

A few significant parts of the book published in Italy by Franco Angeli:

## **The fourth industrial revolution: towards the digital supply chain**

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The future of public and private procurement in the digital age

370 pages, 16 chapters , 15 different authors

As the right to translate the book in other languages belongs to the Editor, we have translated only some parts of 6 chapters omitting the footnotes page

Giovanni Atti  
Past President of ADACI



## Preface

For some years we have entered the digital age where everything is connected: machines with machines, people, machines and products, and where the intelligent enterprise is replacing that of the post-industrial era of the 80s. The fourth industrial revolution is transforming once more the company, which becomes more digitalised and integrated with customers and suppliers, and the procurement which increases its role as producers of innovation and added value. ADACI, the Italian Purchasing and Supply Management Association, in its role of learning and development community across all sectors of the economy, closely follows these developments and on the occasion of its 50th anniversary, gives some indications about the future of public and private procurement. There are many studies and researches that talk about the digital supply chain and the procurement process of the smart enterprise, many are the assumptions made, but no one is, for now, able to define with certainty what their connotations and processes will be in the large, medium and small business. We are in fact only at the beginning of the digital age, some of the enabling technologies are not yet mature and lack of technical and regulatory standards common to the various sectors of the economy.

And it is precisely this situation of uncertainty that has prompted the Association to promote a survey both nationally and internationally and to involve, in the preparation of this book, important people of both the economic and educational system. Many authors, different ideas and solutions to be compared and analyzed. The introduction is by Vincenzo Boccia, President of Confindustria (the Federation of the Italian Employers), an organization that is favoring the introduction of the enabling technologies of the new industrial revolution. The first chapter is dedicated to the knowledge of these tools and underlines how their adoption (more or less extended) by suppliers is not an option, but a necessary choice in a context in which all the developed economies are moving in this direction. The second chapter analyzes the future of purchases, the connotations of the digital supply chain in large, medium and small businesses, and the new type of relationships that should be established with key suppliers. The third chapter, dedicated to the future of the profession, is written four hands by two eminent academics of the School of Management of the Polytechnic of Milan, the first Italian university to have introduced regular courses and teachings on purchasing and supply management.

The following chapter entitled "The 4.0 approach as an enabling factor for the Supply Chain Event Management" analyzes the ways in which the enabling technologies allow to optimize the management of significant supply management events. The fifth proposes to analyze how lean thinking, characteristic of lean management processes, can be applied to the digital supply chain.

Taking into account that the digitization also affects the public administration and that the new procurement code, in addition to the awarding process, also deals with the issues of procurement planning, procurement plan and contract management, reducing the gap between private and public procurement, it is worthwhile to have an overall picture of the new public procurement and to talk about the opportunities and challenges proposed by

the new legislation. The results of a survey conducted by the Association and the point of view of some foreign associations on the future of purchases are then presented.

To confirm the pragmatism that distinguishes the various activities of ADACI, the book ends with the presentation of some case studies.

The President of ADACI  
Fabrizio Santini

## **Introduction**

The first industrial revolution mainly involved the textile sector with the introduction in 1784 of the mechanical frame and the exploitation of the steam energy. The second one, begun in 1870, saw the debut of electricity and mass production. The third, characterized by the introduction of electronics and information technology in the businesses, is conventionally traced back to the '70s, while the fourth, known as "Industry 4.0", saw its debut in 2011 and it is focused on a set of digital technologies or enablers that are generating new production paradigms.

Although it assumes different connotations in different countries, Industry 4.0 is substantially characterized by technological applications such as "Internet of Things" (IoT), Big Data Analytics, Collaborative Robotics, Additive Manufacturing, Digital Factory, Cloud Computing and Cybersecurity. Every industrial revolution has brought with it radical social and economic changes, has increased the productivity of companies and the quality of their products, and has allowed man to no longer have to depend on his own physical strength.

The fourth revolution, which has just begun, is first of all a cultural, social and economic transformation made possible by the global use of the Internet and by the real-time dissemination of information. It is a pervasive and unavoidable revolution based on the digitization and the continuous innovation.

The industrial aspect of this great transformation is secondary compared to the cultural change that it generates. The decision not to adopt the new technologies by a number of organisations will not change the evolutionary trend in progress.

Having said that, it is worth pointing out that the goal of increasing the competitiveness of our manufacturing industry, which generates 82.3% of exports and 72% of research and development, but which in terms of competitiveness languishes at 28th place in the world ranking, is mandatory.

The digital world and the physical world of the company operations converge; the high-tech sectors dominate the global production scene and each country tries to increase its competitiveness.

To understand how this new revolution is first and foremost a cultural change, it is worth considering some of the factors that characterize it, namely the Internet of things, robots, driverless cars, drones, big data and their unlimited applications. Internet of things or intelligence in the heart of every product, connects people, businesses and objects to collect consumer feedback and improve service performance and quality. The robots, as well as being devices to reduce time and costs of production processes, are also mechanisms that allow activities and checks of all kinds. They reduce employment with low added value but allow small businesses and smaller economic systems to increase production output to compete with economies with high market demand.

Driverless cars will soon be on our roads, Google is well on track. General Motors, Mercedes, BMW, Audi, Volvo and Volkswagen have long been conducting complex and expensive tests in this field. Uber is developing a fleet of taxi without driver. DHL, UBS, Amazon and other logistics operators are specializing in drone freight transport. Alex Ross, former head of innovation at the US State Department, points out that "The use of drones and autonomous cars will not depend so much on overcoming the inevitable technological and legislative constraints, but on the fact that man accepts the disruptive changes that these lead."

A series of digital technologies has arrived almost simultaneously to maturity and constitutes what many call the "revolution of revolutions": a more complex transformation of the previous three. These tools allow for more efficient and effective factories and organizations, allowing vertical integration, from the project to product assistance, and horizontal, from the customer to tier one and tier two suppliers, ensuring greater visibility, productivity and awareness of what it happens. They are however "scalable" or adoptable in progressive phases.

The nature of this revolution reduces the boundary between manufacturing and services, with a growing involvement of manufacturing enterprises in service activities. The impact of digital technology is in fact changing customer behavior, shifting consumption patterns from a product (purchase) logic to a service (use) one.

The changes and transformations of this new industrial revolution will generate great opportunities, but also problems. Just think of the difficulties in adapting both public and private organizations; the increase in the socio-economic gap between the population aligned with the new culture and the one that for various reasons does not erupt, the fragmentation of society and the reduction of jobs associated with labor-intensive activities. The way in which the strategies of the sector will be addressed and the more or less widespread application of the enabling technologies will determine the role that our country will play at international level.

Confindustria divides the innovators into four categories: structured, moderately structured, not structured and not innovative. The most structured innovators generate new or significantly improved products in about 61% of cases, against 43% of those on average and 35% less structured. For this category, technological innovation is almost always accompanied by an organizational innovation (around 80%), including commercial and

marketing strategies (74%). In the most complex processes innovation concerns the entire production chain, while in less complex paths only some company functions are involved.

To accompany Italy towards new technological frontiers, our government has prepared the Industry 4.0 plan: the first real national economic development project of the last twenty years, which should allow our companies to re-engineer their management and production processes, creating a close connection between customers and suppliers, and constructive relationships with universities and research centers. Among the specific objectives of the plan it is appropriate to remember:

- the dissemination of knowledge of digital technologies and their application advantages;
- the support to companies in identifying priority areas of intervention;
- the creation of support structures for digital transformation;
- the creation of enabling infrastructures such as the ultra-broadband plan and the development of the 5G.

The plan provides for the organization of a national network consisting of the Digital Business Points, the Innovation Hub and several Competence Centers. **It is not so much the size of the company that makes the difference, but the professionalism and the vision of those who drive it.**

We need to build a synergistic ecosystem where the leading company guides and supports the various links in the chain. We need a partnership between public and private, between companies, universities and research centers. In the opinion of Alessandro Perego, we need a strong control room with adequate political support, which knows how to share the "plot" of digital development with all the actors. With the Calenda plan (Italian law), industrial policy has returned to the center of the Italian government's strategy to favor the transition of our businesses to the new industrial reality. It must not however be reduced to a simple tax rebate, but must be an incentive for a rethinking of our industrial system.

The President of Confindustria  
Vincenzo Boccia

## Chapter 1

### **The smart enterprise and the digital revolution**

by Giovanni Atti

#### 1. Introduction

For some years there has been much talk of the fourth industrial revolution. Some describe it as a disruptive transformation, others as a normal evolution of the production paradigms of the last decades. It is not appropriate to discuss here whether it is a disruptive phenomenon or a progressive transformation, but it is clearly limiting to talk of simple production systems. However, it is certain that in the last decade a series of high potential digital technologies has reached maturity at a reasonable cost, allowing solutions also accessible to SMEs. Industry 4.0 is characterized by an ever more pervasive use of data and information, of intelligent applications and of production assets connected thanks to cyber-physical systems and the Internet.

According to some, it was born as a technology-push phenomenon originating from the German industry to recover competitiveness compared to the Asian one, thus facilitating the backshoring of productions, as recently happened for ADIDAS, which brought back the production of sports shoes in Germany.

There is no doubt that the digitalization and advanced automation of European manufacturing reduces the competitive gap with Asian countries, but the fact that China, India and neighboring countries are also promoting the development of the smart enterprise cannot be ignored. The first industrial revolution refers to the use of water and steam as primary energy for the movement of production machines: this is the case of the frames moved by the water of streams and rivers near which the weaving was built. The Second Revolution finds its incipit in the use of electricity, whose introduction has allowed the reorganization of the factory, the birth of the assembly line and the appearance of the mass production.

The third industrial revolution, which began in the 1970s, was characterized by the introduction of the information technology in our companies and organisations. The first Programmable Logic Computer (PLC) was installed on a machine tool and allowed automatic control without the need for manual adjustments and the supervision of an operator. Finally, the fourth industrial revolution concerns the integrated digital management of the business system and the more or less extensive adoption of the so-called enabling technologies: Internet of things, big data analytics, artificial intelligence, wearable technologies, collaborative robotics, cloud computing, augmented reality, 3D printing and cyber security. All this allows the generation of more automated, efficient and safe factories and organizations, in which the man and the machine interact in close contact. Thanks to the government investment plan, our companies can equip themselves with digital technologies and increase efficiency and competitiveness. A path that is not easy, but that has no alternative. Fortunately, various indicators tell us that only 17.7% of entrepreneurs are not yet willing to invest in the smart factory.

We are at the beginning of a new transformation; new efforts and risks, but also tangible benefits that can be summarized as follows:

- greater accuracy of forecasts
- reduction of time-to-market
- increase in customer satisfaction and market shares;
- greater efficiency of technical workers;

- greater productivity and flexibility;
- possibility of introducing last-minute changes;
- elimination or containment of the economic lot;
- reduction of maintenance costs (self-diagnosis of machine wear and predictive maintenance)
- greater plant efficiency (downtime reduction);
- reduction of quality control costs;
- better business climate.

The study by Oxford Economics, presented at Vienna's "Success Connect 2016", shows that the pioneers of digital transformation have 38% financial results above average and personal motivation, thanks to a data-driven approach and a great attention to skills.

**We must learn to ride the unstoppable, innovative and destructive wave of the technology**

Rich Lesser CEO of Boston Consulting Group

## **2. The smart enterprise**

The smart enterprise is the result of the integrated application of all the enabling factors of industry 4.0 to the traditional enterprise. In concrete terms, the intelligent enterprise can be defined as the integrated digital management of the technical, production and logistics processes of the traditional company, generating the connectivity with customers and suppliers and between systems production and products.

**Smart Enterprise: The industrial renaissance of manufacturing**

Industry 4.0 is not a "shelf product", but a new way of managing the company and the business through the adoption of one or more enabling technologies and the digital connection of the existing ICT applications. It is above all a fact of culture. The company's top management roles must be aware of the great transformation taking place, choose which technologies to apply, prepare a modular application project, inform and train the workers at every level and proceed with the implementation of the plan.

It is necessary to rethink the work from a less tayloristic point of view, to question the traditional constraints linked to the place and time of work and to leave people greater autonomy in exchange of greater responsibility for results. In this new model work is distributed, participatory and oriented towards continuous innovation.

We are witnessing a progressive dematerialization of organizations that become more easily reconfigurable, transferable close to the client and less characterized by the physical presence of their actors.

In the era of globalization and social networks, where every piece of information becomes planetary in the space of a few minutes and the consumer determines the success or failure of consumer goods, the customer is increasingly the trigger of growth and development of our companies. In the near future, the speed of delivery, of the execution of processes and of the decisions in general, will become the most competitive currency, the winning management paradigm.

Our economic system is more and more customer-centric and, never like today, interacting with the customer and satisfying its needs, the companies capture and stimulate the market demand by increasing their turnover. Business exchanges are still part of B2B relations, but thanks to the immediate feedback from social networks and the increasing connectivity of the supply chains, the most important inputs are those of the final customer and it is perhaps more appropriate to talk about the B2B relationship guided by consumers (B2B → C).

As already mentioned, we must move to a new culture and in most cases, it is not an option. The executives of the purchases of the main multinationals have in fact estimated in 20% the reduction of costs related to the transition to the new ecosystem and intend to renew their supply base over the next ten years, preferring smart companies.

The functions of the enterprise, which today are poorly synergistic, must be integrated and supply chains must become cohesive, connected and collaborative. Transparency, visibility and resilience must connote the new enterprise system.

The advantage of the connection allows organizations to obtain visibility in real time and to take advantage of the collaboration of all the actors in the supply chain to meet the increasingly dynamic needs of the market. The trendsetters of the smart industry intercept consumer needs through the social media, prepare virtual samples and show them on the social networks to get an early feedback and to reduce the risks and the costs of launching and selling the real product.

Capturing innovation from outside companies develop and enrich content and can create customized products and services in the space of a few weeks. Industry 4.0 is an end-to-end process that involves design, production and distribution, and impacts the integration of production chains and logistics. Industry 4.0 is a process in which research and production can be delegated to interconnected specialists, and information technology management becomes a hybrid between in-house and cloud systems.

**The huge flow of data from digital supply chains changes how, when and where organizations make their decisions.** One of the problems of senior management is to determine who should decide, what decisions can be made and what data is needed to do so. However, there is no doubt about the need to delegate most of the company's operating decisions.

**Smart company = organization:**

- **customer-centric and integrated upstream and downstream,**
- **supported by a digital infrastructure that interacts with software applications of every hierarchical level,**
- **connected thanks to cyber physical systems and equipped with digital technologies,**
- **innovative, lean, fast and with a flat structure**  
(empowerment vs. accountability on results)

### **3. The products of the smart company and the relevant features**

**The products of the future will be smarter, connected, customized, green and servitised.** Intelligent as they will be equipped with more or less complex sensors that will allow them to be located and to diagnose their performance, any faults and their wear. Connected as they will be connected to the user, to the manufacturer or to other objects through cyber-physical systems and the Internet. Customized in their conception or in their mode of use. Green as sustainable and then made with the least expenditure of electricity and with the lowest emission of polluting gases. Servitised as they can be offered as a service at costs related to their time of use (pay x use, pay per availability or pay per result).

| <b>Smart</b> | <b>Connected</b>      | <b>Customized</b>              | <b>Green</b>                            | <b>Servitised</b>                 |
|--------------|-----------------------|--------------------------------|-----------------------------------------|-----------------------------------|
| diagnostics  | With the manufacturer | In design and execution        | Low energy consumption and gas emission | Combined with services            |
| Localisation | With the user         | In fruition and payment system | Recyclable                              | Provided to customer on pay x use |

|         |                    |  |  |  |
|---------|--------------------|--|--|--|
| Sensors | With other objects |  |  |  |
|---------|--------------------|--|--|--|

Servitisation refers to the ongoing trend of the supply market to propose integrated high added value products and services. In some cases, there is no longer the transfer of ownership of the product, but the seller ensures the use of the product. There are two factors that make this transformation possible: the reliability of the product and the IoT technologies combined with it. A current example is the remote maintenance of machines or equipment made possible thanks to the cyberspherical systems incorporated in them. These communicate the state of the machines to the manufacturer who, in case of need, can fix the fault remotely.

### **Product-Service Evolution**

#### **1. Product**

#### **2. Service added to the product**

#### **3. The Service differentiates the Product**

#### **4. Service is the Product**

#### **5. The product is the Service Platform**

The enabling factors or technologies provided for by the Calenda law are:

- advanced management and production solutions;
- additive technologies and 3D printers;
- augmented reality to support work activities;
- simulation between interconnected machines to optimize production processes;
- vertical and horizontal integration along the value chain;
- communication between processes and products enabled by the Internet (IoT);
- data management on open and remote systems (cloud);
- security of network operations and open systems (cybersecurity);
- analysis of the data collected to optimize products, processes, forecasts and allow predictive maintenance (Big Data & Analytics).

Each of them will be analyzed in the following paragraphs.

### **4 Robots and collaborative robots**

The evolution of the machine

The machines have been supporting the man since ancient times. Their importance has always been recognized, but their continuous evolution has aroused antithetical reactions: some have considered and still consider them a threat, others a promising opportunity.

Today, in an era of ubiquitous technology and in the midst of a new phase of transition, we are living in a similar situation, which however concerns smart machines and processes. The current evolution/revolution made possible by the ubiquity of the technologies, is bringing us in era in which machines and equipment can be installed anywhere, even in the human body, robots will become assistants of man and, in the long run, co-workers.

Since the 2000s "service robots" entered the market. They are devices designed to assist and support man. By 2025 they will become valuable collaborators in businesses, schools, hospitals, institutions and organizations of all kinds. This is stated by the European Agency for Safety and Health at Work. A study by McKinsey Global Institute tells us that machines will replace humans in 49% of activities and that those with greater automation potential are the physical activities (81%), data processing (69%) and data collection (64% ). Depending on the application for which it is intended, a robot can be classified as an industrial robot or service robot. The International Robot Association defines an industrial robot as a "reprogrammable multifunctional manipulator automatically controlled with at least three programmable axes, which can be fixed in place or mobile, intended for use in industrial automation applications" (definition taken from ISO 8373: 1994).

Service robots, also called cobot (collaborative robots) are instead intended to assist, accompany and care for man. Born to carry out simple activities, today they are conceived to think, using artificial intelligence. There are two types of artificial intelligence: weak and strong. The weak one involves the use of a device that depends on a software, designed for a specific problem and which operates in a limited application field. Strong artificial intelligence, on the other hand, envisages a device capable of actions or activities that are both flexible and adaptable, similar to those of man.

### Industrial robots and cobots

The robot is a device driven by a computer that performs tasks in substitution of the man in an autonomous and automatic way. The collaborative robot or cobot, on the other hand, is an intelligent device able to interact and collaborate with humans in a shared work space. The operator trains him and he repeats what he has learned. Its ability to perceive or intercept people in the surrounding space makes it safer and more reliable. General Motors, which for years has used these androids in the assembly of automotive components, defines them as Intelligent Assist Device (IAD). The German Institute for Occupational Safety and Health (IFA) defines them as "complex machines that work side by side with the man, within a shared work process, offering support and freeing him from various tasks." In relation to the specific operational needs, each company chooses one or the other. The first documented project of a humanoid robot was done by Leonardo da Vinci around 1495.

The notes, rediscovered in the fifties, contain detailed drawings of a mechanical knight, (cavalryman) apparently able to stand up, shake his arms and move his head and jaw. It is not known whether or not he tried to make a prototype of it. The robots of the future will have the "brain" in the cloud and will be able to learn continuously from big data and information platforms.

Robot and cobot, as well as are devices that reduce time and costs of production and logistics processes. They are tools for diagnosis and otherwise impossible surgical interventions, humanoids that assist the elderly, systems that defuse mines and inspect territories, devices for the home, for the education and training. As anticipated in the introduction, they reduce employment with low added value, but allow small businesses and smaller economic systems to increase production output to compete with economies characterized by high market demand. In the Industry 4.0 paradigm, cobots, often referred to as co-workers, represent a fundamental resource because they are easy to use, reliable and safe.

Although they are automatic devices, they are distinguished by their ability to interact almost human, low speed, trajectories and soft contacts and non-sharp or dangerous shapes. The cobot-operator cooperation can be:

- physics - joint manipulation for large loads or special placements;
- functional - competition of independent, alternating or parallel activities between operator and cobot;
- cognitive - the organization of shared processes provides a certain degree of interpretation of the context.

This combination of mixed agents (operators and cobot), flexible and effective, inserted into the various working cells, increases the competitiveness of the companies that use it. The managerial flexibility is given by the direct participation of the man in the most complex phases of work and control and by the abandonment of the structural and technological constraints of the fixed automatic systems. The problem of "man-cobot" collaboration or integration arises when it is necessary to perform operations that are too complex to be carried out by robots or vice versa repetitive operations in which the precision and reliability of a robot cannot be equaled by man.

Cobots, and for now especially robots, replace humans in dangerous and heavy activities, reduce errors, execution times and costs and increase process safety. Volkswagen has launched a large-scale project to replace men with assembly-line robots, thus eliminating unergonomic activities. The expected cost of robots is € 3-6 / h against a man cost of € 40 / h. IG Metall is not opposed to their use on condition that man commands them and is not subordinated to them. Robotics reduces employment but enhances the man who can devote himself to activities with greater added value and eliminates burdensome and dangerous activities, making factories more sustainable for senior workers and women. The cobots should ensure significant benefits to our manufacturing, consisting mainly of small and medium-sized enterprises that compete thanks to their flexibility and customization capacity.

Research and innovation activities for the development of collaborative robotic solutions have been going on for about fifteen years and have already led to solutions that can be used by companies. "We have worked hard on their safety, but we need to make them more collaborative, ergonomic and suitable for performing "heavy" tasks." The solutions

currently available also have a low production efficiency which limits their use. Our manufacturing industry has good technological skills for the design, and creation of new robot platforms revisited in the context of Industry 4.0, even if the most advanced and significant companies in the sector are Japanese.

In the mechanical industry, robots are mainly used for handling, welding, palletizing, forging, machining and assembly. 35% of existing robots work in the automotive sector, 31% in electronics, 9% in metals, 7% in chemicals, rubber and plastics and 5% in the food sector. 74% of the robots sold in 2016 went to China, South Korea, Japan, the United States and Germany and the total turnover of the sector was 13.1 billion dollars. In the ranking of robot manufacturers, since 2014 Italy is in the sixth place and the turnover of 2016 has been around 700 million euros.

## **5. Additive technologies and three-dimensional printers**

Additive manufacturing or 3D printing is a digital technology that allows you to create three-dimensional objects through the progressive deposition of layers of materials and not for chip removal, as is the case with traditional machine tools. From a technological point of view, it is not a recent innovation. In fact, it was already used in the 80s for rapid prototyping, but in recent years its applications have expanded thanks to the ability to print larger objects in a much wider range of materials: plastic, metal, ceramic, wax, plastic, composite materials, elastomers, photopolymers, etc. and with lower production times than in the past.

Additive manufacturing is the result of the integration of enabling technologies and production processes, made possible by the use of computers with intelligence and high computing capacity.

It allows:

- produce objects with complex geometries in a single piece, with less weight, better performance and less use of raw materials;
- marginalize the costs of creating variants or customizations with respect to the basic model;
- create products with innovative materials;
- creating prototypes without preparing specific equipment (prototyping is essential to eliminate any design errors that only emerge during the execution phase, thanks to the simplification of the prototyping process, there is no longer any need to take precautions with higher prices to cover the risk of unforeseen complexity in the production phase);
- producing at a distance and reducing or eliminating the stocks of certain parts.

One of its most significant limits is that of the dimensions of the components that can be manufactured: to date, in fact, objects with a maximum size of the cubic meter can be

made for plastic parts, and half for metal parts. The use of additive manufacturing is convenient in the following cases:

- When it allows to produce parts with technical characteristics superior to those obtainable with traditional processes (for example turbine blades and fuel injectors for aeronautical engines) or to obtain unique quality standards. This is the case of orthopedic prostheses and components for cars and racing bikes.
- Productions in which the technology is competitive on condition of modifying the design of the object to be achieved without compromising (or improving) its technical characteristics.
- When the 3D printed component costs more, but the additive manufacturing, thanks to its flexibility and speed of execution, without the need for molds or other tooling, allows to "store files" instead of products, with a consequent reduction of capital immobilized in stocks warehouse (spare parts in the plant engineering and aeronautics sectors).
- When it allows to cope with the sudden and unexpected lack of components for online production. In this case, the part itself can be more expensive, but the flexibility and speed of the new technology avoid higher costs connected to the interruption of production.

3D printers develop their strengths in the sectors in which agility and speed of action are decisive, while they are not well suited for large-scale productions based on economies of scale. However, additive manufacturing becomes faster and more efficient and if we consider that the design phase is developed in less time than the traditional one, that assembly is not always necessary and that the supply chain is simplified thanks to a drastic reduction in transport time, it cannot be ruled out that in the space of ten fifteen years 3D printers find application also in the production of medium-large series.

Additive manufacturing is changing the business system as it changes the mix of its production assets, allows "mass customization" and redefines the processes of localization of production activities. It is no longer necessary to send the product from a central factory, you can download the digital model file and manufacture the product next to the customer. A direct testimony comes from UPS, which has gone from simple delivery to the management of assembly and manufacturing operations, equipping for this purpose the sorting center in Louisville, Kentucky, with a hundred industrial printers.

**3D printing**

**A "local production for local consumption"**

Additive manufacturing:

- does not involve adaptations of the "CAD executive mathematics" to the working characteristics of the 3D printer, an adaptation that is instead necessary when using numerical control machines (customization of the tool path to the specific machine);
- reduces the design constraints related to production processes performed with traditional machines;
- reduces the number of pieces to be assembled in various cases;
- has a production cost (almost) independent of quantity;
- supports the creativity of the designer, as it extends the design possibilities for the search for more attractive and distinctive forms.

The additive manufacturing process is divided into 3 phases:

- modeling: every detail of the object to be created is defined in CAD for 3D modeling. A file is then created which subsequently undergoes a slicing process;
- slicing: subdivision of the virtual model into horizontal layers that the printer can create in succession and which are then realized one above the other for deposition of material. The output of this phase is the generation of a file compatible with the chosen 3D printer;
- print or execute the part.

The typologies of 3D printing to date diffused are various and can be subdivided into four basic categories, according to the method used to realize the output:

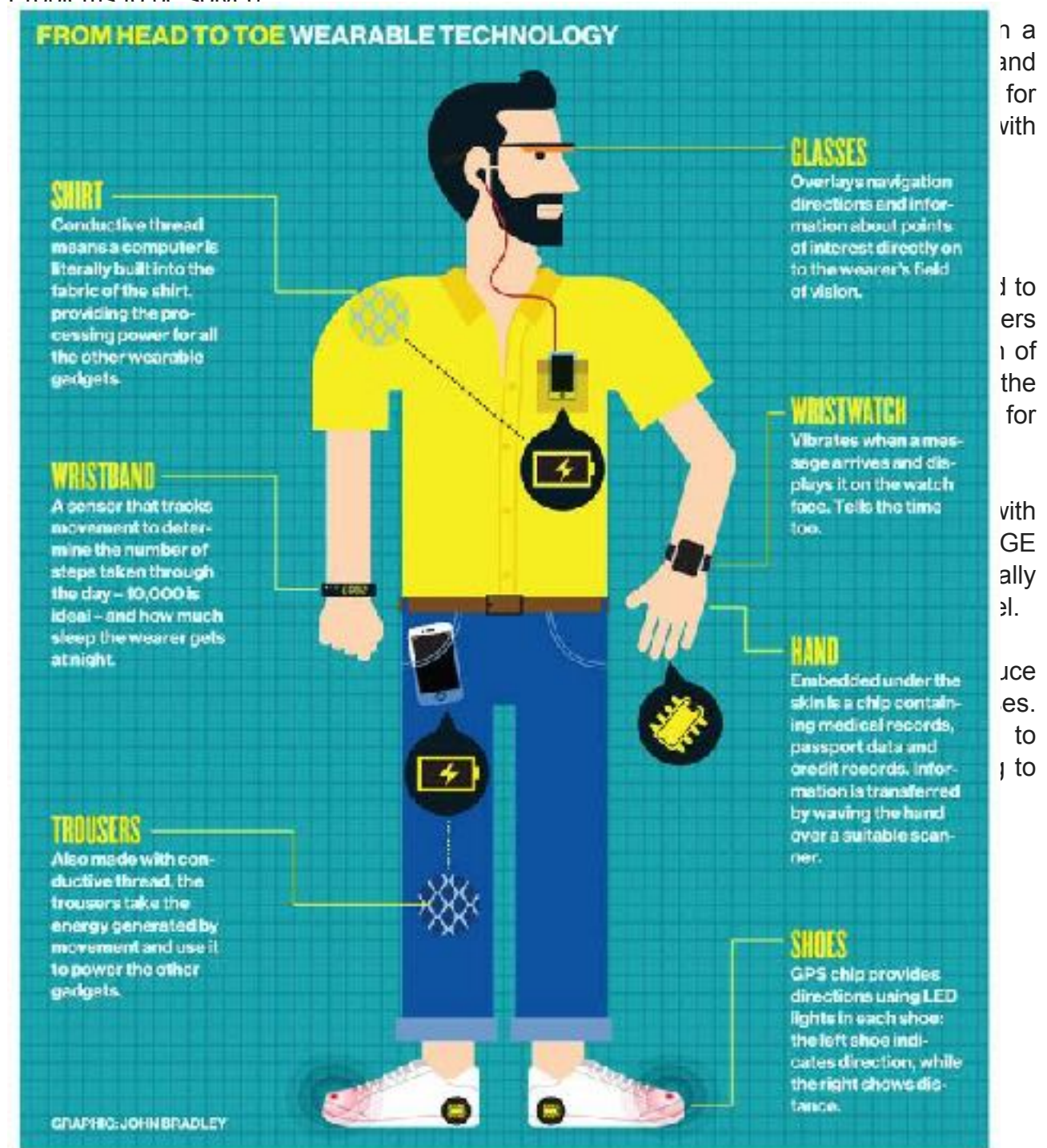
- extrusion technologies: the semi-liquid material is extruded from a heated nozzle and deposited on a surface, layer by layer, to form the object;
- photopolymerization technologies: a liquid polymer is solidified through exposure to a projector / laser;
- granular technologies: a granular material, laid on a support bed, is selectively melted to form a solid object;
- lamination technologies: the sheets of material are overlapped and then carved appropriately.

## Materials used

The state of the materials used changes with respect to traditional processes. In the case of metals, we pass from ingots to extremely fine powders, 45-100 microns, which must be specially produced and subsequently subjected to laser or other sintering processes. In the case of plastics, on the other hand, additive manufacturing requires the production of powders, resins or filaments. The material theme is characterized by two factors of opposite sign. On the one hand 3D printing allows a drastic reduction in the use of raw materials (less waste) and on the other the unit cost of the same is significantly higher

since the processes of powder fusion have a much higher energy consumption compared to traditional processes.

