





# ADAPTATION OF INDUSTRY 4.0 MODEL To the NAVAL SECTOR

New marketing commercialization methods adapted to industry 4.0























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### TABLE OF ABBREVIATIONS

AI, Artificial Intelligence, 8 AR, Augmented Reality, 17 CRM, Customer Relationship Management, 25 EDI, Electronic Data Interchange, 27 GIS, Geographic Information Systems, 26 GPS, Global Positioning Systems, 26 laaS, Infrastructure as a Service, 12 IIoT, Industrial Internet of Things, 8 IoP, Internet of Platforms, 8 IoT, Internet of Things, 8 LTL, Less-Than-Truckload, 21 NFC, Near Field Communication, 10 NLP, Natural Language Processing, 16 PaaS, Platform as a Service, 13 RFID, Radio Frequency Identification, 10 SaaS, Software as a Service, 13 SCADA, Supervisory Control and Data Acquisition system, 25 UCaaS, Unified Communication as a Service, 13 VMI systems, Vendor-Managed Inventory systems, 21 WMS, Warehouse Management Systems, 20 ICT, information and Communications Technology, 42 MaaS, Movility as a Service, 42 SNCF, Société nationale des chemins de fer, 43 BIM, Buildings Information Management, 43 CPS, Cyber-Physical Production Systems, 43 EHR, Electronic Health Records, 44



















## 1. New marketing commercialization methods adapted to industry 4.0

### **1.1. Introduction. Industry 4.0 as a GameChanger**

The Fourth Industrial Revolution, also known as Industry 4.0 - a term coined by the German federal government in the context of its High-tech strategy in 2011 - determines the changes in the domain of manufacturing. The concept refers to a deep digital transformation of value chains, business models, products, and services.

Industry 4.0 encompasses the development and integration of innovative information and communication technologies into the industry. The main goal is to foster the intelligent networking of products and processes along the value chain, thus allowing it to use more efficiently the organizational processes, into the creation of goods and services to enhance customer benefit by offering them novel products and services.

Industry 4.0 mainly concerns a shift in production practice — from mass to personalized production. This results in greater flexibility of production processes and provides means to satisfy the individual needs of different customers more effectively [1].

The Industry 4.0 - through new digital technologies, such as Virtual Reality, Augmented Reality, Big Data Analytics, Internet of Things, Additive Manufacturing, Cloud Computing, Smart Sensors, Artificial Intelligence, among others - is revolutionizing the rules of business, as well as the consumer market and therefore the marketing commercialization methods.

This phenomenon has a direct impact on the changes in the management domain of a product lifecycle and on the relationships with stakeholders in the market. The digital solutions of Industry 4.0 change humans as consumers.





### **1.2. Principles of Industry 4.0 in the context of marketing**

Marketing refers to all activities a company does to promote and sell products or services to consumers. The marketing function is necessary to keep pace with the volatile demand characterizing current markets and identify the most valuable products to offer. Companies transitioning into Industry 4.0 need to devise new marketing strategies and the assessment of their level of the digital market.

At this juncture, one of the most important changes, caused by the appearance of these new technologies, is the amount of information made available to the companies. These data, collected and analyzed, is enabling a deeper understanding of customers, allowing enterprises to enhance the customer experience, developing new direct selling and marketing strategies, and post-sales support. In this way, both customer relationships and brand are strengthened.

The integration of the physical and digital worlds of marketing and sales is changing the way their strategies are built. In this way, Industry 4.0 enables modern marketing strategies such as market sensing and data-driven marketing, among others.

In the following paragraphs, we will analyze the main changes in marketing and sales caused by the irruption of Industry 4.0. [2]

### 1.2.1. Emergence of new distribution channels

Industry 4.0 is transforming the global production paradigm. At present, a factory is capable of increasing or decreasing its production in real-time according to the demand of consumers, whose behavior is live measured. A real-time and accurate 360-degree view of potential customers to determine future market trends and customer demands is already a reality.

