necessarily leads to automation, but, especially if the company is going towards digital transformation, may improve those processes and remove bottlenecks. RPA is considered an enabler for transformation and innovation of company's processes since it helps firms to speed up and simplify workflows and promote continuous improvement. Basically, with RPA tools, companies can delegate "easier" and repetitive tasks, guided by algorithms, to bots, delivering the opportunity to employees to focus on other tasks requiring them emotional intelligence, reasoning, judgement and interaction with customer (Willcocks, Lacity and Craig, 2015).

"Robotic Process Automation is the next wave of innovation, which will change outsourcing. We already are seeing the beginnings of a race to become the top automation-enabled service provider in the industry. In time, we are likely to see an arms-race for innovation in automation tools leading to new offerings and delivery model". This is the definition gave by Sarah Bunnet, Vice President of Research at the Everest Group. From her words we can understand that more and more companies are pushing towards automation and, moreover, the new automation tools that will be developed are likely to change the offering of firms for their clients (Willcocks, Craig and Lacity, 2015).

This will be an extremely important topic that would be touched in particular in the last chapter of this thesis. The next step for now is to take a closer look at the possible application of RPA and the benefits that company can exploit from it.

2.1.1. Benefits and Challenges of RPA

The analysis of Robotics Process Automation proceeds now by addressing the most important benefits that RPA can reap for companies.

New and emerging technologies like RPA itself, Internet of Things (IoT) will increasingly change the shape of many sectors within the following years and the benefits they provide are of a larger size.

As far as our interest is concerned, due to our further look to the application of RPA inside the procurement function, RPA is seen at a first glance a way to reduce costs with software that automates tasks previously human based. This is far from being wrong, in the sense that there are evident benefits of gaining huge cost reduction by automating repetitive and rules-based tasks. Basically RPA bot can execute well defined tasks or processes acting in a super-efficient way: compared to human, bots can log into the same applications as human does, they can capture data from processes and store them for later possible use, instead of copy and paste them different locations as human would do. Furthermore, bots work 24/7 without stopping, reducing mistakes related to fatigue, mis-keying and finally they are fully accountable for the processes and the changes they implement; this means that they do not require training which would take even months for employees (Accenture 2016).

The above benefits are the most evident. According to KPMG (2018), when considering routine office work automation (clerical tasks), the company says that this technology is in practical use in North America, Europe and Japan, providing four main benefits:

- Increased Quality;
- Speed;
- Increased Efficiency;
- Inceased Functionality.

RPA technologies are able to carry out tasks both continuously and reliably, therefore errors and clerical mistakes are widely reduced, improving task quality. Tasks can be performed tens and hundreds of times the speed of human labour. Editing and screening data does not require any additional device like additional computers, thus increasing the speed of operation. Moreover, the speed of implementation and response to changes and overall speed in producing results will increase. RPA technologies can operate virtually with no resource constraints. The results achieved with practices of business process outsourcing and other measures based on labour cost differentials lead to cost reduction of around 15 to 30% while benefits achieved

with the implementation of RPA software enables cost reduction of 40-70% (KPMG, 2018). These benefits lead finally to a shift toward a business with greater added value: humans are freed from routine work, are able to engage in activities that generates innovation, while software will collect big amounts of data in order to identify possible opportunities for improvement.

The main results that company can see from the application of RPA are a significant growth in ROI as the investment required would be fairly low compared to a structured and more expensive complete IT solution, receiving tangible efficiency improvements. Traditionally companies benefit not only from more cost reduction but also from reduced cycle time due to speed of operation; flexible cost structure, since bots can be programmed and scheduled according to company's needs (i.e. placing more robots on urgent processes); improve accuracy, as long as any defects and exception is traced; detailed data capture provide users with a wide sets of reports useful for supporting further process improvements as stated before. According to Gartner (2019), RPA tools helps organizations to move data in or out third-party application systems. Bots are designed to replicate actions of an employee interacting with third-party software; they substitute credentials required for these systems and extract data from them. RPA tools allow also for data migration from a source to a target. This technology also augments employees' capabilities (*unattended automation*). As highlighted before, RPA tools extract information from systems and related documents and prepare them for users (employees or external stakeholders) as "ready to use" even from many systems. Employees are at the core of the change effort needed to put in place RPA and are fundamental for capturing its benefits impacting on their experience and engagement letting them have more one to one interaction and focus innovation related topics with possible benefits for companies (Gartner 2019). Related to this, among all benefits that RPA implementation guarantees, a study by Forrester (2019) indicates that firms include among benefits increased efficiency (86%), deeper insights into customers (67%), improved customer service (57%), and improved employee engagement (57%). Keeping employees engaged and happy must go hand-in-hand with deploying RPA to improve customer outcomes (Forrester, 2019).

It is important to state that, although the widely accepted benefits of RPA technology, they are not equivalent to humans, who can instead interpret and adapt as needed by organizational changes and are not going to replace them allowing perfect substitution. Moreover, RPA are not long-run oriented, meaning that automations performed are related to discrete tasks does not cover long-running processes. This is why RPA tools are to be considered as part of an

intelligent Business Process Management system and combined with other tools can sustain processes end to end.

Another benefit of automation is compliance. Automated solutions can be customized to operate in accordance with already-existing regulations and standards and be ready for audit.

The next paragraph will focus on possible applications of RPA, by reporting also case studies of companies that implemented RPA successfully.

Along with benefits reported above, RPA tools carry some challenges in particular when thinking about its future combination with latest technologies like Artificial Intelligence and Cognitive Computing (see 2.1.4.). Inner challenges of RPA are (Accenture, 2018):

- *Lack of clarity in deciding what to automate*

  Often, the operations team is not skilled enough to identify the right processes or use cases that require automation. In such a scenario, applying traditional RPA to an inefficient process will not suffice as RPA does not address end-to-end automation;

- *Complexity and time consumption*

  Installing lots of bots can be quite time consuming and complex. There are many permutations and combinations that can be chosen to automate a standard process. Sometimes, combining RPA with cognitive technologies reduces diverse permutations, implementation time and maximises benefits;

- *Changing or unstructured data*

  Any changes in upstream and downstream data can affect the functioning of bots. This is because RPA is not a cognitive solution and cannot learn from experience. In addition, RPA is not of much help when data is unstructured. When processes evolve over time, bots can be redundant.

- *Long-term maintenance*

  Maintenance and cybersecurity issues of bots need to be considered as additional costs. The platforms used by bots to interact might often change and they may not always be configured with the required flexibility. When considering an automated solution, companies must take these factors into consideration;

- *Automation is not directly proportional to cost savings*

  Automating several tasks does not always translate into reduction in costs. Generally, people can perform multiple tasks. Therefore, looking at a single area for cost reduction might not explain the actual outcome.

2.1.2. Applications of RPA

Robotic Process Automation is a transformational technology that can automate tasks and processes across functions inside a business, from marketing to finance, from HR to Supply Chain. Thanks to its flexibility, RPA bots have a wide range of application. Possible fields of application are reported in Figure 11 (Ernest and Young, 2016), and some examples are reported below.

This technology often adds the most value for clients who have manual, high-volume, repetitive, rule-based processes involving structured data, such as transaction processing. Financial services, for example, have seen higher rates of adoption than other industries.

As long as industries are enabling latest technologies to drive efficiency and increase productivity, the challenge now is to automate low-level manual data handling and processing tasks performed by employees.

In fast moving consumer goods companies, a possible challenge can be the reporting activity about market performance of various product lines. Given the huge amount of data these companies can generate, it became a challenge to deliver sales report manually using different tools and procedures. It is a time-consuming activity, inclined to mistakes and most of all is a procedure that requires extreme attention to data handling, privacy and integrity. Building bots that can handle rules-driven and high-value tasks in a faster and safer way, would be key for extraction, outbound and transformation of dataset ready for the "consumption" of operations team. In this way, turn-around time reduction, accuracy, availability of data and compliance is achieved.

Figure 11. Applications of RPA. Source: EY

In healthcare companies, quality is the fundamental driver for the business. To support quality of products, the IT infrastructure cannot be based on manually-driven tasks. Processes like bills of material (BOM) extension, which is an elaborate process, involve multiple stages of approval and redundant data entries. This process requires a large amount of time per day leaving aside other tasks and creating delays and possible inconsistencies in the master data. Bots can enter and extend finished or semi-finished goods in a more cohesive way keeping master data synchronized with transactional data.

Pharmaceutical companies receive invoices from suppliers and allocate payments based on pre-determined business that had been done manually or via software like SAP or application like Microsoft Excel. Companies can reduce billing processes in order to reduce manual effort. Robotic process automation tools can break the workflow into components and eliminate non value adding steps and understand the extent of automation for a specific unit of process. This will improve invoice handling, automate reporting and escalation to suppliers.

As written at the beginning of this paragraph, the first sector in which RPA has found its application is Financial Services. Financial services firms are increasingly recognizing the potential benefits of technology and the possibility to transform their business.

Banks for example want to automate manual processes at lower costs. By deploying RPA bots, activities like fraud checks for customers, notification ford cards, account opening, or closing can be easily automated. These achievements help banks save big amounts of money due to efficiency improvements, cost avoidance and fast-tracking service level agreements.

RPA tools can reduce consumer loan-processing time by one third by eliminating the copy and pasting of customer information form one banking system to another one. Tools can boost the accuracy of new bank account opening requests, repeat opening activity with reduced downstream errors and improve data system quality, this can be achieved thanks to the elimination of data-transcription errors from inbound new account opening email requests to the existent banking system. Banks can improve significantly the speed of customer verification during loan process by automatically validate customer data.

As a matter of example, when a customer requests a new loan or line of credit, data of the requests ae collected into a loan process system. Once the bank employee receives the information, he/she runs a manual credit check by transcribing data from the loan processing system into external websites and create a report to be linked to the requestee details with a relative score. Once the credit check is completed, the employee logs in into government websites, copies and pastes customer information to validate its information to get the credit. Actually 80% of this job is mere copy and paste information from a system to another one. With an RPA bot all these activities can be done with on click, just by launching the software that

can log into loan process system, cerate report on customer requesting the loan with relative score, log into government website, validate customer's information and save check and appraisal inside loan process system. The employee may seem to be perfectly substituted by RPA, instead this helps him/her save huge amount of time and can focus more on overall customer experience. BNY Mellon (Bank of New York Mellon) began in 2016 in piloting RPA and reported and 88% improvement in transaction-processing time and account-closure validation (performed across five different systems) with outstanding level of accuracy.

Moreover, health insurance companies receive claims, mostly every day, from customers via email with a PDF file form attached. Employees must attach the file to the claim processing system, copy and paste the claim from data into standard fields in the same system and manually notify the user that the claim is being processed. RPA tool can attach the PDF form into claim processing system, copy and paste data into the predetermined fields and notify customer about the status of the claim.

Here the thesis presented some possible application of RPA in several sectors. Within these sectors is starting to lead its way the Supply Chain field, especially the automation of Procurement is becoming one key points when companies are deploying automation systems.

Later on in this chapter (see 2.3.), we will examine the implementation of RPA into Procurement with real case studies.

2.1.3. How to implement RPA

One of the main pitfalls when organizations start to think about RPA is to think that RPA is just a technical project for IT to worry about. Contrary organizations must think big in this sense; they might want to test it small, but they really should think of RPA in a more holistic way. Companies must not fall into the trap of just doing a proof of concept or a tiny pilot and not to think about how to scale this, so for example they might think about best practices like having a centre of excellence or having robotic operating models, understanding governance, the whole business impact.

In order for firms to prepare for robotic process automation implementation they firstly need to map the processes, meaning they need to map the end to end activities for all processes within a defined scope. This can be one by identifying main actors, systems and applications in the workflow and identifying the volume and time for each activity in the process map. Secondly company should examine the characteristics of the processes. They need to identify those activities that require copying/pasting across systems and ae repetitive in nature and require manual work. These kinds of activities are generally rules-based tasks that don't require

complex decision making, error prone work that is completed on an ongoing basis. Companies should also examine the benefits by identifying those activities that carry out much costs and risk factors and the effort involved by employees. Moreover, companies have to verify if the solution can replicate the task in an effective manner. This means to think is there is a more efficient way to solve the task and then understand if RPA can solve same issues in a more effective way. This is not the end though. It is important to say that RPA need also to be integrated with other company's existing systems (mostly ERP and CRM). From this analysis, firms need to build up a use case by writing down all findings of previous steps in order to further implement it with RPA developer and therefore test it on small test environment multiple times to sort out possible bugs and mistakes. Finally, organizations can go live and show to employees what RPA tools can do with them and for them.

RPA tools adapt processes regarding the needs of the company and completely automate them, in this way, the tools can provide dedicated services in a safe, robust and controllable way. RPA is therefore evolving from a more stand-alone role inside IT department to a more strategic one that supports objectives of digital transformation.

The final RPA tool should though e integrated in a more comprehensive BPM (Business Process Management) software in order supervise the whole business. It creates a framework that allows users to manage company's processes and their automatization (Figure 12).

To sum up, in order to maximize the impact of RPA companies need to:

1. *Select impactful yet easy to automate processes.* To maximize the impact of RPA, companies must identify that will yield the greatest benefits when automated; these processes tend to impact both on costs and revenues, mostly quite expensive and of a high volume. Firms must look to low fault-tolerance activities due to higher risk of manual mistake and speed sensitive processes. Moreover, selected process must satisfy certain characteristics:
    a. Rules-based;
    b. With few exceptions;
    c. Company-specific;
    d. Mature.
2. *Convince the organization.* Even in automation, it is really about people. By knowing the processes to be automated and the possible benefits they can yield, a use case for management leadership (especially in big companies) can be build up. Just a quick note here to underline that low-level workers are those that deal with da-to-day activities and processes and learn to know each variable of them better then managers. Involving these people into automation projects it is not only a matter of engagement but a matter of

increased overall efficiency of the processes. In this sense it is widely important to convince the team about what automation will brig, focusing especially on post automation steps and upskilling possibilities (focus on what RPA cannot do, instead stressing what it can do to encourage employees to focus on more value-added work).

It is of the same importance to discuss with other functions about implementation of RPA. IT function is the most important stakeholder involved in RPA implementation since it will be widely involved in implementation especially in coding and programming and may or may not have related skills to complete implementation; that is why also HR function must be involved in order to schedule training if necessary.

3. *Implement the solution.* Next step involves the choice of RPA provider. Since RPA is an evolving field the company might not have directly the capabilities to implement an RPA solution so it might partner with consulting companies to help automate its process.
4. *Develop RPA solution.* Initially a process map needs to be prepared identifying which parts of the process will be automated. For example, a data entry process can be mapped through several stages performed by different actors inside the organization. Firms must draw down the process and clarify which stage can be automated if it resembles the characteristics defined at the beginning of the implementation process. Documenting such processes is fundamental (and often not all processes are) for the RPA to be programmed.
5. *Test the solution and run a pilot.* RPA solution need to be tested. Minor differences in users' systems such as different browsers of different operative systems have to be considered. RPA tools need to be configured. This might take long since the team running the process has to be involved. The RPA then, need to be tested and finally results of the test need to be evaluated.
6. *Go-Live.* Now that the RPA bot has been tested and evaluated it is time for the Go-Live phase. Going live on a project means designing the governance of the new RPA-driven process by identifying role and responsibilities, writing down procedure in case of maintenance or changes during the process, communicate the new process to relevant stakeholders and then analyse results, track and collect data on the new process.
7. *Maintain the RPA solution.* It is though rare that processes remain constant over time due to ever changing market and regulation, customers' expectations and competition. For the success of the implementation project, companies should dedicate a team in charge of installation and maintenance of the RPA software.

Figure 12. Source: Personal elaboration

2.1.4. Future of RPA

In the next 5 to 7 years, presence of bots in companies would be almost total. At the moment it is one of the main drivers for transformation inside companies and sectors in particular in finance, human resources and supply chain. According to IFR (International Federation of Robotics) by 2020, 1.7 million new industrial robots will be installed in factories worldwide. RPA tools are evolving and will develop new cognitive and automatic learning capabilities that allow them to manage even more complex operations. Future's bot will be able to think and take decision on its own.

Since data often are gathered in an unstructured way, RPA automation tools need to add cognitive features to be able to analyse these data. In this sense RPA can be combined with Artificial Intelligence (AI).

The combination of RPA with the latest advantages in deep learning and cognitive technologies can perform activities carried out by humans and learn to do them even better. The levers of rules-based automation are augmented with the integration of artificial intelligence and machine

learning can radically enhance efficiency, increase workers' performance, reduce operational risk, improve response time and customer journey experience.