Problems to be solved



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The Digital Factory

The goal of the digital factory is the end-to-end management of the processes of the enterprise system. To achieve this, we need a digital infrastructure or an overall and coherent model that allows or favors the integration of type:

- vertical, in relation to product design and development, production planning, industrial engineering, production, after-sales service,
- horizontal between customer, company and primary suppliers.

We need a platform that, thanks to cybersphysical systems, reproduces in the digital world what happens in the operational practice. The digital factory is therefore a top-level application in the corporate software hierarchy, which interacts directly or through intermediate level applications, with all the application software present in the company, up to the field level, where actuators and sensors are installed. This digital infrastructure varies from company to company in relation to its organizational complexity and type of product.

Its adoption and definition is part of the primary business strategies and must be shared with the various function managers. It allows:

- the interaction with the applications that manage the various business processes, automating, whenever possible, any routine activity and control;
- the management in a coherent and informed way every phase of the product life of products, reducing executive times and time-to-market;
- the improvement of the quality and reliability of products by identifying qualitative anomalies;
- the creation a coherent and complete data structure, overcoming departmental or silos communication;
- to work as a single team acquiring agility, flexibility and efficiency;
- to manage maintenance with scheduling of individual activities;
- to make quick and informed decisions at each stage of the product life cycle based on analytical data;
  - to monitor improvement processes through nominal-effective comparison;
  - to define any corrective actions based on feedback and failure analysis and intervene in a timely and often automatic manner.

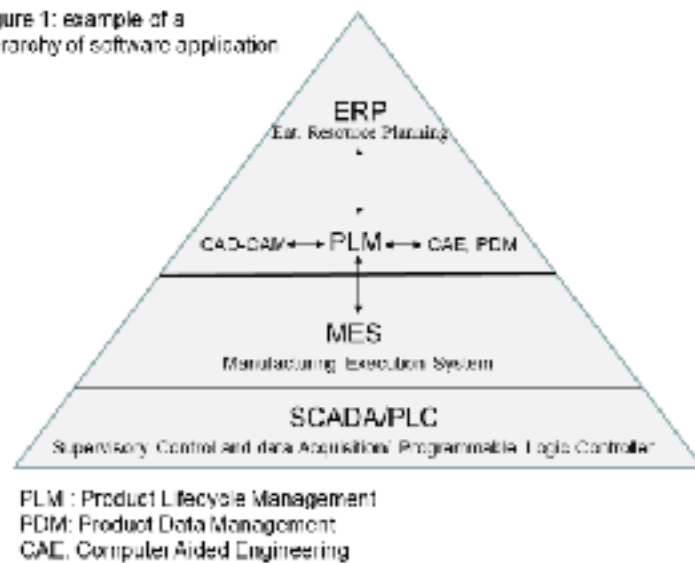
It also allows the smart integration, focused on innovation, CRM and SRM, the smart planning, including supply chain event management and sales cycle management, and the smart execution in design, quality, production and logistics.

It is a platform that integrates various applications in order to manage, view and analyze data to support specific phases of the business, in particular data and events of the product throughout its life cycle. Before being a complex or sophisticated application, it is

an IT strategy that makes it possible to generate a coherent data structure, by consolidating existing applications. **It is a business strategy that allows the company to operate as a single entity.**

With this infrastructure, companies can build a unique and accurate data model and maintainance. There are two types of IT applications common to the manufacturing industry: data silos and between system connection of ERP, design, product lifecycle, MES, SCADA/PLC, MES, recycled. The implementation and realization of business processes of manufacturing (e.g. accounting etc.).

Figure 1: example of a hierarchy of software application



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The platform-focused approach (PLM) is based on a data management strategy independent of individual applications, it has a wider scope and it can address multiple business problems. This allows companies to flexibly define (lean) their own data model, as well as generate specific logic to support "everyday" activities.

The recent potential offered by the Cloud Computing technologies emphasizes the benefits of the digital infrastructure, allowing to allocate operations that require high computational loads to the cloud, using high performance computers (HPC - High Performance Computing). The new technologies allow us to think of a future in which the real world, where the products are made with machines and systems of various kinds, will be replicated in a virtual digital world that will represent the perfect copy. In this sense we talk about Digital Twins or digital twins. It is superfluous to underline that the digital twin will have artificial intelligence and will allow any type of simulation to be carried out on possible variations in production processes associated with changes in the product required by the market. McKinsey believes that digital technologies will radically transform the production departments of our companies by 2025, which must now prepare the basis for this change in order to eliminate their inefficiencies and continue to compete on the market.

Industry 4.0 allows a more modular, flexible and efficient production to cope with the volatility and market dynamics, thanks to a convergence between ERP and the applications of manufacturing. It is a new source of value creation especially for SMEs. Indeed, large companies have already benefited from this type of digital integration. The elimination of digital system inefficiencies improves the potential of the factors indicated below.

- Resources and manufacturing processes:
  - reduction of electricity consumption,
  - elimination or reduction of the economic lot,
  - optimization of yield (productivity),
- use of assets:
  - flexibility of rotation and use,
  - remote monitoring and control,
  - predictive maintenance,
  - augmented reality for repair and maintenance activities,
- work and know-how:
  - man-robot collaboration,
  - remote monitoring and control,
  - optimized digital performance management,
  - facilitation / automation of knowledge,
- stores:
  - made on site with 3D printers,
  - optimization of supply chain flows,
  - reduction of the size of the lots,
- quality:
  - automation of the statistical control process,
  - advanced process control systems,
  - digital quality management,
- harmonization of requested and produced quantities:
  - forecasts supported by the greater volume of data available and by more reliable estimates of customer needs,
  - planning accuracy associated with the value of the parts,
- time to market:
  - customer involvement in the project phase,
  - concurrent engineering,
  - possibility of simulation and rapid experimentation,
- product support:
  - predictive maintenance,
  - remote maintenance,
  - interventions guided / facilitated by augmented reality instruments.

To give rise to the digital factory, the existing ICT technologies must be adapted to the specific needs of design, production and product support and must leave the company boundaries to cover customers and suppliers-partners and create valuable networks. However, it sometimes happens that these have differentiated business models and partially compatible ICT programs. The role of the reference architecture, in these cases,

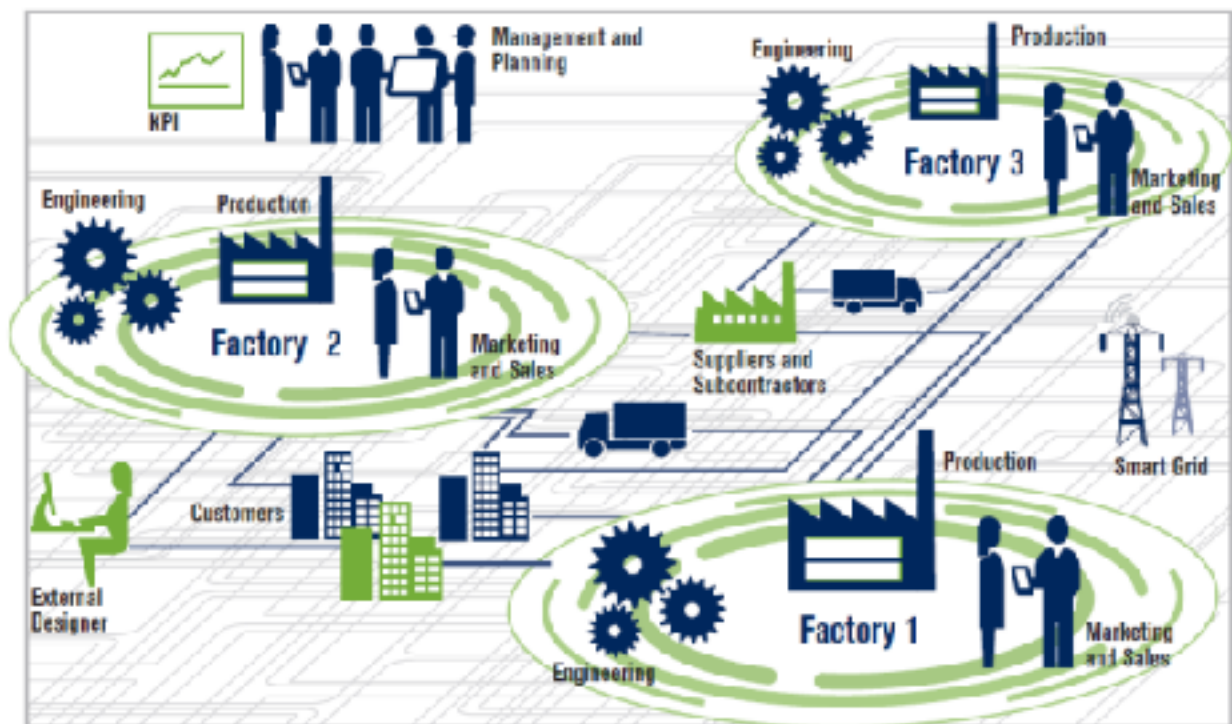
is to harmonize them or to generate a digital infrastructure that interfaces and interacts with each of them.

It should be emphasized that the diffusion of the digital factory in our economic system is subordinated to the standardization of models, cyber-physics systems and applications. Although several standards are already in use in various technical disciplines, professional associations and working groups, a coordinated version of these standards is currently lacking. It is therefore necessary for existing standards, for example in the field of automation (industrial communication, engineering, modeling, security, IT, device integration, digital factories) incorporation into a new reference architecture world-wide.

### Project Simulation and Management Models (Interconnected Machines)

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## 8 La Blockchain



Source: Hewlett-Packard 2013

Exemple of value network

Each company must therefore become "intelligent" both in relation to the activities developed internally, and in relation to the complementary activities carried out outside the company perimeter. These concepts, indisputable and confirmed by a wide literature on a global level; imply however:

- the sharing of medium to long-term strategic objectives between the

various actors of the supply chain;

- the availability of the same to invest in tools and resources to acquire adequate and compatible digital infrastructures;
- the willingness to cooperate openly and constructively in order to foster innovation and continuous improvement;
- adequate protection of intellectual property;
- the adoption of valid cyber security measures.

The sharing of strategic objectives between companies, with different cultures and interests, represents an objective that is not easy to implement, which presupposes, *inter alia*, long-term purchasing partnership agreements. The need to adopt integrated, interactive and secure digital infrastructures implies the need to have transnational standards of reference architectures. Industry 4.0 involves networking and integration of different companies in different countries and this collaboration becomes possible only on condition that a single set of common rules is developed. IT integration is undoubtedly useful, interpersonal integration is essential. Having a digital platform that connects interactively the various actors of the business system, without being able to count on the transparency of relationships, mutual trust and the sharing of research and development results for innovative purposes, is of little use. Innovation and continuous improvement are not the necessary consequence or the product of the enabling technologies.

**Digital is synonymous with business and technology is available to everyone**

Digital technology has the power to generate a convergence among supply chain components: designers, suppliers, manufacturers, distributors, service providers and customers. It stimulates new ways of thinking and working, improving visibility and stimulating innovation.

The connectivity between business-people, processes and products represents the backbone of the new ecosystem. By exploiting the various digital tools, the associated companies enjoy wide visibility, high levels of control and the possibility of interacting in real time with the entire supply chain in every phase of the business. This connectivity or digital transformation in general does not constitute a prerogative reserved only for large companies.

In fact, radical changes are almost always implemented by small-sized innovators who do not have large market shares. The big company is like an aircraft carrier: it needs time to tack. The small company has the right size to try herself in rapid and often significant

changes. Marriott International could have built the AirBnB portal, but it did not. This has been active for four years, it does not have a single hotel, it manages in an indirect way 650,000 rooms in 192 countries and it earns more than the Marriott chain with its 6,000 facilities.

**The business dimension does not matter, it is a question of awareness, courage and determination both of the entrepreneur and of the management. The risk is there, it is inherent to the existence of the company and must be managed.**

## **10. Communication between production processes and products enabled by the Internet (IoT)**

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## **11 Data management on open and remote systems (cloud)**

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### **Advantages of cloud computing**

- Reduction of initial fixed costs (investments in hardware and software). Programs and data reside in the cloud infrastructure, managed by experienced and qualified personnel.
- Greater attention to the core business: resources previously committed to managing the infrastructure are released.
- Increased scalability: faced with the need for more or less resources, the manager can expand or limit the infrastructure with extreme flexibility.
- Access to the cloud also with mobile devices: data can be connected from anywhere and at any time, even through smartphones, notebooks, laptops or desktop PCs.
- Reliability: cloud computing increases simplicity and reduces the costs of data backup, disaster recovery and business continuity, thanks to the ability to mirror data across multiple sites in the service provider's network.
- Independence from peripherals: being online programs and data, it is not bound to use particular hardware or certain network configurations.

### **Disadvantages of cloud computing**

- Internet dependency: any interruption of the connection can lead to the blocking of all activities.
- Risk of disclosure and incorrect transfer of files and stored data, when it is decided to switch from one service provider to another at the end of the contract.

## Computer Security and Privacy Violation

### **Absolute security does not exist either in-house or in the cloud.**

Moreover, it is much more probable that the service provider, especially if it is first level, offers more guarantees than those normally existing in a medium-sized company. Security risk increases with wireless networks, which are much more exposed to hacking attacks and becomes even more complicated, if the server farms, where personal and sensitive data are stored, are located in a different country from that of the user. In case of violation of privacy or of bankruptcy, in fact, serious difficulties can be encountered in proceeding legally.

However, part of these risks exists even if proprietary systems are used and the lack of connection with the Net prevents business connectivity regardless of the use of cloud systems. In fact, the use of dedicated telephone lines is increasingly less frequent. In any case, companies need to invest more and more in Information Technology and cloud models reduce costs and the staff involved.

In this activity of redesigning business processes, the ICT manager has to interpret a profoundly different role than in the past: as an efficiency researcher he must become an enabler of new business models shared with colleagues, as a person dedicated to the repetitive management of processes it must become an "operational mind", increasingly in symbiosis with the top management positions.

## **12. Security in network operations and open systems (cybersecurity)**

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### **13. The analysis of "Big Data" for the optimization of products and processes**

There is no univocal definition of big data, there are many in relation to the sectors of reference, the applications and the databases used. The term big data refers to:

- all the information related to the company system, or to a wealth of data so large that it requires the use of appropriate technologies and tools to exploit it;
- a collection of data that is so extensive in terms of volume, speed and variety that requires specific analytical technologies and methods for the extraction of value.

We are talking about big data when we are dealing with a large and complex set of data. The size referred to is dynamic, as the machines are always faster and the datasets have ever larger dimensions. According to a 2001 study, analyst Doug Laney defined the growth model based on the variables volume, variety and speed.

Over time, veracity, value and variability have also been taken into consideration.

The term "Big Data Analytics" instead refers to the new methods of analysis and data processing or to an advanced system of processing large amounts of data with high performance computing technologies (HPC - High Performance Computing). The concepts of Big Data and Analytics have existed for some time, but data analysis is still underutilized compared to its real potential. In the future, as companies learn to optimize flows, processes and applications according to the needs of their business and, above all, their customers, new market scenarios will open up.

The "data driven" approach, understood as an analysis of the information to detect and confirm the assumptions of the business, will increasingly enter the commercial and business strategies.

**Data creates value and is an important production factor**

The analysis and the timely disclosure of data to the main stakeholders:

- generates transparency;
- facilitates decision-making choices, minimizing risks;
- favors control activities (in some cases it can make them automatic);
- gives an immediate picture of the performance of significant activities and services, allowing, where necessary, a rapid identification of possible remedies;
- favors collaborative behaviors (the data associated with research and development and production, for example, encourage concurrent engineering with a reduction in time-to-market and an improvement in quality);
- facilitates the identification of the models underlying the data and the knowledge of the correlations between them;
- allows the segmentation of markets and the detection of tastes by consumers;
- makes it possible to perform predictive analyzes;
- facilitates innovation;
- improves service levels in the production chain, increasing the efficiency of the business system.

**Big data: intangible assets of the company and  
key factor in competitiveness and development**

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The importance of big data varies from sector to sector, it is related to the level of market competitiveness and it is crucial for producers of consumer goods. But we must know how to read them. To make the right use, it is necessary to insert the data analysis models in the strategic business plan, which must necessarily follow the development of processes capable of supporting them through appropriate infrastructures and with the help of the right talents.

These include the role of 'Data Scientist': a figure able to understand and analyze data, translating it into useful information for the company and capable of acting as an interface between ICT and business. A few years after the spread of the concept of the smart industry, it seems that Italian companies have understood the importance of extracting insights from data, but we are still far from the implementation of "data driven" business strategies.

According to a McKinsey analysis, taking full advantage of the data and the analysis requires three skills: first, companies must be able to identify, merge and manage multiple data sources. Secondly, they need the ability to construct advanced models of analysis for the prediction and optimization of results.

Thirdly, and of paramount importance, management must be able to create a clear strategy to exploit data, so that these actually lead to decisions.

**Companies, products and customers are increasingly connected and informed. Millions of people are connected to each other through social networks and everyone can exchange opinions about this or that product.**

**This large amount of information is able to shape, both positively and negatively, the image that consumers have of a particular brand.** In this scenario it is important for the companies to exploit the potential of predictive analyses, but care must be taken as Big Data alone are not sufficient, they must be used in a structured and harmonious way.

Even if they are contextualized and intersected with different sources, if they are not properly verified through continuous feedback with the market and with the relevance they have for the consumer, they risk being ambiguous or even harmful. The "data driven" approach fosters the analysis of the information in order to support the assumptions of the business, avoiding instinctive decisions.

#### **14. Industry 4.0 in the world**

## **15 The roadmap to smart enterprise**

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### **Chapter 2**

## **The digital supply chain and the procurement of the future**

by Giovanni Atti

### **1. Introduction**

With all the distinctions of the case, in relation to the specific features of the specific industrial sector, the type of goods made, the positioning of the company in the supply pyramid and its dimensions, the progressive digitalization of organizations and, in particular their gradual transformation into connected and synergistic systems, will induce further changes in the purchasing processes and in the supply chain management.

The purpose of this publication is to give a picture of the expected changes, outlining what should be the procurement of the future and in particular the supply chain of the next decade.

As anticipated in the preface of the book, there are many studies and research that talk about the digital supply chain and the procurement of the 'smart' company, many are the hypotheses made, but it is difficult to define with certainty what will be their connotations and specific processes in the big, medium and small business. In fact, we are only at the beginning of a great transformation, digital technologies are constantly evolving and some transnational technical and regulatory standards that are applicable to ecosystems are missing. What is noticeable, however, are the trends that have been widely analyzed, discussed and shared with the various authors and which do not differ from those indicated by strategic consultancy experts such as: McKinsey, IBM, Accenture, pricewaterhousecoopers, Gartner Group, Capgemini and Deloitte.

In the following pages, in addition to the features of the digital supply chains and the future of the procurement, we will review some basic concepts that should characterize the purchasing and supply chain management processes, regardless of the advent of the fourth industrial revolution. Concepts that, for different reasons, are not yet part of the operational practice of all companies.

### **2. From cross-functional integration to cross-company process management**

In the Purchasing & Supply Chain Management manual, Monczka, Trent and Handfield illustrate in detail the various stages of the evolution of purchases from 1850 to the beginning of the third millennium and highlight the progressive integration of activities

related to the management of material flows. They point out that until the 1960s, purchasing activities, materials management, reception, warehousing, internal handling, packaging and transport were fragmented and managed in a non-collaborative way, with low levels of global efficiency, high crossing times and abundant inventories. In the mid-1960s, in order to contain the negative effects of this excessive segmentation, the materials management was established, whose purpose consisted in the coordination of the materials planning, purchasing, reception and warehouse management. Twenty years later, given the increasing impact of the purchasing portfolio on the company's turnover and the need to ensure continuity of supply of machines and assembly lines, organizational experts favored the birth of the 'logistics', whose objectives were reduction of lead times, management costs, inventories and optimization of inbound and outbound flows.

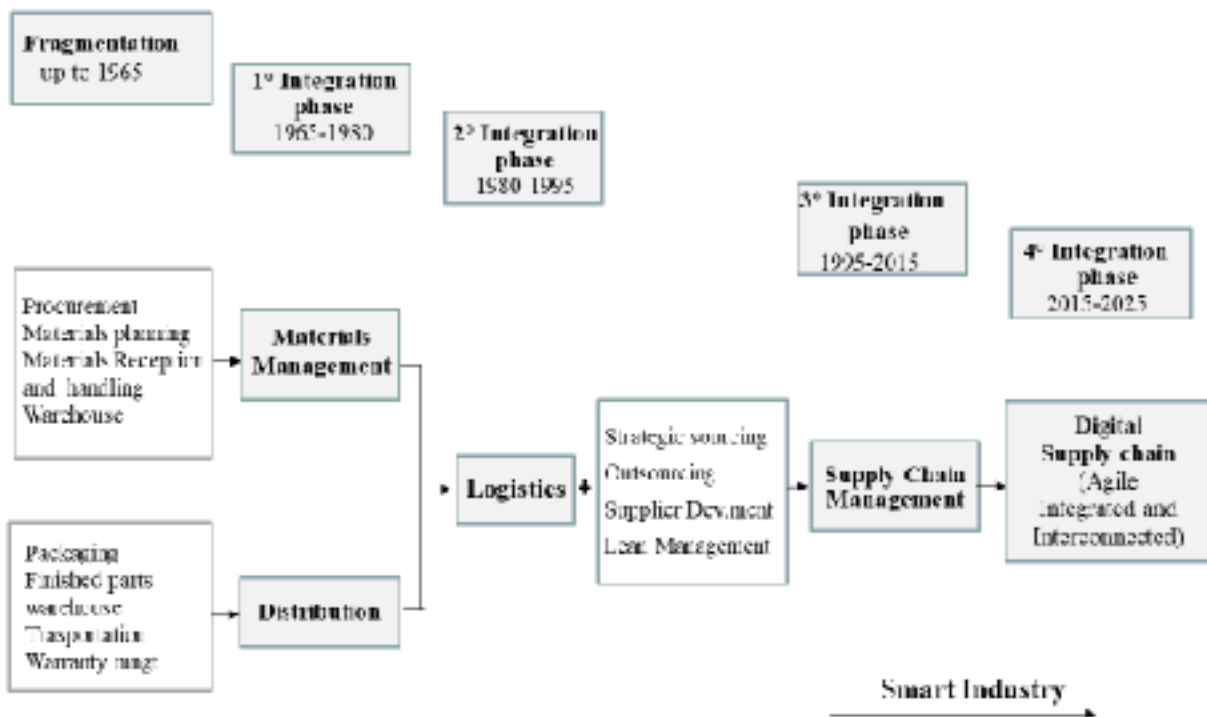
The advent of the globalization, which began in the mid-1990s, has increased the international competitiveness and has forced companies to use new tools, to reduce time and costs, and improve the quality of their products.

The result is the current supply chain management or value chain illustrated by Michael Porter in his best seller 'Competitive Advantage: Creating and Sustaining Superior Performance'. New tools and activities such as strategic sourcing, outsourcing, supplier development and lean management came into the operational practice of many businesses, increasing the added value of the function.

The category management has progressively spread out and its diffusion has reinforced the subdivision between strategic and tactical roles in the procurement organisation. With a few exceptions, the supply chain integration is unfortunately limited to a few links (lack of a real synergy between sales, purchases and operations) and rarely reaches the customer.

**Customer satisfaction often remains a declaration of intent and the relationships with tier one suppliers are rarely characterized by effective collaboration and synergies for the innovation.**

Figure 1. Evolution of Purchasing and Supply Chain Management



Obtained and adapted from: Purchasing & Supply Chain Management di R.M. Monczka, R. J. Trent e R.B. Handfield

For some years now, we have entered the digital age in which everything is connected and every information becomes planetary in a few minutes. The customer is increasingly the basis of the growth and development of companies and the diffusion of the digital technologies facilitates their transformation into agile and synergistic systems connected end-to-end, from the customer to tier two suppliers. The progressive diffusion of the 'smart' industry generates a new ecosystem that requires the update of the business vision, and the creation of extended, agile, fast, interconnected, innovative and competitive supply chains.

The company functions will continue to exist as they are associated with repetitive activities that imply specific skills and responsibilities, but the cross-functional boundaries will be increasingly soften and management and information silos will have to disappear as they are limiting the efficiency and effectiveness of the enterprise. In the near future, business processes will be increasingly divided into:

- tactical-operational activities (repetitive processes), and
- strategic activities (development of new products and projects to improve the manufacturing and management systems of the extended enterprise).

**In the future the company success will depend:**

- **from the speed of decisions**
- **from the speed of the processes**
- **from the speed of deliveries**

**and will be enabled by**

- **the end-to-end supply chain connectivity**
- **analysis of data**
- **empowerment of the employees**

Each repetitive task will be increasingly subject to automation and centralized control, with automatic calculation of the performance indicators. Strategic activities will increasingly be managed by teams with multidisciplinary expertise:

- supported by artificial intelligence applications and more reliable metrics validated by data analysis;
- led by managers not involved in the management of traditional company functions;
- who migrate from one project to the next without ever entering into the company's basic functions.

As repeatedly stated, if we want to benefit from the advantages that new enabling technologies can provide, it is necessary to redesign the company and its mission. The intelligent organization must be in all respects customer-centric and able to capture in advance, perhaps through the crowdsourcing, the needs of customers, thus stimulating the market demand for specific products, services and customized treatments.

Connectivity and digitization will be the factors that will differentiate companies that expand from those that lose market share. An Oxford Economics study presented in Vienna at the 'Success Connect 2016' highlighted that the pioneers of digital transformation have financial results above 38% average and more motivated staff, thanks to a data-driven approach and a great attention to the competences and skills.

### **3. Supply chain management**

The aim of Supply Chain Management (SCM) is to ensure that the operations of the supply chain are efficient, flexible and well-integrated and that the decisions on costs, inventories and services are carried out in an end-to-end perspective and are not limited to the individual functions or to the single company.

There are various definitions of Supply Chain Management and this is due to the fact that it is a mix of activities in continuous evolution, whose executive modalities change from sector to sector and assume different connotations in relation to the objectives that are to be pursued, the length of the supply chain, and the positioning of the company in the supply chain. In relation to the objectives of the buying organisation, the SCM can:

- limits itself to harmonizing the production planning of the entire supply chain, coordinating the activities of its main players to ensure compliance with deliveries, quality and service parameters (tactical-operational management);
- or, in addition to the above, give rise to continuous improvement activities to increase the added value of the output (strategic management).

The list of activities that can be optimized ranges from the product development to the refinement of forecasting and planning criteria, from strategic sourcing to feedback and supplier development plans, from the reduction of intermediate and warehouse inventories to the optimization of production cycles and of the production plans, from the rationalization of packaging to the optimization of inbound and outbound logistics, from the reduction of indirect costs to the preventive maintenance and sustainable recycling.

Each of them can become the driver of the supply relationship in its development phase. Supply Chain Management can therefore be tactical or strategic in relation to the objectives that are pursued. In the first case its management is relatively simple and partly automated with the help of specific IT applications, in the second, the management of drivers of improvement involves the preparation and sharing of a specific plan and the collaborative and synergistic participation of company officials involved.

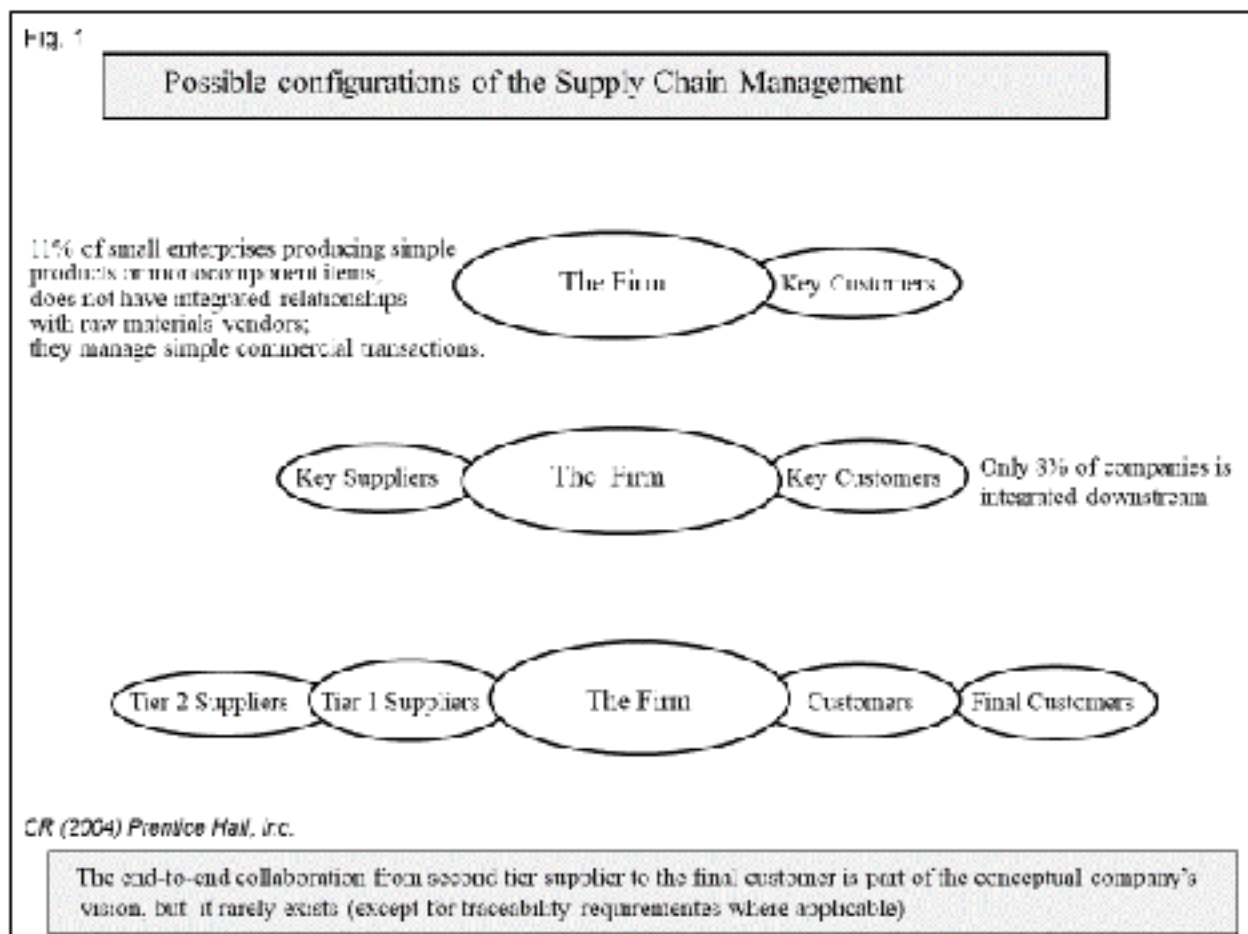
To increase the competitiveness of our manufacturing industry, the supply chain management processes of companies should go beyond the synchronization of production plans and contractual compliance and include continuous improvement initiatives aimed at:

- the efficient use of resources throughout the supply chain;
- the containment of total time and costs;
- the continuous improvement of products and manufacturing processes;
- the greater satisfaction of the final customer;
- the development of the overall management system of the company;
- the increasing the profitability of the business.