Besides, customers could change their orders and ideas at any time during production even at the last minute with no extra charge.

### 1.2.2. Increased direct contact





Thanks to all the 4.0 technologies, sales and marketing strategies directly engage with the customer during all the post-sale and throughout the entire life cycle. End customers are now directly connected to manufacturers early in the buying process. Cyber-physical systems, people, and all smart factory components have now the ability to communicate with each other through the Internet of Things (IoT). IoT lengthens the relationship by providing constant connectivity and leveraging it to deliver upgrades, service additions, and even new features throughout the product's life, completely changing the way sales are conducted.

On the other hand, the smart products' benefits enable the customer not only to get information about product's production but also to receive users' feedback depending on their own behaviors. [3].

### 1.2.3. Emergence of a new customer profile

4.0 technologies allow customer's participation in value creation. Today's consumer demands to be part of the product, to participate, to interact with the products, to have the possibility to share their experience and check, either in person or virtually, that the product really satisfies what it promises.

Industry 4.0 also allows the personalization of the product. Customers are now able to order whatever function of products, color, message, or size they are fancying.

It is also important to keep in mind that the new customer is omnipresent, and customers use multiple communication channels almost at once. Because of this, account has to be taken of all types of communication channels [4]: social media (Linkedin, Instagram, Facebook...), Instant Messaging (e.g. WhatsApp), websites, blogs, etc.

Last but not least, customers had never been more informed. They have endless tools for researching companies and understanding their benchmarking. Therefore, content creation is very important for all companies.

### 1.2.4. From print to modern marketing





All these changes and improvements are facilitated through the adoption of new technologies such as the Industrial Internet of Things (IIoT), Artificial Intelligence (AI), the Internet of Platforms (IoP), and Big Data Analytics platforms that need to be integrated as well in the marketing and commercialization processes. The modern manufacturing marketing department needs to be connected, optimized, transparent, and agile. Manufacturers now have access to information about what buyers are doing at every stage of the funnel, allowing them to engage them with the right information at the appropriate time.

To sum up, the technologies applied in Industry 4.0 combined with marketing facilitates [5]:

- Connectivity and Interoperability, with the customer and the product.
- **Cognitivity**, the new technologies offer the possibility of collecting and analyzing data throughout the product lifecycle to recognize the needs and customer behavior in greater detail, even in real-time.
- **Co-creation**, which gives an opportunity to co-create value with the customer at every stage of product creation.
- **Conversation**, personalized customer communication making use of digital customer assistants.
- **Cooperation** in the supply chain, the ability to use data from the entire product lifecycle to implement product servitization and new business models.

Following this introduction of Industry 4.0 principles in the context of marketing, we can only conclude that, in this modern era, an industrial marketing strategy should try and include as many Industry 4.0 technologies as possible to take full advantage of their business potential. To ease its implementation, the main 4.0 technologies that can be applied in marketing and commercialization implementation are described below.









## 1.3. Examples of Marketing & Commercialization technologies in Industry 4.0

### 1.3.1. Industrial IoT

The Industrial IoT refers to the extension and use of the IoT in industrial sectors and applications. The IIoT enables industries and enterprises to have better efficiency and reliability in their operations.

The use of IoT solutions helps companies to gather and make readily available supply- and demand-side raw data, subsequently elaborated and used to match demand and supply strategies.

In the domain of marketing, more and less mature IoT technologies are frequently combined: QR codes, Radio Frequency Identification (RFID) readers and tags, and Near Field Communication (NFC) solutions are among the most common solutions applied by the industry.

Sensors include methods and tools for measuring and sensing various variables that are important in an industrial automation system. A new generation of wireless sensors and actuators, such as smart sensors, ubiquitous and in-store positioning technologies are also being adopted by the industry. Among them, the RFID/NFC tag is one of the most widely used systems.