The automation journey does not end with RPA. In fact, the journey becomes more intriguing with disruptive technologies such as cognitive RPA and Artificial Intelligence (AI), which take automation to the next level. While traditional RPA automates processes that are repetitive and manually intensive, cognitive technologies leverage natural language processing, data mining and pattern recognition to behave like a human brain to solve complex problems. RPA gives quick benefits, but cognitive technologies provide long-term value added and both these technologies are helping companies solve problems that require human judgement to understand complex data patterns and business scenarios

The combination of RPA tools with AI make a step further from rules-based automation, RPA bots would be able to mimic human behaviour through language and pattern detection, moreover they will "learn" and improve their performance over time without being explicitly programmed, based on data collected. Thanks to Machine Learning (ML), Natural Language Process (NLP) and advanced analytics, the "smart" RPA can process unstructured data in the form of documents (Figure 13).

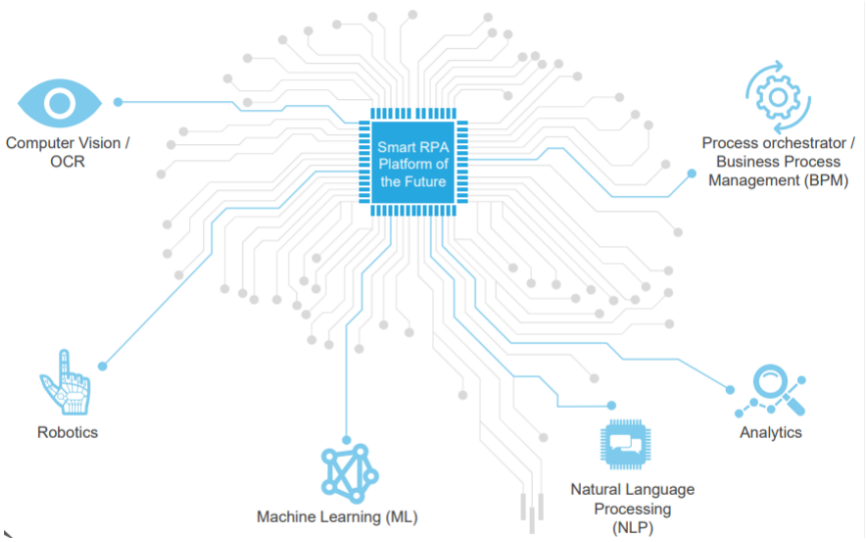


Figure 13. RPA and AI combination. Source: Everest Group Research

The combination of RPA with Artificial Intelligence can create enhanced capabilities for workforce and enable digital transformation of front- and back- office. Unstructured data are collected along Workflow of by Business Process Management software in the form of emails, pdfs, images or other documents like invoices or bills. These data can be distributed between agents and cognitive bots who can structure them in excel spreadsheets. RPA bots handle back-

end transactional tasks leaving exceptions be handled by agents. The integrated BPM manage the flow across employees, bots and company's systems to enable end-to-end automation.
As stated above, Artificial Intelligence and Cognitive Computing will play a critical role in the future of RPA. In particular these two technologies will have a major impact on companies' workforce, culture, and processes.
According to McKinsey (2018) the core technologies that will be encompassed to shape the future of RPA are:

1. *Smart Workflow.* Process management tools that integrates tasks performed by both humans and machines (i.e. processes completed of RPA bots and employees). This software allows users to track and initiate the status of an end-toend process in real-time; the software is going to manage handoffs between users and robots and provide statistical data on bottlenecks;
2. *Machine Learning/Advanced Analytics*. Machine learning allow extracting information that machines can learn from structured data sets of inputs and outputs beginning to make predictions based on new inputs from their own. Moreover, algorithms can provide can recognize patterns provide insights on them. Advanced analytics focus on forecasting future events and behaviours. Enabling businesses to discover deeper insights on potential business strategies;
3. *Natural-language Generation*. Software that create seamless interactions between humans and technologies by following rules to translate observations (mainly documents) into readable contents for the engine. Structured data are the input to natural-language engine that can write reports automatically.
4. *Cognitive Agents*. Technologies that combine machine learning and natural-language generation to build up a virtual workforce ("agent") that is capable to execute tasks, learn from data sets, communicate and take decisions. Cognitive agents can be used to support employees via chatbots.

When thinking of a fundamental ad imperative automation technology, for sure RPA can deliver significant short-term benefits. However, when considering long-term competitive advantage, companies should consider AI-related technologies in order to be disruptive.
Advancements in hardware and software especially including artificial intelligence lead the way for Robotic Process Automation to adapt it. Cognitive automation, combined with RPA can be

very disruptive of conventional people-outsourcing model (Madakam, M. Holmukhe, & Kumar Jaiswal, 2019).

The future of RPA seems bright, nevertheless most companies have still to embark the journey in Robotic Process Automation. According to the Global RPA Survey from Deloitte, 53% of companies have already started the implementation process; however, this is expected to increase to 72% in the next two years and those who are actually implementing it reported f intentions to increase investments on RPA. Unfortunately, companies may need firstly to consolidate and scale RPA along with their workforce – 3% reported to have scaled it successfully (Deloitte, 2018).

In the next section of the thesis, the analysis on procurement continue. In particular, the implementation of RPA in the procurement function will be addressed. Further on, case studies of the adoption digital technologies and of robotic process automation will be reported.

2.2. RPA and Procurement

The thesis now aims to start from where the first chapter left: automation of Procurement.

More and more companies are nowadays recognizing the impact procurement can have inside their business; source goods and services (strategic or not) is a significant activity and if fully optimized can lead to innovation, growth and competitive advantage. Sourcing and procurement are embracing new ways to interact with service suppliers, implementing new technologies and process automation to fulfil specific and ever-changing needs.

2.2.1. Robotic Process Automation application in Procurement

Big changes are on their way for the procurement function. Digital transformation is one of the greatest opportunities for Procurement today. Starting with E-Procurement that have seen the introduction of electronic RFX, procurement is going to move towards integration of end-to-end automation technologies, advanced analytics that will create better, faster insights that dramatically increase value. Companies are required to develop tools that support all main activities across digital procurement landscape, to ensure adoption and create higher quality user experience and finally to acquire tomorrow’s technologies (automation, big data and blockchain).

In particular, automation technologies (for example RPA) are increasingly evolving allowing for the development of cognitive capabilities and integration with artificial intelligence. This

would allow for a wider number of judgement-based tasks to be automated and therefore fundamentally transforming key aspects of procurement. Asian companies are already piloting and implementing automation for procurement tasks like supplier management, purchase order creation and invoice processing, gaining all main previously discussed benefits of automation: reduced costs, improved efficiency and speed.

Since more complex activities will be automated in the following years, the procurement function is going to become the coordinating centre of a digital workforce formed by AI, chatbots and RPA tools.

Indeed, benefits of automation provided by RPA can't be denied. RPA allows chief procurement officers to improve overall Procurement process and cut costs without hiring new employees and make huge IT investments. Improvements in this function involve procurement efficiency by optimization of supplier onboarding, contract review, improve overall data management, eliminate overpayment errors with accounts payable therefore increase savings.

The rapid evolution of RPA technology and the number of companies looking to adopt bots (according to an ISG Report, the number of European companies using RPA to automate ten or more processes will double, with less than 10% of them not having started the RPA journey yet), brings strong motivation for procurement executives to consider the deployment of bots within the organization.

Here follows a list of procurement function that can be handled by bots and how they are going to work to improve the procurement (Figure 14).

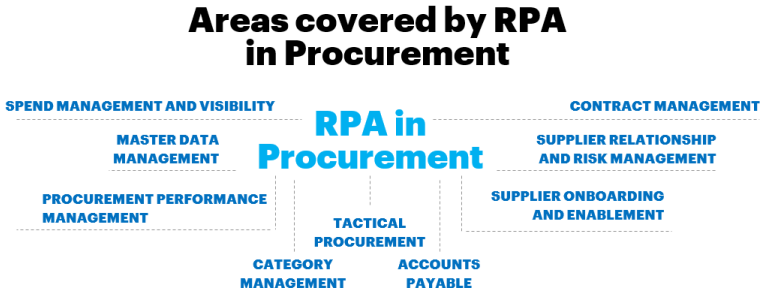


Figure 14. Source: Personal elaboration

Contract management

Contract management is defined as the process of awarding and administering contracts generally referred to as purchasing in companies (Rendon, 2008). Contract management involves key process areas such as procurement planning (the process of identification of business needs, and of which purchasing products or services can best met these needs); solicitation planning (the process of preparing the documents needed to support solicitation) and solicitation (the process of obtaining bids or proposals from sellers); source selection (the

process of receiving proposals and further select a supplier); contract administration and closeout (the process of verifying that all contractual requirements are met and the assurance that the contract is complete) (Rendon, 2008). Usually all these activities are manually performed, but often contract management involves ERP systems collecting contracts across the firm crawling email and scanning documents and fill them in company's source-to-pay system (source to pay system involves the entire end-to-end process in procurement, it ranges from spend and supplier management to performance management and accounts payable).

An RPA bot can review contracts, compare them with standard templates, and verify non-standard conditions. The bot can also send a summary to the users that revise contracts for supplier negotiation therefore improving speed.

Supplier relationship and risk management

RPA bots can track contract over time to collect discounts, tiered pricing and remuneration changes or penalties related to service-level agreements issues. Bots can also adjust invoices for reduced payments and notify supplier or answer supplier's questions or disputes. Bots can rank suppliers by gathering huge amount of data with mixed qualitative and quantitative measures. If the scoring process could be standardized, then collecting, analysing and producing valuable summaries and report for executive-level discussions (on quarterly basis for example) can be automated with bots.

Moreover, bots can organize and scan emails and highlight the suppliers that have the largest number of escalation ad interactions. This can help procurement staff to detect the time spent with each supplier and classify them for strategical or tactical importance.

For large companies, purchasing cards (is a form of charge card that allow goods and services to be procured without using traditional purchasing process). In order to help suppliers to shift from traditional procurement prices to a purchasing card and to facilitate this conversion, a bot can notify designed suppliers by sending automatic emails and inform the customer's intent to switch to purchasing cards and gather the required information using simple, web-based forms. The bot will then use the collected data and connect it to the accounts payable system of the company.

Finally, companies may have scarce resources to monitor suppliers' risk in a comprehensive and accurate way (i.e. for a coffee producer, it may be difficult to monitor the methods by which coffee is harvested, if these comply with certain environmental standards or quality standards, for example; this is all part of the risk management phase of procurement); bots can perform supplier due diligence, meaning processing, reviewing and scoring suppliers KPI, across a number of risk categories hundred the speed than manually.

Supplier onboarding and enablement

Supplier onboarding is the process of collecting the documentation needed to set up a company as an approved supplier in order to start transactions effectively and purchase goods or services Supplier onboarding process have been always conducted manually with repetitive and time-consuming tasks involving reading PDF form, file data in Excel spreadsheet, recording vendors' details with rules-based procedures and multiple levels of approval. Procurement bots can automate many of these tasks by checking supplier's documents, reviewing them and perform follow-up actions in case of missing information. Bots can also start the onboarding process.

Accounts payable

Accounts payable is probably the main function that could be made less costly, more efficient and more accurate thanks to the implementation of intelligent procurement bots.

The vast majority of invoices arrive as paper documents, PDF email documents or fax documents. Some of them do not follow standardized formats therefore they must be handled manually by accounts payable staff, looking for example if the Purchase Order (PO) matched the ERP. Accounts staffs also manually transfers data from the various invoice formats into the company's standard format; this repetitive task is slow and prone to errors. The manual process continues by solving discrepancies and approval.

When a supplier submits an invoice, the procurement bot can scan it and create a digital copy, perform check for missing information, like checking the correct name of supplier in the system, purchase order limits and contract pay outs. If there are gaps within the check, the bot can decide the next action to be implemented according to specific rules, in this case the bot can prevent the invoice to be paid and instead send a request to the supplier to provide the right information. Once the missing information is gathered, the bot can adjust the invoice automatically, start the approval process and sent it to employees for the final pay out.

The accounting payable process automation with RPA does not came without challenges. Some of these challenges include (KPMG, 2018):

- *Non-standard invoicing.* Invoices that companies receive from their suppliers sometimes still arrive in multiple different formats: as a paper copy, a Word document, a PDF email attachment, or a fax. Since invoice formats are not always standardized, it

is often a challenge for companies and automation software to handle them in the same way.

- *Unstructured data.* A company's finance team is responsible for transferring the data from various invoice formats into the company's database. The A/P staff is also responsible for manually dealing with any discrepancies between, purchase order and invoice as well as approving payments. The data in these invoices is typically unstructured, this manual transfer process is time-consuming, prone to errors, and can be difficult for certain automation software to handle.

Despite these obstacles, there have been recent significant improvements in the capabilities of RPA, especially in terms of optical character recognition (OCR) and automated approval/exception resolution. Improved OCR, for example, has allowed software robots to interpret and handle scans of paper invoices in a more efficient manner. As a result of these developments, there has been an increased ability to handle invoice discrepancies and even paper documents without as much employee involvement. This means that RPA technology can deliver even more improvements to the efficiency of AP processes to promote positive business outcomes and competitive advantages.

Tactical procurement

Tactical sourcing on the other hand is a short term, transactional activity, commonly practiced in small to medium size manufacturing organizations. Tactical sourcing takes a routine and sometimes reactive approach to purchasing materials and supplies using quick quote & order processes to support the production operations.

Advancer RPA tools can help companies to review contracts and compare them with best-in-class templates and underline terms and conditions that are non-standard as well as helping procurement employees to set contracts that are non-strategic. This would allow procurement function to save large amounts of time and focus more on strategic contracts.

Category management

Category management is the practice of segmenting the main areas of organizational spending on sourced goods and services into discrete groups of products and services according to the function and to mirror how individual marketplaces are organized. Using a category system, companies work across functions on individual categories, examine the whole spend category and how the organization uses products or services within the category, in order to determine and implant procurement strategies that will deliver significant value (O'Brien, 2009), some

example of categories are: (1) *direct categories*: raw materials or services that are directly linked to the final product; (2) *indirect category*: goods or services that are not related to the final product.

Rely on manual processes makes it difficult to categorize transactions in an accurate way. Transactions can be categorized by bots thanks to machine learning and assign them to more likely categories. If the information in not sufficient to assign a category, the bot can start follow-up questions to the person who submit the transaction ar to the supplier in order to identify the spend category.

Procurement performance management

Procurement performance is a measure of identifying the extent to which procurement's objectives are met with respect of planned goals to be achieved (effectiveness) and also it relates on hour these goals are achieved with respect of the resources available (efficiency) (Van Weele, 2002).

Companies (especially large ones) extract data from multiple systems along the purchasing cycle, like spend data for suppliers, cost centres, departments. Bots can all activities related of data extraction, collection as well as analytics and reporting. These activities are structured and rule-based therefore perfect for RPA bots to work optimally and be automated. Bots can extract procurement data from several systems used for sourcing services and goods and store them in determined locations (folders).

Master data management

Most companies face challenges with maintaining data sources. Vendor master data management involves the compilation of suppliers' data like name, address, phone number, email and so on. This information may come from different sources and the existence of rules and processes for updating, creating and maintaining vendors' master data can lead to duplication of data. Procurement bots are ideal tool to automate all or part of process of update vendors' master data, due to the unstructured nature of the rules governing these processes, inf converted into standardize tasks, automation bots can be ideal tools.

Bots can make vendor master data management more efficient and reduce the probability of errors. To do this, the bot can scan existing master data, check if duplicates have been added incorrectly and double check added information if valid from emails and phone calls recorded.

Spend management and visibility

Automating procurement with RPA can help increase compliance y increasing by increasing accuracy of information and spend data and making easier the access of information to employees. As seen for category management, bots classify procurement transactions once requested by scanning the requisition's text. This help classify spend category in the right one, reducing need for reclassification in a more accurate way.

After having analysed some of the benefits RPA tools can bring to Procurement, the next Chapter is going to examine some case studies of implementation of digital technologies and RPA inside Procurement function.

3. Chapter 3.Implementing E-Procurement and RPA (Robotic Process Automation): Case Studies

3.1. Implementing E-Procurement and RPA

The following sections are going to present five case studies of companies that successfully implemented E-procurement tools and Robotic Process Automation in the procurement function.

However, before proceeding with the presentation of the five cases, it is worth describing the world's leading e-procurement tool, SAP Ariba, in order to better understand its application in the case studies that will follow.

The market leader e-procurement tool is SAP Ariba, provided by the German provider of business software, SAP, which in 2012 acquired Ariba, an American company founded in 1996 with the aim of using internet to enable companies improve the procurement process. From this acquisition, the brand SAP Ariba born. Now the company generates 152$ billion in revenues (2019), serving roughly 200 companies all over the world, until becoming the Procurement Software market leader.