Strategic supply chain management can therefore be defined as the integrated, collaborative and synergistic management of all the activities and processes involved in the creation of products and services, aimed at maximizing the added value to the final customer and reducing the time-to-market and process costs.

The term 'supply chain' refers instead to the network of companies that operate in a more or less integrated and synergistic way in the product development, production, delivery and support of the product to the final customer. As illustrated in Figure 1, the supply chain can be more or less long and complex, circumscribed to a limited geographical area or extended over several regions and continents.

Conceptually, the SCM aims to synchronize the market demand with the output of the production chain, minimizing costs, time and inventory. Doing this means harmonizing the supply chain planning systems to eliminate waiting times and bottlenecks, find an appropriate balance between the lower cost of output and the right quality, use lean management techniques and optimize the traditional logistics to maximize the efficiency of the distribution phases.



## Activities included in SCM and pre-requisites for its application

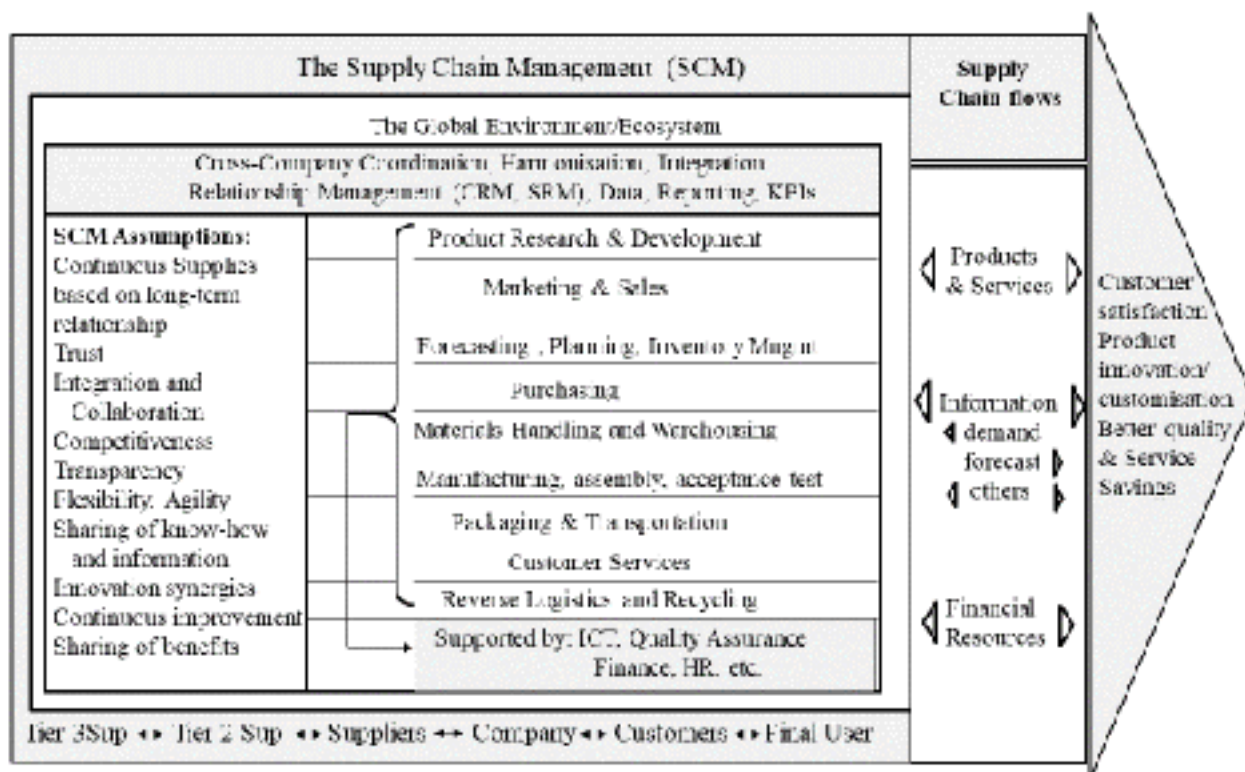


Figure 2

The SCM is a medium-long term strategy that:

- applies to the continuous supply of goods and services that are placed in the second and third quadrant of the Kraljic matrix and which are characterized by significant business volumes;
- does not concern the spot purchase of machines, plants, equipment and the non-continuous acquisition of indirect materials;
- is proposed to harmonize the production planning of the supply chain, reducing warehouse inventories and eliminating possible malfunctions related to crossing flows;
- allows improvements in one or more activities and processes related to the supply (indicated in the central part of Figure 2);
- harmonizes incoming and outgoing cash flows trying to avoid negative cash flow situations.

The supply chain management is a multidisciplinary activity in which several people interact with the supplier to manage or coordinate activities of specific competence. The

lack of harmonization of their actions sometimes generates management anomalies in the entire supply chain, with an increase in costs and inventories and a reduction in service levels (Figure 3).

| Fig. 3<br>Process                          | Anomalies found                                                                                                                                                                                                            |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Marketing and Sales                        | Complex and little segmented portfolio<br>Insufficient focus on customer needs<br>Chronic distortion of forecasts<br>Proliferation SKU and inventories                                                                     |
| Demand Planning                            | Limited internal and end-to-end visibility                                                                                                                                                                                 |
| Operational Plan                           | Misalignment between programs of the various functions<br>Limited reliability of the MRP output<br>Insufficient coordination of the partners                                                                               |
| Purchasing and supply management processes | Long lead times<br>Difficulty in providing forecast to key suppliers<br>Limited level of compliance with contractual requirements<br>Excessive variation programs delivery<br>Value added of suppliers lower than expected |
| Manufacturing                              | Poor compliance with execution programs<br>Discontinuity of materials flow<br>Poor machine / plant saturation<br>Excessive processing times<br>High intermediate inventories                                               |
| Distribution                               | Inventory levels set by the financial<br>Delay in deliveries                                                                                                                                                               |

Where it involves the execution of activities of continuous improvement or product development, it is advisable to prepare a specific project:

- shared by the managers of the departments involved;

- approved by the supplier or suppliers involved;
- complete with GANTT indicating activities, ownership, dates, interdependencies and reporting;
- showing the estimated costs to be incurred, the potential risks and the expected benefits;
- indicating the contractual parameters and clauses to be amended at the end of the project, in order to formalize the improvements obtained.

The agile and efficient management of the supply chain eliminates any process dysfunction and ensures added value through the implementation of continuous improvement plans. The results achieved depend on the synchronization of the flow of materials (raw, semi-finished and finished products), the flow of information (data, reports, KPI, etc.) and financial (payment of services provided) and compliance with the prerequisites that must distinguish the relationships between the various actors involved in the process.

More difficult, ambitious and labor-intensive are the targets to be pursued, the greater must be the degree of trust and collaboration existing between the parties who work to achieve them. **In some cases, the objectives of the SCM imply high levels of integration and sharing of company know-how and give rise to real forms of purchasing partnerships.** Also essential is the distinction between improvement activities carried out by the supplier and also extendable to other customers and activities intended for a single user.

### **The Supply Chain Management prerequisites**

The main prerequisites of supply chain management are:

- continuity of supply in the medium-long term.

The commitment of qualified resources for the implementation of continuous improvement objectives involves investments that are not amortizable in the short term. In many cases, the improvement is incremental or progressive and reaches its peak within one or more years.

- Collaborative relationships based on shared goals and mutual trust.

The activities of concurrent engineering and optimization of the manufacturing planning, sourcing, production, logistics and recycling processes imply time, resources and the sharing of knowledge and know-how built up over the years. **Without the sharing of the strategic objectives and the existence of relationships of mutual trust, no company is willing to make its intellectual assets available to third parties and to commit resources.**

Trust means certainty of operating in the context of a relationship, which, except for unforeseen events not attributable to the buying organisation, can continue in the long term. Sharing objectives means agreeing on a plan or improvement project and modifying it consensually whenever necessary.

- Openness, proactivity and mutual support.

In order to reduce operational time and avoid misunderstandings, all members of the working group must demonstrate openness and constructive spirit and must support their colleagues whenever necessary.

- Transparency and information

Transparency means clarity of objectives and consistent behavior. Information means having the knowledge base to achieve the agreed objectives. Transparency and information are interrelated and interdependent. The lack of transparency and information prevents the members of the working group from understanding the usefulness of certain activities or from knowing relevant aspects of the operating context, with a negative impact on executive times or results obtained.

- Pragmatism, agility, flexibility and responsiveness.

In the era of real-time information and lean management, companies and business functions must be agile, flexible and respond in a timely manner to any specific need.

### **Supply Chain Management**

- **difficult to implement among non-mature companies**
- **it is only a burden if adequate information is not shared**
- **if not open, the ecosystem is less competitive**
- **it ensures value if it is transparent and balanced**

## **4 The digital supply chain in large, medium and small businesses**

Digital technologies are transforming the way companies design, buy, produce and transport their products and the way they organize and manage their supply chains,

making them more competitive, faster and customer-oriented. The Digital Supply Chain (DSC) is:

- the extension of the smart enterprise to the supply chain and a means to operate effectively in an increasingly customer-centric economic system;
- the integration of all activities associated with the flow of materials and information flow, through collaborative relationships aimed at obtaining competitive advantages.

Customers want increasingly customized products, in the shortest time possible and at ever lower costs. The digital supply chain seems able to ensure the necessary competitive agility.

There is no univocal way to define it and its structure varies depending on the degree of integration of the various links (nodes) in the supply chain and the methods of connection between them. With reference to the new technologies illustrated in figure 1 below, the digital supply chain is the traditional production chain that thanks to the end-to-end connection enabled by ICT platforms and to the adoption of 'smart' management, production and logistics processes:

- generates a convergence of the elements of the supply chain and works more collaboratively with customers and suppliers;
- detects the needs of customers (internal and external) in a structured way, improving their own forecasts;
- harmonizes planning, manufacturing and logistics activities;
- adopts preventive maintenance programs;
- increases its flexibility and agility, reducing production times, costs, lead time and time-to-market;
- improves its visibility, transparency and traceability, facilitating the control of the extended enterprise and processes;
- optimizes the management of inventories and spare parts;
- tracks and trace the physical flows of goods and reduce logistics costs;
- promptly analyzes and manages data and information (the timely sharing of information affects the speed and flexibility of the supply chain);

- optimizes the customer service by delivering the right product at the right time;
- reduces the invested capital and increases the competitiveness of the extended enterprise or ecosystem.

**The digitalization of the traditional supply chain allows significant advantages, but the evolution towards a connected and intelligent ecosystem is progressive, long and tough. It represents an objective that not all companies can pursue in its globality.**

According to the Center for Global Enterprise, the digital supply chain is a customer-focused platform model that captures and maximizes the real-time use of data from various sources, which allows the stimulation of demand and its comparison with the offer, as well as the optimal management of supply chain operations, minimizing the risks of discontinuity of supply flows. This ecosystem:

- is based on the broad or extensive use of the digital technologies;
- involves a wide range of activities such as: the workplace, product development and innovation, engineering and production, distribution and digital sales channels and management of customer relations (Figure 2) ;
- is characterized by transparency, communication, collaboration, flexibility and responsiveness as detailed in Figure 3;
- it is perfectly integrated, coordinated and controlled through an ICT platform also called 'hub' or 'control tower' (figure 3).

Thanks to this control tower the information and operational communications are no longer transferred from company to company with the risk of delays and alteration of the original message, but from the central hub directly to each actor in the supply chain. Companies with highly digitalized supply chains and operations can expect global efficiency gains of 20% -25% and a significant cost reduction.

Figure 1

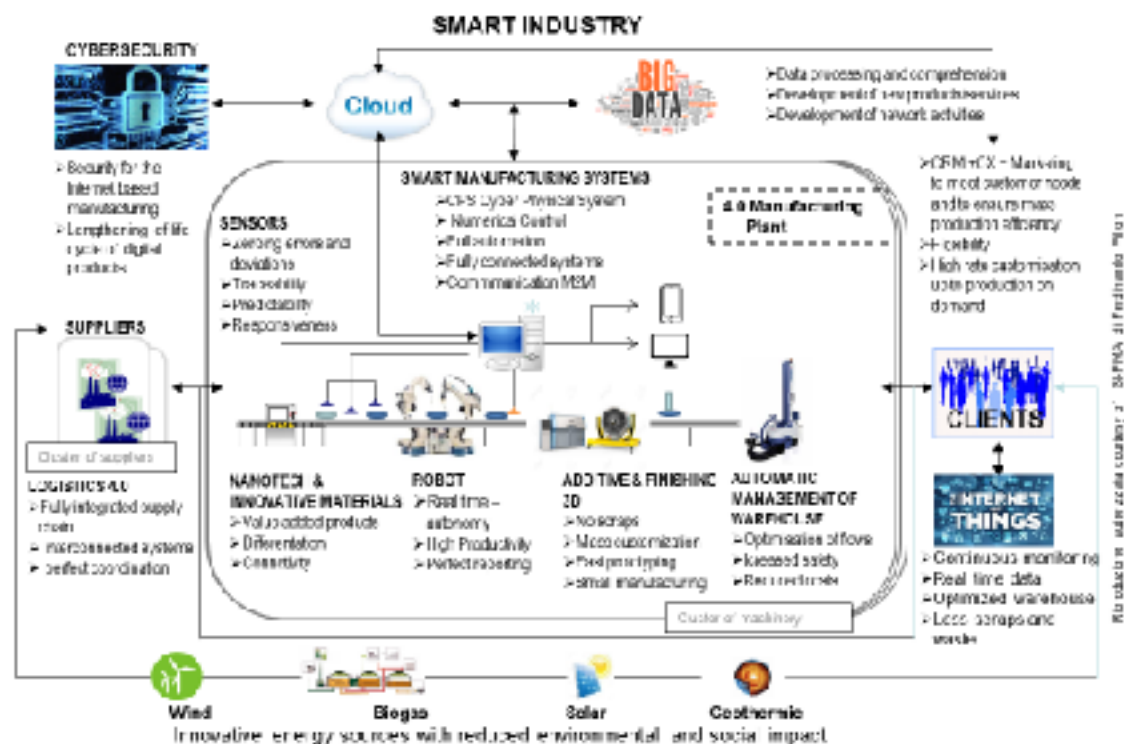
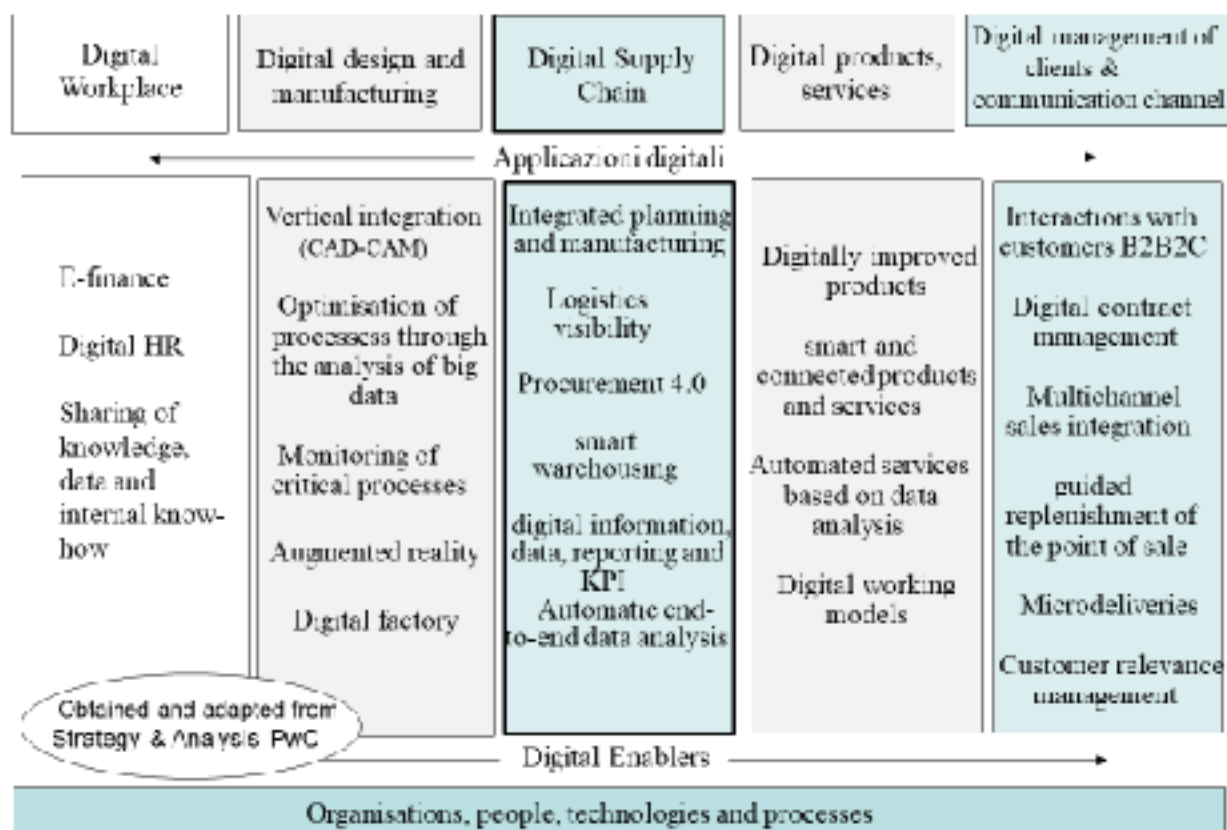
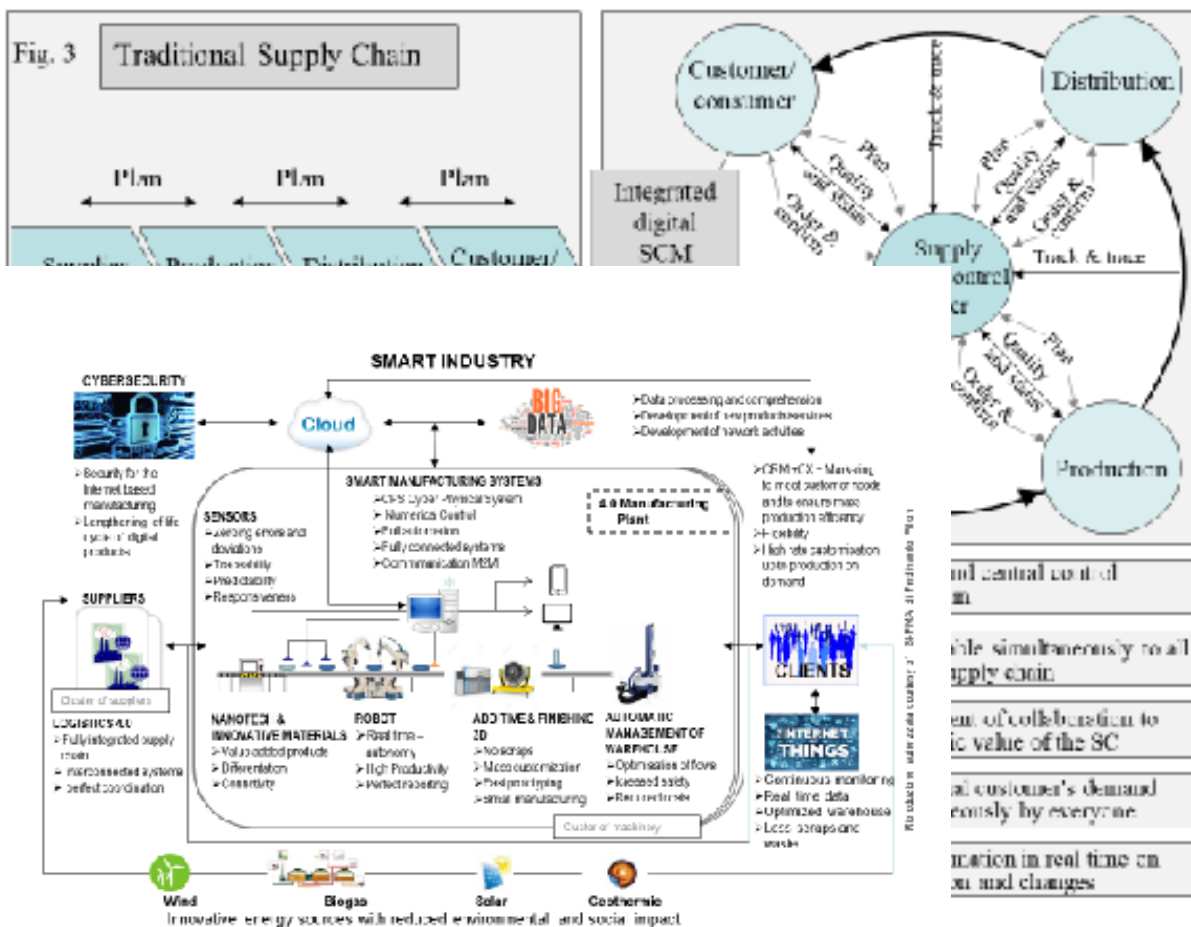


Figure 2 The Digital Supply Chain at the Center of the Smart Industry



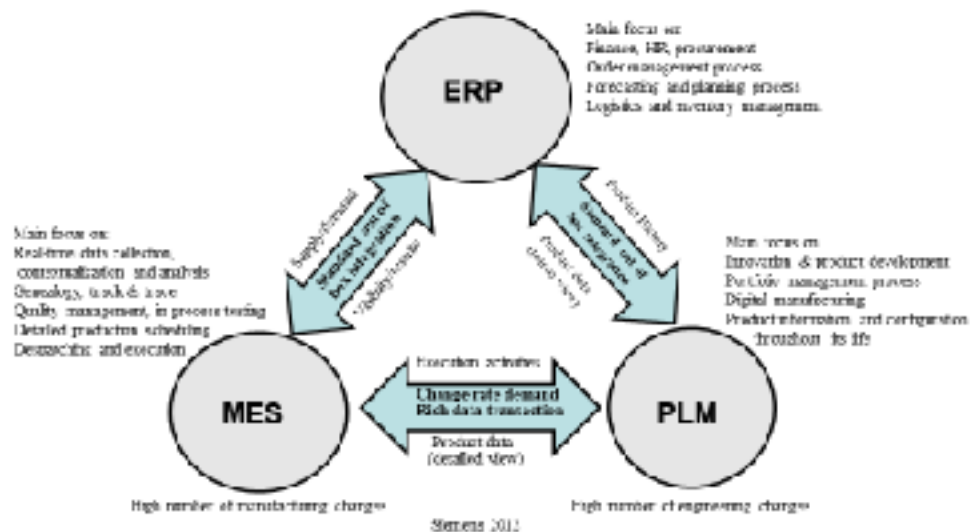


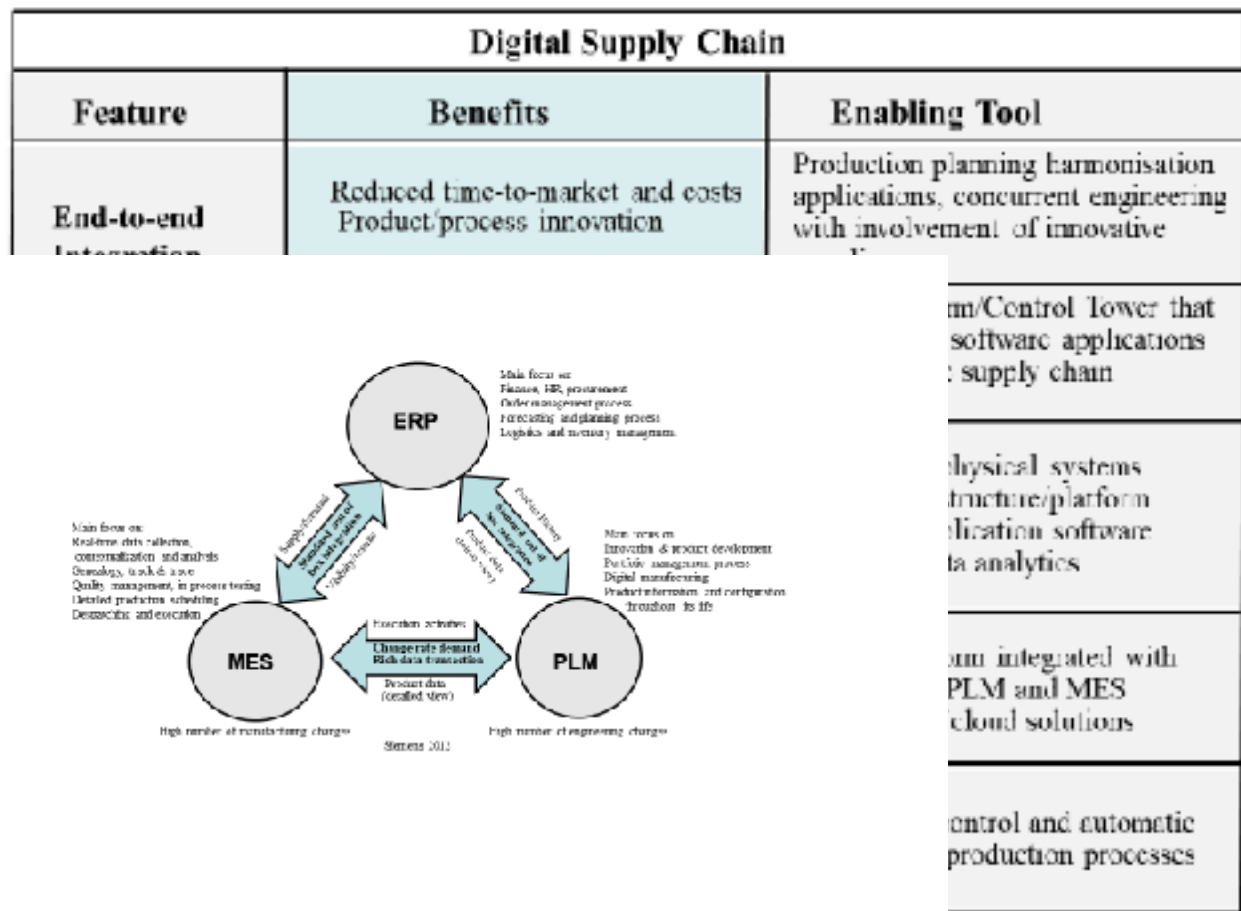
The primary goal of the digital supply chain is to deliver the right and reliable product in the hands of the customer as quickly as possible, while increasing efficiency and reducing costs through automation. This goal cannot be pursued in its entirety if the supply chain is not completely integrated and monitored by a centralized cloud system. The integration platforms:

- have basic planning functions with the possibility of simulation and analysis of "what if" scenarios;
- allow, as a result of changes in customer demand, to automatically verify the impact of changes on work in progress, load machines, materials, inventories and cash in;
- provide automatic warning signals in the case of chain failures, allowing timely implementation of the necessary remedies; and
- allow the management of numerous risks associated with supply chain activities in a more rapid and informed manner.

Any hypothesis advanced by the supply chain manager can be immediately submitted to customers, suppliers, subcontractors and logistics providers for acceptance or further refinement and workflows can be modeled in order to integrate all the collaborative processes and provide rapid information on reliable delivery dates. By integrating data in real time along the supply chain, delivery times can be significantly reduced and materials and inventory management optimized. The rapid exchange of information also increases the agility of the supply chain, while allowing a much closer integration with customers.

However, achieving a high degree of transparency in the system is not an easy task, it requires a mix of technical sophistication, will and human talent, but once obtained, the benefits are significant. In a world where customized manufacturing is fast becoming the norm and customers are increasingly demanding, the fully reactive supply chain represents a competitive advantage and becomes an essential organizational feature.





## Track-and-trace technologies

The ability to trace and track down goods in the transport phase has evolved significantly thanks to the new technologies and lower prices. Radio frequency (RFID) and Bluetooth identification tools are used to inventory and track the movement of materials both inside and outside the factory. Special printers generate readable sensor-labels that can be connected to the box and detect temperature and humidity conditions. The global system for mobile communication (GSM) and satellite tracking are used in maritime transport.

Much of this is due to the increase in battery life of the tracking devices, which today provide power for five years and which are equipped with intelligent algorithms that stop the device when the sensor is inactive. The control center for these remote sensing activities is the control room or the logistics visibility platform, similar to a traffic control tower. It provides a complete picture of the supply chain and facilitates decision-making processes to be adopted in any critical situation.

## Intelligent warehousing

Another component of the digital supply chain is the warehouse that is becoming an instrument that generates added value both to the company and its customers. Its organizational review must be focused on improving efficiency and safety, by automating a large part of the activities it manages. The Industry 4.0 version provides for a low labor-

intensive configuration and its transformation begins with inbound logistics. Oncoming trucks communicate their location and time of entry to the logistics platform subassembly, which chooses and prepares a docking slot, optimizing just-in-time and just-in-sequence delivery. RFID sensors detect what is delivered and send information to the functions involved. The management system:

- automatically assigns the space in which to place the goods arrived and activates the most suitable means for its handling;
- constantly updates the inventory in real time, through the use of sensors incorporated in the goods.

Outbound logistics involves picking activities facilitated by the use of augmented reality tools such as smart glasses, uses autonomous vehicles for the handling of goods and robots for their packaging, as well as trucks without drivers or drones for their delivery to the customer. Ad hoc software applications control temperature and humidity, switching off lights and radiators in areas where all the work is done by robots and autonomous vehicles, significantly reducing energy consumption.

### Artificial Intelligence and Big Data

The management of the numerous activities of the supply chain can be facilitated by the use of intelligent applications able to detect the different operational contexts and to operate in a coherent way, from the analysis of big data and the automation of knowledge work by providing personnel with best practices, guidelines and information related to the type of job or problem they are managing. In the consumer goods sector, some large companies have started using predictive analysis in demand planning, while taking into account multiple internal and external variables.

### Relevance and dimensions of the supply chain connectivity

The content of the previous paragraphs is the synthesis of studies and reports made by consultants and academics. They mainly concern large companies and are affected in some cases by the euphoria that accompanies the beginning of technological revolutions. They insist on the need for a general cultural change, but do not consider the actual availability of companies and people to put in place behaviors essential to achieve the mentioned targets.