### 1.3.2 RFID/NFC tag

RFID is the main technology for IoT and consequently, it is also the version of RFID integrated into smart-phones, i.e. NFC. NFC/RFID tags and cards are chosen for identification from the new generation of solutions based on IoT. However, since devices with RFID/NFC are not very extended, this solution also considers the use of legacy technology such as barcodes because all products use it. NFC is a contactless or proximity communication medium, which is based on magnetic induction. It also offers, as the matrix barcodes, the capacity to store and extended quantity of data, such as descriptions of the products, and URLs. The main advantage of NFC compared with matrix barcodes is that the relation size/capacity is better. It is more quickly and



easy to read, just approaching an object to another, compared with another type of technology, like QR codes, which requires a perfect approaching and direct view through a camera. Therefore, NFC tags are easier to use by customers, which makes them more suitable its use in this kind of solution. Finally, the costs from NFC/RFID tags are higher than the QR code, which is directly printed on the product [6].

Most frequent combinations include RFID and NFC technologies used for real-time information processing and monitoring across their supply chain management and marketing functions. Supply-focussed and demand-focussed processes are enabled by the data acquisition of such digital technologies.

Another approach is the use of Industrial IoT solutions on products and customers first, so designing the supply chain based on the data acquired from them.

### **1.3.3. Cloud computing**

Cloud solutions are used to store "big data", such as unstructured data. Using cloud solutions opens up opportunities for productivity growth and cost optimization. The big advantage is the possibility to share information among hundreds of branches of one company, e.g., about customers or sales structure.

In the marketing industry, cloud computing is helping companies of all sizes find success and become more versatile. Cloud computing levels the playing field, allowing small marketing companies to gain traction and collaborate more easily. The cloud has also become a money-saving device, negating the need for major on-site infrastructure.

Cloud computing eases the sharing and rapid organization of multiple types of structured information (e.g. market and operational information). The migration to cloud-based solutions is rising, especially intending to integrate information originated from the supply chain and the market.

Services such as Gmail, Google Docs, and Dropbox are widely used. Through social networks (Facebook, LinkedIn, Twitter), a significant part of personal and business data is collected and saved in the cloud. All these services and their data are easily accessible and available for different





purposes. Ultimately, cloud services ensure an infinite flow of information about consumers, which can be used to improve products and services.

Some marketing concepts that are impossible without cloud computing:

- Marketing automation and lead tracking
- Inbound marketing
- Conversational marketing

Generally speaking, cloud computing applied to marketing enables real-time conversations between companies and customers by powering tools like chatbots, able to prepare specific responses and information for each contact reaching them. It directly works strengthening Brand communication, which in turn increases sales.

Cloud computing includes technologies enabling various types of services. These services are referred to as:

#### • laaS (Infrastructure as a service – servers, networks, virtual machines) [7]

Cloud infrastructure services, known as Infrastructure as a Service (IaaS), are made of highly scalable and automated compute resources. IaaS is fully self-service for accessing and monitoring computers, networking, storage, and other services. IaaS allows businesses to purchase resources on-demand and as-needed instead of having to buy the hardware outright.

IaaS delivers cloud computing infrastructure, including servers, networks, operating systems, and storage, through virtualization technology. These cloud servers are typically provided to the organization through a dashboard or an API, giving IaaS clients complete control over the entire infrastructure. IaaS provides the same technologies and capabilities as a traditional data center without having to physically maintain or manage all of it. IaaS clients can still access their servers and storage directly, but it is all outsourced through a "virtual data center" in the cloud.

Popular examples of IaaS include DigitalOcean, Linode, Rackspace, Amazon Web Services





(AWS), Cisco Metacloud, Microsoft Azure, and Google Compute Engine (GCE).

#### • SaaS (Software as a service – virtual desktops, Email, CRM) [8]

Software as a Service (SaaS), also known as cloud application services, represents the most commonly utilized option for businesses in the cloud market. SaaS utilizes the internet to deliver applications, which are managed by a third-party vendor, to its users. A majority of SaaS applications run directly through the web browser, which means they do not require any downloads or installations on the client-side.