The creation of a unique brand could deliver the value that Ariba gives to suppliers and buyers, exploiting the business knowledge of SAP as leader in business software. In this way Ariba merges the procurement-specific applicative with the latest technologies enabled by the global vendor house.

Ariba allows for the creation of relationships between suppliers and buyers that can generate long-term value; in the Ariba Network, the portal where suppliers register themselves in order to digitally manage the transactions with buyers, there are as of today 3,1 million of companies operating in more than 190 countries. Buyers can manage the entire purchasing process, while controlling spending, finding new sources of savings, and building a healthy supply chain and suppliers can connect with profitable customers and efficiently scale existing relationships.

Company's main solutions involve the following areas:

- Supplier Management:
- Strategic Sourcing;
- Solutions for Direct Spend;
- Procurement;
- Financial Supply Chain;
- Solutions for Midsize and Growing Companies;
- Platform Solutions;
- Integration Solutions;
- Service for Buyers;
- Selling and Fulfilment.

As far as Procurement solutions are concerned, the company offers a procure to order solution called *Ariba Buying*, which help front-end procurement process to operate with efficiency by integration with internal ERP systems for invoice and payment processing. It offers a simple shopping experience helping employees buying goods and services with pre-defined guidelines. *Ariba Catalog* offers a spot buy marketplace: suppliers can upload all their content using a simple interface, which will be further validated in order to guarantee the best compliance of catalogue contents.
Ariba Supplier Network is an online platform where buyers can manage suppliers seamlessly from a unique place; buyers can monitor each step of the enablement of suppliers, from the invitation to the registration and qualification, to the purchase orders and invoicing process. Suppliers need to register via the Ariba Network by filling a questionnaire, inserting all data needed including bank information, in order to start doing business with buyers digitally. Form this network of suppliers, buyers can have access directly to vendors' data about risks, financial and economic data and legal data, but what really concerns buyers is the monitoring of the entire enablement process.

Below, the thesis will proceed showing five case studies about five companies that participate in different business, for which three of them have decided to partner with SAP Ariba to implement tools for E-Procurement. These case studies represent a journey of the procurement function, especially from the gradual substitution of paper-based work with basic and simple E-procurement tool (Unilever), to the implementation of Robotic Process Automation and Artificial Intelligence in procurement (Maersk and Vodafone).
The first case study presented is the Unilever case study, will follow the case studies of AB SKF, Adecco, Maersk and Vodafone.

3.1.1. Unilever's Case Study

3.1.1.1. Company Profile

Unilever Plc is a British-Dutch multinational consumer goods company that provides fast moving consumer goods. Its product categories include savoury, dressings and spread; ice cream and beverages; personal care, and home care. Unilever was founded by Antonius Johannes Jurgens, Samuel van den Bergh and William Hulme Lever on January 1, 1930 and is headquartered in London, the United Kingdom.

Each day, 2.5 billion people use company's products, the company's geographical segments include Asia, America and Western Europe, Africa and Central and Eastern Europe. Unilever has four core business units: Beauty & Personal Care, which includes skin care and hair care products, deodorants and oral care products; Foods and Refreshments, which includes soups, bouillons, sauces, snacks, salad dressings and margarines and ice creams; Home Care, which involving home care products, such as powders, liquids and capsules, soaps and a range of cleaning products; and Water Purifiers, which includes ice cream and tea-based beverages.

Among Unilever's main brands there are Dove for personal and skin care, a specific brand for women's skin care encouraging all of them to develop a positive relationship with beauty, helping to raise their self-esteem, and thereby enabling them to realise their full potential; Lipton which is one of the most famous best-selling tea brands available in more than one hundred countries; Heartbrand, the famous heart-shaped logo for ice-cream producer of Magnum, Solero and Viennetta.

The competitive landscape of Unilever is populated by the American company Procter & Gamble mainly for health care, beauty and personal care products; and Nestlè for Food and Refreshments business. The company can count a workforce of 155,000 people (as at 31 December 2018); as a matter of fact, one of the greatest challenges for the company is the presence of highly substitutable products especially in Asian and African Market where local communities tend to use traditional and locally produced goods (Unilever Annual Report, 2018).

A global digital economy is fuelling rapid change characterised by fragmentation throughout the value chain. This requires fast, innovative, profitable global and local responses in areas such as supply chain, customer development, marketing and brand innovation. With consumers taking different paths to purchase, often combining offline and online channels where

influencers are a growing force, the company from its side has early decide to implement digital solutions in some way preparing itself for incoming market changes.
The implementation of an E-Procurement system early in 2001 enable the company to develop relationships with suppliers, at the same time reducing costs and errors due to manual-handling of documents.
In the next section the journey of Unilever through an E-Procurement solution is explained.

3.1.1.2. Unilever's Journey towards E-Procurement

In 1999, Unilever launched its "Strategy for Growth", a strategic plan aimed at increasing overall growth and operating margins by 2004. This strategy was focused on 400 brands of the Group and to their procurement and manufacturing functions. Part of this strategy for growth was to align overall procurement activities with the requirement of these brands. The main objective of this strategy was to reorganize Procurement by focusing on reducing components complexity and find an international buying procedure accepted and applied throughout the brand of the company.
Before the launch of the strategy, there were, for production-related goods, a mix of initiatives form local to national levels, that, however, resulted in some inefficiencies. For non-production-related products (indirect spending), Unilever lacked a systematic process of tracking expenditure through the several operating companies.
This situation was the outcome of the decentralized structure of Unilever: local managers focused their attention into tailoring brands into local markets and develop them, increasing the desire to succeed in local markets. The headquarter provided and overall strategic leadership by establishing frameworks of policy and values, by setting priorities, targets and goals, by monitoring businesses strategy, without interfering in operational situations. Along with this decentralized strategy, the world-wide purchasing has become a relevant issue for Unilever (Anderson & Woolley, 2002).
The main question for the Group was: how much the traditional approach to procurement would meet the expectations for the future of sourcing? The main objective for the company was to make of its sourcing strategy an enterprise-wide process, by consolidate e-business, supply chain management and information systems in order to align the whole organization upon shared growth ambitions.
Unilever estimated, thanks to the revolution of Procurement, cost savings for 1,5€ billion annually and 1,6€ billion of additional saving due to global buying practices. Estimated costs

would have been of 5€ billion. The creations of two global divisions (Foods and Home and Personal Care) contributed to reduce the autonomy from local companies and move it to the headquarter (Anderson & Woolley, 2002).

Unilever recognized that the company should focus on total cost of ownership rather than negotiating to obtain the lowest price. This new focus involves supplier relationship management capabilities, in particular the focus features such as technology level, quality, responsiveness, innovation, delivery. For the purchasing strategy to be effective, the company had to be able to bundle purchases and assess the economic (and further) value of suppliers; the area of expenditure that would have delivered the biggest benefits in terms of cutting costs where indirect goods (all those goods that are non-production related).

Through 1999 and 2000 the company identified specific spending categories that might be moved to strategic sourcing and at the same time explored systems (software) that allow achieving global consolidation and efficiency in procurement.

3.1.1.3. Software selection

As partner for the implementation of the strategy, Unilever needed a system than grants scalability, standard practices, integration with company's existing systems and ease of implementation. The service provider chosen by the company was the e-procurement package of software vendor, Ariba.

Eventually, the Ariba spend-management system offered buyers key benefits such as:

- Elimination of slow, repetitive and paper-based tasks along the procurement cycle: from inbound logistics to end payment;
- Elimination of the need to maintain physical and direct contact with supplier, allowing buyers to send Purchase Orders (PO) and benefit from an e-commerce-style of transaction with each supplier enabled with Ariba;
- Receiving real-time orders confirmations and transaction historic data improving tracking and control of spending;
- Concentrating spending on preferred suppliers and managing compliance by controlling that the purchasing process follows all the correct steps;
- Managing all global enterprise-wide spending via one single system.

The Ariba system provided for a user-friendly ecosystem that can be updated and adapted to changes in spending conditions from each of employee's desktop. Moreover, Ariba provide

each buyer a catalogue of previously agreed sources in terms of volume and price in order to find the optimal total cost solution.

Ariba offered a plan-to-pay solution with requisitioning capability (the process of requesting items from supplier's warehouse or new items; the requisition must include quantity, item description, date and other information - the requisition typically passes through an approval process) and integration with static and dynamic catalogue. The system offers also integration of contracts to provide visibility, to track suppliers' compliance and online invoice reconciliation to speed up the payment cycle.

Another benefit of the Ariba system is the possibility to extract pre-built reports to view the spending by commodity, by supplier, by department and monitor supplier efficiency. In this way Unilever is able to create customized reports to meet business needs (Anderson & Woolley, 2002).

3.1.1.4. Implementation and challenges

The Ariba project with Unilever was launched in June 2000 involving headquarters, R&D function and manufacturing for a total of 240 buyers across North America. The adoption of Ariba system simplified the buying process by removing paperwork and reduce PO errors and most users were satisfied by the system. In this way the company had the possibility to monitor under a unified approach the analysis and reporting of purchasing spend across categories and companies within the group.

The implementation of such a new system globally provide some challenges. Some users found it difficult to switch form paper-based management of sourcing activities to a completely online system and found themselves uncomfortable with interface of Ariba (Figure 15); moreover, companies' supplier may already use online purchasing systems and they decided to avoid switching costs by continuing using these systems. The company understands that the implementation of e-procurement solutions was not just technology delivery, but change management was needed for a successful software adoption.

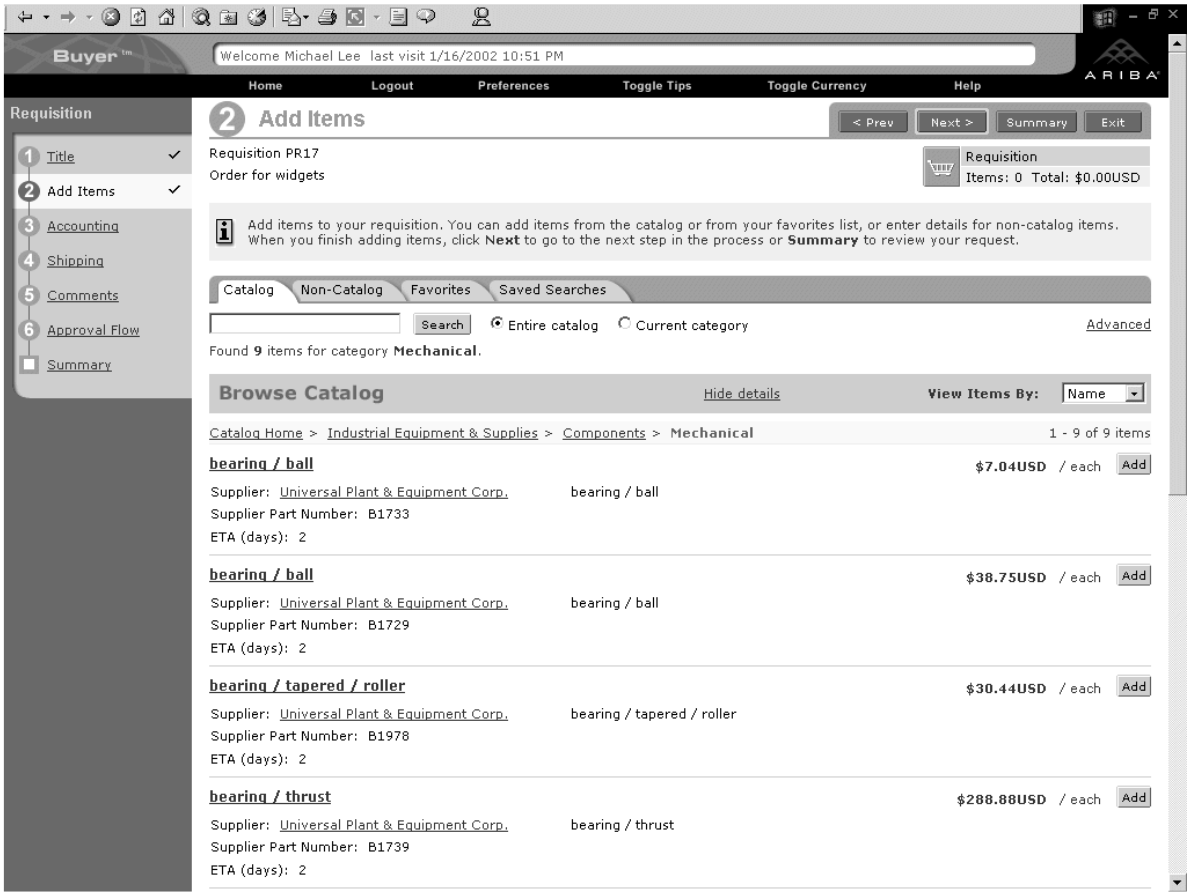


Figure 15. Ariba user Interface Source: Anderson & Woolley, 2002

The expansion of Ariba system in 2001 reached Europe. Contrary to the US, European companies were characterized by multiple languages and various local and regional buyers that have established long-term relationships with suppliers that developed unique abilities to negotiate. One of the main challenges was to spread the business case of the successful pilot launched in the US to the various operating companies (Anderson & Woolley, 2002).

The pilot was launched firstly in Germany and England as test locations. The pilot saw successful implementation across companies' suppliers, and this contributes to spread the success of the entire project. After a short test in Italy, the implementation of Ariba expands in Israel and Turkey. These trials showed that Ariba was ready to be rolled out across different countries covering large categories. By the end of 2001, 350 users across Europe were invited, with 85% utilizing the system. In its annual report of 2001, the company reported to have realised 1,2€ billion of euros in savings (Unilever, Annual Report, 2001).

Although some issues of integration and the need of paper invoices in some countries, the major challenge for Unilever was due to the fact that before the Ariba system, all the Group's companies have operated autonomously reaching optimization only at national level. However, operating across Europe require high collaboration across divisions.

According to the difficulties the Group was facing in monitoring all spending across relatively autonomous companies and departments, the company encountered the need to aggregate purchases. The variability of contracts was another critical element for buyers since it was difficult to negotiate on optimal volumes and adhere on contracts they stipulate.
Without adequate tools to monitor procurement and contract compliance, the off-sides of contracts were difficult to be kept under control or eliminated; send analysis became difficult for Unilever.

3.1.1.5. Key benefits for the Group

The introduction of e-procurement solutions like Ariba, helped overcoming these issues by creating an e-commerce infrastructure to analyse corporate-wide purchasing, direct and indirect spending directly from the desktop of each employee. The Ariba implementation eventually enabled every Unilever employee involved in buying items from office supplies to travel to select from a batch of previously agreed sources at volume-negotiated pricing (Anderson & Woolley, 2002). To conclude the Unilever's case study, the main benefits identified by the e-procurement solutions are he followings:

- *Increased contract compliance*: the company benefitted increased usage of the Ariba software from suppliers. This in turn has translated into less off-contract spending and lower prices for goods and services sourced;
- *Leverage of purchasing power*: the implementation of an e-procurement solution had given greater insights to the company on detailed spending for each supplier and product category; the power that this insight could give to Unilever allows for more contractual power in order to obtain greater discounts for increased volumes;
- *Reduction in process costs*: using an e-procurement tool allow for significant reduction of errors and time for tasks to be processed. As a more significant benefit, procurement staff had the possibility to focus on more value-added activities.

The Unilever case study, which dates back to 2001, explains how significant benefits can arise from the implementation of an online solution. Partnering with the provider Ariba, the Group was able to unify the procurement function on an enterprise-wide level, no longer national or regional, providing guidelines globally shared and adopted. The process of adoption has been gradual, but the starting point was certainly the good results obtained by the pilot in North

America. Nowadays Unilever manages its procurement function with SAP (Material Management) for direct procurement and Ariba Buyer for indirect procurement.
To continue the journey towards the future of Procurement, the next case (AB SKF) will show the adoption of an e-procurement tool, again Ariba, this time SAP Ariba (after the acquisition of Ariba by SAP), more than fifteen years later than Unilever and the integration with Robotic Process Automation applications.