Collaboration and transparency, for example, are two key factors of both vertical and horizontal integration; enabling technologies can facilitate them by making available information in real time, databases and applications of artificial intelligence, **but if there is no willingness to collaborate and make available of the supply chain certain data and information, the technical enablers alone can do nothing.**

Fortunately for small and medium-sized businesses, some of the advantages associated with connectivity depend above all on human decisions and behavior and are therefore partially achievable even without the use of technology. **The basic problem is to understand that competitiveness is a dimension of the supply chain** and not of a

single company and that in certain situations, openness and mutual support represent the basis on which to build added value.

**Competing today does not only mean ensuring adequate prices, but also being fast, agile, reactive and continuously improving products and processes**, and this is possible if the supply chain is a single, compact and synergistic body.

**If the continuity of the relationship with the supplier is subordinated to the result of frequent bidding processes, the relationship cannot be collaborative and there will be no contribution to continuous improvement.** This does not mean underestimating the importance of costs, because in an open and transparent relationship these become a visible factor from which to optimize processes.

In short: the benefits of connectivity depend on the binomial 'behaviors' and technologies. If they coexist, we will have a value-added chain, if there is only one of the two elements, the advantages will be reduced. Difficult to state which of the two prevails in terms of relative importance.

These considerations are not intended to question the validity of the concept of connectivity and are independent of the indisputable advantage associated with the digitization and automation of production and logistics processes. They simply intend to reassure in part those who cannot give implement the digital connectivity as they confirm that part of the benefits is still achievable. It is no coincidence that the supply chain executives of twenty-four multinationals have shown that a supply chain is defined digital not so much because its products are the output of automated operations, but in relation to the way in which inter-company processes are handled and in particular way in relation to the fact that the products have been designed and manufactured according to the specific needs of the customer. And all this depends only partially on the technological enablers.

The long path of the digitalization of the supply chain

Pricewaterhousecoopers configures two types of digital supply chains, one of smaller size and less connected, achievable as of now and an ecosystem characterized by connected, flexible and effectively integrated value networks, progressively achievable by 2030 (Figure 4). The reasons for this slow transformation, also confirmed by Gartner Group in its Hype Cycle model, are due to:

- the necessary progressiveness of the application projects that must go hand in hand with the cultural and organizational transformation of both the company and its primary suppliers;
- the difficulties connected to the creation of an ICT platform that must interface and interact with the main software applications of customers and suppliers;
- the slow standardization of market software applications;
- the current difficulty on the part of companies to recur to cloud solutions

- the need to optimize cybersecurity systems;
- the need to dilute over time financial costs and charges that do not guarantee a short-term ROI.

25% of respondents in a recent survey of pricewaterhousecoopers on the development of Industry 4.0, said they have already begun to digitize their supply chains, while about 70% plan to do so within the next five years. At the international level, companies give priority to the digitization of operations, planning later the implementation of connectivity along the supply chain.

### The digital platform

Currently, a large part of the supply chain is characterized by discrete and poorly integrated processes that affect activities such as marketing, product development, production, distribution and delivery to the customer. Digitization helps to break down these walls by allowing the supply chain to gradually become an integrated and transparent ecosystem for all the parties involved: from raw material and components suppliers to operations, from finished product transporters to customers.

This digital network is more resilient and reactive than the current one and allows those who realize it to benefit from the competition, satisfying customers in a more agile, timely and personalized way. Virtual connectivity undoubtedly represents the added value of the digital supply chain and the digital platform or control tower that connects end-to-end customers, business and critical suppliers is the tool that enables it. Apart from the costs associated with it and underlining the fact that it can be acquired in terms of Software as a Service, its adoption can be problematic.

Figure 4

| The long journey towards the total digitalisation of the extended enterprise                                                                                                 |                                                                                                                                                                                               |                                                                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1970 Industry 3.0                                                                                                                                                            | 2015– Industry 4.0                                                                                                                                                                            | 2030 Digital Ecosystem                                                                                                                                                                                        |
| <p>Electronics, IT and Robots for the automation of production processes</p> <p>Electronics, ICT (computers and CAD-CAM) and Internet as outsider of the information age</p> | <p>Digital Supply Chain</p> <p>Smart Manufacturing</p> <p>Digital products, services and working tools (models)</p> <p>Analysis of data as the basis for key decisions (basic competence)</p> | <p>Flexible and integrated value chains and value networks</p> <p>Virtualisation of processes</p> <p>Virtual interface with customers</p> <p>Collaboration between companies as a primary driver of value</p> |

Obtained and adapted from Strategy & Analysis PwC

Only a limited percentage of companies are in fact able to meet the necessary investments to create and manage autonomous, technologically advanced and sustainable ecosystems that are applicable to the entire supply chain. The likelihood that the software constituting the platform is compatible with the existing applications at the various companies in the supply chain is also extremely low. It is also unlikely that a medium-sized company will be able to persuade its customers to interact with its IT infrastructure.

Last but not least, the same companies or suppliers, at the request of the various customers should interact with different ecosystems or platforms that are incompatible with each other. Waiting for a greater standardization of existing applications on the market and a greater openness to the use of 'cloud' solutions, it is clear that the issue of connectivity must be solved by the small and medium-sized enterprises with partially conventional solutions. It should also be noted that the relevance of connectivity finds its peak in companies operating in the consumer goods sector, characterized by an increasingly limited life cycle and influenced by social networks.

First phase of digitalization of the supply chain and the drivers of the creation of value

While waiting for the conditions for the creation of ecosystems, it is necessary to start transforming our supply chains to make them more reactive and integrated, acting, where possible and worthwhile, on the enabling factors and drivers of value creation. The diagram illustrated in figure 5 represents the reference base of every possible project. The

aim to reach is a customer-centric value network, connected, integrated, agile, innovative and competitive (Figures 6, 7 and 8).

The macro-activities considered: marketing, sales and product development, production planning and materials management, purchasing, production and assembly, sales contract management, delivery and return logistics go beyond the hierarchical areas of supply chain manager (figure 7). They represent a hypothetical macro-process that must:

- be harmonized and coordinated in order to minimize any misalignment, discontinuity and waiting phase,
- transcend the interests, the boundaries and the competences of the functions it passes through, eliminating the silos and closures that often characterize them;
- be harmonized with the production planning of critical suppliers in order to ensure continuity of material flows and minimize stock levels;
- allow integrated planning of sales and operations (S & OP), and
- understand innovation and continuous improvement strategies.

## Marketing

The marketing activity can take advantage of the analysis of big data and this is particularly convenient for companies that make consumer goods that call the attention of the social networks. Various analytical applications exist on the market, but in some cases, software applications adapted to the specific product and context may be needed, which means, among other things, defining ad hoc algorithms.

Big data is important, but initially a good market segmentation by product and a good promotional interaction with the most critical and significant customers could be sufficient, with detection, updating and tracking of the various feedbacks.

# First phase of digitalisation of the supply chain and drivers of the creation of value

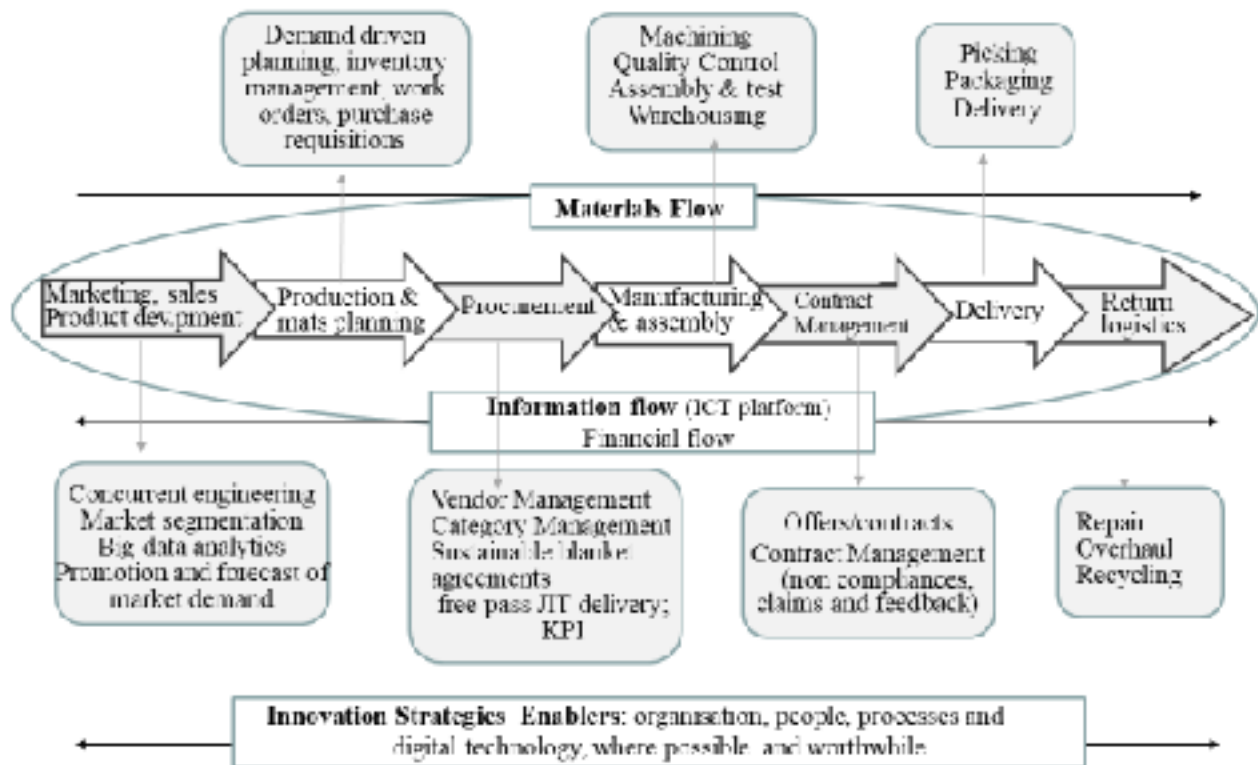


Figure 5

# DIGITAL SUPPLY CHAIN or VALUE NETWORK

customer-centric, connected, integrated, agile, innovative and competitive

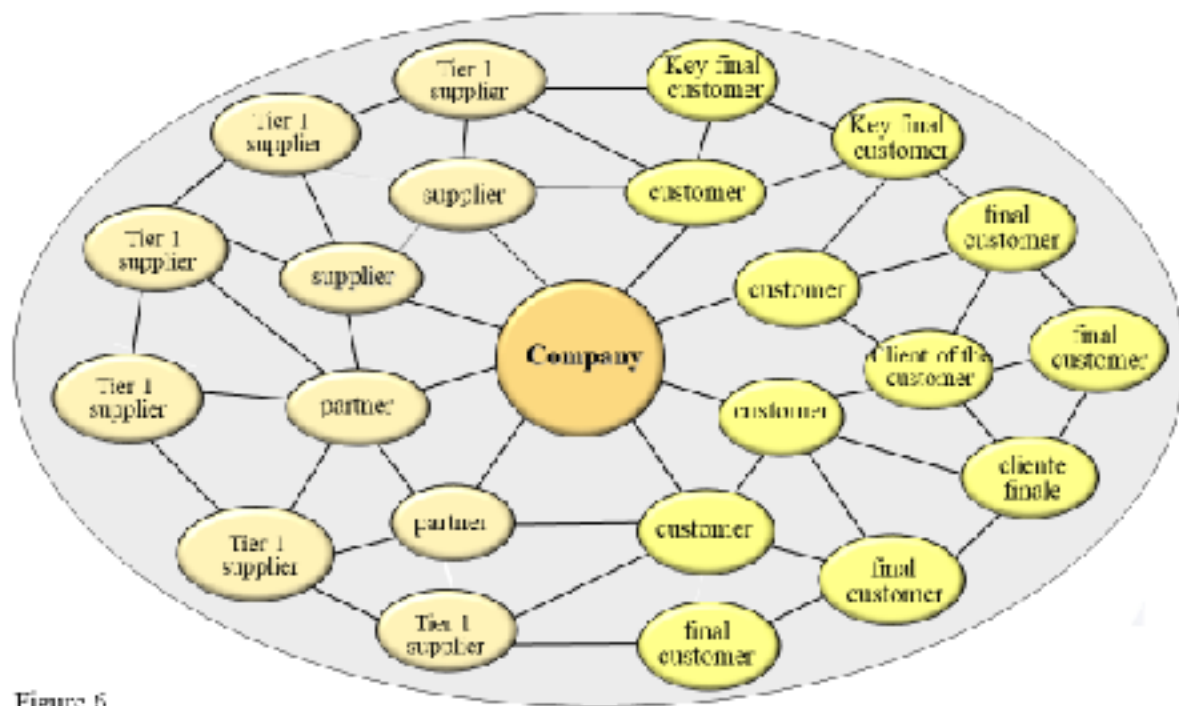
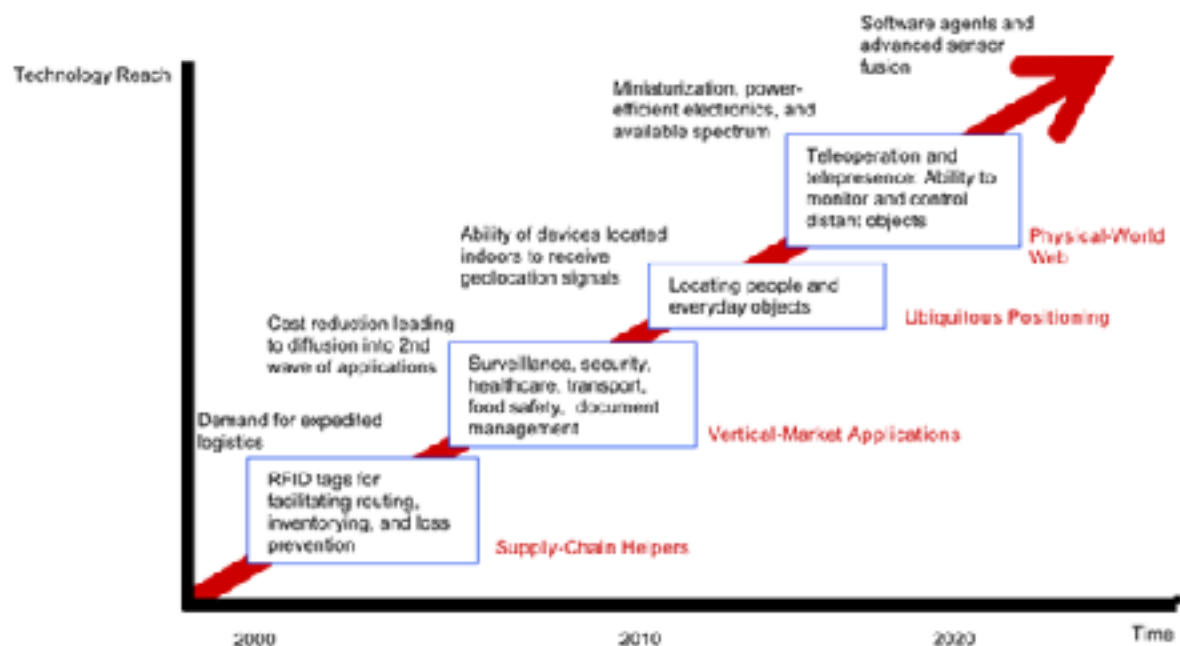


Figure 6

## TECHNOLOGY ROADMAP: THE INTERNET OF THINGS



Source: SRI Consulting Business Intelligence

Industrial companies are moving towards greater digital value creation, from augmented products to serving digital ecosystems

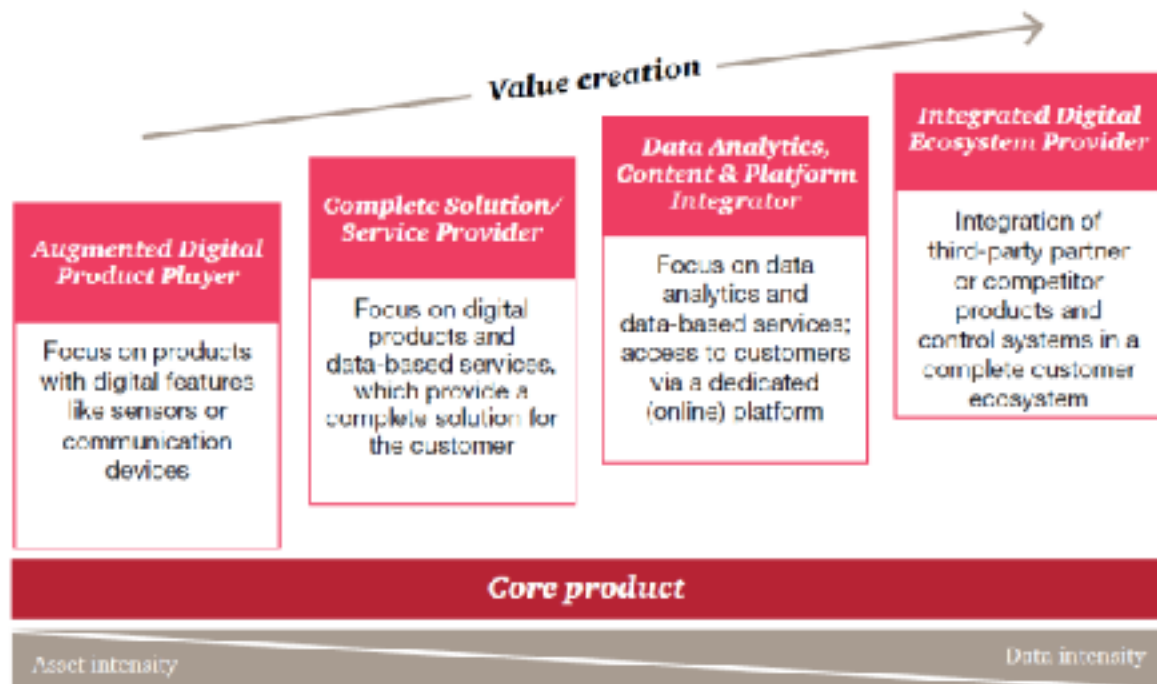
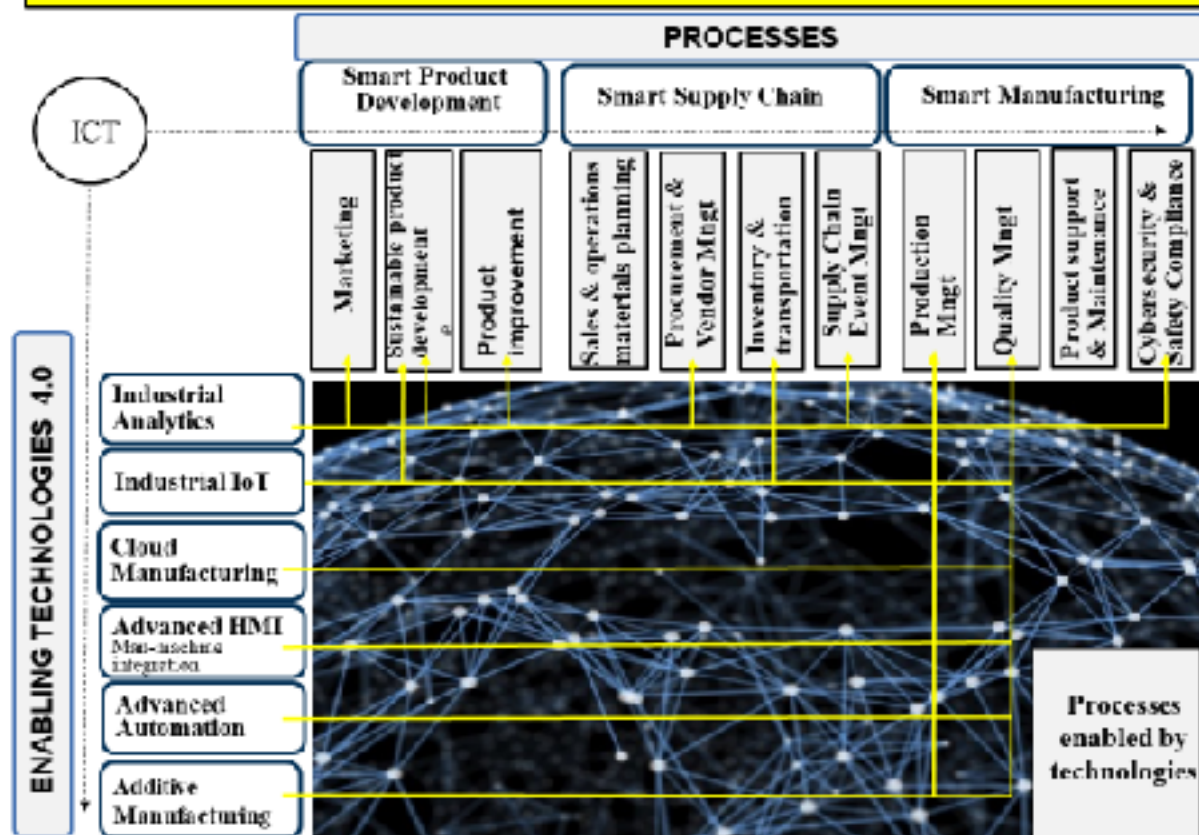
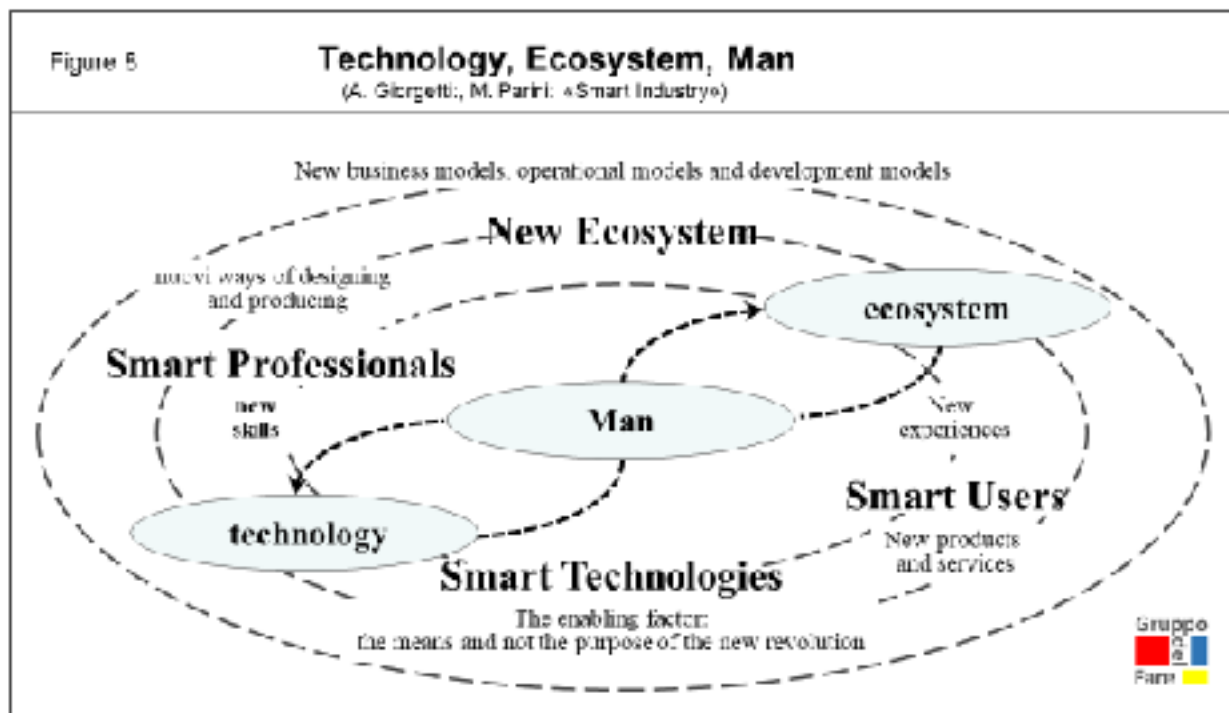


Figure 7 The digital supply chain: technologies and processes integration





## Sales

When large quantities or complex orders are involved, commercials must interact with the supply chain manager in order to verify the feasibility of the delivery program to be included in the offer and lay the foundations for the integrated planning of sales and operations (S & OP).

**The whole organization and not just the sales department  
must give priority to the needs of the customers**

## Product development and subsequent optimization

The development of the product, the definition of its configurations and its subsequent optimization form the basis of the company's success. Also, in this case we need big data or analytical information on the tastes and needs of the various customer segments and on the materials and solutions offered by the various markets (purchase marketing). The contribution that can be obtained at this stage by the start-ups can be decisive. The Innovation of the future will in fact depend more and more on external resources that must be identified and managed in an appropriate manner in order to maintain a privileged link with them. After its launch, the product must be optimized and at the end of its maturity phase revitalized, in order to ensure its continuous attractiveness. In both phases the

contribution of innovative suppliers can be decisive. Where it is appropriate to have information about its use, operation and state of wear or if one wants to be able to remotely control it, the product must be equipped with smart sensors and transmitters (Internet of things).

### Integrated planning of sales and operations (S & OP)

The focus of supply chain management must shift to advanced planning processes, such as demand planning or integrated sales and operations planning (S & OP). This task is not easy, but if you want to reduce the time to market and to maximize business integration, there are no alternatives. Intelligent analysis of big data to 'sensing' the market demand could be very useful. In fact, it is a matter of capturing and interpreting customers' tastes and needs, perhaps influencing them in order to estimate and plan market demand and prepare production plans focused on estimates deemed reliable at least at 55% -60%.

The greater the interaction and loyalty with individual customers, the lower the risks. Planning in the near future means ensuring that every process is well integrated, from suppliers to customers and taking into account time, load, costs, inventories and after-sales services in an end-to-end perspective, rather than in the perspective of each single function.

#### **The software applications allow:**

- **the analysis of past performances**
- **the analysis of current performances**
- **the forecast of future needs**

### Procurement

Next paragraph is dedicated to the Procurement. Here we simply underline that the purchasing function should, at least functionally, report to the supply chain manager. Therefore, there are excellent prospects for procurement managers with multidisciplinary preparation, relationship skills and systematic approach to businesses.

### Warehouse and Transportation Management

Warehouse management must be progressively automated both with the help of localization technologies and with the use of robots. Transport must be entrusted to reliable logistics providers able to ensure traceability and localization in real time.

### Manufacturing and assembly

Each production department must be progressively automated and digitized. Big data and digital platforms can constitute solutions for a few, but the connectivity of production assets through cyber-physical systems, the opportunity to have the remote control of the machinery and software applications that interact with the ERP and provide information that it does not provide, represent the basis of the intelligent enterprise.

#### Intermediate Controls and Final Testing

The incoming materials must be managed with the free pass model, while the intermediate checks and final testing must progressively be automated.

#### Product Support

Repairs and overhaul of products placed on the market are facilitated and made more timely if they are equipped with sensors for detecting faults and wear.

#### Maintenance

Predictive maintenance reduces failures and downtime. Similarly, to the products it is advisable to insert in the most critical production assets, sensors able to detect malfunctions and states of wear of the most delicate parts of the asset itself.

#### **The KPIs of the Digital Supply Chain**

- **product and process innovation**
- **stimulation of market demand**
- **customization time**
- **collaboration (internal and cross-functional)**
- **compliance with national and international standards and corporate guidelines.**

### **5. Procurement and Procurement 4.0**

In the smart company, the procurement ensures a decisive contribution to the creation of an efficient, collaborative, agile, fast, innovative supply chain that ensures high added value for the entire extended company. Before entering into the application peculiarities of enabling technologies, it may be appropriate to summarize some basic features that characterize a modern procurement function. It is a primary unit that:

- contributes to the business development and profitability;

- originates, shapes and manages its supply chain;
- sets supply strategies and tactics, also managing operational activities;
- manages multidisciplinary issues;
- is structured by product categories and commodity groups;
- is required to pursue a multiplicity of objectives that are not always convergent, such as: quality and operational efficiency, saving, technological innovation, internationalisation, time-to-market, compliance with health, safety, ethics and sustainability standards.

The procurement process is structured into four macro activities:

- planning of needs and preparation of the multi-year budget for materials, services and capital investments;
- the definition of category management strategies and the preparation of the procurement plan divided into categories and commodity groups;
- the bidding and contracting process;
- the management the contract, its close-out and the issue of the related feedback.

The function is also supported:

- by the governance staff that deals with budgets, procedures, saving calculation, reporting and KPIs and process automation;
- by the vendor management staff that manages the procurement marketing process, the supplier qualification and the establishment and maintenance of the supply base.

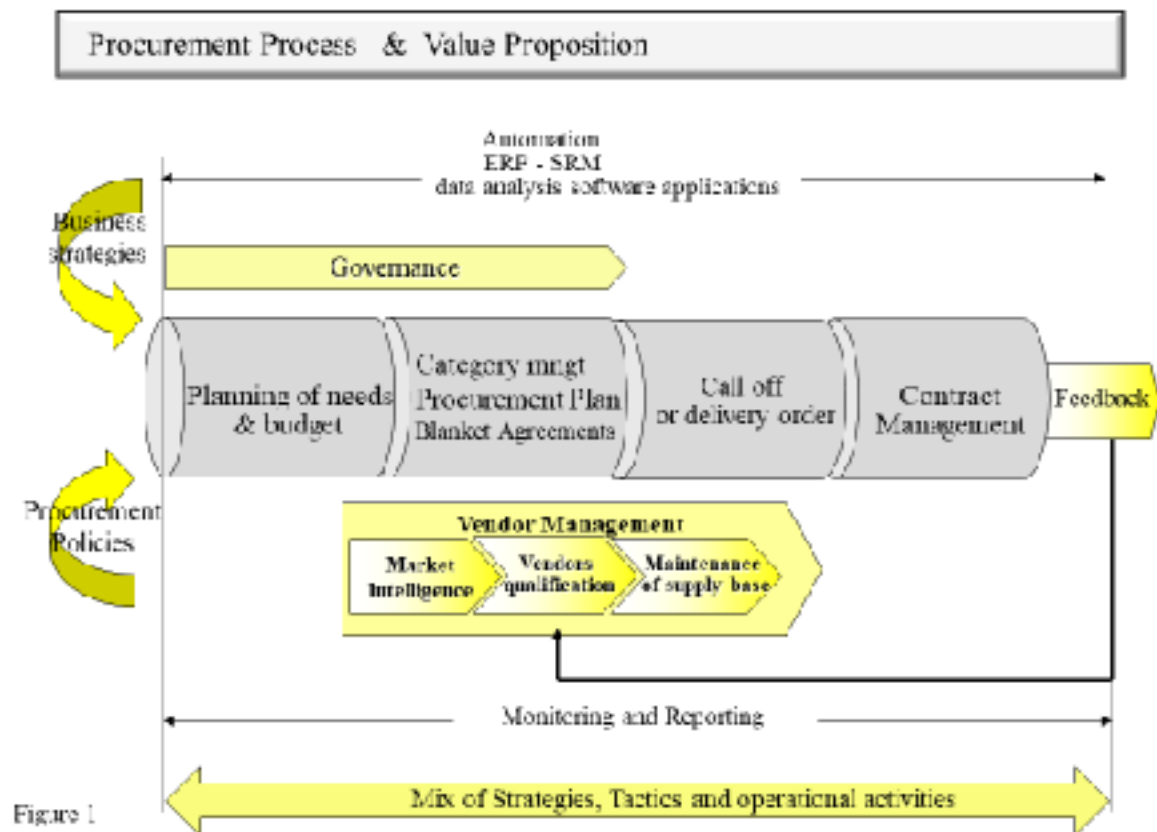


Figure 1

The activities and processes that are part of procurement can be divided into two categories: strategic and tactical-operative. The first are those that concern the definition of the policies of the function and the choices that bring added value. They include the planning of the needs and the preparation of the multi-year budget, the spend analysis and the setting of the category management plans, the preparation of the procurement plan and the issuing of framework contracts, governance and vendor management.