SaaS eases the management of all potential technical issues, such as data, middleware, servers, and storage, resulting in streamlined maintenance and support for the business.

These are several popular examples of SaaS, including Microsoft Office 365, Google apps like Drive and Docs, Dropbox, Salesforce, Cisco WebEx, SAP Concur, Podio, GoToMeeting.

#### • PaaS (Platform as a Service – databases, development tools)

Cloud platform services, also known as Platform as a Service (PaaS), provide cloud components to certain software while being used mainly for applications. PaaS delivers a framework for developers that they can build upon and use to create customized applications. All servers, storage, and networking can be managed by the enterprise or a third-party provider while the developers can maintain management of the applications.

PaaS provides a platform for software creation. This platform is delivered via the web, giving developers the freedom to concentrate on building the software without having to worry about operating systems, software updates, storage, or infrastructure.

PaaS allows businesses to design and create applications that are built into the PaaS with special software components. These applications, sometimes called middleware, are scalable and highly available as they take on certain cloud characteristics.

Popular examples of PaaS include AWS Elastic Beanstalk, Windows Azure, Heroku, Force.com, Google App Engine, and OpenShift.





#### • UCaaS (Unified Communication as a Service).

The concept of Unified Communications isn't entirely new by itself, but UCaaS is all about the new delivery method for these services. The business gains access to software and tools to use, like calling services, messaging services, and softphones.

UCaaS combine the same factors: voice and telephony, conferencing solutions (web, audio, and video), messaging (email and unified messaging), as well as the presence and instant team messaging and desktop or lightweight web clients. UCaaS fits under the umbrella of SaaS since the software and services are hosted by the provider:

- Instant message/chat
- Presence Technology (makes it possible to locate and identify a computing device)
- Audio, web, and video conferencing
- Voice/VoIP technology
- Team collaboration features (e.g. screen sharing)
- Business email
- Call recording
- Centralized management

They mainly serve to structure, share, and customize remote network infrastructures (IaaS), IT platforms (PaaS), operating systems and applications of third-party organizations (SaaS), or raw data (DaaS) [8]

### **1.3.4. Analytics and Artificial Intelligence**

Big Data is usually considered to be data in the range of petabytes that are currently at the edge of database technology capability. Examples are image data, text data from the Internet, business



and security data, and combined multimodal data.

Today data is collected everywhere, from systems and sensors to mobile devices. The challenge is being able to develop methods to best interpret data. Big Data has proven particularly popular for [9]:

- Customer profiling targeted marketing (e.g. product recommendations)
- Predictive analytics (e.g. customer needs foresight)
- Improved customer relationship management

Consumer analytics is at the epicenter of a Big Data revolution. The era of Big Data brings an increasing number of opportunities for the collection, processing, and analysis of vast and complex data sets from individual consumers [10].

The study of consumer analytics lies at the junction of Big Data and consumer behavior. Data provide behavioral insights about consumers; marketers translate those insights into market advantage.

Big Data consumer analytics is defined as the extraction of hidden insight about consumer behavior from Big Data and the exploitation of that insight through advantageous interpretation.

Artificial Intelligence [11] is ubiquitous in the foundation of 4.0 technologies and has a very relevant impact in digital marketing. All marketing is a method of leveraging customer data to anticipate the customer's needs and behavior. The most common uses of innovative AI-powered solutions for content marketing are: [12]

- Al-enhanced pay-per-click advertising. Al analyzes, manages, and optimizes paid advertisement campaigns. Learning algorithms are a big help for optimizing the content, layout, and targeting more efficiently your campaigns.
- **Highly personalized website experience.** On a website, content automatically adapts to who's on the page. By analyzing user's data (including location, demographics, device,



interaction with the website, etc.), AI can display the best-fitting offers and content. Moreover, push notifications can be specific to individual users, delivering them the right message at the right time. AI can help you display the most relevant products – or content – based on how the visitor has interacted with your company from the website.