3.1.2. SKF Case Study

3.1.2.1. Company's Profile

AB SKF is a Sweden-based supplier of products, solutions and services within rolling bearings, seals, mechatronics, and lubrication systems. The Company's services include technical support, maintenance services, condition monitoring, asset efficiency optimization, engineering consultancy and training.
Aktiebolaget Svenska Kullagerfabriken was founded on 16 February 1907. Sven Wingquist, the inventor of the double-row self-aligning ball bearing, was one of the founding members and the first Managing Director. Afterwards, a subsidiary of the company was founded in New York, the SKF Ball Bearing Co; during the following years the company moves through acquisitions and establishment of subsidiaries in USA, Latin America and China. The company now operates in 130 countries with around 44.000 employees and 108 manufacturing plants.
The company has two core divisions: Automotive and Industrial. For the automotive industry, SKF is a market leader in wheel-end solutions and has a strong position in application-driven powertrain solutions. SKF is leading the development of components for automotive electrification. In the aftermarket, the company has built up a strong global position with its extensive distribution network. In the Industrial sector it has a leading position in certain industries, such as railway and energy. In other industries, SKF shares the leadership position with other companies, deploying a network of over 7.000 distributors of mainly ball-bearing systems and lubrification solution.
SKF has long recognised the important role that digitalisation will play within the industry, including meeting more ambitious sustainability goals. The company began pioneering some of the elements that form the IIoT many years ago and has been monitoring equipment remotely for 15 years. By using SKF technologies to connect, collect and analyse critical data from

customers' machines, events can be predicted and performance optimised (SKF Annual Report); the company provides solutions that are used all over the world in different fields of applications. Customer's expectations are to be sustained in the most efficient way.

To achieve this accomplishment, recently (beginning of 2018) the company decided to digitize part of its supply chain, in particular the Procurement Process, by partnering with the software provider SAP Ariba in order to improve the whole range of activities performed in the sourcing area of the company.

This case study is similar to the one of Unilever: both companies adopted an E-Procurement solution; in the case of Unilever, Ariba, which at that time was still a standalone company, allowing for a creation of an e-commerce style guided-buying solution for buyers. In the case of SKF, the company adopted a broader solution, adopting more digital platforms provided by the SAP, in particular the Ariba Network, Ariba Buying, Ariba Supplier, Ariba Contracts and other management and information applications.

The next paragraph will show how the implementation plan has evolved and what SAP Ariba allowed the company to achieve.

3.1.2.2. SKF Project Plan

Optimal facilitators of motion, ball bearings are supplied to industrial, automotive, electronics, and aerospace manufacturers worldwide by AB SKF (SKF). Across 108 manufacturing units in 29 countries, SKF's global standard of excellence ensures customers get consistently high quality.

To keep this standard of excellence, SKF harmonized its direct procurement processes company-wide. Ariba solutions helped digitalize its procure-to-pay and share best practices across manufacturing units worldwide. Coupled with greater compliance with its procurement policy, SKF has achieved significant saving with SAP Ariba solutions. Keeping pace with high customer expectations, SKF continues to provide outstanding product quality and to live up to its reputation for excellence

SKF has transferred to an e-procurement system and to one global approach for purchasing of direct and indirect goods and services. An integrated global solution for the company will increase operational overall efficiency, increase compliance, leverage on the global buying power the company has established, and increase spend transparency.

In order to achieve all these benefits, SKF partnered in 2017 with SAP Aiba, the global leader for SAP and Cloud solutions that offers a comprehensive procurement management software

integrated with core SAP solution (already in place) and a centralized compliance thanks to a constant monitoring of purchasing behaviour.

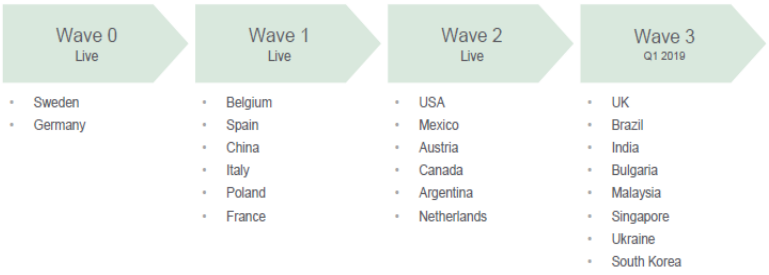


Figure 16. Waves of Implementation of Ariba in SKF. Source: SKF.com

The first wave of implementation journey started with Sweden and Germany which are live at the moment and followed by other 12 countries along 2017 and 2018; the third wave of the project was to adopt the Ariba solution in UK, Brazil, India, Bulgaria, Malaysia, Singapore, Ukraine and South Korea by the end of the first quarter of 2019 (Figure 16).

3.1.2.3. Challenges and Benefits

From sourcing to payment, passing from contract definition, requisition, approval phase, purchase order, (order confirmation and delivery notification are performed by suppliers through Ariba), goods receiving and invoice management, Ariba allowed SKF to manage all procure to pay process on both ends of the process.

Before the adoption of an e-procurement system, the company was facing the needs of standardization and simplification of procurement across a global enterprise, of reduction of administration and bureaucratic costs and complexity by introduction of digital procurement workflows, and of increase compliance with the company procurement policy.

Thanks to the Ariba implementation, SKF was able to adopt the following solutions:

Supplier Relationship Management

Ariba allows for managing the negotiation phase with several suppliers, including definition of price policies. The company can create contract requests, that are bids in which several suppliers are considered and evaluated for the requests. SKF will then choose for the best offers. Digitizing this process is crucial for companies since the can apply standard pricing policies for more suppliers. The function of knowledge posting, and quick quote posting allow to understand how much suppliers are interested to a certain request and to send them a request

for a quote. The platform allows companies to add new suppliers and once the bid is complete, the contract can be created (Contract Workspace); once uploaded in Ariba it will be possible to make orders (PO).

Creation of Catalogues

Once the contract is reached with a supplier, it is ready to be uploaded on the platform. The upload of the contract includes the release of a PO. By creating a PO, the system automatically creates catalogues through which the company can choose the agreed-on items. The functioning of this process is very similar to the one of an-ecommerce: the value of each purchase by the company will be reflected inside the purchase order. This is wholly automatized process because Ariba fills all data about the buyer and sends them directly to the supplier. This is a process that allows SKF to manage orders at a much faster pace than doing it manually.

Instead, for contracts that do not require the issuing of a purchase order, such as leasing contracts, the system, each month or at a defined time fame, when the invoice is issued Ariba will match it with the respective contract.

Issue of Purchase Order and Smart Invoicing

The peculiarity of Ariba system is that the Purchase Order goes through an approval flow according to which is entitles to approve it, depending on cost centres, price threshold or business units. In the nearest future, the main objective is to exploit artificial intelligence capabilities in order to increase the speed of the process which could be performed by algorithms.

Through the Ariba Network, smart invoicing offers cost reduction reducing incorrect invoice errors preventing them to enter in the process workflow or back-end system. Ariba allows also for automation of invoice processing, including PDF files, or non-PO invoices (as seen in the previous point). A smart invoice process gives SKF accelerated cycle time and exception handling, stronger compliance and a bigger supplier visibility of payment status, improved cash flow and automated capture of negotiated terms.

Analytic Report

Finally, based on these processes, Ariba allows to create reports. In this system, algorithms allow for the presentation of dashboards of preferred reports (than can be customized) according to which users can modify data to be reported depending to the needs of the company.

Some examples of reports involve accruals, spending reports, pending approval and forecasts on contract spending.

SKF's introduction of the Ariba Network allowed for a 10% growth of minority owned businesses and an 80% of business came from suppliers enabled in the Ariba Network. Moreover, the company added 16.000 suppliers to its vendor master database increasing compliance and controlling over 4$ million in spending. The company shifted completely the indirect spending on Ariba avoiding completely the traditional procurement system.
This case study shows the benefits that a company cha achieves and practically what the e-procurement systems can do for companies. What was theoretically stated in the previous chapter about e-procurement has been effectively achieved by SKF, aiming at global implementation and saving results.
The next case study involved Adecco, the global leader for employee placement and HR solutions; the case shows a step over the SKF's case study since the company in 2019 mastered the implementation of two RPA bots.

3.1.3. Adecco Case Study

3.1.3.1. Company's Profile

Adecco was founded in 1996 in Glattbrugg, Switzerland, now it is considered the global leader in HR solutions, helping every year more than 3.5 million people find employment opportunities, supporting more than 100.000 companies across more than 60 countries and it is part of the Fortune Global 500. The company is listed the capital markets of Zurich, Paris and New York. The Adecco Grouped last year has registered revenues for around 24€ billion.
The Group has registered solid performance throughout the fiscal year, with good financial performance and significant progresses along the strategic plan. The growth of revenues has increased of 6% since in several final markets the economic conditions has slightly improved and the EBITDA has remained stable at 4,9% (Adecco Annual Report, 2018). All these results have been possible thanks to the intent investments the company made in digital technologies and in the IT infrastructure, which is going to transform in the following years the business and will contribute to create bigger value for clients, future employees, investors and stakeholders.
Adecco was born by the incorporation of two companies: the French company Ecco and the Swiss one Adia Interim. Nowadays the Group has more than 33.000 employees and 5.700

branches in 63 countries all over the world, mainly in Europe, North America and Japan and Australia.

In these countries the company offers the following services:

- Temporary staffing: the company provides associates (temporary employees) to organizations through allowing flexibility for clients and new opportunities for employees;
- Permanent placing: the company help employers find permanent roles;
- Career transition: Adecco supports other companies and their employees through career changes that require employee to exit from their role;
- Outsourcing: finally, the company provides HR solutions in which Adecco staffs and manage the labour-intensive processes like call centre operations, IT support or warehouse logistics.

Company's size allows to cover all sectors in which temporary employees or higher figures are required. All branches of the group are quire autonomous, but each branch is well grounded on the core values of the company: perform, transform and innovate offering wide and homogeneous services. Having a lot of branches in a single territory, helps the company to understand the needs of local firms, regardless the size and anticipating the market needs thanks to a bottom-up approach that allows identifying changing trends.

Company's Brands

Adecco Group is made of several brands which are:

- Adecco: the most important and diffused brand of the Group with more than 300 branches and 2000 employees working on it. This division is mainly focused on finding the best candidate for each companies' needs;
- Adia: a digital staffing service, delivering jobs on demand in hospitality and catering, promotions and events as well as retail;
- Badenoch & Clark: a global recruitment specialist, offering interim and permanent placement for senior management and executive roles.
  Since 1978 Badenoch & Clark accompanies managers in their work choices and offers consulting services in Head Hunting for managerial and executive figures, for small and medium-sized companies and large multinationals;

- General Assembly: is a pioneer in education and career transformation, specializing in today's most in-demand skills. The leading source for training, staffing, and career transitions, we foster a flourishing community of professionals pursuing careers they love. General Assembly educates individuals building skill at al professional levels, bridging the gap between job seekers and companies needing talent with relevant skills;
- Lee Hecht Harrison: a global talent development and transition company, helping individuals and organisations navigate workforce change. The company offers 4.000 thoughts leaders, business leaders, career consultant, executive coaches, industry experts, client and project managers, and technology professionals;
- Modis: this company is a provider of consulting, outsourcing, project services and staffing across IT, engineering and life sciences. In these sectors, Modis operates as a consulting company;
- Pontoon: deals with contingent and permanent workforce planning, recruiter-on-demand and talent advisory solutions across all industries.
- Spring Professionals: it is a consulting company that connects management professionals with roles and opportunities across industries. This company is a recruitment expert in IT and TLC industry;
- Vettery: a talent recruitment platform that uses machine learning and real-time analytics to match highly qualified job-seekers with top companies. User can create a profile via Vattery website and according to the experience of each candidate, companies can easily reach them out and request interviews;
- Yoos: it is an online marketplace for enabling connections between freelancers and their clients.

3.1.3.2. Adecco's Digitalization of Procurement: Business needs and Benefits

Adecco, in 2018, jumped on the innovation wave, in particular, it started the journey in the digitalization of Procurement in order to promote company's growth at global level and be a leader in the market.

Starting from the phase of supplier selection, to the phase of contracting, up to the creation of Purchase Order, payment and issuing of invoices. The business needs that guided the company through this process, were the need of digitization of procurement processes, of standardization of procurement activities and of reducing the incidence of manual and repetitive activities. Calling supplier or meeting them physically produces huge wasting of time and inefficiencies.

Thanks to e-procurement, the company could manage with digital tools all tasks related to purchasing function, speeding up bureaucratic tasks relate to procurement cycle, allowing for data collection useful for decisional process.

Sourcing activity was not managed centrally: each branch of the group aimed at satisfying branches' need, instead of focussing on procurement strategy at core level, allowing for wastes in terms of costs and increasing bureaucracy (as in the Unilever case study). Moreover, as a consequence, reporting activities was biased and problems with reconciliation of invoices arose. Without an e-procurement tool, approving invoices and matching them with purchase orders was another time-consuming activity.

Another need achieved by the digitalization of e-procurement is to remove employees (or FTEs: full time employees) from performing repetitive and operating tasks like invoice checking, managing invoice exceptions, upload of orders and so on. Thanks to algorithms and RPA systems, the company was able to move focus of its employees to more value-added activities that are core for the growth of the company. Deploying RPA systems translates for automatization of non-core activities and allows for increased accuracy of reporting and invoicing activity.

The main benefit that the company achieved thanks to the implementation of a digital solution for its Procurement function was essentially related to the reduction of overall cost of procurement process and invoicing process: the installed tool, SAP Ariba, as in the case of Unilever, works more or less autonomously, with the supervision of few people. Consequently, other benefits of the e-procurement solution, impacted the whole organization, creating more economic value thanks to the rapid management of the sourcing process. Lastly, using digital solutions, allowed for creating huge amount of meaningful information, not only for reporting, but also for decisional processes. Ariba dashboards are constantly updated on the ongoing situation of the company, allowing from more accurate decisions. In the next paragraph the thesis is going to examine what Ariba adoption can bring to a company and the step further taken by the digitalization of the procure to pay process in Adecco: the adoption of RPA systems.

3.1.3.3. E-Procurement (SAP Ariba) and RPA implementation

What makes this case study stands a step beyond the SKF's one, is the adoption of one of the latest (someone will say also outdated) technologies: Robotic Process Automation.

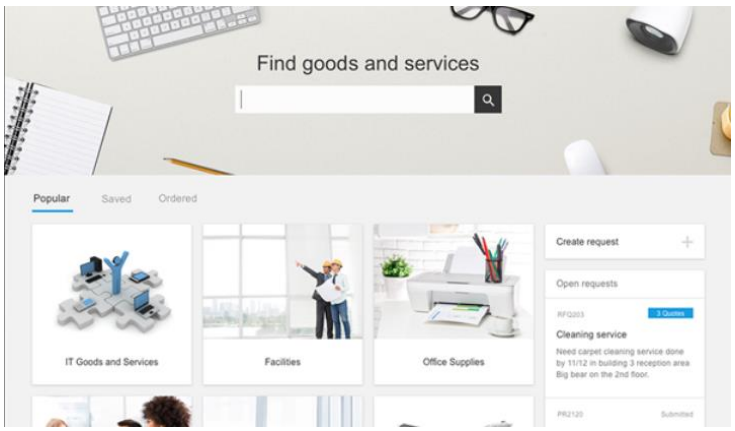


Figure 17: Ariba Guided Buying. Source: Ariba.com

Firstly, the paragraph is going to examine the digitally enabled procure to pay process of Ariba, which is similar to the one of AB SKF and the developed RPA solutions.

The activities that Ariba can manage, scale from the supplier relationship management to the final phase of analytic report. Within these phases there are: creation of catalogues; creation of purchasing requests, issue of purchase order, inbound of goods, contract management, invoicing and invoicing reconciliation (Figure 17 and 18).

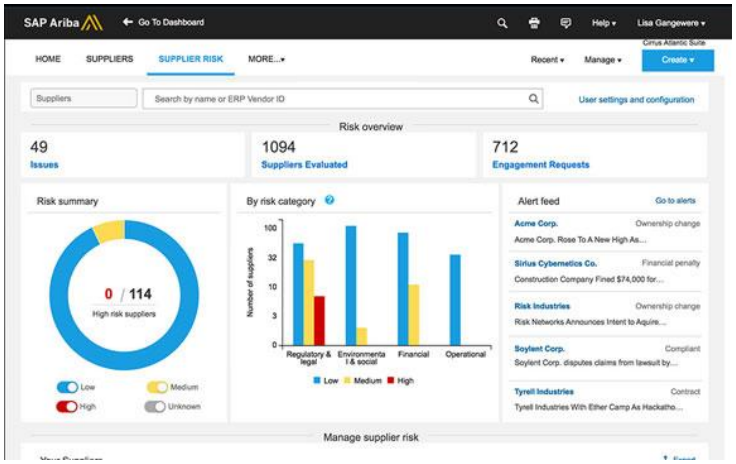


Figure 18: Ariba Supplier Nework. Source: Ariba.com

The new procure to pay process aims at standardizing purchasing activities and through catalogues and automation of approval procedures for purchasing requests. This process starts with the creation of a Purchasing Request (PR) based on goods available through catalogues; the request then must be approved by the system and then it is processed. Once processed and approved, a Purchase Order (PO) is created and sent to the supplier; when the order is elaborated and the supplier confirms the receipt of the order, the invoicing process starts.