The tactical-operative ones involve the material acquisition processes and the management of the related contracts. In the last twenty years, the objectives of the function have seen an increase of the strategic component. In fact, until the 2000s, the focus of the function was on prices, on compliance with deliveries and on contractual compliance in general (Figure 2). From 2000 to 2015 it has moved on reducing the cost drivers of the most significant commodity groups (high spending) and on the improvement of the efficiency of supply chains.

In the next few years the focus of the function will be based on the innovation of the materials and services purchased, on the contribution to the improvement of finished products made by start-ups and on the improvement of the supply chain processes in order to reduce costs and delivery time and improve customer services. In this way, procurement will make a significant contribution to the development of turnover and to the profitability of the company business.

## Evolution of Procurement Targets

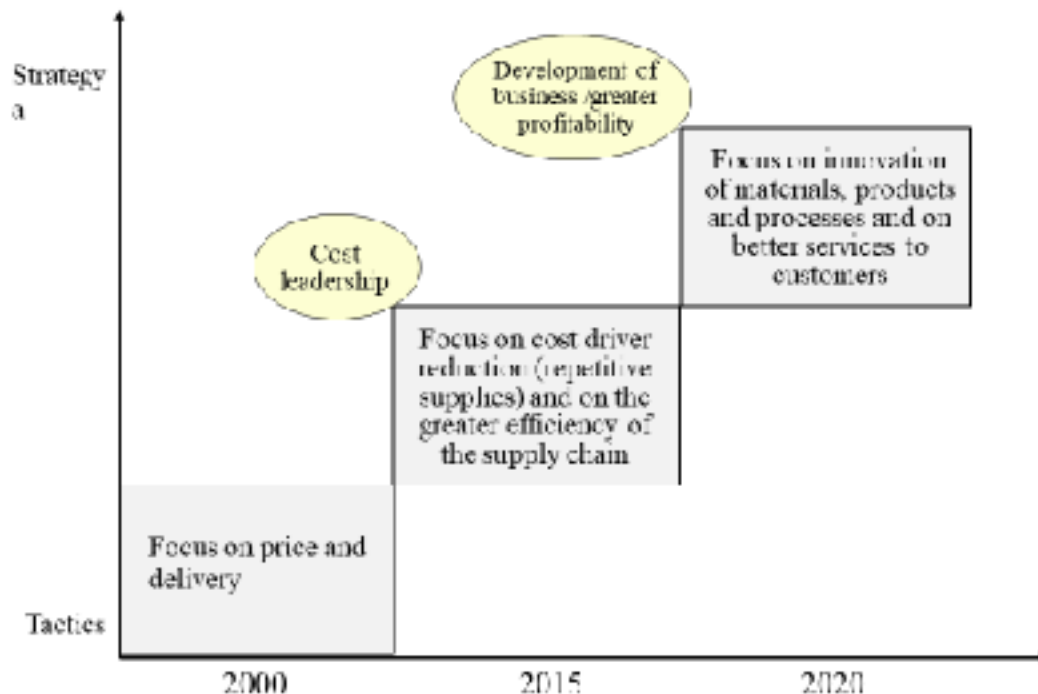


Figure 2

Planning of the needs and preparation of the multi-year materials budget

The multi-year planning of the requirements for the various materials groups or categories of the purchasing portfolio is the basis:

- for the preparation of the procurement budget;
- for the execution of the spending analysis, and
- for the definition the category management strategies and the procurement plan.

Each department of the company has to communicate to the controller and to the purchasing the expected needs of the goods and services for the two or three years subsequent to that of the preparation of the budget. Later on, each category manager, using reliable price variation indicators, reports to the procurement governance the unit prices expected for each year of the budget and the saving or cost avoidance that he undertakes to carry out. The above data, divided by commodity groups represents the procurement budget, that once approved constitutes the basis for the release of the purchase orders issued by the function.

Category Management strategies and preparation of the Procurement Plan

Category management is a cross-function and cross-company process that, for high-spending categories, aims to provide added value through the implementation of one or more of the following activities:

- reduction of the cost drivers of each materials group (categories);
- standardization of materials and technical solutions adopted;
- optimization of the technical specification with the elimination of the unnecessary functionalities and sophistication;
- changes to the technical specification to improve performances and reliability of the equipment/systems bought;
- improvement or automation of the production processes (lean management) of the key parts bought;
- introduction of new technologies and new suppliers;
- harmonization of buyer-supplier production planning to reduce inventories;
- optimization of the transportation processes and logistics in general.

If the annual spending for a specific material group is consistent, its category manager, supported by the engineering and by the relevant suppliers, will define the drivers on which to build the category management plan to be implemented, will evaluate their cost and the expected benefits and will ask for its approval. Once authorized, it will become part of the procurement plan. If the annual spending for a specific material group is low, it is appropriate to evaluate the possibility to delegate to relevant buying process to a service provider that, thanks to the scale economies achieved, is able to do so at favorable economic conditions.

The procurement plan is therefore a set of authorized category management plans or a set of activities the function intends to implement in the following two or three-year period to ensure added value to the company. Their implementation can involve months of work and that is why they must be developed in parallel and independently of the management of the regular purchasing requisitions and processes, which will benefit from the category management benefits at their completion.

## Value creation strategies

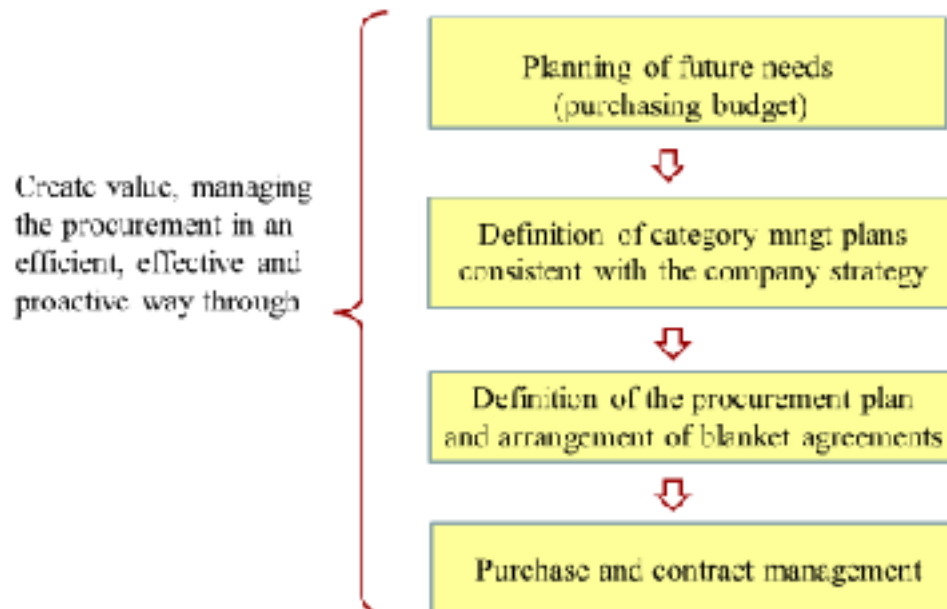


Figure 3

## Analysis and optimisation of the demand in public procurement

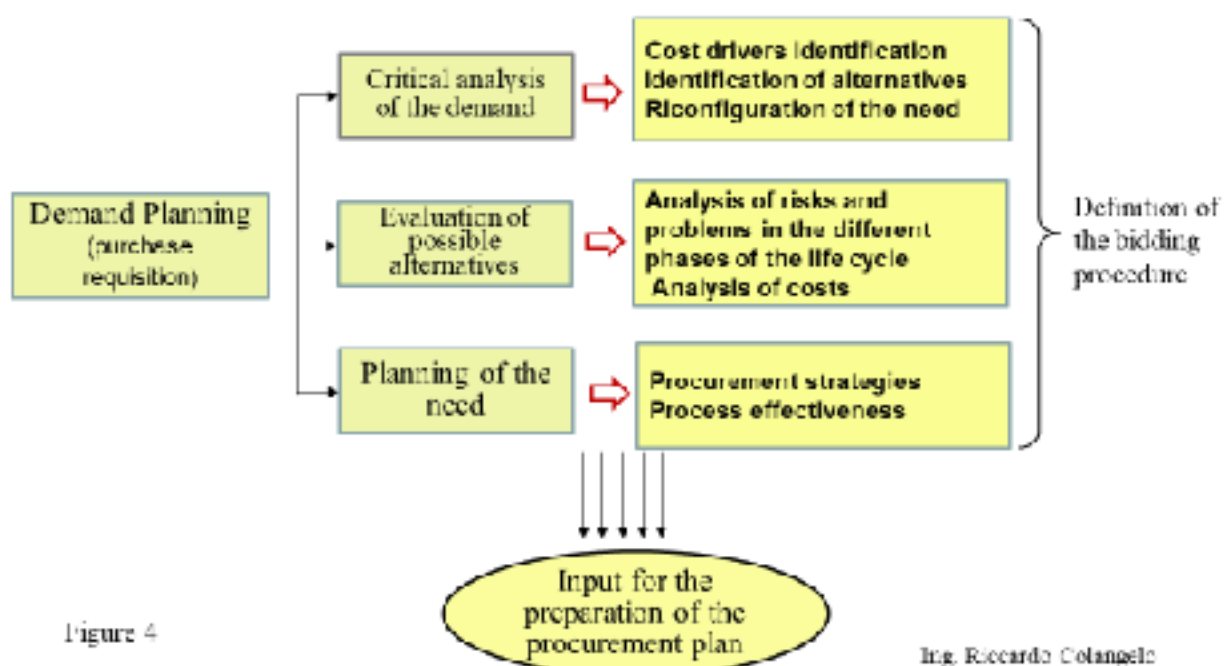


Figure 4

Ing. Riccardo Colangelo

The schemes illustrated in Figures 3 and 4 summarize the process of analyzing and optimizing the demand or the need of the requesting unit. The first relates to the best practices used in the private sector, the second is what is done in the public procurement. They are basically the same.

Lacking the element of repetition in the public sector, the attention devoted to the evaluation of alternative solutions is understandable. A similar situation occurs in every company operating in the private sector in relation to the purchase of equipment, machinery, plants and services.

### Framework contracts

Except for cases of high price volatility and variability of the technical characteristics of the supply, for all that is purchased in repetitive terms it is appropriate to stipulate one or more framework contracts, against which the requesting unit will then issue call-offs or delivery orders in relation to its specific needs. Their use does not bind the buyer as they do not imply any obligation to issue purchase orders and they ensure numerous advantages such as:

- the reduction in unit prices resulting from the multi-year duration of the contract;
- the possibility of obtaining a fixed price for the entire duration of the contract or of disciplining its variation criteria through the inclusion of a price variation formula;
- reducing the risk of late delivery;
- the possibility of having safety stock at the supplier premises;
- reduction of workload for activities without added value;
- the possibility of involving the supplier in continuous improvement activities (category management plan).

### Contract Management

A major task of the procurement is the arrangement and management of contracts to ensure that the supplier fully complies with the obligations contained therein. If the supplier delivers late or does not meet the technical and safety requirements, the buying company has to cope with delays, extra costs, delays and impacts on its reputation and image.

Once signed, contracts must not be left in the drawer to be resumed when there is a problem. They are a mix of rights and obligations that imply full compliance by contractors. Investigations carried out by Aberdeen Group and by pricewaterhousecoopers have shown that the inefficient management of the contract increases on average the costs of supply of 4% -5% and that, in the case of work contracts, this extra cost can reach 15%.

Contracts must therefore be adequately managed trying to prevent possible non-compliance. The time and attention to be paid to their management depend on the complexity of the supply and the severity of the consequences associated with the possible failure to comply with its requirements by the supplier.

Large companies have established the role of contract manager and contract administrator and have set up ad hoc procedures and operational instructions.

The closing of the contract and the evaluation of the supplier's performance

Whenever the contractual obligations have been satisfied and the testing or acceptance of the supply has been carried out, it is advisable to proceed with the formal closure of the contract. This means, for example:

- to verify that all the expected objectives have been pursued;
- to underline any non-completed activities, specifying the reasons;
- to record the date of execution of the final test, the expiry of the guarantee period of the work and the bank or insurance guarantee associated with the completion or proper functioning of the same;
- the issue of the feedback or a score associated to the significant dimensions of the supply such as: technical-qualitative requirements, delivery terms, economic conditions, health requirements, safety and respect for the environment, compliance with the code of ethics and commercial behavior (fairness during the tender stage and execution);
- the issue a closing report inclusive of the 'lessons learned'.

## **Procurement 4.0**

The changes and challenges that businesses face require a new approach to the business. We need:

- greater knowledge of the context in which we operate and therefore the systematic analysis of company data and of those relating to the supply and demand markets;
- faster decisions;

- a greater collaboration with start-ups and innovative suppliers to exploit their skills and creativity and to respond in a timely manner to the growing demands of customers.

As the procurement is the liaison with the supply markets, its role in pursuing new business objectives may be relevant. In addition to discussing prices and cost drivers, it should trigger and facilitate product development proposals and stimulate process optimization and speeding.

The volume of spending with 'critical' suppliers must be seen as an investment that implies a return. And this is possible if they are considered as partners, through long-term relationships, measured on the contribution to the improvement and innovation and sharing of the benefits obtained. It is a game that goes beyond the short term and that requires trust and transparency. It is necessary to extend perspectives and scope of action and to go beyond the first level suppliers with:

- a broader vision: from cost reduction it is necessary to move on product development and differentiation;
- a deeper vision: understanding and shaping the supply chain structure in order to strengthen it and making it more proactive and competitive;
- an external vision: understanding what the competition does and encouraging innovation and differentiation, helping the company to become a 'first mover' with all the advantages that come with it.

**Being competitive is no longer enough**

**Buyers have to become "designer" and stimulators of the value chain**

We need a new vision and a coherent mission. Procurement must operate as a 'business function' and become a 'core' unit of the company. To do all this, the use of digital technologies can be of great help. Considering that their application reduces costs and delivery times, it follows that in order to promote the company competitiveness, it is necessary to review the structure the supply base progressively eliminating the vendors that:

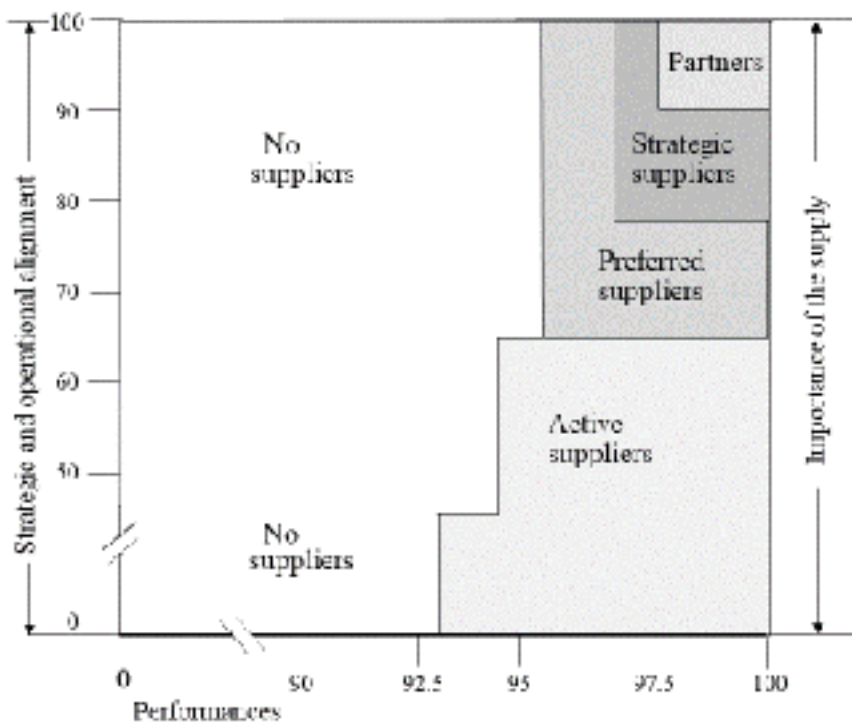
- do not operate with CAD-CAM systems (vertical integration);
- do not adopt criteria of connectivity and centralized command of production assets;
- do not automate the warehouse management (at least partially);

- do not ensure the location and traceability of supplies;
- do not establish integrated and collaborative relationships with their primary suppliers.

It is therefore appropriate to prepare a specific supply base modernization project, to be presented formally to the main suppliers during a dedicated 'vendors meeting' and to support them, where necessary, in their transformation, in exchange of clear and binding objectives.

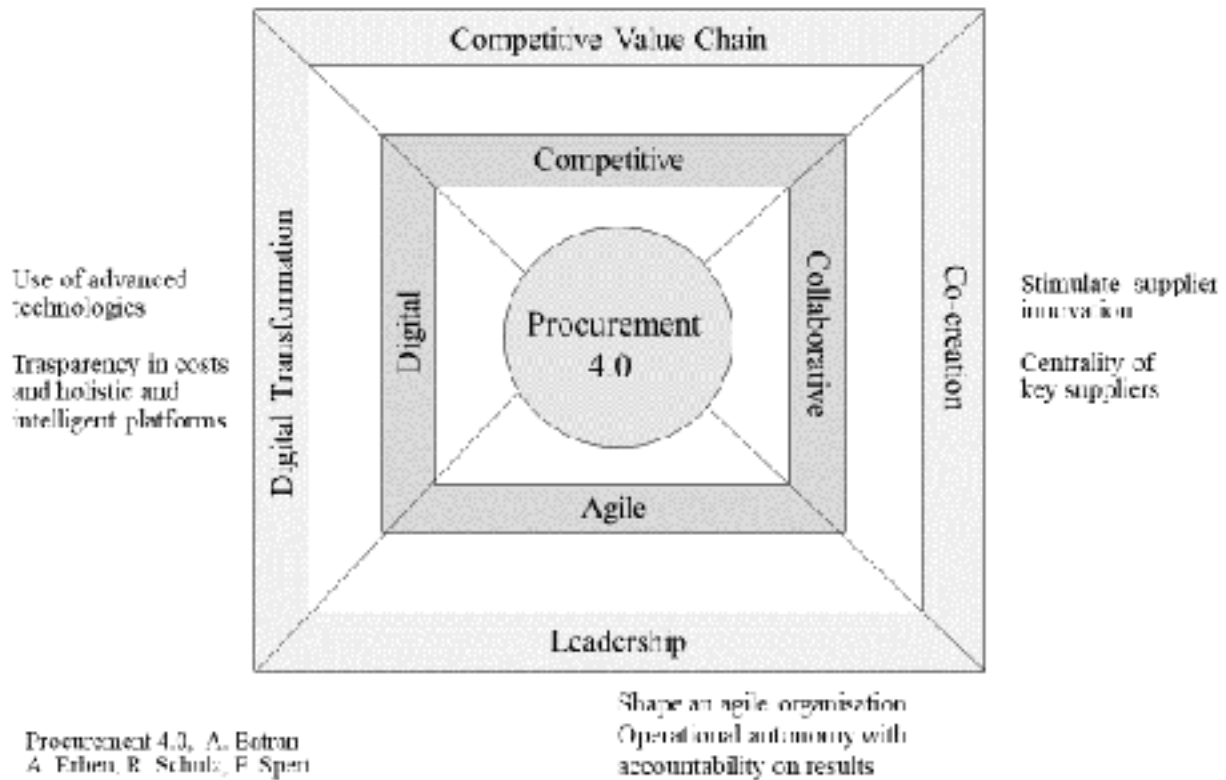
Please note that the Calenda law provides significant tax breaks for the purchase of 4.0 hardware and software applications and for education and training courses focused on digital technologies. Where a scouting activity is required for benchmarking comparisons or to locate new sources, artificial intelligence applications or specialized service providers can simplify and limit the time spent in the research activity.

Figure 6 Example of Supplier Classification Matrix



Shape competitive supply chains  
Visibility beyond the first level

Figure 7



Moving according to the criteria of Industry 4.0 means clearly, automating processes where possible from material planning, contract management, reporting, performance evaluation and feed-back issue. Having a digital platform would be a great help. It is not necessary to manage all the reports and contracts on holistic and intelligent platforms. In the next five years it may be sufficient to have a platform, integrated with the ERP that allows the 'paperless' management of the entire purchasing process of the most important and critical suppliers.

As highlighted above, it is essential to systematically collect and analyze information on new materials, solutions and technologies offered by the markets, on the organization and financial situation of suppliers, as well as on research and development projects launched and completed by them. The connectivity ensured by a digital infrastructure or ecosystem could be of great help, but where it is not possible to have it, one can proceed in the traditional manner. What matters are the results and not the tools used

Figure 8

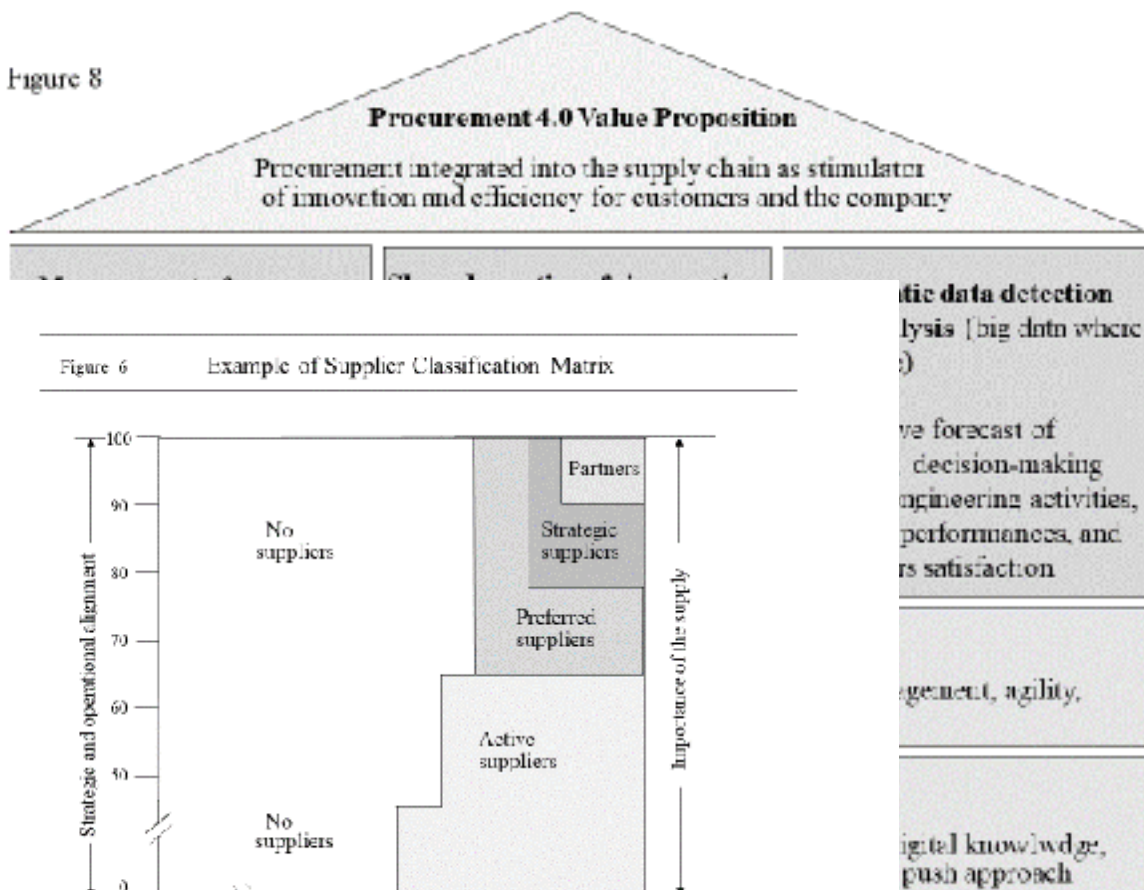


Figure 8 summarizes the features of Procurement 4.0 and the targets of a possible development project. Each company must develop a version adapted to its context and adopt a roadmap that is progressive and coherent with the overall digital development plan. The existence of adequate skills, talents and education and training programs, extended to suppliers, is a relevant factor for its satisfactory implementation.

## Conclusions

The fourth industrial revolution is changing the social and economic ecosystem in which we live and work. In the next decade the frontier of competitiveness will be based on a mix of factors that includes: digitalization, automation, connectivity, innovation, artificial intelligence, data analysis and agile management of processes.

**The greater integration of the supply chain**, aimed at improving products and processes and achieving greater levels of efficiency, **is a key element in the success of our companies**. Buyers and supply chain managers are therefore faced with new challenges, incentives and responsibilities. They must become the architects and project managers of added value supply chains. Each one, in its operating context, must set up and manage medium-long term strategic plans, choosing the drivers to operate on and the implementation methods that best suit its company. The only option not available is to

continue as before, letting our country system slide towards the thirtieth place in the international competitiveness ranking of the manufacturing industry.

## Chapter 4

### The 4.0 concept as enabling condition for Supply Chain self-regulation

*Fabrizio Albino Russo*

#### Introduction

In a hypercompetitive<sup>1</sup> world in which it's possible to execute and conclude practically every type of transaction at light speed, it's now essential to ensure not only the correctness of the transactions themselves, but also the continuity of their execution. Therefore, the concept of Business Continuity, once intended as a structure<sup>2</sup> to guarantee an acceptable level of activity following sudden and sometimes unforeseeable events, most often classified as real "cases of force majeure", it becomes a fundamental element of the company's Supply Chain, which cannot afford to undergo interruptions (disruptions).

Consequently, the principles of Supply Chain Risk analysis and the relative analysis of vulnerabilities have become essential elements of the business management, from which to bring down the set of policies and preventive actions, in the best of hypothesis, or mitigation of negative effects, in the worst cases, in order to make the Supply Chain as resilient<sup>3</sup> as possible.

In recent years, thanks to the increasingly marked revolution brought by the 4.0 technologies, we are seeing a paradigmatic jump also in this field. As it is becoming more and more evident the possibility to develop a Supply Chain resilient not as this or as a result of what has been planned and/or previously configured, but resilient because adaptive, thanks to the embedding in its structure of elements able to allow some self-regulating behaviors.

This is a basic and important concept, because it finds its foundation in the principle of survival of the company system intended as an organism and therefore, according to the concept of «Industrial Darwinism»<sup>4</sup>, able to increase its possibilities of survival, as much he's able to adapt himself to the events that are vital for his life. Direct consequence of the developments to be witnessed during this period thanks to the 4.0 technologies is

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<sup>1</sup> «We talk about Hypercompetition when technologies or commercial offers are so innovative that the standards and rules of the game change continuously, so that competitive advantages become indefensible..... and is characterized by rapid and intense competitive actions, in scenarios where competitors move fast to build new advantages and to undermine those of rivals». Stretch and adapted from: Kotler P., Caslione J. A., 2009, *Chaotics*, Ed. Sperling & Kupfer, Milan – (Italy)

<sup>2</sup> In this case we mean the structure in its entirety, not only physical, but also inclusive of processes, procedures, instructions, rules, etc.....

<sup>3</sup> For resilience and therefore, consequently, for resilient supply chain, we mean a supply chain able to sustain unexpected disturbances (disruptions), in order to avoid traumatic and/or unexpected and/or sudden interruptions of its processes and flows of materials, goods and services necessary to achieve the company results.

<sup>4</sup> The concept of industrial Darwinism derives from the concept of Social Darwinism and argues that in the economic-business world doesn't survive the strongest, the fastest, the largest, etc...., but the most adaptable.

therefore the absolute increase of the potentialities and the applications of the SCEM (Supply Chain Event Management) systems, no more defined as simple devices useful to interconnect and interface different elements of the supply chain, but defined as elements of a functional and operative approach that it's now essential to steer the configuration of a resilient supply chain in an adaptive perspective; transforming to all effects the Supply Chain Event Management in a real management methodology.

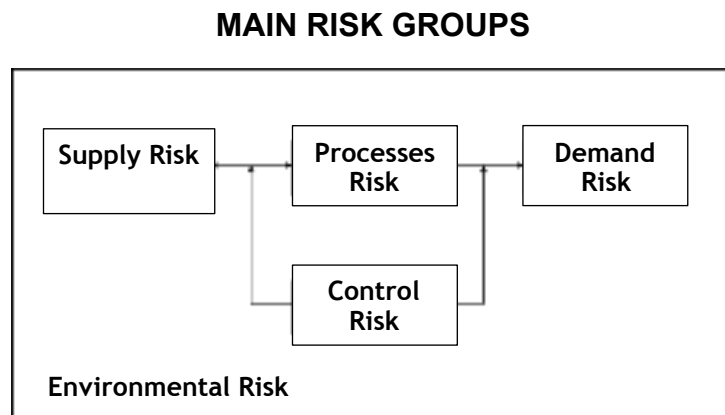
## Supply Chain vulnerability and Risk Assessment

By definition, with the term vulnerability, we mean “a fragile, very sensitive state that can be harmed, damaged, which can be wounded and hit”<sup>5</sup>. By applying this definition to the Supply Chain it's therefore clear that it is very vulnerable because it's extremely prone to be injured, damaged, wounded and affected: in a few words disturbed and interrupted (disrupted).

In order to mitigate this situation, the first step to do is then to try to understand the vulnerability status of the Supply Chain we are using or we want to use or implement, so that we can put in place all the necessary actions to make it as resilient as possible.

To do this, the process of Risk Assessment is extremely important, because it's by its proper implementation that it is possible to bring to the surface the main vulnerabilities of the Supply Chain that is being analyzed. In short words, the supply chain vulnerability is due to specific factors of risk that are activated as a result of certain events.