Ariba facilitates also the Invoice Reconciliation process. Adecco could match the bank statements of outgoing and ingoing invoices to basically making sure that amounts leaving one bank account perfectly matched the amount spent. However, an invoice can be sent with or without exceptions. The first case is more likely to happen. The invoice can present exceptions in terms of amount, taxability or quantity: in these cases, the employee must manage personally

the exception and match data between the invoice and the purchase order. Once the invoice has been "fixed" it goes through an approval process entirely visible through dashboards (Figure 19); after this check has been performed an "OK to Pay File" is then sent to the accountability software (internal to the company) that will proceed with the payment of the invoice. Should the information between the invoice and the Purchase Order mismatch, the system will automatically recover them by looking at this latter document (PO).

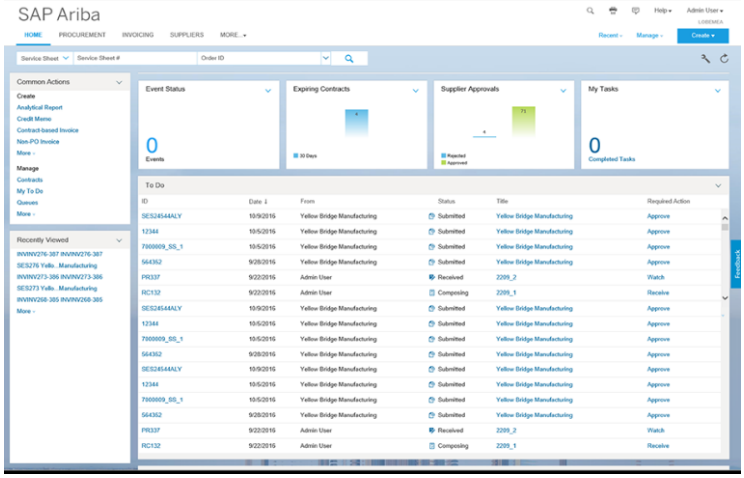


Figure 19: Ariba Invoices Approval. Source Ariba.com

In this sense, Adecco has been able to fully automate some existing processes. Some has been previously seen and have been provided by Ariba. In addition to these simple processes, more complex tools have been implemented, in particular a Massive requisition Import RPA and an OK to Pay File Check RPA.

The first applicative, has emerged with the need of the group to upload massive purchasing requests coming from branches. This operation required huge amount of work and the spending categories were of the most variable. Users should analyse complex spreadsheets full of heterogeneous information, therefore the need of the implementation of a bot that could be able to upload automatically orders in Ariba emerged. The bot extract information from the internal system, combine this information with spending details and match them with branch information; finally upload all data inside Ariba which in turn process the order.

This is an example of how employees can spend more effectively their time by focusing on more value-added task like definition of price policies or of contracts.

The second applicative, deals with the matching of invoice exceptions and the compliance with the internal accountable system of the company. This bot can read information about invoices and codify them from Ariba in order to make them readable in the internal software.

The case study of Adecco offers a prime approach to RPA solutions inside Procurement functions and represent basically the state of the art of mostly all companies. The next case

studies that will be presented, explain what the future of procurement could be or, better, where the procurement function is actually moving to: Cognitive (or Intelligent) Procurement.

3.1.4. Maersk Case Study

3.1.4.1. Company's Profile

A.P. Moller - Maersk is an integrated container logistics company working to connect and simplify its customers' supply chains. Maersk has been the largest container ship and supply vessel operator in the world since 1996.

The company history starts with by Peter Mærsk Møller when, back in 1904, after an experience as cabin boy and then steamship master, he acquired his first steamer and decided to set up a steamship company in Svendborg (Denmark).

From 1912 the company established offices overseas, in New York and in the following years covered routes from USA to the Far East. As far as containerization expanded in 1970, Maersk's presence was required all over the world, therefore the company establishes subsidiaries in Taiwn, Hong Kong, and Singapore and establishes Maersk Logistics, now Damco.

After years of acquisitions and record-breaking shipments of containers, today Maersk became the global leader in shipping services, the company operates in 130 countries and employs roughly 79,900 people. The company has a fleet of 786 vessels which sail every major trade lane on the globe and operates through four main businesses: Ocean Activities, Logistics and Services, Terminals and Towage and Mnufacturing and Others.

A.P. Moller - Maersk consists of Maersk, APM Terminals, Damco, Svitzer and Maersk Container Industry. The mission of these businesses is to enable and facilitate global supply chains and provide opportunities for customers to trade globally. The world's largest container shipping company is known for reliable, flexible and eco-efficient services.

On behalf of a solid year in 2018, the company's objective is to lead the transformation of the industry, using digitalization to make global supply chains simpler, transparent and more efficient – for example, in ocean transports, all transactions have been digitalized, from the price quote to the booking (Maersk Annual Report 2018).

In this sense, the company started its journey to lead the transformation journey also in the procurement function; indeed, the company during the 2019 implemented the latest technologies, such as Robotic Process Automation, Machine Learning and Artificial Intelligence to start building the future of Procurement. A journey which is still ongoing.

In the following paragraphs, the result of this ongoing journey will be presented.

3.1.4.2. Maersk Procurement Evolution

Maersk Procurement performs 20$ billion of dollars in total spends, with 600 employees in 10 locations and offices globally (Figure 20).

The procurement journey of Maersk started in 2001 when Maersk located in Copenhagen an international team that from 2002 to 2006 to manage the group's procurement coordination. From 2006 the procurement of Maersk started going beyond Copenhagen, focusing on indirect spending in order to optimize capital expenditures. Each business unit of the group managed centrally its procurement and at the same time the Group started its journey through e-sourcing with software provider Coupa for e-auctions.

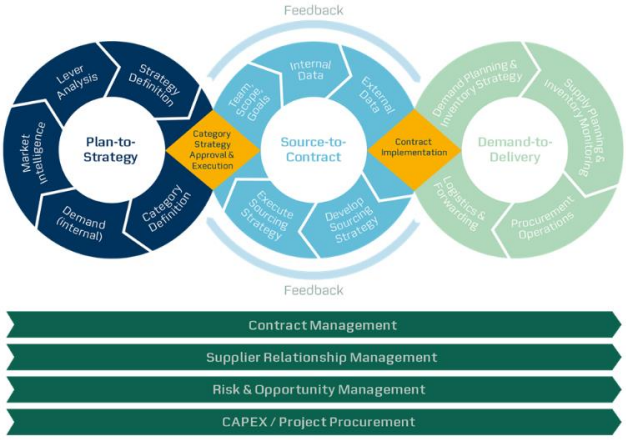


Figure 20: Maersk Procurement Cycle. Source: Maersk.com

Coupa is a cloud business spend management platform offering solutions for procurement, invoicing, expenses management, payments and global sourcing. In particular with Coupa Maersk is able to digitalize all the negotiation phase of procurement: e-auctions are negotiation conducted via an online platform where suppliers have the possibility to improve their proposals based on market feedback. In this way, transparency is assured. Moreover, only pre-qualified suppliers get invited to e-auctions, ensuring for a time efficient process and giving the opportunity for suppliers to work globally.

E-auctions can be also split to negotiate either commodity-type of goods or more complex engineered goods and services that have a major impact on business operations. In complex spend categories, more parameters are considered from the company to decide which supplier to start a negotiation, including quality, terms and service level. Maersk established also principles on which basing e-auctions, mainly indicating previously awarding principles, and including non-price factors in order to ensure competition between different suppliers (the

evaluation and choice of suppliers on non-price related factors will be the subject of the third cheater of the thesis). In Figure 21, the system's platform shows there the supplier is placing itself in the e-auction and also shows how much time is left for the bid to be closed (Maersk E-auction Guideline).

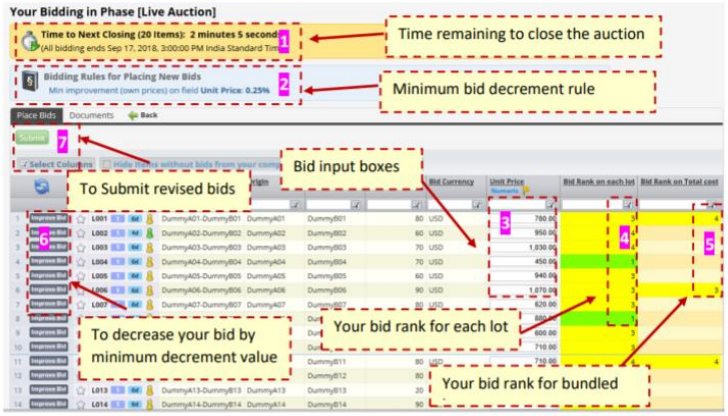


Figure 21: Maersk e-auction platform. Source: Maersk e-auction guideline

As shown in Figure 22, in 2019, Maersk has reached fully automated e-auction processes for selected categories of goods and services. The e-auction model allowed for 2.8% of incremental saving from e-auctions and of a reduction of tendering time that was previously wasted of 7 days. The 53% of e-auctions lead to double digit saving. This implementation of e-auctions allows for a data-driven sourcing strategy, which as estimated by numerous researches (Accenture, 2108; KPMG, 2018), will lead to competitive advantages and lead the Procurement function to strategically drive the business.

Exactly from this point, Maersk from 2016 started the ongoing Procurement excellence that the company is trying to achieve. Maersk is making of procurement the core of its business, enabling digital procurement and sharing objectives and targets along its business units.

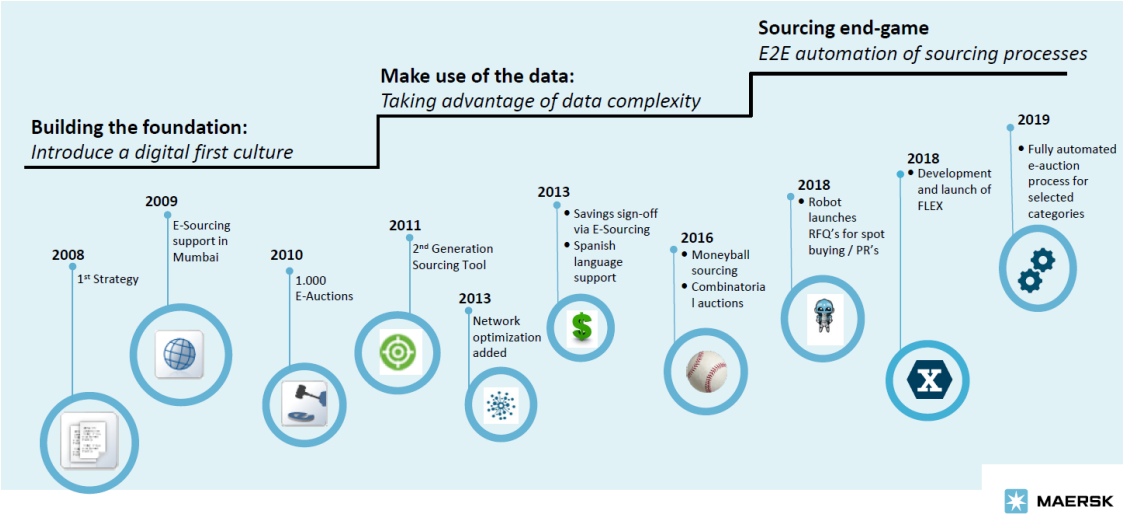


Figure 22. Maersk RPA Implementation Journey, Source: SKI.com

This project is still ongoing nowadays, but it is involving the latest technologies in Procurement function, meaning the Robotic Process Automation enhanced by Artificial Intelligence which both lead to Cognitive Procurement.

3.1.4.3. Cognitive Procurement implementation

As explained at the beginning of the chapter (see Paragraph 2.2.) Robotic Process Automation (RPA) are software robots (bots) that perform on top of existing applications and execute tasks that are rule-based, requiring on human judgement and deliver outputs 24/7. Application in procurement involve the creation of suppliers, the release of POs or data migration or compliance.

The solution developed by Maersk is named Holger. Holger is the name of the 5 bots that the company has implemented in 2019; these bots has performed successfully more than 160.000 tasks, for which 38 processes have been automated and the bots are able to log to 26 different systems (Figure 23).

When the vessels form Maersk fleets creates a requisition. Holger find prices in catalogue and automatically creates a Request for Quotation (RFQ) extracting data from Excel spreadsheets. Thanks to the implementation of Artificial Intelligence algorithms, bots are able to extract prices from online catalogues (e-Cat), analyse purchase history and principles designed by the company, combine all these data with the buyer experience continuous feedbacks to finally obtain a Purchase Recommendation. As outcome the process, bots prepare Purchase Orders for buyers.

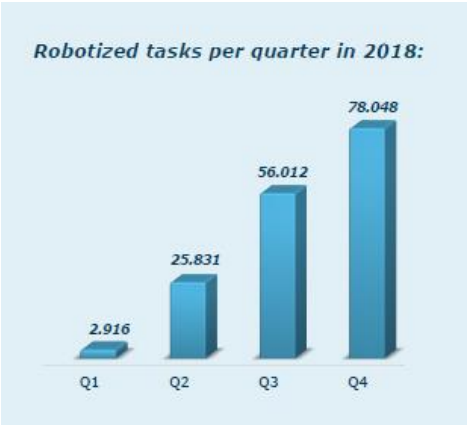


Figure 23. Amount of Robotized Tasks. Source: SKI.com

3.1.5. Vodafone case study

3.1.5.1. Company's Profile

Vodafone Group PLC is the world's leading mobile phone operator, with more than 165 million users and annual revenues of 43,7€ billion of annual revenues. The company operates in 25 countries ranging from Europe, where the core amount of revenues is generated to Australia. The range of products the company offers are of a major stake made by Mobile Services, Fixed broadband, TV and voice and Convergence combining mobile, fixed and content services; the other main service is Vodafone Business, offering IoT solutions, Cloud and Security ad Carrier services; finally the smaller part of revenues is made of payment systems, developed specifically for African customers (M-Pesa).

Vodafone was founded as in 1991 following a demerger from Racal Electronics, British radar and electronics company, with Gerry Whent as CEO. During the following year, until 2000, the company was able to double its size, also through one of the largest acquisitions ever, the acquisition of the German firm Mannesmann AG in 2000.

During the 2000s the company expands its retail stores to 400 and wins awards as the best Network Awards. In the following years the company covered with its 4G network over 300 cities and districts and becoming the UK first network for voice.

Along with the world moving towards rapid digital transformation, new technologies artificial intelligence and Robotic Process Automation came at company's attention in order to enable consumers to be connected rapidly and automate operational processes. In this instance, the company started implementing Robotic Process Automation early in 2016 achieving big results in 2019.

The following brief case study will present this implementation which leads to the deployment of two bots for automation of activities in its Procurement Process.

3.1.5.2. The Vodafone Procurement company

The Vodafone Procurement Company centrally manages around €20 billion of spend every year for Vodafone businesses and partners in more than 26 countries. Its category managers will soon be using cognitive computing to support virtually every aspect of the procurement and supply chain management process. The aim is to create the "category managers of the future",

to improve decision making and to open up new business opportunities through the practice of self-disruption.

In June 2017 the British multinational telecom unit of the German Company processed about 800.000 purchase orders each year and receive about 5 million invoices, from its 23 operating companies all over the world requisition goods and services.

In 2017, Vodafone implemented two RPA robots that heled the company speed-up the request-for-quote process. The initial RFQ processing involved employees to manually insert data and converting text from orders. This task used to take at least 20 minutes to be completed, after the implementation of bots, the time has been reduced to six minutes (Geyer-Klingeberg, et *al.*, 2018).

Two years later, the Wall Street Journal reported the actual improvements achieved by Vodafone after charging procurement with automation and Artificial Intelligence. The company partnered with Celonis, a process mining software provider, to deploy a tool for procurement automation that relies on robotic process automation, artificial intelligence and machine learning to identify patterns and create predictive models. Vodafone hired six data scientists managing the tool and reassign procurement staff, who previously collect data, to more value-added activities such as strategic sourcing and negotiations.

3.1.5.3. Benefits Achieved

At the moment, the company can track nearly in real-time the issue of a process order and its path along the system, from the requisition to its approval and the invoice issued and paid. Before the implementation of the tools, the POs issued correctly by the company were of 73%, this percentage increased up to 96%, registered in June 2019.

The cost of each purchase order in two years has reduced from 2,7€ to 2,3€; since the company processes roughly 800.000 purchase orders a year the cost reduction is quite relevant in terms of savings. Moreover, the objective of the company is to increasingly reduce the cost for each purchase order to 1€ by 2021.