These risk factors, responsible for possible and/or potential interruptions, blocks and collapses (disruptions) of the Supply Chain<sup>6</sup>, can be grouped into “main risk groups”, interdependent and interconnected, as showed below (*Diagram 1*)<sup>7</sup>.



*Diagram 1 - Main risk groups*

As evidenced by the *diagram 1*, the main risk groups can be classified as follows:

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<sup>5</sup> Translated from: Lo Zingarelli – «Italian Language Vocabulary» – Zanichelli – Bologna (Italy)- 2006

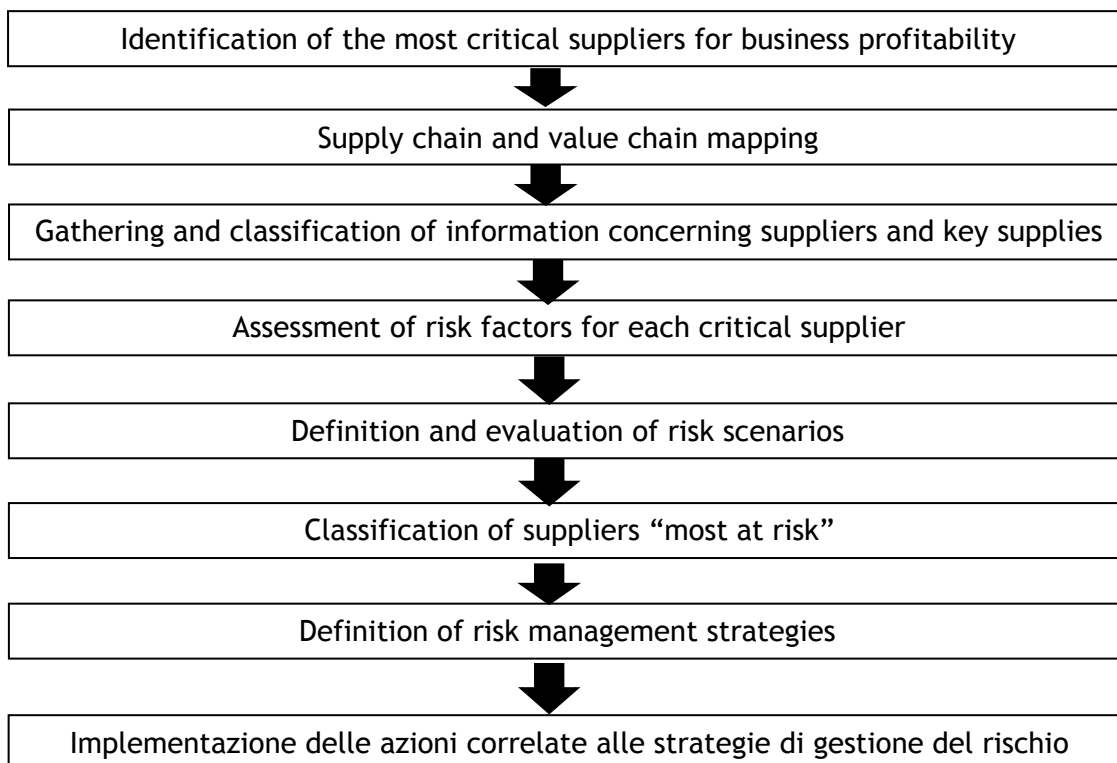
<sup>6</sup> This fact is more evident at business level

<sup>7</sup> Stretch and adapted from: «Shrinking the Supply Chain»- Mason-Jones, Towill – and from «Supply Chain Management»- Martin Cristopher - Ed. Prentice Hall - 2005

**Environmental<sup>8</sup> risks;**  
**Supply risks;**  
**Processes risks;**  
**Demand risks;**

In order to be able to ensure a correct analysis of these main risk groups, as well as their declination in factors and micro-factors of risk affecting them, methodologies of Supply Chain risk evaluation and management have been developed, in order to focus as much as possible peculiarities and criticalities.

Practically all the methodologies thus developed have common denominators, which can be summarized in the Supply Chain Risk Assessment and Management diagram reported below (*diagram 2*)<sup>9</sup>.



*Diagram 2 - Common denominators of Supply Chain Risk Assessment & Management methods*

All before said, if we look at the main vulnerabilities evidenced from risk analysis activity, regardless of whether they are focused on the Supply Chain rather than affecting the entire business, it is rather typical to find criticalities related to the following aspects:

- 1) Globalization and/or relocation
- 2) Decrease of production sites
- 3) Tendency to centralize distribution

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<sup>8</sup> As environmental risk we intend all the factors that can impact the business and that are linked to the location of the Company (e.g. : rules, politics, economy, etc.....)

<sup>9</sup> Stretch and adapted from: «*The Risk Management Handbook*» - Edited by David Hillson - Chapt. 08 written by Lisa Conrad – Source Zurich - Ed. Kogan Page – London (UK) - 2016

- 4) Outsourcing trends
- 5) Reduction of supplier base

An evident thing that is appearing examining the list reported above, is not so much the level and potential of risk inherent in the above-mentioned aspects, as the fact that this listing seems the typical «action list» of what is generally required to Company managers by representatives of the property or shareholders, in order to see efficiency recoveries as soon as possible.

So, as already discussed in other occasions "we find ourselves in front of a real paradox, finding bitterly that not only the efficient supply chain and the effective supply chain are operating at the opposites (this is a known fact), but that more the Supply Chain is efficient, less is resilient or, if you prefer, more is vulnerable»<sup>10</sup>..... let's see why a little bit more in detail.

### **Business Continuity and risk mitigation**

Taking into account that the ultimate objective of the risk-analysis process is not so much the identification of risks in itself, but the successful implementation of an effective system of prevention, mitigation and management, in order to ensure the business Continuity, it is clear that we can't be able to run out of the topic in a simple paragraph. "First of all it should be wise to make peace with ourselves and to take note of the fact that, at least in the field of risk management of the Supply Chain, the term efficacy, or the ability to react and the speed of reaction (or reactivity that we want to say) has between its pillars the redundancy"<sup>11</sup>.

Redundancy which, based on the previously mentioned vulnerability points, can be briefly detailed as follows.

### **Globalization and/or outsourcing<sup>12</sup>**

The redundancy here regards the capability to maintain some (even minimum) production and supply capacity on a local basis, in order to mitigate the relative risks of disruptions;

### **Reduction of production sites<sup>13</sup>**

The redundancy here regards the capability to maintain a flexible production capacity, so as to be able to compensate any production failures of the other sites, thus avoiding the "specific single specialization" of the production sites;

### **Tendency to centralize the distribution<sup>14</sup>**

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<sup>10</sup> F. Albino Russo – «*Il paradosso della Supply Chain resiliente-The resilient supply chain paradox*» – Logistica Management, April 2017; F. Albino Russo – «*Il paradosso della Supply Chain resiliente-The resilient supply chain paradox*» – AD-NET – [www.adnet.it](http://www.adnet.it); F. Albino Russo - «*Il Supply Chain Event Management come raccordo tra supply chain risk management ed execution-SCEM as linking element from SC risk management and execution*» – Event proceedings «Fabbrica Futuro» for ADACI, 15/02/2017, Event Master: Este S.r.l.-[www.este.it](http://www.este.it)

<sup>11</sup> *Ibidem*

<sup>12</sup> *Ibidem*

<sup>13</sup> *Ibidem*

<sup>14</sup> *Ibidem*

The redundancy here regards the capability to implement a networked system instead of a “star system” (with one or few big hubs), in order to compensate for any distribution lacks or breakdown;

### **Outsourcing trend<sup>15</sup>**

The redundancy here regards the capability to have an internal or external alternative respect to the “outsourcer” involved;

### **Reduction of supplier base<sup>16</sup>**

The redundancy here regards the capability to have alternatives for each type of supply commensurate with the required or expected volumes.

Unfortunately, the redundancy is expensive....

## **The Agility**

"A very important aspect, but generally little emphasized within the Supply Chain Risk Management, is about agility, briefly defined as the ability of quick problem solving, with a quick adaptation to changes.

Apart from all the possible considerations that are well known in other managerial and organizational areas, in the specific context under examination the agility is rather important because, if properly implemented, it reveals itself as a lever that, at a reasonable cost, can allow the maintenance, albeit within certain limits, of execution levels and performance required by the Supply Chain, thus representing an excellent "trade off" between the need for effectiveness in the management of risks and the ubiquitous pursuit of efficiency.

Among the various ways in which agility can be implemented, it has been found that companies are increasingly tending to move towards systems and tools called SCEM (Supply Chain Event Management)" <sup>17</sup>.

## **The Supply Chain Event Management (SCEM)**

With the term Supply Chain Event Management, generally abbreviated with the acronym SCEM, we mean «the preparatory work and implementation of the activities necessary to face unusual changes, which can occur starting from the process of realization of a product in a certain place, until its delivery to the customer»<sup>18</sup>. So already from the definition it appears in all its evidence how much this concept can be useful for securing the Supply Chain.

A typical SCEM system can be represented according to the architecture shown in *Diagram 3* <sup>19</sup>. The scheme in question shows how this structure is set up so as to "be able to monitor and collect all the data and information regarding the state of the activities and

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<sup>15</sup> *Ibidem*

<sup>16</sup> *Ibidem*

<sup>17</sup> *Ibidem*

<sup>18</sup> Definition of «Supply Chain Event Management» adapted from Cambridge Business English Dictionary © Cambridge University Press

<sup>19</sup> **St**retch and adapted from «*Supply Chain Graphic of the Week: The Changing Nature of Supply Chain Visibility*» - Supply Chain News Bites - Only from SCDigest - By SCDigest Editorial Staff - 26/04/2012

the processes related to the Supply Chain, and then to decide whether and how to activate to react to any deviant events compared to the planned, or independently, or through the intervention of the "actors" of the Supply Chain itself" <sup>20</sup>.

The logic of intervention and operations of similar structures can be outlined as shown into the *Diagram 4* <sup>21</sup>.

"Basically, the SCEM system observes and monitors the Supply Chain processes, steering them through policies, directives, procedures, flows, schemes and rules of engagement".

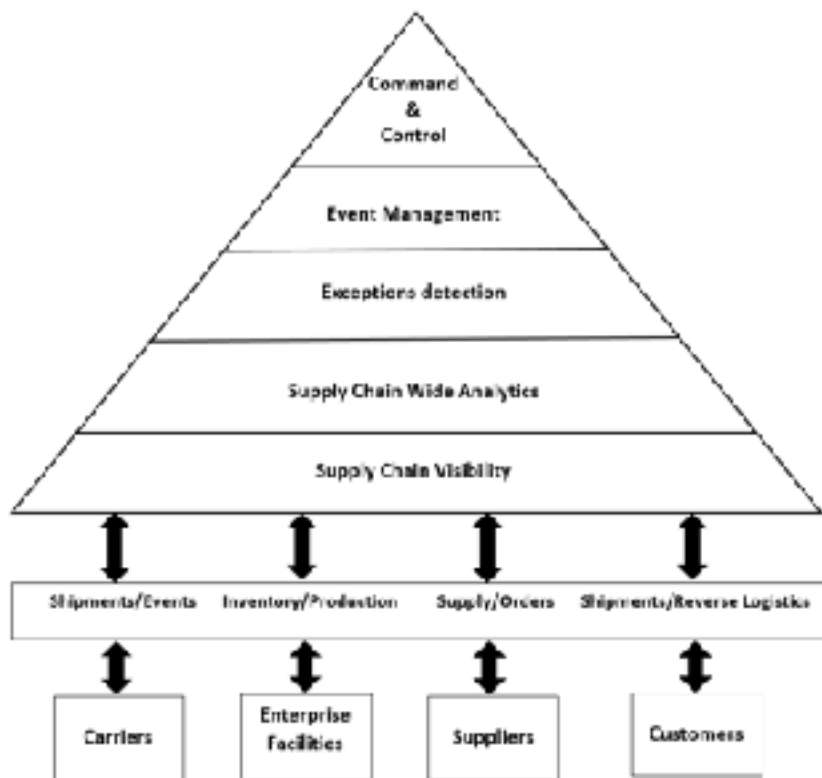
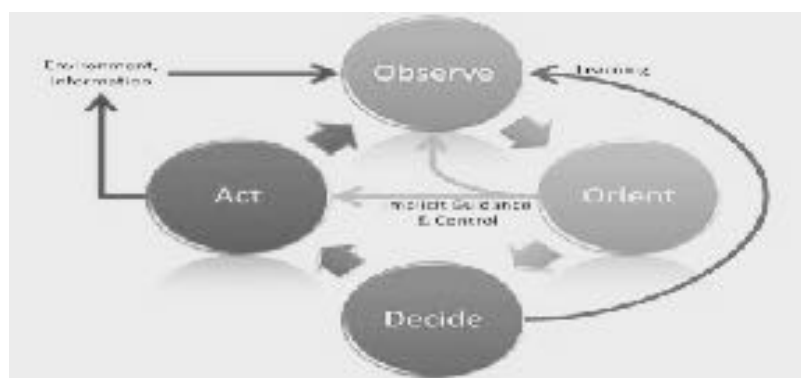


Diagram 3 - Typical SCEM architecture



<sup>20</sup> *Ibidem*

<sup>21</sup> Stretch and adapted from «*Extending Supply Chain Planning Paradigms Beyond Advanced Planning Solutions*» – Trevor Myles – 10/10/2013

*Diagram 4 - logic of Intervention and operations logic of a typical SCEM system*

According to these guidelines, the SCEM system guides and controls the Supply Chain by activating itself according to the specific events against which a reaction has been set and is represented by the schematized flows called "implicit guidance and control" in *Diagram 4*; leaving to the Supply Chain actors the burden of decisions against events for which there is no autonomous reaction.

Unfortunately, the current state of things, is seeing the supply chain event Management structures very unbalanced on monitoring and control of the supply chain, on the measurement of performances and processes through the appropriate KPIs, on notification of events and sometimes also on possible scenario simulations, while in practice little is seen on the specific aspect of the event management.

### **The missing link, the 4.0 environment for the supply chain self-regulation**

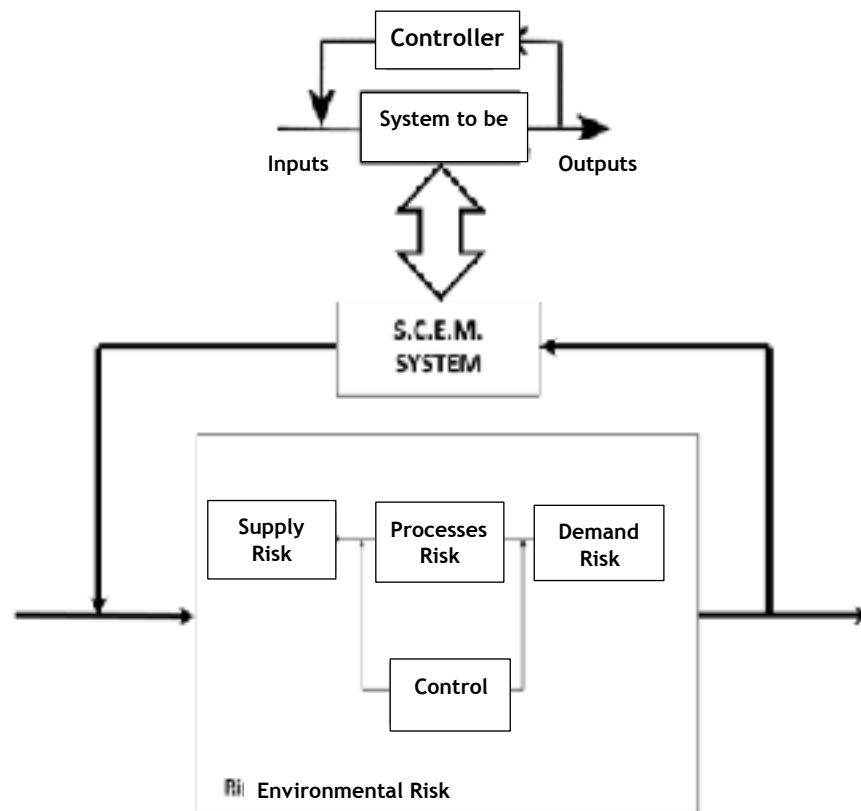
Taking a look at the state of the art it's possible to affirm that, one of the main obstacles to the balancing of the SCEM systems towards the event management and the possibility of obtaining the relative time of intervention as close as possible to the real time, it's consisting into the capability to promptly intercept the signals of "deviance" of performances and the ability to collect and elaborate in this case promptly and quickly the amount of information generated by a similar approach distributed throughout the Supply Chain.

In fact, if we integrate the main risk groups, previously represented in *Diagram 1*, with a block representing a system of SCEM conceived to interact and react to the events generated by the main risk groups in question, we find ourselves neither more or less than in the presence of a system connected in feedback<sup>22</sup>, as exemplified in *Diagram 5*<sup>23</sup>.

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<sup>22</sup> Two systems are said to be connected in feedback when the output of the first is the input of the second, while the output of the second is summed or subtracted to an external input to determine the input of the first system.. - P. Rocco – «*Dispense di Automatica*» – Lez. 5 – Politecnico di Milano (Italy) – Dip. di Elettronica ed Informatica – October 2001

<sup>23</sup> F. Albino Russo – «*Il paradosso della Supply Chain resiliente-The resilient supply chain paradox*» – Logistica Management, April 2017; F. Albino Russo – «*Il paradosso della Supply Chain resiliente-The resilient supply chain paradox* » – AD-NET – [www.adnet.it](http://www.adnet.it);



*Diagram 5 - Basic diagram of a SCEM system used as feedback element to control the risks of the system that need to be monitored*

This diagram shows how the SCEM system plays the role of controller and the Supply Chain, integrated in the previously commented risk assessment model, plays the role of controlled. On the basis of this schematization, it is also possible to assume the partial implementation of SCEM systems on every single block of the risk assessment model, but honestly it would still be detrimental to the overall effectiveness of the method.

From all this it seems very clear that a fundamental element for the effectiveness of a system so conceived is without a shadow of a doubt the reactivity of the system, or the time of reaction to the events in order to intervene, when necessary, so timely.

Not only..... a system so conceived, if it's able to function properly, it is also efficient, thus managing to settle, at least partially, the ubiquitous paradox of the costs associated with the redundancy needed to make the Supply Chain resilient. In fact, by implementing a system to a certain degree "self-regulating", we are promoting the so-called agility which, declined in terms of supply chain, is nothing more than the ability to adapt quickly to the changes imposed by the events, in order to avoid supply chain disruptions and ensure business continuity and, consequently, safeguard the value chain, which is what really keeps the companies alive and that allows businesses to thrive.

The 4.0 environment therefore presents itself as a real paradigmatic leap able to move, with regard to the Supply Chain, the system of mitigation and security typical of redundancy, with all related costs, to a different level, that of agility, interconnection and, above all, reconfigurability, thanks to the new technologies put in place by this new paradigm. Specifically, when it comes to technologies 4.0, we talk about technologies that can interconnect all the elements of a particular environment, usually called "ecosystem",

in order to allow an almost complete digitalization, in order to share any kind of information useful to ensure the expected performance of the systems immersed in this environment.

Information sharing that, creating a better visibility along the whole supply chain, enable the possibility of implementing a really collaborative planning and the possibility of building systems able to react timely to events in a really adaptive perspective. Technologies such as the IoT<sup>24</sup> allow the interaction and connection between objects, extremely improving the speed and the way of connection<sup>25</sup> and allowing also a fast transmission of moles of data once unimaginable. All this guarantees the timelines of information necessary for the implementation of a truly responsive system.

In conclusion of this brief examination of how the 4.0 can be seen as an enabling factor for the management of events in the Supply Chain, wanting to use a term rather appreciated to the system experts, it is as if the concept of Environment 4.0 has the management of events « Embedded» in itself.

So, let's go along this new promising road, without forgetting that every innovation always consists of "two steps forward and a step backward".....

## **Chapter 5**

### **Lean Thinking, Industry and Supply Chain 4.0**

*by Stefano Ruffini*

#### **Lean Thinking, thirty years later**

In the fall of 1996, James Womack and Daniel Jones published a book that soon would have changed production systems globally: *Lean Thinking, Banish Waste and Create Wealth in your Corporation* invaded bookstores, libraries and business schools across the planet. It was about the stories of Japanese, American and European companies that had been able to implement a set of principles, named *lean thinking*, to overcome the 1991 recession. Five years later, in 1996, those companies not only had survived, but had increased sales and profits, in an unfavorable economic environment. Other recessions, starting from the 2001 crisis, would soon have happened, and the interest in a set of principles so simple to understand grew exponentially.

To be honest, Lean Thinking was more the arrival, than the starting point. American scholars began analyzing the Toyota production system in the late 70s, through the *International Motor Vehicle Program (IMVP)* of Massachusetts Institute of Technology (MIT), which, in 1990, led to the publication of the book *The Machine That Changed the World*, where the expression *lean thinking* is utilized for the first time.

Now, fast forward to 2018. Thirty-nine years after the launch of the *IMVP*, twenty-eight years after publication of *The Machine that Changed the World* and twenty-two years after the release of *Lean Thinking*. Since then, a lot has happened, certainly enough to try to assess the "lean phenomenon" and its impact on corporate world. Two global recessions (2001 and 2007-2009), and a European debt crisis (2010-2011) posed enormous challenges to many companies. A new far-reaching change, which goes under the name of

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<sup>24</sup> Internet of Things

<sup>25</sup> Right now we are already talking about 5G

Industry 4.0, has recently appeared, promising radical changes. Will lean thinking be able to meet customer and company needs in the near future? Will Industry 4.0 replace lean? Womack and Jones identified five basic principles of lean thinking:

- Identify the value, that is what the customer is willing to pay for
- Identify the value stream, or define the sequence of actions that creates value for the customer
- Make value flow, or perform activities in the value stream with no interruption and no waste
- Implement pull, so that value can flow according to customer requests
- Reach perfection, deliver what customer wants, exactly when she wants it and at a fair price

For many reasons, primarily the structure of many companies that are organized by functions and not by value chains, applying lean principles in the right sequence is not an easy task.

More often than not, main goal of the business is to meet a basket of departmental metrics. Purchasing department strives to produce savings, logistics department works to achieve unprecedented on-time delivery, finance and control department tirelessly releases business cases, planning department is aimed at minimizing inventory. In this environment, customer is very far from company life, resembling a distant, weak voice. Customer should be happy to receive a product or service that, in fact, is the by-product of the work performed by many departments in the company.

The difference between value chain, which is horizontal by nature, and the vertical company hierarchy is quite evident when we act as customers, who need to decide how to allocate their resources. Today, more than ever, customers are interested in satisfying their needs, rather than being held hostage of internal dynamics of a company. Trying to satisfy a customer in search of the horizontal value flow, through a vertically organized enterprise is an especially complex balancing act.

### **Is there still something to improve?**

Decades of lean initiatives have brought to us a long series of successes, errors and failures, sometimes occasional, some other continued. For a long time, hundreds of companies have sought (and still seek) to reduce waste and increase productivity. Not so frequently, the five principles of lean thinking are implemented in the right sequence, the one described by Womack and Jones, which starts from the identification of value for the customer, and then subordinates everything else to that. Many reasons could explain why this happens, primarily the fact that it is much easier to improve an existing (and visible) production system, rather than defining value for the customer at first. Some companies have introduced a parallel approach that goes along two directions: while the first team focuses on the reduction of waste, a second team works on the definition of value for the customer. Combination of these two activities can deliver encouraging results: what the customer is willing to pay for is produced in a system where waste is minimized, and emphasis on quality is non-negotiable.

This is exactly the area where there are still tremendous opportunities for improvement: for some sectors, especially among the pioneers of lean thinking, further reduction of waste is increasingly difficult per se: the law of diminishing returns seems not to make concessions, even to lean thinkers. The implementation of a greater number of lean tools does not

automatically leads to a further decrease of waste. Staying competitive means continually improving productivity, quality and service, but also being able to generate value for the customer throughout the entire value stream, not just in some parts, maybe always the same for decades. The two-speed company, where who works to reduce waste and who acts to identify value for customer are separate entities, has not a bright future ahead. Like companies that try to do better what have long done well. Reducing existing waste, without wondering if, in the not too distant future, customers will be paying for same products or services is a kind of exceptionally dangerous waste. Identifying value for the customer and then defining the value stream – first and second principle of lean thinking – does not mean telling the same story once again, only with less waste and a better verbiage.

The law of diminishing returns applied to lean tools, increasingly demanding customers, and a volatile environment require that the five principles of lean thinking are applied in the sequence in which they were originally conceived. New technologies, including Industry 4.0, changing expectations from customers and new competitors drastically reduce time to react. Companies that only five years ago did not exist, or that were not perceived as a threat, suddenly become fierce competitors that are able to steal valued historical customers, leveraging the utilization of new business models. Because of that, traditional companies have less time to react, and fewer opportunities to make mistakes without bearing the full set of consequences. Tough competition shifts towards the ability to identify value for the customer, and to the ability to deliver it in a consistent, sustainable and profitable manner. Companies with decades of history are no stranger to change: countless times customers promoted change in many sectors. However, more often than not, change process took years, sometimes a generation. This is no longer the case. Focus shifts towards velocity, which, inevitably, has to be higher, and implies a much greater risk appetite, the same risk that new entrants have in their DNA since day one. Managing change is never easy, but in some cases, there are no alternatives.

Thirty years of lean thinking have delivered significant progresses in all industries, however the identification of value for the customer, and reduction of waste are far from having delivered their full potential, particularly in environments where rapidity of change is a must.

## **Lean Thinking and Industry 4.0**

A number of enabling technologies, commonly labelled as Industry 4.0, has reached the maturity required to move from laboratories to the everyday life of millions of consumers and professional users. What could be their impact on lean thinking? Many of these technologies are not truly new; some have been introduced a few years ago, others still require significant investments to be utilized widely. However, many of them are ready to be integrated into current production systems.

What could be the impact of Internet of Things (IoT), Big Data, collaborative robotics or additive manufacturing on lean thinking? Will Industry 4.0 replace lean? Can new technologies perform much of the work needed to identify value for the customer and then reduce waste? Ultimately, will Industry 4.0 act as a sort of “autopilot” for the definitive implementation of lean thinking? Alternatively, will it be so revolutionary to make lean obsolete?

Cross-pollination between lean thinking and technological progress is not new: think of the countless innovations that have been introduced in production systems in the last half-century. Some to support lean principles, some others not, most of them able to promote a healthy debate on the relationship between innovation and lean. Results are largely positive, for example, when it comes to promoting innovation that makes setup reduction possible. However, we should reaffirm that in the lean universe, technological innovation is

never the end of the story. Since the very beginning, technology has always acted as an enabler of lean transformation, not as its substitute, and we have not seen this changing over the years. Industry 4.0, that is a collection of enabling technologies, does not seem to be an exception.

In the future, a steep increase of productivity will not come solely from the implementation of a variety of enabling technologies. Even today, the use of predictive maintenance systems, combined with remote monitoring can reduce the downtime by 30-50%, increasing the use of assets installed. However, a link between increased productivity of a group of machines and value for the customer is not as automatic as one might think. Only the combination of strong skills-sets in traditional business disciplines (operations, supply chain, production, design and maintenance) with Industry 4.0 is able to transform companies in the right way. Industry 4.0 is not going to replace one of the key pillars of the Toyota Production System: jidoka or autononomation. The only way to build quality into products comes from the continued interaction between automation and human touch. The former does not exclude the latter.

Traditionally people, processes and technology are critical elements of any company. A fourth element has to be added: a greater risk appetite, a key factor of any transformation process. Organizational inertia, which originates from focus on the very short term, thrives in any place driven by departmental metrics, and on hierarchical structures that reward budget at the expense of innovation. Lean thinking, complemented with Industry 4.0 tools, can fix this issue, but only if a company accepts a greater level of risk, that, incidentally, is one of the strengths of many startups. Top management needs to act quickly and effectively: the approval of another business case and yet another cover article in the latest company newsletter is not enough to trigger change.

#### Lean Thinking and Supply Chain 4.0

Supply chain management is a relatively young discipline, born approximately thirty years ago. It has grown in a period of continuous – and often tumultuous – changes of the economic scenario. In the exact same period, manufacturing systems have evolved from vertical factories to outsourced networks. Supply chains went global, in the very moment when volatility of demand and supply reached unprecedented peaks. Meanwhile, another radical change was occurring: power shifted from suppliers, their technology, resources and reputation, to customers, who continuously change their mind. The impact on the design of supply chains was not negligible. From mass production, designed to serve the mass market, to mass customization.

Supply chain transitioned from the department that works to make components available and fight stock-out to a very different role. Primary focus shifted towards higher value-added areas, such as demand planning and Sales, Inventory & Operations Planning (SIOP). This change has been largely enabled by the implementation of new technologies, which delivered better visibility on the whole supply chain. There is still much to be done, as current supply chains, extended in space and time, are the ideal place for waste to grow. Paradoxically, today, supply chains are essential to provide value to the customer, but contain a good dose of waste, that customers are not willing to pay. More than ever, competitive advantage is measured in relative terms: companies that deliver flexibility and reduce waste end up increasing their market shares.

#### **The future of Lean Thinking**

Search for competitive advantage through the identification of value for the customer, and continuous reduction of waste is not going to end any time soon. However, hope is that a number of enabling technologies, labelled as Industry 4.0, will be able to increase speed of implementation and effectiveness. The path, however, will not be linear, despite the massive support that technology can provide. Like any deep transformation, identifying and eliminating pitfalls that arise along the way is key. Primarily, temptation to exchange tools for solutions, technology for customer value. The introduction of even more powerful devices for data collection and analysis (which, incidentally, have been around for decades) will rely on the development of organizational synapses that can translate results of Big Data Analytics applications into value for the customer. Quick identification of what is value for the customer is not equivalent to have it delivered, ready to ship, and in a nice box. Perfectly knowing the exact moment when a machine will fail, does not imply that the company is able to determine its impact on customer. In a not so distant future, we may find that knowing exactly day and hour when a machine will fail, requires appropriate countermeasures to be implemented throughout the entire value chain. Otherwise, the result of a brilliant application of Big Data Analytics will be very similar to a shoot in the dark. Trying to make up for an unstable process with an overdose of technology will not deliver any worthwhile result, other than the huge cost of the investment. Organizational inertia will remain the main obstacle to remove in the near future. Fear is that dogmatic introduction of Industry 4.0 applications might further widen the distance between people, processes and technology, rather than reducing it.

PwC estimates that global investments on Industry 4.0 solutions will reach \$907 billion annually, until 2020. A huge amount of money, only in part supported by government or research programs: Industry 4.0 is not only an organizational challenge, but also a financial threat.

The exploration of unknown territories is always exciting and worrying at the same time. It is our belief that the combination of lean thinking and Industry 4.0 is the next frontier of value for the customer. More than a revolution, an evolution, at a speed never experienced before.