To conclude, the new tool deployed by Vodafone Procurement allows to track areas of improvement in terms of automation and standardization, because the tools implemented can monitor defined efficiency measures.

The two brief case studies of Maersk and Vodafone Procurement Company show how large corporations are going beyond standard Procurement functions and activities: these examples

explain where how likely is the future of procurement where this business area became strategic for firms.

In the last section of chapter of Chapter 2, the thesis will analyse deeply the procurement's next frontier for the following years.

3.2. Procurement's next frontier

In the following years, human involvement in operational activities will become limited. Cognitive, self-learning machines will have the ability to perform more complex activities, while repetitive and routine tasks activities will be fully undertaken by Robotic Process Automation. Along with automation of more and more tasks that require human judgement, automation technologies are allowing integration of cognitive capabilities and artificial intelligence (Figure 24).

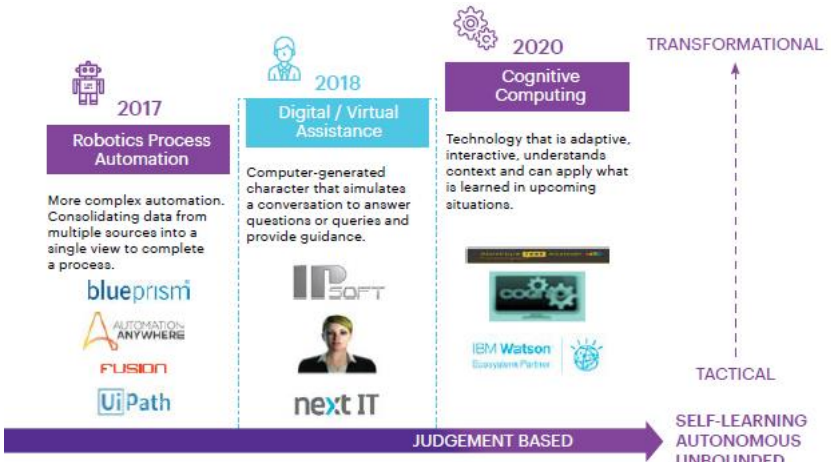


Figure 24. RPA Future Evolution. Source: Accenture, 2018

It is indeed estimated that 72% of companies globally will implement on RPA technologies to manage operational functions, including procurement; as it is the basement of the future of procurement, this function will become the center of a virtual workforce governed by AI technologies, chatbots and RPA tools. This will lead procurement employee redeployed on more strategical activities, like contracts terms and compliance definition; moreover, it is needful considering the upskilling of personnel and the development of multiple skillsets to be able to interact with digital ever-expanding digital instruments.

In a recent IBM Institute of Business Valuer research, CPOs indicated as critical, the investments on top three technologies over the next three years: cognitive computing, cloud and predictive analytics. The resource found that, gaining real-time insights about buying and supply functions is the major concern for CPOs nowadays (Figure 25).

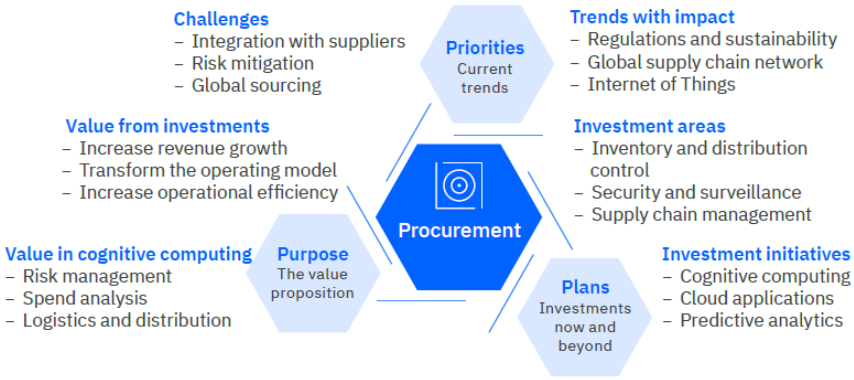


Figure 25. Source: IBM IBV (Institute of Business Value)

Investments in digital capabilities are crucial, as intelligent automation can drive the procurement function to be increasingly part of the growth agenda of companies. There are already activities that have the highest potential of being fully performed by RPA tools such as reporting activity, savings tracking, online auctions, catalogue management, vendor master data management, purchase order issue ad invoice matching. These activities can be considering the must-haves of the following two to three years for procurement functions of firms; some other activities instead are still to be managed by human intervention: resolving exceptions, definition of user authority on workflow, definition of policies and procedure or supplier relationship ownership. The integration of RPA with AI and cognitive computing has highly the chance of intervene in help desk support activities, category spend forecasting and supplier selection.

Companies leveraging RPA technologies benefits, as already explained, by increase in productivity, reduction of costs and human errors and reduction in operational time. However, the next wave of procurement will be characterized by AI based cognitive machines which will be able to process huge amount of information and take even strategic decisions (i.e. chatbots integrating wider range of verbal interactions).

Through intelligent automation of several procurement activities, machines will help reduce overall impact of the function on business costs. Such technologies will also make the procurement function more agile, so increasing speed of adaptability to market changes, responding more quickly to business opportunities. The implementation of a data-driven strategy for procurement, will increase supplier collaboration and further increase innovation.

The most main areas to be touched by cognitive automation in the future of procurement will be:

- *Document management and scanning*: combining technologies like optical character recognition (OCR) and intelligent character recognition (ICR), which allows for image and document format recognition and comparison with pre-defined standards, with RPA tools increase the amount of invoice handled. Matching between invoice to purchase orders and then to goo receipt can be performed by bots leaving exemption handling to human intervention. Both OCR and ICR, will simplify the process of data-checking on documents and categorization of files; closed with RPA software, both can scan and send documents to the right departments with no low errors rate.

  This technologies correlation can also extract data from documents and execute proper payment functions, that in the future of self-learning machines, could transform in accuracy levels of 100%, since bots learnt and correct themselves without notifying human users where errors are identified in data extractions;
- *Invoice* matching: bots can perform the matching process between invoices, purchase orders and good receipt. Departments can then use ICR technologies for finding discrepancies between documents and finding exceptions, the resolution of these exceptions requires, however, human judgement. Tax calculations on transactions offers another use of RPA: due to tax impositions, which is rules-based, it can be automated by bots than can be programmed with taxability matrix for proper tax treatment between countries;
- *Payment processing*: the payment cycle offers opportunities for RPA to be implemented. According to the time required for payments, expiration dates, bots can send payment details to vendors to increase their visibility over payment details. This in turn will lead to more accurate payments (on time), or, as follow-up actions in case of delay, bots can send emails for solicitation, track submissions, and escalate for human review in case of inconsistencies within vendors' statement.

RPA can be considered as an enabler for future integration of AI-enabled technologies. After having completed the RPA journey successfully, companies will feature their procurement function (also other functions) with latest technologies that will improve company's performance.

4. Chapter 4. Responsible Procurement Practices for Suppliers Selection

The following chapter is going to introduce the topic of Responsible Procurement (also known as Responsible Purchasing or Responsible Sourcing). The first section will be dedicated to the literature review of responsible Purchasing, giving various definitions and main determinants of the topic. The second section addresses the main drivers and barriers of responsible procurement that can facilitate or harm the adoption of Responsible Procurement. The third section examines the implementation of Responsible Procurement. It expresses which could be the best practices to be followed by organization in order to start implementing this new driver for managing procurement. The fourth and last section considers an important factor that must be taken into consideration while dealing with suppliers: supply chain risks. The section exposes how it is fundamental for companied to evaluate suppliers' risks, moreover, it presents a digital tool that allow companies to understand and evaluate the risk of their entire network od suppliers: EcoVadis.

It is important to note that in the following the words Responsible Procurement and Responsible Sourcing are used interchangeably.

4.1. Responsible Procurement Literature Review

In recent years, academics and practitioners have become increasingly interested in how organizations and their suppliers, impact on the environment, society and the economy.

Despite the incisive attention on social and environmental responsibility in supply chain, researches on responsible purchasing are relatively new little has been done to address practices of socially and environmentally responsible procurement (Mont & Leire, 2009).

Socially and environmentally responsible purchasing is a continuously emerging issue among literature, actually, the broader literature has been produced during the 21st Century (Hoejmose, Brammer, & Millington, 2013), even if this field has been addressed also earlier (Carter & Carter, 1998). Although it has the potential of harm a company's reputation and improve competitive performance still within firms, issues related to socially and environmentally responsible procurement are limited.

Responsible purchasing has become an issue of growing concern for companies due to an increasing interest in non-financial responsibility and sustainability matters; it represents a

relatively new field in the much broader Sustainability agendas, but still the level of engagement has not reached the desired outcomes. Responsible or sustainable procurement can lead to a resilient and healthy society, empowering more safety ways of living and working and promoting good governance. Moreover, engagement in responsible purchasing practices exploits organizational efficiency, compliance and transparency as well as financial savings and a more productive work environment (McMurray, et *al.*, 2014).

A wider stream of literature reflects the importance of environmental purchasing, mainly in private sectors, like manufacturing organizations. It is basically the inclusion of environmental factors in decisions on purchase of products and/or services, with the aim of buying materials that have less impact on the environment and human health than comparable products/services. Green purchasing aims to minimize negative environmental impacts in manufacturing process and transportation by using durable, recyclable and reusable materials. Manufacturing companies that practiced environmental strategy in purchasing benefitted from cost savings, better public image and decreased liability. In addition, firms that are able to leverage their green supply base with lower cost, higher quality and concern about environment aspects to impact their total cost structure and product quality could have a competitive advantage in their markets (Chin, Dawei, & Ab Malik, 2015).

In a much more broader sense, responsible purchasing has been defined among literature by Defra (2006), as "a process whereby organizations meet their need for goods, works and utilities in a way that achieves value for money on a whole life basis in terms of generating benefits not only to the organization, but also to society and economy, whilst minimizing damage to the environment" (Defra, 2006). Others (Walker & Philips, 2006), define sustainable procurement as the pursuit of development objectives through the purchasing and supply process, and involves a balance between environmental, social and economic objectives.

From these definitions, it is clear that embracing responsible purchasing make companies achieve benefits that inevitably produces positive externalities for the environment and the society, which in turn reflect on workplace and employees' life. In addition to this, companies can reduce further the imbalances against society by choosing suppliers from domestic minority-owned small businesses or if sourcing globally, from developing countries.

As stated in Chapter 1, the procurement function is increasingly growing its strategic role. This view of procurement as a core strategic function can be a lever for a sustainable development of companies: an increasing research on responsible procurement and supply and measures to improve the environmental and social performance of their suppliers is a clear manifestation on procurement new role (Walker & Philips, 2006).

4.2. Drivers and Barriers for Responsible Procurement

Responsible procurement is an opportunity to provide more value to a single organization towards improving its productivity, assessing value and performance, enabling communication between buyers, suppliers and stakeholders and by encouraging innovation. Indeed procurement has a big impact on environmental, social and economic across life cycle of goods and services (Breckland Council, 2009).

Some examples of these impacts are related to inputs of natural resources, raw materials, energy and water in manufacture of goods; pollution and carbon emissions produced by manufacturing; labor conditions and alterations or removal of natural resources.

Responsible procurement involves looking beyond the traditional economic parameters and making decisions based on the whole life cost, the associated risks, measures of success and implications for society and the environment. Making decisions in this way requires setting procurement into the broader strategic context including value for money, performance management, corporate and community priorities.

The challenge for responsible procurement is the integration of environmental and social consideration into procurement process, aiming at the reduction of its impact upon wealth, social conditions and environment, adding saving costs both for the company and for the society. Figure 26 below shows the macro areas impacted by socially and environmentally responsible procurement practices.

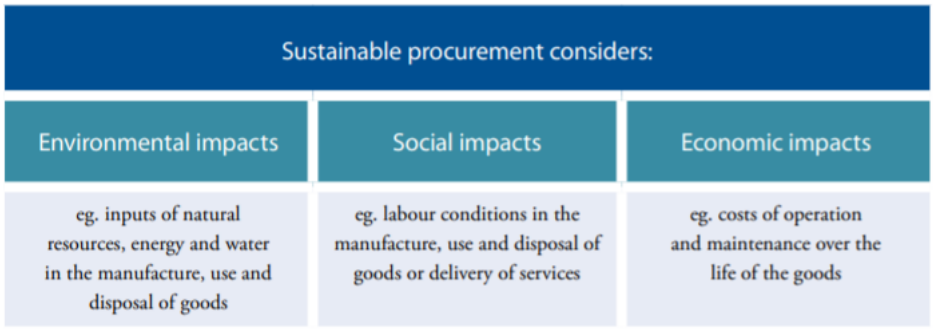


Figure 26. Source: Sustainable procurement guide - Australian Government

4.2.1. Drivers of Responsible Purchasing

The drivers of responsible purchasing are enabling factors which can have a positive or negative impact upon the adoption of responsible purchasing policies/practices. The first driver that will be considered in this instance is the *external and internal environment*. Stakeholders,

customers, governments, NGOs are among the actors that can pressure companies to be involved in environmental and social supply chain issues (Worthington, 2009). Moreover, it can be also stated that pressures are also context-depending: some industries are more exposed to pressure for a more responsible supply chain behavior, such as textile industries, housewares, toys or automobiles.

Although these drivers are fundamental for starting responsible sourcing, they must be followed by internal resources and support. Internal drivers are considered as crucial for sustainable sourcing.

Top management has been identified as a major factor for successful responsible procurement implementation since top managers can define and have an impact on organizational culture. In general, top managers can define the whole set of supply chain practices. Further research has identified as internal rivers for development of responsible procurement employees; in addition the desire of the entire organization to reduce waste and costs and individual pressure by shareholder in order to avoid negative publicity can be considered as internal drivers (Carter & Jennings, 2002).

Anoher internal factors to be considered as relevant is the amount of investments in technology that prevent pollution or induce reduction of wastes and close organizational links between the focal company and its suppliers in order to engage them towards a more responsible behavior.

Nadeem et al. identified three major drivers or responsible purchasing: (1) awareness; (2) organizational commitment to change and (3) approach to green suppliers are the drivers considered (Nadeem, Mohamad, & Nik Abdullah, 2017). Awareness is addressed by the authors as familiarity with regulations policies and laws connected to responsible purchasing, which can influence the adoption of responsible procurement practices in governments and organizations. Procurement functions inside companies are required to be acknowledged with laws, regulations and policies related to contracting, tendering and sourcing for sustainable procurement; not only to be aware of current regulations, but also are required to follow these laws since governments can impose penalties such as taxes and charges upon violations of regulations. Training the buyers, for instance, can have a significant effect on reducing the risk of penalties for companies and can have a positive effect on implementation of sustainable practices (Geldermann, Treitz, & Rentz, 2007). Awareness can also help overcoming barriers to sustainable sourcing: inertia and risk avoidance of managers are among these barriers.

Each organizational change involves tasks and activities, which must be re-scheduled and re-thought from their roots. The organizational commitment, training and awareness have a strongly positive effects during organizational changes like the implementation of responsible

purchasing practices; this commitment to change can lead to sustainable behavior. The commitment of leadership is therefore significant for successful implementation.

In addition, as the last driver for implementation of responsible purchasing, the approach to "greener" suppliers is identified by the presence of certification requirements such as ISO 9000 and ISO 140001 that incentive the production of sustainable product, especially for manufacturing firms, in order to source for source for more sustainable products. Not only the availability of sustainable products in the market, but also the availability of green suppliers became critical in the field of Responsible Procurement. These suppliers must be in turn aware of regulations and laws in terms of contracting and tendering of sustainable goods because generally environmentally sustainable and proactive organizations encourage their suppliers to take certifications (Darnall, Jolley, & Handfield, 2008). Incentives form governments such as tax exemptions, import duties exemptions and investment tax allowances can be applied to suppliers of green products that undertake environmental and social certifications (Nadeem et al., 2017).

Among external factors that would enter in the external factor's category, the media and various NGOs, pay particular attention on companies' behavior in terms of sourcing raw materials. Others external enablers are socially responsible investors, but their influence depends on the sector (Leire & Mont, 2010); an example of socially responsible investor is Ekobanken, a Swedish company that has defined social and environmental criteria for their investments in helping start-ups supporting responsible souring.

Another driver to be considered is the maintenance of reputation. Implementing responsible purchasing practices helps organizations avoiding risks upon brand and reputation, which are crucial intangible assets for companies. Additionally, users and consumers are becoming more and more aware on how much companies are impacting environment and society overall. Following this increased consciousness, some firms are seeing CSR as a competitive advantage that can translate in finding alternative suppliers in sourcing for goods.