## Chapter 8

### **The future of the procurement seen by some member associations of the International Federation of Purchasing and Supply Management**

by Stefano Ruffini

#### 1. Introduction

In order to analyze the impact on the procurement and supply chain management of the fourth industrial revolution from a global perspective, ADACI also asked for the opinion of some members of the International Federation of Purchasing and Supply Management. The world federation of purchasing - so called for brevity by its members - was established in London on May 14, 1974 and represents the outcome of the merger between the pre-existing European Federation of Purchasing (EFP) and the International Federation of Purchasing (IFP). ADACI, founding member of IFPSM, was an active member of both.

Today, 48 associations are members of the Federation, representing about 250,000 purchasing professionals who globally manage a portfolio of over 4 trillion euro. Divided by regions are:

### **Africa**

|         |                                                                  |
|---------|------------------------------------------------------------------|
| Kenya   | Kenya Institute of Supplies Management                           |
| Malawi  | Malawi Institute of Procurement and Supply                       |
| Nigeria | Chartered Institute of Purchasing & Supply Management of Nigeria |
| Uganda  | Institute of Procurement Professionals of Uganda                 |

### **Americas**

|                   |                                                                          |
|-------------------|--------------------------------------------------------------------------|
| Argentina         | Asociación Argentina de Compras Administracion de Materiales y Logistica |
| Brazil            | Brazilian Council of Purchasing Executives                               |
| Canada            | Supply Chain Management Association                                      |
| Messico           | Asociación de Profesionales en Compras, Abastecimiento y Logística,      |
| Trinidad & Tobago | Caribbean Association of Procurement Professionals                       |

### **Asia- Pacific**

|             |                                                                                        |
|-------------|----------------------------------------------------------------------------------------|
| China       | China Federation of Logistics and Purchasing                                           |
| Philippines | Procurement and Supply Institute of Asia<br>Philippine Institute for Supply Management |
| Hong Kong   | The Institute of Purchasing and Supply of Hong Kong                                    |
| India       | Indian Institute of Materials Management                                               |
| Indonesia   | Ikatan Ahli Pengadaan Indonesia<br>Asosiasi Pengacara Pengadaan Indonesia              |
| Japan       | Japan Materials Management Association                                                 |
| Malaysia    | Malaysian Institute of Purchasing & Materials Management                               |
| Singapore   | Singapore Institute of Materials Management                                            |
| Sri Lanka   | Institute of Supply and Materials Management                                           |
| Taiwan      | Supply Management Institute, Taiwan                                                    |
| Thailand    | Purchasing and Supply Chain Management Association of Thailand                         |

### **Europe**

|         |                                                                                    |
|---------|------------------------------------------------------------------------------------|
| Austria | Forum Einkauf Bundesverband Materialwirtschaft, Einkauf und Logistik in Österreich |
| Belgium | Association Belge des Cardes d'Achat et de Logistique                              |
| Croatia | Croatian Association of Purchasing                                                 |
| Denmark | Danish Purchasing and Logistics Forum                                              |
| Estonia | Estonian Purchasing and Supply Chain Management Association                        |
| Finland | Finnish Association of Purchasing and Logistics                                    |
| Germany | Bundesverband Materialwirtschaft, Einkauf und Logistik                             |
| Greece  | Hellenic Purchasing Institute                                                      |

|                 |                                                                                                              |
|-----------------|--------------------------------------------------------------------------------------------------------------|
| Ireland (Rep)   | Irish Institute of Purchasing and Materials Management                                                       |
| Israel          | Israeli Purchasing & Logistics Managers Association                                                          |
| Italy           | Associazione Italiana Acquisti e Supply Management                                                           |
| The Netherlands | Nederlandse Vereniging voor Inkoop Management                                                                |
| Norvegia        | Norsk Forbund for Innkjøp og Logistikk (The Norwegian Association of Purchasing and Logistics)               |
| Poland          | Polskie Stowarzyszenie Menedżerów Logistyki                                                                  |
| Portugal        | Portuguese association for Purchasing and Supply Management                                                  |
| Russia          | Federation Federation of Purchases and Supply Management of Russia                                           |
| Serbia          | Serbian Association of Professionals in Public Procurement<br>Serbian Supply Chain Professionals Association |
| Slovenia        | Združenje nabavnikov Slovenije (Slovenian Purchasing Association)                                            |
| Spain           | Asociación Española de Profesionales de Compras, Contratación y Aprovisionamientos                           |
| Sweden          | Swedish Purchasing and Logistic Association                                                                  |
| Switzerland     | procure.ch Swiss Association for Purchasing and Supply Management                                            |
| Turkey          | TUSAYDER                                                                                                     |
| Hungary         | Hungarian Association of Logistics, Purchasing and Inventory Management                                      |
| United Kingdom  | International Federation of Purchasing & Supply Management                                                   |

## 2. Five megatrends that will change the industry from Helsinki to Rome in 2018

*Markku Henttinen, CEO of the Finnish Association of Purchasing and Logistics LOGY*

For most people, change is a threat. Historically this makes sense, as change has always made some people into winners and some into losers, at least in the short run. With the rise of motor vehicle transport, coachmen needed to find new professions. We are facing a similar change when vehicles are automated. Additionally, Ubers, airbnbs and the like are shaking traditional service provision to its roots and forcing a change upon both business models and legislation. In the process a lot of winners are made, but some losers as well. The automation of vehicles and business models based on sharing economy are merely consequences of a wider global change in humanity. It is the era of information and trends and phenomena spread effortlessly across artificial borders. They may be controlled and constrained through regulation, but they cannot be stopped.

Crossing geographical borders is an inherent aspect of logistics and procurement, so it is only natural for us to be at the forefront of this change. It is just as natural to prepare ourselves for the future together. The megatrends that a logistics expert has to deal with in Rome today will be knocking on our doors in Helsinki tomorrow.

### 2.1. Digitalisation streamlines the logistics of e-commerce

In the future, the supply chains of goods will be optimised to the limit. However, issues concerning gaining and distributing the right and necessary information need to be solved

first. Digitalisation is an immense possibility for procurement and logistics. It enables the information systems to talk with each other, and information is linked together more efficiently than ever before. With smart knowledge management and smart information systems the supply chain can be optimised. However, all information is not digital yet. Supply chains still contain manual work phases and this increases the risk of mistakes. Specific information on the properties and volumes of the products and packages may still be missing, which makes loading them difficult and prevents the automation of load planning. There may also be errors in address information, which complicates the smart optimisation of transport. The Ministry of Transport and Communications of Finland supports the digital development in order to streamline traffic and transport. The goal is that mobility and transport could in the future be purchased much like telecommunications services. Delivering in urban areas could be made more efficient with real time traffic situation information, which would enable optimising local transport. We already have the necessary systems to achieve this, but we cannot obtain information for example on the traffic on a specific stretch of street. We are in a sort of an intermediate stage: we are not quite capable of producing the kind of information smart systems need or conveying the information between the information systems of different operators. The growing trend of e-commerce will increase the number of transports while the consumers' expectations must be met. The companies providing logistics services will have to be capable of creating delivery networks that enable the consumer to easily pick up a parcel near them. The consumer needs to be able to return the goods with ease, and it has to be cost-effective for the retailer.

## **2.2 The driver does not have to be in the car**

The current Finnish legislation states that a vehicle needs to have a driver, but the driver does not need to be inside the vehicle. The driver can be in a traffic control centre, for example, and steer several vehicles simultaneously. The states with enabling rather than disabling legislations have an excellent opportunity to become global frontrunners of automated traffic and automated systems of transport. The central question of automated traffic will be how a vehicle can be located with the accuracy of a couple of centimeters. Autonomic vehicles need to be able to perceive its surroundings and changes to it with the help of sensors, cameras, radars, and laser technology. The technology for automated traffic exists already. Many experts believe that the car industry will soon be able to economically produce vehicles with automated driving systems. However, the transition to automated traffic will not be easy. One of the biggest challenges is managing the transition. There are ethical and security questions involved that need to be addressed. Based on what criteria does the vehicle react in a dangerous situation? Is the primary objective of the car to save its passengers or, for example, the pedestrians? If a collision is inevitable, in which direction will the vehicle swerve? Cyber safety will gain more significance. The feelings and fears of people on the road will also be a key issue: how does it feel like to encounter a heavy vehicle combination that does not have a driver in it? This is a good question, although the automatically or centrally steered vehicles may be safer than the ones we have now because there will no longer be accidents caused by human error. The throughput capacity of the transport network will improve, as there will

be no driver's reaction delay in traffic lights, for example. Producing traffic services will be more cost efficient and more profitable for the consumers. The automation of freight transport will most likely begin on motorways. It is more difficult to automate the customer service aspect than to automate the driving. That is why transport professionals will still be needed in the future.

## **2.3 Technology breaks down old structures**

Traffic is not the only aspect of our society going through a rupture. Technological development has a similar breaking down effect on old structures and business models like telecommunications had. Mobile technology, internet, and fast information networks have revolutionised communication. Combining traffic with communication creates whole new ecosystems. Both States and businesses should aim at being at the forefront of this development. To get there, three things are needed at individual, organisational, and State levels: a readiness for change, new know-how and a culture of experimentation. Global connections are crucial here. The local areas and the European internal market will remain important, but simultaneously it is necessary to look further than that. Phenomena, trends, innovations, and increasingly employees, too, move effortlessly from one continent to another. It is easy to believe that the megatrends should be the building blocks of the future of logistics and procurement both in Finland and Italy. The central forces of change are technological development, globalisation and an increased emphasis on environmental matters. Other forces are urbanisation, the effects of the age structure of population and migration and safety issues.

## **2.4 Artificial intelligence revolutionises supply chains**

As a chess player, I know from bitter experience that playing chess against the program on my tablet is upsetting. The program does not make mistakes. Out of millions of possible positions, it finds the most beneficial one for itself. Even worse yet, the machine learns from its mistakes – just like people do, but more efficiently. The machine does not forget. What happens when artificial intelligence (AI) is put to use in an online store? AI can scan the market prices of desired market areas and optimise its own pricing accordingly. Alternatively, AI can collect product ideas from the procurement market, calculate their commercial success in advance and determine the most reasonable delivery method. Calculating the costs of procurement and logistics is a piece of cake to a machine. Then what do you need procurement and logistics professionals in the future for? It is obvious that with the development of technology and AI, routine tasks will soon be history. The change is not much different from earlier industrial changes. Agriculture employs just a fraction of the people it did before and in the future it will employ even less, as plowing and harvesting will be automated. The same will happen to cash registers. They will be automated. The self-serving checkouts will just be a short intermediate stage and they will have to make way for remote scanning applications. Could AI take care of deliveries for stores, especially for those online? As procurement and logistics professionals, we are capable of thinking out of the box. It is as if we were able to reposition our brain in a way that might feel uncomfortable at first, but that enables us to see things differently. The

quick development of AI and big data has shown that there is a need and space for fresh points of view. What is slowing down the utilisation of AI to its full potential in managing delivery networks are the current structures and systems of operation and people's attitudes. Once an ERP system is obtained, it is used. Changing it is slow. What is needed is intelligence, disruptive technologies, and companies that have an operation logic completely different from what we are used to.

## **2.5 Sustainable is successful**

Sustainable development was the overarching theme of the IFPSM (International Federation of Purchasing and Supply Management) meeting in Taipei, Taiwan, 2017. The message of the annual conference was that investing in sustainable development will result in business success now and in the future. The goals of sustainable development need to become a part of the goals and meters of every organisation. Procurement experts are in a key position in achieving this. There are 17 global goals for sustainable development set by the UN, the most of which are linked with procurement and logistics. Digitalisation, automation, and AI will significantly change all operation and decision making processes. Environmental aspects will gain emphasis. Developing and using efficient forms of energy play a key role in controlling climate change and supporting sustainable development. A big change will take place on the demand of the consumers and with legislation the process can be speeded up. One interesting new solution could be placing sustainability indicator labels on the packaging of consumer goods. The changes affecting the behaviour of the global population and consumers are clearly visible now. The centre of gravity of global economy is changing. The regional differences in the age structure of population, population growth and economic prosperity are growing bigger. This will enhance both intercontinental migration and migration within countries. The effect of digitalisation and open market can be seen in the consumers' behaviour. Consumeristic behaviour is reaching its saturation point: sharing economy and circulation economy gain more prominence among the environmentally aware consumers. Individuals, businesses, and the society are faced with new challenges, as demands in know-how are changing rapidly. There will be a lack of top experts in special areas of expertise. As a result, there will be competition for experts in the global job market. Hence making use of digitalisation, robotics, and AI should be strongly present in education and research activities.

## **2.6 AI reinforces information security**

Information security is constantly gaining significance as a business-critical aspect. There is an ongoing race between the defenders of information security and hostile attackers. Outside attackers have managed to bring the production lines of a car factory in Germany to a full stop. Superpowers have technology that can be used to disturb the GPS-signal so that navigating a ship or locating an autonomic vehicle becomes impossible. The defenders are forced resource all their creativity. The supreme command of the USA has in use airplanes that are equipped both with top electronics and analogic technology less susceptible to interference. AI makes it possible to automate repetitive tasks the performance of which demands know-how and accuracy. It will be necessary to be able to share massive amounts of information safely across different organisations. In

the future, the robots responsible for the daily information security will relentlessly scan the data traffic of a company and recognise hostile codes. Robots can also be used to look for gaps in information security by performing test attacks on the information security protection of the company.

### **3. The future of purchasing**

*José Francisco Garrido Casas, President IFPSM-Europe*

It is not easy to know what will happen in the world in the next 50 years, and the principal reason it is the speed of how the management world is moving. Some of us think that independent on the fast moving electronical advance, It will be always necessary to dominate the principle of the matters. and this is also our idea about the purchasing world.

#### **3.1 People are the key**

Not much years ago we thought that it would not be possible to change the status quo of the making of the things in purchasing. At the end, everybody needs to know what to buy, where and how and the cost to obtain it. Today and 300 years ago. The great difference of the actual purchasing way of functioning and the previous one it is that now it is easier to obtain information, but still we have the same problem, how to separate the important from the urgent and the urgent from the necessary. In this article we will try to answer to this question. Although in the near future we will be able to use better tools for purchasing actions, the companies will be in the market and this means for them to accommodate the procedure to the necessities of the customer. Talking about purchasing, the feeling of the “urgency” will continue existing. How to solve then this situation? With the same weapons than today: experience. And who has the experience? The people.

In the future it will be much more necessary the knowledge of the way of functioning than today because it will not be so easy to find people with experience enough precisely because the automation of processes and the use of Artificial Intelligence will avoid to achieve experience like today. If we look from the positive part of this situation, people with experience will have more possibilities in the future than today, although the problem will be to achieve this experience. If we summarize what has been seen so far it is completely sure that we need people with enough knowledge to demonstrate they have enough experience to take the right decisions. To distinguish between the important things and the urgent things, it is necessary not only to know what to do or what to decide but to have in mind the consequences to take those decisions.

#### **3.2 Purchasing like a key process**

But if this is the future what can we do? Perhaps the solution it is not to consider purchasing like a function but like a key process in the company. It is completely different to think in the purchasing like a key process and not like a function. This is the beginning of the real position of this key process in the company. It is not a question of being

important or not in the Company, but to be sure that the people of purchasing know perfectly what is going on in the short, medium and long term and then will be really of good help to the strategy of the company. But how can you control that this is done regularly? How may you control that the people will be able to follow the real strategy of the company and not the personal feelings? How can you assure to maintain the right way without depending on people?

### **3.3 A management tool for purchasing: CWA 15896**

The question was answered several years ago, controlling the “human capital”, the “talent” and how do you do it? With a management tool. The purchasing people represented by IFPSM decided that there were too many management tools, too much generic, to be used for the purchasing process and then took the decision to create one specifically for this process. That was in Brussel, in the CEN (European Committee for Standardization) and it was created: CWA 15896:2008 or CEN Workshop Agreement Purchasing Management Value Added, today it has been updated in Spain and it is called UNE 15896:2015. So, a normative document was created in Brussels, with the same premises as the “so famous” and today discredited “ISO standards”, but only with the premises, the Gordian knot would not be in the “wording” or “written text” of the normative document, but in the correct interpretation that this text was given, an interpretation that would remain under the custody of the Purchasing Associations.

### **3.4 The philosophy of the norm**

The normative instrument was created in order to be certifiable by an independent certification body (AENOR, Bureau Veritas...). Of course, the auditors of these certifying bodies, besides being “auditors”, according to the corresponding ISO standard, must be “experts” in the correct interpretation of the CWA. The Standard is based on a clear premise, only organizations that demonstrate a “healthy” state in all its areas can have this certification, and it will be demanded by the auditor that someone with signature power confirm it. But until now, it is only conveyed that an organization that has this certificate would simply verify that the organization is “excellent” and in several fields of influence and before a third party is able to prove it, who wants to give value to this reality, knowing that it is Certified organization, you know it is. Certification goes much further, firstly it will be rethought at least annually that everything remains excellent, and the pulse will not shake the certifier in annulling the certificate in an annual review if that premise is not followed, which depends not only on the world of comparisons if of the organization in full. Once confirmed, the auditor must do his work and must be shown that the person responsible for the purchasing function performs his function as a “charismatic leader” in all actions, the simplest simile to understand this requirement is the one in which that person leave that position and the organization should be able to continue the path taken by its leader. This is talent management. How to do it? Each organization must find its formula, but in the end, it must present evidence that it is so. As it could not be otherwise, the requirement is transmitted to the entire organization and fundamentally to the guarantors of talent, to people, it will not be enough to “show” the auditor that “what is done is what is shown” in a

written document and is also shown with the corresponding “records or evidence”. It will be necessary to give reasons that what is done is what “must be done”, at the given time in which it is done and with the means available, always with maximum results within the possibility. To get to know what is to be done, to have the necessary skills to carry out what must be done or to know the attitudes that allow to maximize in a habitual way what is “in the hands” is to “touch” the “talent” in an “obvious” way. The organization should foster the environment of improvement, give the necessary opportunities of progression to its staff, facilitate the exchange of innovative ideas, in order to manage the talent with the clear purpose of obtaining the expected results in the organization. All this is what the auditor will require audit after audit, and not in vain, the “continued” continuous improvement of organizations in this certificate is to demonstrate with evidence, since it is required to prove it again and again. Is certification simple? Of course, no. Excellence is an objective, which does not mean that you cannot be on that path. The certification model around the normative document created by the associations of purchasing is much more extensive and detailed, here we only wanted to give a few brushstrokes of all its potentiality, and we firmly believe that the answer to the question that we asked ourselves. Will you ever manage to manage the talent of the companies? In the application of this standard we have a possible answer, another thing is that the business world is prepared for it. Perhaps there is a lack of application of what Mother Teresa of Calcutta dared to explain in a leadership congress:

“I do not know anything about leadership and change; but if I know that if they want to see change in their organizations they need to know and love their people, because if they do not know their people there will be no trust, and if there is no trust people will not take risks, and if they do not take risks there will be no change. And they must love their people, because without love there will be no passion, and if there is no passion they will not feel powerful, and if they do not feel powerful there will be no change. So, if you want to see change in your people you must first know them and love them.” Our standard also values these issues from the requirement of demonstrable corporate responsibility.

### **3.5 The management of talent from the perspective of purchasing**

A business organization is based on two key elements: the strategic part and the operational part. The one that manages to manage both, by the mere fact of its management and, if it is consistent with the same, will obtain the result of expected success. The standard, for that reason, focuses in two of its main sections the management of both aspects, chapters 8 and 9. But if we go further, we will verify that the application of these regulations implies having a robust business management model in the organization. Take, for example, the well-known conceptual model of management by Black and Porter. And compare it with the requirements of the regulations:

- leadership – demanded in the definition of responsible of purchases in the standard
- process management – chapters 8 and 9
- human resources management – chapters 7 and 10
- strategic planning – chapters 6 and 8

- information and analysis – chapters 8, 9 and 11
- consumer satisfaction – chapters 10 and 11
- business results – it's the philosophy of all the rules

It is demonstrated that the regulations as such are conceived covers everything that the business world has traditionally considered a management tool. And if we are faced with a management tool that involves the entire organization and also generates mimicry in nearby companies (stakeholder), we are faced with the real possibility of managing talent. The question that remains to be answered is whether we want to be consistent with it or not, since coherence in business management and more in detail, in talent management, forces us to “commit” rather than to “get involved”. If it is extrapolated to the particular case of the personnel assigned to the purchasing department, the correct interpretation of the regulations requires an integral training plan of the personnel and the objective, however “commercial”, it seems to be “all terrain”, any situation, not just the purchasing function. And then, we are already in talent management, which always starts in the right training and at the right time. But like everything in the business world it is necessary that there is a gleaming, “kind” but “sure” way back to the right path if there is any deviation from that correct path, and that function has touched the Association of Purchases, which is thus established as “arbiter” and “coach” for the interpretation and correct application of the normative document. The management model of the standard is a proven and capable model and it is to touch the future of purchasing even today.

#### **4. Procurement 4.0: what is procurement 4.0 and how should we react?**

*Seán O'Dwyer, CEO of the Irish Institute of Purchasing and Materials Management (IIPMM)*

Industrialization in the western world began towards the end of the 18th century with the introduction of steam power and the power loom, which radically changed the manufacturing process. This was the first industrial revolution. About 100 years later, electricity and assembly lines saw the introduction of mass production as part of the second industrial revolution. In the 1970s, the third industrial revolution began with computer powered automation enabling us to program machines and assembly lines<sup>26</sup>. Now we face a fourth industrial revolution, which is referred to as Industry 4.0. Physical and digital technologies are combining through analytics, artificial intelligence, cognitive

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<sup>26</sup> Renjen, *Industry 4.0: Are you ready?*, Deloitte Review, 22, Deloitte Global.

technologies, and the Internet of Things (IoT) to create what are called “cyber physical systems<sup>27</sup>”.

Procurement 4.0 is a subset of, and derived from, Industry 4.0, so the introduction above is important in being clear on its provenance and context. Each “revolution” has had implications for procurement and this latest one perhaps has the most profound implications. Industry 4.0 however is not yet a fait accompli. According to Hfs research<sup>28</sup>, Industry 4.0 is on a journey and procurement must follow. That journey leads to “integrating connected factories with smart supply chain, suppliers, customers, product design and aftermarket services”. Procurement is now a critical part of the cyber physical systems environment in a new and very demanding way. Even in the domestic context refrigerators can now carry out their own stock control and suggest replenishment of used or expired contents. This is not radical and, in the domestic context, the supply chain can be very simple. For example, an account with one a large supermarket (one supplier) that delivers to the door may be all that’s required to keep the refrigerator “happy”. As procurement professionals, we have had access to similar capability for many years through our Enterprise Resource Planning or ERP systems. But what about complex factories using many parts and many materials from many suppliers? Cyber physical systems are now not just suggesting reordering as reorder points are hit, they are anticipating and predicting demand based on run rates. They are even diagnosing themselves and requesting preventative maintenance before the problem happens, without having to wait for a traditional preventative maintenance schedule. All of this demands a very responsive supply chain with elevated levels of performance and trust.

But have we not been here before? Supplier innovation, supplier centricity, agile organisations, moving from supply chains to value chains, spend transparency; these are concepts which are familiar to many in our profession. Advanced ERP systems promised many of these things as well as concepts already alluded to like automatic reordering of inventory and planned preventative maintenance schedules.

“Embracing Disruptive Technologies”, “Artificial Intelligence Seen as Security Boon”, “Trying to Cope with Changing Technology” and “The Need for Agility”. It would be reasonable to assume these were recent headlines; in fact, they were published over 16 years ago. It’s interesting that we still discuss how innovative technologies can transform businesses and how firms should be sufficiently agile to exploit disruption. However, CEB/Gartner<sup>29</sup> argue that what they call the current digital revolution is emphatically not a rerun of the previous e-revolution. They argue two factors make the Industry 4.0 different. Firstly, digital capabilities are far more pervasive; as technology costs decrease, companies can use digital capabilities for almost any activity, changing how companies generate value. In an environment where microchips cost about a cent and computing power doubles every 18 months, “every step, every input and every output will be reshaped by digital capabilities and continuously enhanced by expanding computer power. In contrast, the

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<sup>27</sup> Glas H., Kellmann F.C. (2016), *The Impact of Industry 4.0 on Procurement and Supply Management: A Conceptual and Qualitative Analysis*, International Journal of Business and Management Innovation, 6, 55-56.

<sup>28</sup> Pareekh J., Mondal T. (2017), *Industry 4.0 Services*, HfS Blueprint Guide, 4.

<sup>29</sup> Lozada A. (2017), *Today’s Digital Revolution is not a Rerun of the E-Revolution*, CEB/Gartner, 23 Aug.

impact of the internet began far more narrowly". Secondly, digital capabilities amplify one another; the original e-revolution was driven by one key innovation – the modern internet. This enabled new services such as email, internet telephony, internet television, online music, etc. but the current phase of business disruption is driven by many different technologies; artificial intelligence (AI), genetics, nanotechnology, biotechnology, and robotics. Each technology generates its own disruption but also amplifies the impact of the other technologies.

Change in procurement as in most areas is inevitable. Our relationship with the market is one example, which typifies how procurement is changing. Traditionally we have focused on supplier performance management. The focus here is on what is relatively easy to measure e.g. on time delivery, first time invoice match rates, quality control etc. This is a non-holistic and relatively narrow view of the relationship with a purely operational focus. We then moved to supplier relationship management, which sought to take a more holistic or strategic approach. We typically apply segmentation to our supply base using, for example, the Kraljic matrix<sup>30</sup> or a derivative of that model and then take a more holistic view, typically focusing on the suppliers we determine to be "strategic". The focus is now on the overall relationship of which performance is but one aspect.

We are however rapidly moving to a product/service relationship model. Internet enabled sensors embedded in products produce performance metrics. Real-time feedback from devices has been a feature for many years, but real-time feedback on services is now increasingly a reality. Devices which deliver instant feedback such as those provided by "HappyorNot"<sup>31</sup> are ubiquitous. There is constant monitoring of whole of life performance for both products and services. The feedback data is becoming as important as the product or service. As procurement professionals we must be ready to capitalise on this and perhaps more fundamentally be able to design our specifications, tenders and contracts to take full advantage of this new reality. Performance data on goods and services may even be "sold back" to suppliers or monetised by innovative procurement functions. So, apart from a perceived pressure to keep up with Industry 4.0, why should Procurement bother with this agenda? There are many who believe this is just another passing fad. It is clear, however, that one of the major promises of Industry 4.0 and by extension Procurement 4.0, is digitalisation.

The key, however, to capitalising on any digital technology is having sufficient data available for analysis and action by the digital tools. The availability of the data necessary is not a given. A 2017 Deloitte Global CPO survey<sup>32</sup> found that the quality of data and the lack of integration were the two most cited barriers to the effective application of digital technologies. It seems that gathering and structuring data from multiple, often disparate, systems remains a challenge for many organizations. It follows therefore that any procurement specific digital technology we implement will similarly struggle. A paper in the International Journal of Business and Management Invention in 2016 concluded:

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<sup>30</sup> Kraljic P. (1983), *Purchasing Must Become Supply Management*, Harvard Business Review, 8, 1983.

<sup>31</sup> <https://www.happy-or-not.com/en/>

<sup>32</sup> *Growth: the Cost and Digital Imperative*, The Deloitte Global Chief Procurement Officer Survey 2017.

«Obviously, procurement 4.0 must support superior Industry 4.0 strategies of the company. However, research on the topic is still in its infancy, while practice signalled a high demand for explanative knowledge. More conceptual and empirical work is needed to better understand the effects of Industry 4.0 on procurement in detail».

Procurements response should come under three main headings: data, investment and education. Procurement 4.0 is not some nebulous, separate, concept for others to worry about. As a derivative or subset of Industry 4.0, it informs us about the environment in which we operate. The environment is changing and that change brings new, significant and urgent challenges. Procurement 4.0 is also a way to describe the potential of the broader digitalisation agenda. One of the biggest challenges for procurement professionals is to stop separating the job from the data. Even if we consider our processes already optimised, if we don't capture everything we do in a digital form, we cannot easily access it again in the future and we certainly cannot expect technology, no matter how sophisticated it may become, to derive value from data which do not exists or are in such an unstructured form as to be unintelligible. So, this should be our first response: address the data issues.

Secondly, invest! It is widely documented and anecdotally obvious that the adoption and implementation of technology in procurement has been, and continues to be, slow. One example of this is in European Public Procurement, where mandatory electronic transactions had a very long lead in period. Even in organisations which have implemented so called ERP systems, which include a procurement module, very often gaps remain. The ERP system may not include an inventory module or a planning module for example. Even where good ERP implementations have happened, it is not unusual to have some procurement related activities done completely manually, or on systems which are poorly integrated or not integrated at all. The net result of this, as we know, is poor visibility or invisibility of activity. This is often compensated for with intensive manual effort to combine dispirit data sources or worse, subjective commentary masquerading as fact. Our procurement systems do not necessarily have to be very sophisticated, but they do have to be complete and they do have to be integrated. There can be no blind spots and when we need to get data we must be able to get it quickly and be confident in its accuracy. It is worth emphasising that this is simply a starting point, but there is no point in investing in any new digital technology, no matter how compelling the business case until we have made the necessary investment in our basic procurement systems.

The third element of our response is education. Procurement professionals must be continuously learning through education and training to ensure that we can remain innovative and take best advantages of the opportunities new technologies offer. The typical procurement function has individuals who tend to specialise in various areas. Very often a function will have a relatively small number of individuals who are "the data people" or the people who specialise in analytics and/or technology. This approach can promote a culture where data capture and management becomes "someone else's job". Those who use applications such as LinkedIn or other social media do not typically get someone else to do it for them or consider the capture or management of their data to be "someone else's job". No matter your competence, it is something you do yourself. If one needs to improve, one seeks assistance or learns. In an age of pervasive digitalisation, all

procurement professionals need to become completely self-sufficient and autonomous in the use of digital technologies. It must not only be understood how they work and how they are used, but when to use them and how to get the best return on investment from them. As digital technologies become more pervasive, any segregation of activity from data which currently exists in procurement is likely to be removed and we need to be ready. One of the ways in which we use our data must also improve rapidly. Current data analysis in procurement tends to focus on the past, or at best the present, but rarely on the future. We must learn to be forward looking in our analysis to be able to predict demand and opportunities and to better support innovation.

Blockchain has the potential to radically change the way we contract with suppliers as well as the potential to change how we monitor our supply chains, assuming we monitor them at all. There is currently insufficient awareness of Blockchain and often an assumption that its relevance is restricted to logisticians and supply chain managers. That may well be naïve. Blockchain is but one item on the digital menu in which we must become expert and we must do so quickly; Blockchain is expected to be a mainstream technology in the next three to five years. Innovation in category management will be required to facilitate the acquisition of innovative technology and to deal with the need for innovative contracting methods. Contracting will be impacted not just by blockchain, but by the likely speed and agility required to meet new demand patterns and to on board and contract with suppliers as fast as our cyber physical systems demand.