As the last driver, organizations are incentive to follow responsible purchasing activities also by their own values. Companies such as Unilever, IKEA, Patagonia, are examples of companies driven by a sustainable value driven strategy, with already established policies of sourcing and supplier selection.

4.2.2. Barriers of Responsible Procurement

The introduction of responsible procurement may require changes not only in processes and criteria for suppliers selection, but also it may impact employees training, established procedures, performance assessment, product design (easily think about sustainable packaging), logistics and maintenance (Mont & Leire, 2009).

In the past, buyers were more focused on quality- and cost-related objectives while purchasing, as well as risk-delivery conditions, today's buyers considers also suppliers' sustainability-related conditions feeling also external pressures of stakeholders (Busse et *al.,* 2016). However, the availability of sustainable products is set as a barrier for procurer to implement a responsible behavior. The difficulties in finding sustainable products can disincentive buyers in adopting responsible practices in their procurement function.

A study conducted by Giunipero, Hooker and Denslow, identified as major barriers to responsible procurement are the initial investment required to implement responsible procurement and the economic uncertainty related to it. As far as the initial investments and related costs are concerned, initially, on a short-term basis, companies may face increasing cots related for example to more energy-efficient machines, green raw material that will eventually rise the overall costs of products, or more banally companies can face costs related to indirect sourcing like recycled printed paper.

In addition, getting raw materials from different companies that on their own manage an entire supply chain involving different countries with different environmentally and social standards, it is not a straightforward process; cooperation between focal companies with their suppliers could be difficult due to restriction imposed according to different countries regulations (Giunipero, Hooker, & Denslow, 2012). Differences in cultures between countries and regions lead to discrepancy in expectations between organizations and their customers with respect to social aspects, health and safety standards, as well as environmental issues (Mont & Leire, 2009). Moreover, there are also different management cultures in management style between countries (for instance between Europe and Asia).

Some companies can take also advantage of weak regulations in certain countries by outsourcing companies in these. The absence of social and environmental laws addressing worker's welfare and climate impact may lead buyers to continue doing business in these economies. In addition to this, regulatory factors are indicated by Chkanikova and Mont as crucial factors that can influence responsible procurement: the lack of governmental leadership to support companies towards sustainability transition is an important obstacle, in particular, unclear messages from policymakers generate confusion among firms and their responsibilities.

This in turn generates a lack of action plans developed in collaboration between firms and their suppliers and, as stated above, a lack of a sort of merging or harmonization between regulations among countries is imposing further challenges. Being said that, regulations may not also be too strict, leading to forms of protectionism and preventing free trade.

Chkanikova and Mont added also barriers related to resource factors. The lack of financial resources and lack of expertise induces companies towards an incomplete responsible transformation or even a complete avoidance. Firms may lack of competences that are out of their core business, like safety rules implementation competence or sustainable transformation competences that can in turn influence their own suppliers and engage more suppliers towards establishment of more solid collaboration (that may require additional costs of maintaining this relationship).

Lastly, product attributes related to a greater quality may not be able to justify a higher cost and, related to this, consumers' willingness to pay and extra price for eco-labelled products is still not so high. Confusion among consumers exists with the rise of eco-labelled products and the inability to recognize real quality goods reduces more their willingness to pay. The implementation of responsible initiatives strongly depends on consumers' awareness and interest, which at the moment may still not be sufficient (even though in the last couple of years is rising) (Chkanikova & Mont, 2015).

Considering again the organization internal point of view, even knowledge can be considered among barriers for responsible procurement. Having limited understanding of responsible e procurement practices can harm the potential benefits the companies can gain. Having therefore limited access to training and learning opportunities for buyers prevent them understand for example working conditions inside factories, or supplier's method of raw material extraction.

This barrier is a lot related to the fact that most companies do not make ethic, socially and environmentally related decisions a priority: without considerations of responsible practices, buyers would continue to stay focused on drivers such as unit cost and quality.

If only a short-term analysis is conducted, benefits would not be visible, companied that instead are focused on long-term analysis of risks would be more conscious of possible benefits of responsible procurement and in the final section the theme of Supply Chain Risk is addressed.

Barriers can be identified not only for focal companies, but also for suppliers. Suppliers need to comply with a new set of rules and code of conducts of buyers and be audited by auditors (which can be NGOs or audit companies) to verify their attendance to health and safety workplace practices and environment-related policies. Getting approval from suppliers is not an easy task to accomplish: they may be forced to raise wages, costs of energy and material

Table 3.

Internal barriers for focal organisation	External barriers for focal organisation	External barriers for suppliers
Lack of information on how to develop and implement SRP	High costs of auditing suppliers and poor quality of external auditors due to increasing competition among auditing companies and lower prices for audits	Customers' practices of short-term orders and increasing speed of deliveries facilitate poor working conditions and lack of attention to health and safety
Lack of top management commitment for initiation and especially implementation phases of SRP	Difficulties with establishing long-term and cooperative relations with suppliers, partially due to fire-fighting management style of suppliers	Numerous, often contradictory requirements, from different customers
Need to justify the activity and its cost based on profit or business benefit	Lack of understanding of the importance of social aspects by suppliers and double-bookkeeping and cheating at audits	Lack of legislation or its enforcement for suppliers in various countries
Significant changes in the focal organisation might be needed	Difficulties with influencing beyond the first tier suppliers and high costs of switching suppliers	Conflict between higher social performance standards and diminishing margins for products
Additional costs for education, training in focal organisation	Suppliers' employees may support current practices, e.g. overtime	Difficulties with influencing beyond the first tier suppliers
Lack of educational material for personnel training due to specificity of each sector and company	Lack of clear legislation for customers on how to integrate social issues in supply chain	Time spent on preparing for audits and inspections, keeping several sets of accounting books

supplies may increase, while on the other side their customers may constantly push towards cost reduction. The table below, reported by Mont and Leire, summarizes all the external barriers to implementation of responsible procurement practices for both companies and suppliers (Table 3).

4.3. Responsible Procurement Implementation

In this paragraph the thesis will analyze the implementation process of responsible procurement, so the following paragraphs will take a closer look at the steps to be implemented to adopt responsible procurement practices. A particular focus will be done on the topic of supplier evaluation and selection, and in particular on how companies are increasingly adopting social and environmental criteria upon selection and evaluation of their suppliers. Finally, a brief focus of the EcoVadis tool will be addressed: a digital and innovative tool for "green" evaluation of suppliers along the supply chain.

4.3.1. Responsible procurement practice: the implementation journey

It is becoming widely recognized that companies not only have to consider only their social and environmental impact, but also the one of the entire supply chain. Given central role that procurement is gaining for value delivering inside companies, its social and environmental impact offers wide range of analysis and improvements. It is therefore the core function where buyer and supplier relationships developed. Responsible procurement fits itself inside the wider term corporate social responsibility (CSR) which is nowadays a precondition for the existence of various organizations; it deals with the integration of social and environmental concerns into business operations.

Socially and environmentally responsible purchasing takes into consideration the social consequences as well as the environmental impact that operations have in terms of pollution, natural resources, safety, health, gender and race equality and so on. In this sense it is important for companies to determine a code of conduct for suppliers to comply with, to determine whether the company is able to impose standards to suppliers (Leire & Mont, 2010) and these standards are available globally via international organizations or certification companies. Another activity that companies can do is training suppliers in order to improve existing competences and benchmark their position inside responsible purchasing. Below, on the basis of a framework developed by Leire & Mont (2010) (based on a study conducted on Swedish companies) the thesis will address the possible best practices for the implementation of socially and environmentally responsible procurement (Figure 27).

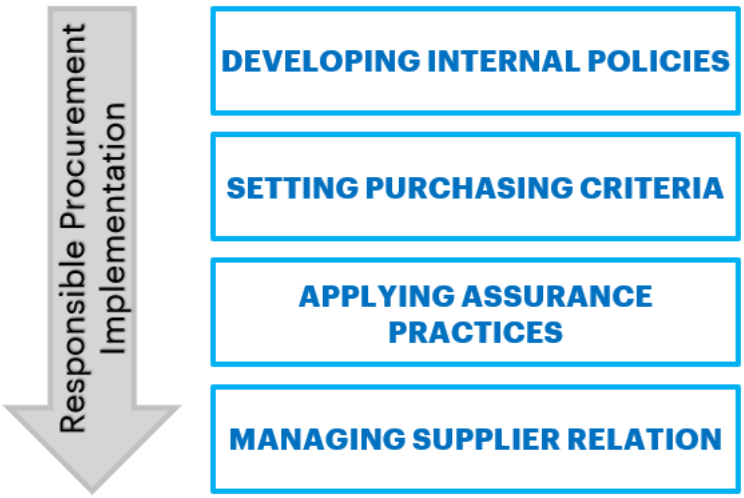


Figure 27. Responsible Procurement Framework. Personal Elaboration

Developing an Internal Policy

Companies develop internal documents that include social and environmental aspects, such as purchasing policies and code of conduct. These documents are usually attached to procurement contract and can comprehend attending courses and benchmarking. These internal policies can be developed based on conventions and standards approved by UN Guideline and Code of Conducts, ILO (International Labor Organization) as well as more sector-specific associations. Environmental policies for instance can be related to the source of products that reflects the most benefits in terms of environmental impact and have the highest rate of reusage, meaning that the product can be easily recycled and reused in other different or complementary processes.

Companies policies can be centered on assessing the environmental impacts of the product sourced and underlining the engagement of employees and raising their awareness upon social and environmental topics.

Developing and Integrating Purchasing Criteria

Another practice is to set, from internal policies, purchasing criteria that are then integrated into technical specifics of the sourced goods. Major aspects of these criteria concern working conditions, child labor, diversity and inclusion practices, health and safety, discrimination, legal compliance, corruption, product labelling and so on. It is important to state that these criteria tend to be very different according to the different countries. Companies can make vendors aware of sustainable purchasing guidelines: it is becoming important for companies to send a clear message to their vendors and so selecting those that respect the focal company's requirement. Among the purchasing criteria, companies should consider not only short-term benefits and costs, but considering also long-terms benefits; firms can define criteria giving priority to suppliers that have already in place policies that support labor practices or give preference to local suppliers.

Although the need of defining purchasing criteria, sometimes companies find it difficult to understand which information must be considered for these criteria, since all possible impacts and effects of materials it is not known yet. Some companies, for this reason, collaborate with International Organization for Standards in developing new international standards.

Assessing Practices

Assessment of practices involves the auditing of suppliers, some companies audit only critical suppliers, some other assure the implementation of practices for all suppliers. Some examples can be IKEA that audits around 1300 of its suppliers at least once a year; contrary SKF audits

only the critical ones which are around 200 for which the company has defined procedures and requirements for evaluation. However not all companies have the resources to audit suppliers and most of them rely on the information disclosed by suppliers. For supplier auditing, companies can use internal or external auditors or even both: for local suppliers, internal auditor can be used, while for distant suppliers, external auditors can give more credibility and help verify the information collected via internal auditors.

In practice company's buyers rank suppliers basing on a scorecard and if the score is below a predefined range, corrective actions take place; if instead, some violations are detected, the company can decide to conduct audit on site (that can be internally or externally driven) or even decide to terminate the relationship.

From the point of view of suppliers, meeting CSR expectations of a company allows suppliers to be included in strategic sourcing decisions, for being better positioned among their competitors, for controlling results and communicate them to their own clients in order to increase reputation in the supply chain.

However, the audit of supplier is subject to some issues and problems. The auditing practices can be subject of bribery or corruption that can alter the results of the audit due to differences in cultural, environmental and social standards. According to SKF, there are problems of verification of information that are presented to supplier. This happens especially in countries like India or China where regulations upon working conditions or environmental impact of operations are less strict than other countries; documentation especially regarding accounting not always can be considered as reliable, that is why audits started to became unannounced (Leire & Mont, 2010).

In order to reduce fatigue of auditing practice, companies can, instead of creating custom-made code of conduct, use standards such as SA 8000 or BSCI (Business Social Compliance Initiative) that may cover the requirement outlined by the company since they bundle a wide range of best auditing practices. Some suppliers may have already received audit from other focal companies and may have already complied with required standards, so these results should not be validated again, speeding up the audit and focus on still to be achieved objectives. Suppliers can be classified according to the level of risk they represent for the buying company; for instance, according to the inherent risk for regions and industries (such as macroeconomic situation, wage structure, unemployment rate) and to the risk that individual suppliers represent, based on previous audits. Finally, companies can focus on improving suppliers' approach to a social and environmental approach to procurement, helping them to reach standards required and rewarding them improving their return on investments with additional sales.

Supplier Selection and Relation Management

Nowadays only few companies build long-term relationships with their suppliers. In today's world a company cannot be competitive without working closely in collaboration with external suppliers (Gurel et *al.*, 2015); it is important for companies to pay particular attention in identifying and selecting critical suppliers, because this process has critical impact on competitiveness of the whole supply chain. Apart from the common criteria for supplier selection, which are cost and quality, also green issues should be considered since they play an important role in sourcing. Below, follows a description of the different criteria adopted during a conventional supplier selection and a sustainable supplier selection in order to highlight which drivers are integrating the usual criteria of supplier selection.

- *Conventional Supplier Selection*

  In the context of conventional supplier selection literature agrees that the three main drivers are cost, delivery and quality. Stevic, in this sense, proposed a review of literature of supplier selection criteria, identifying as main drivers cost, quality and delivery (Stevic, 2017). Cost includes the price of raw materials that the company will source form suppliers; it involves not only the mere cost of raw materials, but also the transportation cost due to the different transportation modalities available. Delivery is the driver associated to the order fulfillment which is considered as very important to achieve competitive advantage. The fulfillment of the order consists on the optimization of the phases in which the order is received and then delivered to the buyer organization; this driver became critical when customers require just-in-time inventory. Lead time is another fundamental component of the delivery driver. The quality driver is then referred to the quality control and assurance (Gurel et al., 2015). Quality deals with optimization of resources in order to satisfy suppliers' customers and be consistent with their policies. Quality is also referred to quality management, in particular to programs of continuous improvement, support services or certifications. In a study by Hou and Su (2007) quality has been identified also in integration of technical and design level and reliability which are factors that cannot represent however the quality of product itself (Hou & Su, 2007).

  The service criteria is referred to the ability of supplier to satisfy buyers' demand (Molamohamadi et *al.*, 2013). The service driver can be thought in terms of responsiveness at changes in demand, stock management and design capabilities.

Another criterion for supplier selection has emerged in literature is the possibility to form strategic alliances. Strategic alliances are defined as an agreement through which companies cooperate to reach common objectives thanks to an implementation of a successful plan. The evaluation to form a strategic alliance is determined also by the willingness of the supplier to share information and on its understanding of focal company's culture and policies.

- *Sustainable Supplier Selection*

  Research upon environmental and social factors in supplier evaluation and selection is increasing. According to these researches, including more environmental evaluation criteria in supplier selection will lead to the choice of more compliant suppliers (Green, Morton, & New, 1996). These criteria have been grouped by Noci (1997) into four categories: (1) green competencies, (2) current environmental efficiency, (3) supplier's green image and (4) net lifecycle cost (Noci, 1997).

  Then, criteria have been also distinguished into qualitative and quantitative criteria. Quantitative criteria may include waste rate, emissions, natural resource depletion, energy consumption. In monetary terms, the adopted criteria refer to pollutant costs/effects and improvement costs; in terms of waste-related criteria, they may refer to gas emissions, air and water pollution; regarding natural depletion, the criteria refer to depletion of mineral, plant, fossils and similar resources. Qualitative or intangible criteria are more related to company image and reputation and their application depends on the weight given to each one depending on its importance to the organization or industry and total points score obtained on the bases of the measured parameters (Awasthi & Grzybowska, 2014). Within these qualitative criteria can be found: management competences (environmental partners, reputation, senior manager support); green image (green market share, stakeholders relationship); design for environment (recycle, reuse, remanufacture); environmental management system (Environmental certification – such as ISO 14001 –, environmental planning, environmental policies); and green competences (clean technology availability, environmental friendly material).

  Although the environmental issue has been added to the procurement function quite recently, the Environmental Management is a quite old topic and many developments have been reached until today. Numerous guidelines and certifications have been issued

during the years, for instance EUP (Energy Using Products), RoHs (Restriction of Hazardous Substances) and the most famous ISO 14001 (International Organization for Standardization) and companies are trying to comply with.

As far as social criteria are concerned, the increased awareness of companies regarding mad companies more concerned about problems such as safety, working conditions, wages, diversity and inclusion, human rights and child labor. The pressure from top management (which we recall here is a fundamental driver for the implementation of responsible procurement) and stakeholders are forcing organizations to include these aspects when selecting suppliers.