PWC recently published research on the so-called sharing economy, where goods and services are borrowed, rented or subscribed to rather than owned. Some well known examples include Uber, Airbnb and bicycle share schemes, which are common in cities throughout the world. Initially this development was met with scepticism but in 2015 “Airbnb averaged 425,000 guests per night, nearly 22% more than Hilton Worldwide”. The sharing economy may be here to stay, but how does a corporate procurement function source and contract in this market?

In the face of any change, a gap analysis of capability is typically advised; but it should be completed not based on current understanding of what is required by a procurement function, but on what our requirements are likely to be in 5 or even 10 years’ time, insofar as we can tell. The training and education required to successfully prepare for Procurement 4.0 represents a sea change, not least in terms of the scope it covers, but also in terms of our basic approach to procurement. Procurement 4.0 will embed quicker than we anticipate. Many may not be ready, but the world won’t wait; preparation is urgently required. Preparation must include a change of attitude to data capture and maintenance, so that it ceases to be some else’s responsibility; a change of attitude to technology so that our interaction with it more closely resembles what we do in our personal lives and renewed focus on education in a profession that must constantly adapt.

Using social media, internet shopping, chatbots, near field communications to pay for things, ATMs, facial recognition systems etc. means that digitalisation is part of our day-to-day lives. To properly support the demands of Industry 4.0 and to deliver the promise of Procurement 4.0, digitalisation must also be as pervasive in our professional lives. We must change our attitude to what we consider to be “in scope” for procurement.

“Digitisation will determine procurement’s future as its biggest opportunity and its biggest challenge ... ever<sup>33</sup>”. Caveat emptor!

Recognized as a high profession in many industries, but was also raised this position close to the level of chief executive and call it as “Chief Procurement Officer” or “CPO” in many global organizations as of today. On one hand, “The progression to world class supply management (WCSM)” as shown below (Figure 1) in the book of world class supply management by Burt, Dobler and Starling (2004) has well described the related functions from clerical basic to world class challenge, a process of moving from tactical focus to being strategic focus as of today.

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<sup>33</sup> Batran A. Erben A., Schulz R., Sperl F., *Procurement 4.0 - A survival guide in a digital, disruptive world*, Campus.

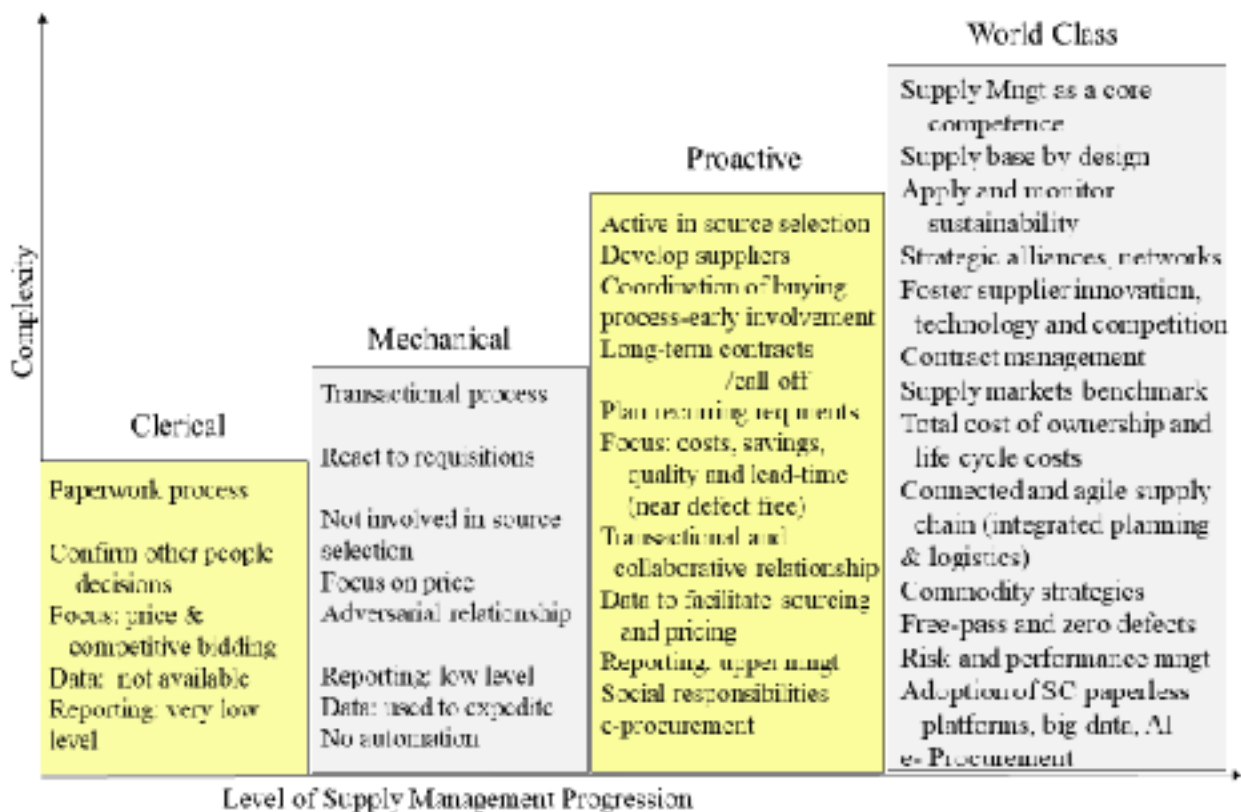
## **5. The Role of Future Purchasing and Supply Chain in Asia Pacific, an Example of China & Hong Kong Approaching to the Year 2035 and Beyond!**

*Prof. Stephen W. K. Ng, President of the Institute of Purchasing & Supply of Hong Kong*

### **5.1 Introduction**

The growth of a purchasing function from a clerical job to an executive professional in the last 20 years in Asia Pacific was huge, it was not only recognized as a high profession in many industries, but was also raised this position close to the level of chief executive and call it as “Chief Procurement Officer” or “CPO” in many global organizations as of today. On one hand, “The progression to world class supply management (WCSM)” as shown below (Figure 1) in the book of world class supply management by Burt, Dobler and Starling (2004) has well described the related functions from clerical basic to world class challenge, a process of moving from tactical focus to being strategic focus as of today.

Figure 1 The Progression to World Class Supply Management (WCSM)



On the other hand, it has to be clear that the differences between supply management and supply chain management in many areas of our profession. As a result of the global activities emerged in the last 3 decades, these two terms have long become “Global Supply Management” and “Global Supply Chain Management”. In brief, the followings are some of the basic understandings and how it is being managed by global business organizations.

## 5.2 The global supply chain management, an example from Li & Fung Company

One of the best examples of illustrating the global supply chain concept is the over 112 years Li & Fung Company, now is called “The Fung Group”. Li & Fung started her global supply chain empire in Guangzhou, China back in 1906 and has been successfully evolved through different levels of changes, successes and failures and then became The Fung Group today. She makes use of the best free trade location, Hong Kong to house as her headquarters to manage her global purchasing and supply chain businesses. Currently, the The Fung Group is being managed by the 4<sup>th</sup> generation leaders and their focuses are innovation, speed and digitalization. The new leadership team believes that these are the areas for faster growth in the next 20-30 years in global purchasing and digital supply chain. Li & Fung managed a successful strategic move, namely from acting as a regional sourcing agent, becoming a manager and a deliverer in a manufacturing

program, breaking the value chain to manage the dispersed manufacturing, and finally becoming a world class supply chain leader.

As indicated in the book of “The Fung Group at 110”, the challenges in the past years of Li & Fung were to manage the total costs of logistics, transportation and delivery of the products faster and cheaper to the consumers all over the world. With this concept, Li & Fung was able to dissect the manufacturing processes and look for the best solutions at each step or location, requesting each country to perform the best in her overall job to achieve the targeted results. Li & Fung was basically pulling apart the value chain and optimizing each step on a global basis. In the last 2 decades, this process management under the title of “dispersed borderless manufacturing process” was proven to be very successful in her global business.

### 5.3 Integrating the Big data along the global supply chain

Li & Fung has never stopped her drive to develop herself in the area of digital supply chain management. The concept of digitalization from source to store (figure 2) is a good example to illustrate the complicated business model and the digital activities involved. The use of the big data also enables Li & Fung to acquire specific patterns and trends of customer behaviors for developing customization products or services to satisfy future needs of her targeted customers. Each of her partner comes across her global supply chains can utilize outcome of the data analysis to turn information into intelligence and further achieve better performance in market place. Big data analytics can reinforce performance across all parties in her global supply chain. As demand of analytic capability continuously upgrading, Li & Fung is able to gather more intelligence to enhance her global performance in the total supply chains management.

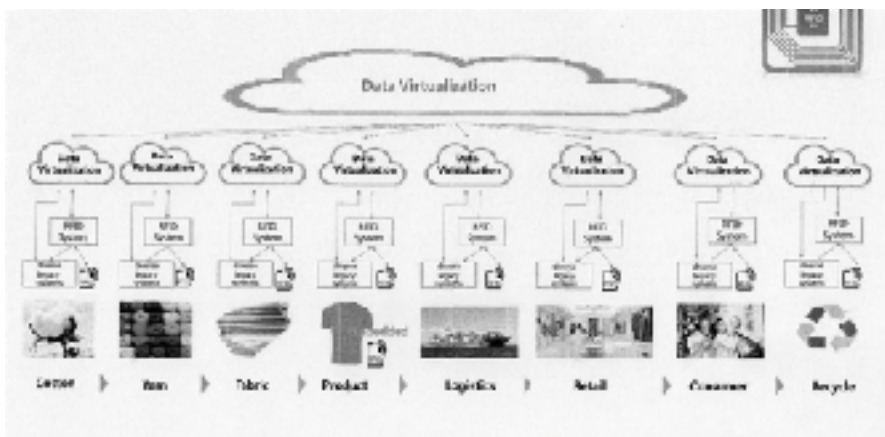


Figure 2: Digitalization from Source to Store (STS) by Li & Fung to Manage the Total Supply Chain for her World Business

### 5.4 Changes in global business and in global technologies business, the Key Projects in China

Back in 2012, the Ceo of CIPS shared the “80:20 Vision” and quoted that “many in business are also determined to move to a faster, higher, stronger level of performance. The look eastwards is a timely reminder of where true completion in global markets lies

and why the people leading modern procurement and supply chain need to be at the top of their game”.

Along with this thinking, we examine some of the key programs developed by China in recent years, such as The One Belt, One Road (or OBOR); the Asian Infrastructure Investment Bank (or AIIB); Made in China 2025, 2035 and 2045 Strategies, the Greater Bay Area Plan etc. Academically and practically, these are the global purchasing and supply chain giant projects which will also be powered by technologies and would last for another 20-30 years down the road.

In a brief term, the One Belt, One Road (or OBOR) or Belt & Road Initiative was unveiled by President Xi Jinping of China in 2013. As quoted by the report of HKGCC in 2015, China's Belt and Road initiative consists of a dual trade passage of a modern “Silk Road Economic Belt” with a “21<sup>st</sup> Century Maritime Silk Road”. Contrary to its modest title, it is grandiose project, stretching across much of Asia, Europe and Africa. Its policy goals are straightforward: to boost economic and political relations with neighboring countries through the establishment of infrastructure and trade links. President Xi himself announced the five main goals of the Belt and Road: policy coordination, facilitate connectivity, trade, financial integration and people-to-people bounds. Figure 3 indicates the routing of the Belt and Road.

As of today, more than 60 countries are participating in China's Belt and Road plan. No doubt, this is a huge challenge to all the participating countries and particularly, the challenge to the role of purchasing and supply chain professionals in the next 20-30 years.

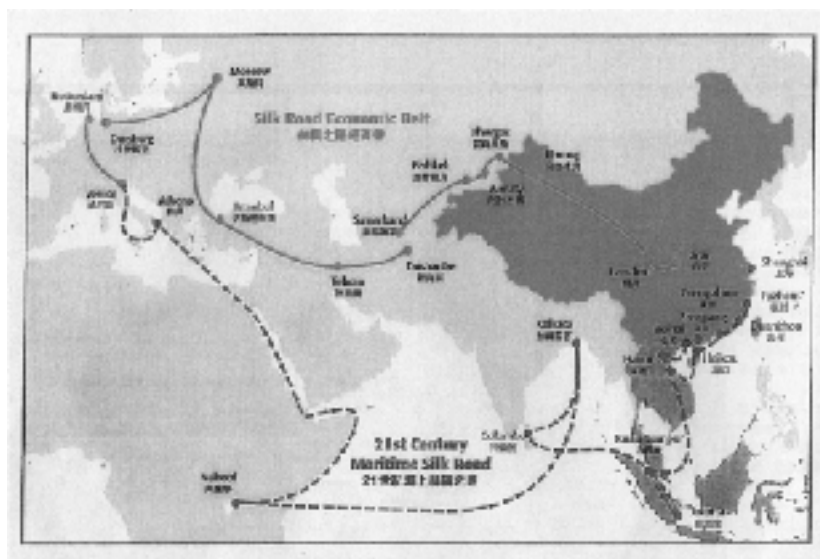


Figure 3: The Belt and Road Map

Another project called “The Greater Bay Area Initiative” is similar to the developed bay areas of San Francisco Bay area, Greater Tokyo area, and New York Metropolitan area. A survey on key drivers of success done by KPMG in September 2017 described as «its goal of building a world-class city cluster across the Guangdong-Hong Kong-Macau region. By 2030, the region is expected to play a leading role in advanced manufacturing, innovation, shipping, trade and finance». In depth, the activities are supply chain related and therefore is a major challenge to the future role of purchasing professionals in the

region. The figure 4 below gives a total view of all related cities and their comparisons in the southern part of China including Hong Kong.

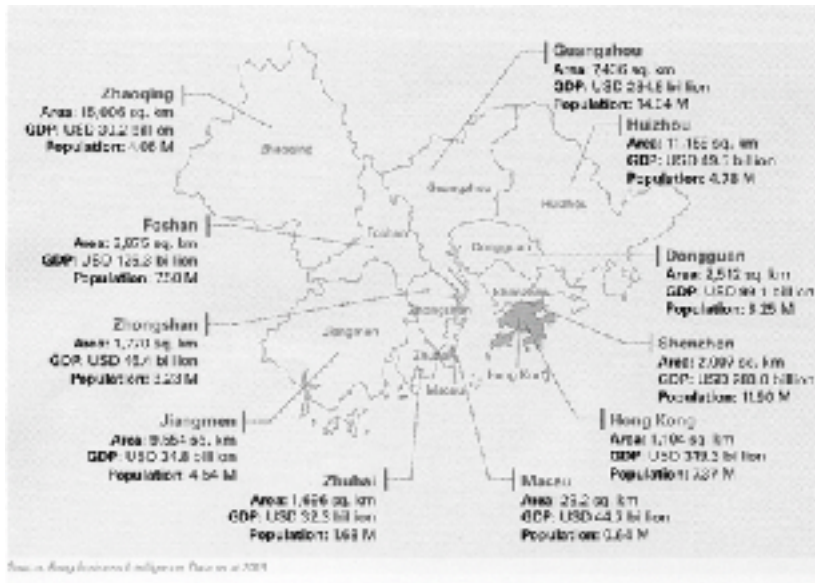
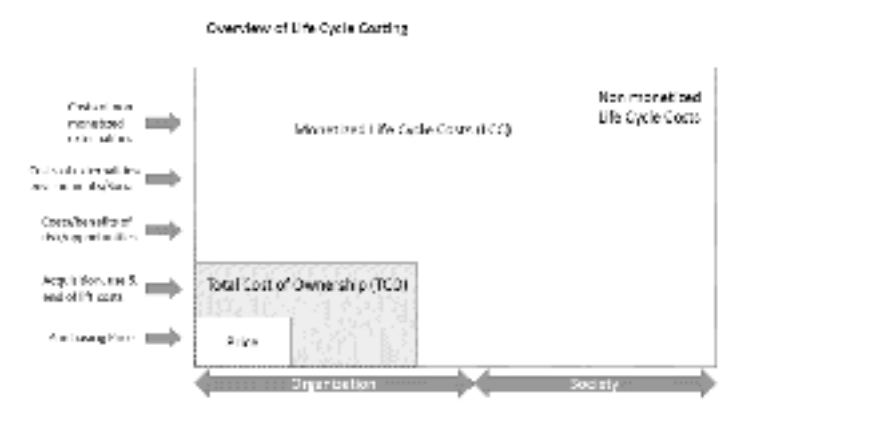


Figure 4: The Greater Bay Area Cities Comparison

It is clear now that purchasing role is not only starting the global supply chain, it is more important that the purchasing professionals should lead the entire chain to the end where the overall objective is to achieve higher consumer satisfaction, and the organization involved would continue making good profits and grow. Since the technologies applied in business have been speedily developed in the last 2 decades, it is believed that the new technology would come up much faster in the future.

## 5.5 Future challenge of green purchasing, every time and everywhere

The introduction of the ISO 20400:2017 sustainable procurement guidance was an excellent paper encouraging all global purchasing & supply chain professionals to contribute more in the green procurement & supply chain areas. NEVI, well represented for IFPSM has done beautifully in spearheading the “socially responsible procurement” concept in past years to reach the current status of the “ISO20400 Guidance” publication. A simple graphic picture of “Life Cycle Costing” in figure 5 would help professionals to think differently in the years ahead in contributing to the long-term sustainability.



## Chapter 9

### **9. Results of the Surveys made by ADACI on The Future of Purchasing**

by Fabrizio Albino Russo

#### 1. Introduction

Aware of the fact that the continuous evolution of the social, economic and cultural system and the progressive adoption of enabling technologies, typical of the smart or digitalized enterprise, are changing the way of managing the company, the supply chain, the features and the characteristics of the supply base, and the type of relationships to be established with the key suppliers, ADACI in collaboration with some associations belonging to the International Federation of Purchasing and Supply Management, conducted a survey on the future of purchasing, involving a significant number of purchasing managers. and supply chain managers associated with their respective purchasing organisations.

From the analysis of the responses, apart from a few exceptions, it became clear that the majority of the participants to the survey intend to adopt technologies that enable the digitalization on the company in the near future, even if very few have actually evaluated the impact that this will have on the way to manage the company, despite having a good level of delegation (classified in the possibility of taking at least 30% of the decisions autonomously).

Aspect this that, if examined in conjunction with the widely positive answers inherent to the question of sharing the principle that the Supply Chain gurus believe that collaborative approaches based upon the transparency along the supply chain will be increasingly relevant and applied, still denoting the need in-depth analysis of the concepts of Industry 4.0, which have in transparency and collaboration a real cornerstone.

Concepts that must then be fully implemented through long-term agreements that are already abundantly applied and that the survey participants unanimously believe they need to increase and refine to ensure the greatest possible added value, which is perfectly consistent with the priorities which have been assigned to the main factors characterizing the purchasing process (with an obvious degree of efficiency, and then emphasizing immediately after all other process factors).

In a nutshell, therefore, from the survey the need to keep up with the new challenges of digitalization was quite evident, but the lack of awareness and / or knowledge of how to redesign supply chain relationships is also evident in the new para - Collaborative name still in development.

At the same time, always in the light of the results emerging from the analysis of the survey responses, it is reasonable to foresee, in order to support the development of Industry 4.0 also in terms of purchases and supply chain, the need to implement and provide new contractual models suitable for incorporating the new collaborative rules under development; as well as supporting the development of new organizational models that will inevitably have to be implemented to maximize the effectiveness of the benefits brought by this real new industrial revolution.

## **Outcome of the International Survey**

Eight answers received on a population of 48 Institutes/Associations

### **Question 1**

Does the majority of the large and medium-sized local enterprises intend to adopt some of the enabling technologies of the so called "smart enterprise"?

Possible Answers

1. Less than 50% are convinced of the need to adopt the new digital technologies to increase the productivity of their companies/organizations.
2. Most companies intend to adopt the new technologies, but only a small percentage have realized that Industry 4.0 mainly means a different way of managing the company and collaborating with key customers to shape the market demand, and with suppliers to foster innovation and to reduce costs and time-to-market.
3. Not less than 30% of the companies have already launched a digital strategic plan.
4. By the end of 2018 the number of enterprises/organizations dealing with the implementation of digital plans will be around 45%.
5. By the end of 2018 the number of enterprises/organizations dealing with the implementation of digital plans will be around 60%.
6. Other .....

Outcome of the survey:

1. 25.0%
2. 62.5%
- 3 12.5%

### **Question 2**

Do you think the senior buyer and the category managers represented by your association have a sufficient level of delegation, albeit within the framework of an operational plan and budget that set targets and costs not to be exceeded?

Possible answers

1. They have a good level of delegation (about 80% of operational decisions are taken without involving the hierarchical superior).
2. They have a sufficient level of delegation (about 30% of the operational decisions are taken without involving the hierarchical superior).
3. Other

.....  
 .....

Outcome of the survey:

1. 37.5%
2. 62.5%

### Question 3

Supply chain gurus claim that collaboration, innovation and continuous improvement will increasingly characterize the supply relationships for the important repetitive purchases, and that these targets imply long-term relationships, transparency and mutual beneficial support. Do you think these concepts are shared by the majority of your members?

Possible answers

1. Most of our members believe that the concepts above are theoretical and distant from day-by-day reality.
2. About 20% of our members already apply these concepts to maximize the added value of the relationship.
3. About 50% of our members believe they have to apply these concepts in the near future to maximize the added value of the relationship.

4 . O t h e r

.....  
 .....

Outcome of the survey:

1. 12.5%
2. 37.5%
3. 50.0%

### Question 4

Does the majority of your members, working in large and medium-sized enterprises, have long-term framework agreements for the major repetitive supplies? Do they intend to increase their number in the near future?

Possible answers

1. Most of our members do not have many long-term framework agreements and do not intend to increase their number as they want to be free to seize the market opportunities.
2. Most of our members intends to arrange such agreements with all the suppliers who are in the position to provide value added in terms of innovation and continuous improvement.

3 . O t h e r

Outcome of the survey:

1. 12.5%
2. 87.5%

### Question 5

Labour organization experts argue that the ineffective management of complex contracts often results in delays and average cost increases of 3%-4%. Does the majority of your members have a structured system for their management?

Possible Answers

1. Most of our members does not have a structured contract management system.
2. In most cases, contract management does not fall within the purchasing competencies.
3. Most of our members will set up in the near future a structured management system for all critical contracts and for those which prescribe contributions in terms of innovation and continuous improvement.
4. Other

Outcome of the survey:

1. 12.5%
2. 25.0%
3. 62.5%

### Question 6

What importance does the majority of your members attribute to the following factors? (1 very important, 5 not important):

|                                           | 1                        | 2                        | 3                        | 4                        | 5                        |
|-------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Cost reduction                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Efficiency                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Service level and on-time deliveries      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Product Innovation                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Process improvement/automation            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Compliance to procedures/contracts        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Sustainability                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Performance mgnt and structured reporting | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

|                       | 1      | 2      | 3       | 4      | 5 |
|-----------------------|--------|--------|---------|--------|---|
| 1.Cost reduction      | 57.14% | 42.86% |         |        |   |
| 2.Efficiency          | 42.86% | 42.86% | 14.28%  |        |   |
| 3.Service level       | 14.28% | 85.72% |         |        |   |
| 4.Product Innovation  |        | 42.86% | 57.14%  |        |   |
| 5.Process Improvement | 14.18% | 42.86% | 42.86%% |        |   |
| 6.Compliance to       | 14.18% | 42.86% | 42.86%  |        |   |
| 7.Sustainability      |        | 28.57% |         | 71.43% |   |
| 8.Performance M.      |        | 57.14% | 28.58%  | 14.28% |   |

## Survey conducted in Italy

115 answers received over a population of 1,100 units

### Question 1

1. Does your company intend to revise its organization in order to adopt, at least in part, the typical management and operating system of the "smart" company? (review of the governance system, process digitization, use of cloud systems, greater automation of production and logistics systems, review of the supply chain management system, greater attention to reporting and data in general, inclusion of sensors in products to detect remotely some of their performances or internet of things, warehouse automation)

1. I do not believe it is aware of the great cultural, social and economic transformation in being.

2. I believe it intends to proceed with greater automation of production processes but is not aware of the fact that the adoption of the management principles of Industry 4.0 implies above all the need to conduct both the company and its production chains differently.

3. My company has already prepared a specific strategic plan

Outcome of the survey:

Answer 1: 8.57%

Answer 2: 46.67%

Answer 3: 44.76%

### Question 2

In the near future, success will depend more and more on speed: speed of decisions, speed of processes and speed of delivery. The speed of decision depends on the professionalism of the various officials and on the power delegated to them. Do you think you have a sufficient level of delegation, albeit within the framework of a strategic-operational plan and / or budget that sets targets and costs not to be exceeded?

1. I have a good level of delegation (80% of operational decisions are taken without involving the hierarchical superior)
2. I have a sufficient level of delegation (30% of operational decisions are taken without involving the hierarchical superior)

Outcome of the survey:

Answer 1: 55.45%

Answer 2: 44.55%

### Question 3

Supply chain gurus claim that collaboration, innovation and continuous improvement will increasingly characterize the supply relationships for the important repetitive purchases, and that these targets imply long-term relationships, transparency and mutual beneficial support. Do you think these concepts are shared by the majority of your members?

Possible answers

1. Most of our members believe that the concepts above are theoretical and distant from day-by-day reality.
2. About 20% of our members already apply these concepts to maximize the added value of the relationship.
3. About 50% of our members believe they have to apply these concepts in the near future to maximize the added value of the relationship.

Outcome of the survey:

Answer 1: 62.86%

Answer 2: 4.76%

Answer 3: 32.38%

### Question 4

Labor organization experts argue that the ineffective management of complex contracts often results in delays and to an average cost increases of 3% -4%. Do you have a structured system for managing them?

1. We do not have a structured system and, by default we devote them little time.
2. Contract management does not fall within the purchasing competencies.

3. We will set up a structured management system for all the critical contracts and for those which prescribe contributions in terms of innovation and continuous improvement.

Outcome of the survey:

Answer 1: 40.63%

Answer 2: 10.42%

Answer 3: 48.96%

### Question 5

Do you think that the purchasing function will have greater relevance in the next few years?

1. Yes, of course, it will become a function with more strategic features.
2. Its relative weight in business management will not change
3. It will be increasingly involved in cross-functional and inter-company activities that bring added value to the company.

Outcome of the survey:

Answer 1: 25.71%

Answer 2: 10.48%

Answer 3: 63.81%

### Question 6

Does your purchasing function have an equal role in your company compared to other functions? Is it involved in the strategic decisions process or does it rarely enter the "button room"?

1. It has an equal role
2. It is second to none and sometimes it is the driving force behind certain initiatives
3. It rarely participate in meetings organized by the top management to define corporate strategic issues.

Outcome of the survey:

Answer 1: 52.38%

Answer 2: 20.00%

Answer 3: 27.62%

### Question 7

Experts believe that product and process innovation will be one of the main goals of the next decade and that the early involvement of the procurement and of the most innovative suppliers will facilitate their pursuit. What is your thought about it?

1. Product innovation already takes place through the regular involvement of purchases, start-ups and / or suppliers that make research and development
2. Product innovation is managed exclusively inside the company with the sporadic involvement of purchases and suppliers
3. The regular and structured involvement of purchases and suppliers in product innovation will take place in the near future.
4. The innovation of management processes is not yet viewed as a whole integrated and coherent system of governance and with the participation of all the managers involved.
5. I believe that in future there will be greater decision-making collegiality in order to harmonize and make the various process choices coherent.

Outcome of the survey:

Answer 1: 34.58%  
Answer 2: 8.41%  
Answer 3: 14.02%  
Answer 4: 14.02%  
Answer 5: 28.97%

## Question 8

The preparation of the procurement plan allows to define and pursue in a structured way improvement targets related to the main categories /material groups (added value in terms of innovation, cost reduction, improvement of quality and service). This implies however a medium-long term planning and cross-functional activities. What is your thought about it? Do you have specific plans for the future?

1. I agree with the above, we do it for the main categories and we intend to expand this activity in the next future. However, it is not easy to convince other functions to collaborate and to provide their contribution.
2. Day-by-day operations absorb all the time available and we cannot prepare a procurement plan. We plan to do it in the next future.
3. As we do not have a company medium to long-term strategic planning, we cannot prepare a procurement plan worthy of the name. We manage non-systematic initiatives to improve commodities with a high volume of spending. In the future, however, we are counting on doing so based on historical consumption.

Outcome of the survey:

Answer 1: 64.42%

Answer 2: 11.54%

Answer 3: 24.04%

### Question 9

**What importance does the majority of your members attribute to the following factors?** (1 very important, 5 not important):

|                                                    | 1                        | 2                        | 3                        | 4                        | 5                        |
|----------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1.Cost reduction                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.Efficiency                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3.Service level and on-time deliveries             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4.Product Innovation                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5.Process improvement/automation                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6.Compliance to procedures/contracts               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7.Sustainability                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8.Performance management and structured reporting. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

### Outcome of the survey

|                      | 1      | 2      | 3      | 4     | 5     |
|----------------------|--------|--------|--------|-------|-------|
| 1.Cost reduction     | 38.68% | 32.08% | 24.53% | 4.72% | 0.00% |
| 2.Efficiency         | 66.04% | 22.64% | 8.49%  | 1.89% | 0.94% |
| 3.Service level      | 62.04% | 30.56% | 4.63%  | 1.85% | 0.93% |
| 4.Product Innovation | 44.44% | 33.33% | 18.52% | 1.85% | 1.85% |
| 5.Process Improv.t.  | 32.08% | 36.79% | 26.42% | 3.77% | 0.94% |
| 6.Compliance to      | 39.25% | 31.78% | 26.17% | 1.87% | 0.93% |
| 7.Sustainability     | 28.97% | 39.25% | 24.30% | 6.54% | 0.93% |
| 8.Performance M.     | 38.32% | 40.19% | 19.63% | 0.93% | 0.93% |

### Question 10

Do you have a system for qualifying suppliers of direct materials and a performance evaluation system? Do you plan to adopt / improve it in the near future?

1.We have a good supplier qualification system and a discrete system for detecting their performance:

2. We have an essential qualification system, but we do not have a structured system of performance detection in continuous terms.

3. In the near future, we will update the qualification system and adopt a structured and continuous system to measure the performance of critical and / or complex supplies.

Outcome of the survey:

Answer 1: 44.23%

Answer 2: 21.15%

Answer 3: 34.62%