Examples of social criteria to be included are health and safety practices, social responsibility (such as supporting long/short term social projects), educational infrastructure, employment practices in particular related to working conditions and facilities (Carter, 2005).

Other important practices that fall into the category of *Supplier Selection and Relation Management* are the implementation of tools and procedures and the definition of *Risk, Opportunities and Innovation.* The former one involves the development and application of procurement tools and procedures such as questionnaire, checklists and RFP, and evaluation tools, to standardize operations and support staff in implementing sustainability measures for purchase. The latter one (risk, opportunity and innovation) is related to the conduction of an analysis to understand short- and long-term risks and opportunities in the supply chain and to gain an understanding on how to mitigate risks and seize opportunities. Companies can in this sense develop strategies to leverage innovation in procurement, and this can be done for instance by piloting clean technologies or circular economy products (Reeve Consulting).

In the above framework the practices for the implementation of responsible purchasing have been outlined. The framework expresses what could be the steps towards the implementation of responsible procurement practices; but all these practices, especially supplier selection and relationship building, must consider the level of risk intrinsic to the supply chain, which will be the subject of the next section.

4.4. Supply Chain Risks

Over the past decades, an increasing amount of companies have taken further steps into updating their procurement criteria by including factors that goes beyond basics of price and quality. The focus on sustainable procurement is extending to different areas, from understanding deeply how existing materials can be recycled and reused, to reducing sourcing requirements and pursuing deeper supplier partnerships that drive innovation (Accenture, 2019).

This focus can lead to an increasingly close relationship with suppliers, with the aim of improving risk management capabilities – which can space form risks for customers first and then for company's brand. Screening suppliers using sustainable criteria can detect suppliers that may pose reputational risk on (think about a manufacturer that uses toxic materials); regulation and evolving customer preferences are factors that are nowadays shaping procurement rivers, as well as investors that are increasingly considering sustainability-related metrics in allocating their portfolio. This is why risk is becoming a crucial factor to be considered when evaluating the decision of building relationships with suppliers.

According to the Eventwatch Annual Report (2018), in 2017 the number of shutdowns of supplier sites due to pollution control enforced by Chinese government has been 86.000, moreover, outsourcing of more functions, globalization and a broader awareness of reputational, legal and ethical issues have contributed to increasing the complexity of supply chains, leading to a greater exposure to risk. Supply chain risk refer to external risk, which is typically outside company's control: it involves the environment with respect to the change in price of commodities or natural disasters, labor laws, policy and macroeconomic uncertainty and exchange/interest rates. Consequences for companies are related to losses in productivity, increased cost of commodities, a decrease on product quality, brand reputation and damage and direct loss of sales.

Suppliers can be screened among a broad range of potential risks, that will improve the supply risk management capabilities of the company. These capabilities are enhanced by a combination of policies, processes and digital solutions that allow access risk profiles of suppliers and inserting each supplier's risk among the awarding factors for supplier selection.

As far as digital solutions are concerned, the company EcoVadis was founded in 2007 in order to address the needs of Procurement Executives who were looking for reliable Sustainability indicators on their suppliers. EcoVadis is the most trusted provider of business sustainability ratings and is helping companies of all sized and industries to benchmark and drive improvements.

All companies are increasing their interest in sustainability, therefore are trying to improve company's practices or the sustainability performance of the entire supply chain. In addition to

reducing risks and costs, companies are uncovering new opportunities and reimaging their business models in terms of environmental, social, and ethical performance. However, in assessing all the sustainability practices of the supply chain, companies have to monitor each supplier across industries and geographies. Each region has its own regulations and languages, and each industry has its own labels and certifications.

4.4.1. EcoVadis: a digital tool for evaluating Suppliers

Each supplier may face a growing list of standards and customers with similar concerns, but each of them with them on questionnaire, therefore it may be difficult, or the focal company to receive feedbacks from suppliers.

In terms of digital tools EcoVadis offers a common platform, along with universal scorecard and performance improvement tools which are part of the assessment model developed by the company. This assessment model value seven management indicators for sustainability across 21 sustainable criteria (Figure 28 and 29) in four main themes: Environment, Labor and Human Right, Ethics and Sustainable Procurement.

Figure 29. EcoVadis 7 Indicators. Source: EcoVadis.com

Figure 28. EcoVadis 21 Criteria. Source: EcoVadis.com

Suppliers receive an online questionnaire customized questionnaire based on the industry of which the supplier belongs, country of operation and size. The assessment takes into account company's own documentation, third party's documents like certifications and an AI-based engine that monitors news, watchlists and databases. Results are then published in an overall scorecard along with benchmarks, detailed feedbacks on strengths and possible improvement areas in each on the four main areas.

Moreover, the company offers a complete service of solutions to companies sch as supplier selection strategies, roll-out planning, buyer training, procurement process integration and supplier onboarding. The service offered by the company can be scaled globally and helps partner companies to reduce supplier risk.

Basically, on the buyer's side, EcoVadis offers sustainability risk and performance monitoring tools for global supply chains; practically it offers CSR scorecards through which the companies can reduce the risk to brand image and reputation preventing fines, and overall exposure to damage. It allows to meet stakeholders' expectations, being more transparent on CSR issues and finally allow for integration of suppliers into the innovation process for new solutions.

Buyer's platform (Figure 30) include dashboards to monitor performance of the entire portfolio of each buyer or category. It allows to create reports, export data and manage performance goals; buyers can compare supplier performance by choosing the preferred category or filtering by country, see improvements needed per area and schedule corrective plan.

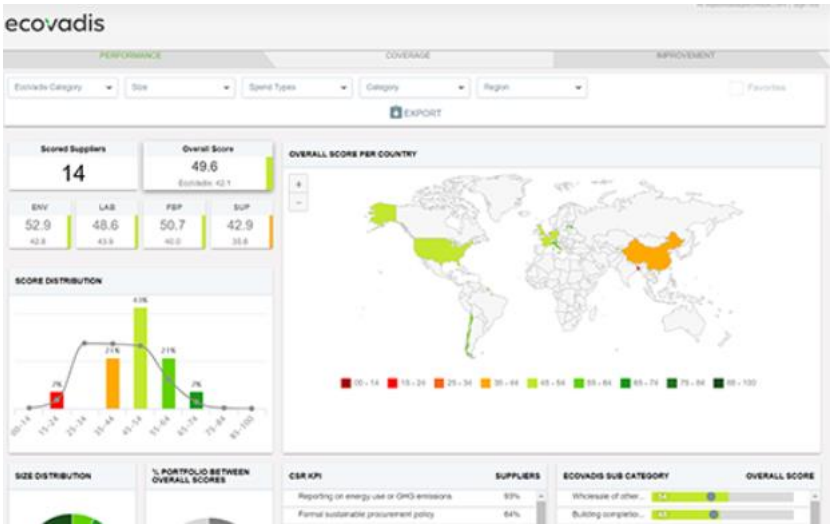


Figure 30. EcoVadis Buyer's Platform. Source: EcoVadis.com

On the suppliers' side, the CSR platform offered by the company, avoids reviving multiple questionnaire from different clients (sometimes duplicated) leading to lack of feedback by suppliers. Each supplier, as soon it receives the questionnaire, which is customized to the sector, size and country, can fill it online, then after the feedback is received, the supplier can monitor

its performance through CSR scorecards, which can be shared with clients or internally (Figure 31).

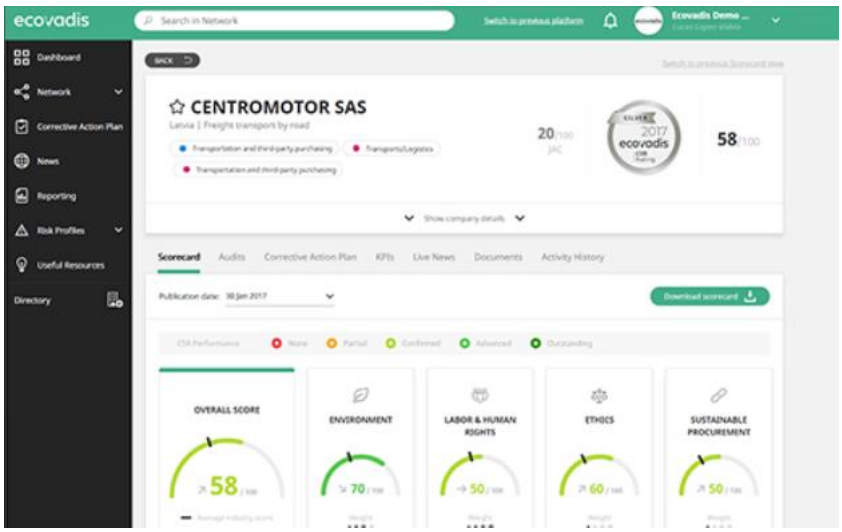


Figure 31. EcoVadis Supplier's Dashboard. Source: EcoVadis.com

Some big corporations are using EcoVadis ad a tool for suppliers' audit and performance measuring in terms of CSR. Nestlé for instance considers its procurement function as a fundamental contributor to company's value. Its responsible procurement activity is involving the assessment of first tier suppliers promoting continuous improvement in sustainability and human rights area. Over the last four years the company has assessed over 80.000 suppliers and today, more that 99% of suppliers are engaged in social and sustainability practices and are also engaged on applying corrective plans where needed.

Moreover, the company has adopted a multi-tier supplier approach, by selecting suppliers tracing from the origin of the supply chain, from farmers or plantations; for each raw material the company apply responsible sourcing criteria to evaluate and select these suppliers, from the first tier to the origin of the chain. Nestlé partnered with EcoVadis since 2015 started implementing the tool for indirect materials performing 700 audits (Marco Goncalves – *Senior Vice President and CPO at Neslté*).

According to Cristian Galichon, CPO at LVMH, one of the pillars of sustainability strategy is transparency in Supply Chain. Through EcoVadis, LMVH can benefit from a mapping of suppliers who are at risk and rank the suppliers can help the company focus to critical suppliers and which of them are at risk and which further action is needed like audits or remediation plans to keep everything under control.

The company aims at developing closer relationships with suppliers by helping them implement and comply with social and environmental vest practices, while raising awareness and providing training on sustainable development and responsible purchasing issues. In 2017, LVMH joined EcoVadis platform to strengthen upstream CSR evaluation of Suppliers.

As a final example, Henkel (which generates 20$ billion of revenues in 2018) one of the main global player in three business units, adhesive technologies, laundry and home care and beauty care. Sustainability is considered as one of the core values, and sustainable practices are fundamental not only for Henkel's operations but for the whole supply chain. Last year, the company performed its own audit program to evaluate suppliers' conformance to the company's requirements; with the environmental and social aspects becoming more important, the Henkel needed to address these topics on the entire supply base.

Since the company is a global player, it was fundamental to have a scalable program in place. Eco Vadis, through customized questionnaire, provided transparency and proof of suppliers' performance, driving performance and allowing to add more and more suppliers to Henkel sustainability program (called Together for Sustainability – TFS) and going beyond Tier I supplier creating impact on the value chain. This platform allowed dialogue for innovation with suppliers creating then competitive advantage (Katrin Feyeraband – *Head of Responsible Sourcing at Henkel*).

Sustainability represents for Henkel not only a core value, but also represents additional business opportunities, therefore the company decides to choose EcoVadis to see best practices becoming standards and creating an impact on the value chain.

These large corporations decided to implement a digital solution in order to implement a socially and environmentally responsible evaluation of their suppliers. The environmental and social issues have gradually broadened their scope touching procurement of companies. Companies are inserting among their qualitative criteria in suppliers' selection environmental management competencies, environmental image of suppliers, development of products with high environmental performance, environmental management system and environmental competencies. As a matter of example, companies prioritize ISO 14001 certification as a requirement for selection and maintenance of suppliers (Jabbour & Jabbour, 2009).

In this chapter the thesis has examined the ongoing trend in Procurement, in particular responsible Procurement that deal with the introduction in selection and evaluation of supplier of sustainable and social criteria. Companies are inserting among the criteria used for selection of supplier, factors that involve also the proactiveness and engagement of environmental and social issues, ranging from labour conditions, diversity and inclusion among workforce to eco-labelled products and responsible sourcing of raw materials.

5. Chapter 5. Conclusions

The thesis has showed how the role Procurement has changed from being merely a simplistic function, to becoming a core part of each organization. It is not surprising than a great number of articles has focused on this topic especially in recent years when it has gained lot of attention. An increasing attention is being given also to the adoption of latest technologies, like Machine Learning, Robotic Process Automation (RPA) and Artificial intelligence to procurement. Companies are trying to discover more and more about how to use Big Data and leverage these technologies. Although this task is not so simple to complete, some big corporations managed (even if on a small scale) to adopt digital technologies. The Case study of Maersk in particular shows how the company has successfully implemented and combined RPA and Artificial Intelligence, for automation of repetitive tasks and for handling spreadsheets and paper-based work.

Not all companies, can exploit these advantages, due to size, financial resource constraints, lack of technical competences. However, the possibilities that these technologies can enable and the possible benefits that companies can get from them are still to be fully discovered; this vast landscape is in "exploration", meaning that companies (especially larger ones) are trying to obtain required competences to manage and implement latest technologies, therefore the outcomes may seem not too distant even though a big effort is still needed.

For what concerns the Responsible Procurement adoption, the adoption is not so widespread: only in the last three to five years the focus upon social and environmental issues has intensified and companies are paying more attention to it, even though on a small scale. This raised concerns involves especially the sources of raw materials and labor conditions of employees.

In this sense, a broader emphasis of research could highlight the benefits that the adoption of responsible purchasing practices can give to companies, in order to understand better what the returns can be of being "greener" and paying more attention of social issues. Moreover, with the help of digital technologies, implementation can be even easier, increasing the range of activities of benefits and activities that companies can do to monitor and select their suppliers and leading to the building of a closer relationship.

Digital tools and technologies are reported to be helpful for companies especially when it comes to managing supply chains. In particular, the EcoVadis tools can provide big benefits for the companies that decide to subscribe to this kind of service. These benefits impact not only the company that is requiring evaluation for suppliers, but also the companies that are subject to the assessment.

Firstly, companies who request an assessment from their suppliers can monitor the CSR performance of their trading partners and manage the risk related to each of them. Companies can promote transparency along the supply chain o CSR practices by relying on global benchmarks and ratings; companies can have an overview on which are the key sustainability issues across different countries, but, more importantly, which are the most important regulations, laws, key KPIs and improvement areas. Finally, companies can drive continuous improvement on CSR practices and foster innovation.

Benefits does not come only for assessing companies, but also for companies that are being assessed. Companies that are assessed can have a clear view of where their CSR commitment is positioned comparing to industry and regional benchmarks. Moreover, achievements can be shared easily with partners even outside the network. EcoVadis tools allows also to instantly update the network on corrective actions needed and reassessments.

In the buyer's perspective, adopting this digital solution require contributions from different departments. With EcoVadis platform the Sustainability department takes the lead, however, several other departments, from the HR to IT, from Purchasing to Security, must contribute in providing the documentation needed for the questionnaire. This can be an advantage to identify all key information and key people inside the organization that can provide the data.

However, the definition of selection criteria, meaning the decision of which criteria to use to select which suppliers are going to be assessed and which are not, is a process that involve several departments inside the organization. The involvement of different departments, especially in large companies can slow down the entire adoption process, especially if sustainability and social issues are not among the core values of the department.

From the point of view of Suppliers, the digital tool offered by EcoVadis (like some other digital tools), come with different subscription prices according to the size of the organization. For each size range of the company, there are three levels of pricing, which is a very flexible solution. This may be one of the possible obstacles that buyers may find while promoting the implementation of EcoVadis to their suppliers; suppliers may find the adoption of this digital tool too costly compared to their size, especially if sustainability and social issues are not considered fundamental (or considered at all) by these vendors. For this reason, it is important for buyers to state if the implementation of the solution is mandatory for suppliers or optional. In the second case, suppliers may not be willing to fill in the questionnaire, since it is considered as optional by the buyer, they may not have incentives to complete it. Moreover, they may not be willing to receive on-site audit by EcoVadis, actually, part of the EcoVadis assessment is about receiving on-site verifications, which are performed by a third-party actor, once an assessment is completed.

As a final consideration, it is important to state that, when companies consider for their suppliers the adoption of such tool, they should take into account the possible barriers that can be encountered. For this reason, it is fundamental that the roll-out of the program of responsible procurement and the supplier onboarding process, evaluating what they need to consider during RFP campaigns, what are the key success factors to ensure program success, and, most importantly, explain effectively which the key benefits are of integrating EcoVadis.

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