- Al-powered content creation. All is used as well to write newsletters, posts, automatically generate email content, personalized reports, or messages. Various All tools are available to suggest social media content that the brand's followers are likely to engage with.
- Content-creation chatbots are becoming an essential content marketing tool. Chatbots are simple artificial intelligence applications that users interact with through text in a messaging app. It uses Natural Language Processing (NLP) which makes chatbots able to "read" what a customer writes and "accomplish" with what the consumer wants. Its main benefits are: provides quality customer support, more customized experiences, offers better content, increases engagement, humanizes the Brand, and leverages the existing content. Conversational Marketing and Support using chatbots is undoubtedly the future at large, regardless of the industry.
- Intelligent email content curation. All makes it possible to send personal curated emails to every single customer. Algorithms can analyze a customer's website experience and email browsing data to understand all the individual's interactions with the content. This knowledge allows the algorithm to identify hyper-contextual content to create one-on-one personalized emails.
- Inbound marketing. As there's a transformation in how people interact with brands and companies, new marketing strategies are needed. Inbound marketing has gained increasing popularity among marketers and differs from traditional marketing by pulling customers to the firm instead of reaching them out through traditional advertising. It's primarily based on compelling content, and on producing brand-neutral information to educate and attract consumers without promoting branded products. Recent industry surveys show that 86% of business-to-consumer brands are employing content marketing with diversified formats, like bylined articles, white papers, podcasts, infographics,





webinars, visuals, videos, and case studies [13].

Furthermore, AI finds its place in the supply chain as well. It introduces automation in data processing/analysis and allows to emulate human decisions in processes such as demand forecasting, production planning, or predictive maintenance. From the analysis of large amounts of data related to logistic processes, AI finds anomalies, makes forecasts concerning events that may occur and even provides recommendations to find potential resolutions.

#### 1.3.5. Augmented reality, virtual reality, 3D print, or smart design tools

Augmented Reality (AR) connects the physical and virtual worlds. AR is enhancing the real world (e.g. websites, web apps, other apps, entertainment, images, movies, games, applications, etc.) with computer-generated objects.

It extends the human perception of the world with new information that is not easily and quickly recognizable. Current applications are focused on smartphones and tablets that enable visualization of virtual tours, composing product groups, etc. Applications can be found in warehouse and logistics operations (barcode reading) in transport (traffic information) and service (component visualization).

AR overlays digital content and information onto the physical world. Technological advances in both virtual reality and augmented reality have resulted in products that inform, entertain, and engage audiences. The future of marketing and sales offers a variety of solutions for industries to present product information to potential clients. AR brings better visual recognition and emotional attachment than conventional advertising.

AR can capture people's attention for longer periods than conventional content, increase interaction rates, and improve click-through rates to purchase.

By applying technologies — such as virtual reality, 3D print, or smart design tools— the customer can participate in creating the product. The ability to use fast prototyping that involves 3D printing allows companies to work closely with customers.



For example, home buyers or car buyers can view the interior and exterior of a house or a car and get a better feel than if they were only viewing static images on a website. This allows potential buyers to travel through space or around a product without the need to be physically present. It also allows marketers to present prototypes for custom work, whether it's a small manufactured item or an entire pre-construction building.

AR solutions can engage customers, save time, and simplify the purchasing process. A brochure can nowadays become a virtual shop, easily accessed from anywhere and a virtual sales assistant can shorter the sales cycle.

### 1.3.6. Computer simulation and digital twins

Simulations refer to digital models that imitate the operations or processes within a system. It relates to technologies that will be mostly used in plant operations to simulate production techniques and the testing and implementation of new ideas, hence allowing operators to test and optimize the machine settings for the next product line before the physical changeover [14].

Simulation modeling is the method of using models of a real or imagined system or a process to better understand or predict the behavior of the modeled system or process. As an analog representation, a physical, mathematical, or another type of model is constructed.

A digital twin [15] goes beyond simulation and is exploding in terms of its benefits for marketing. Multiple technologies such as 3D simulation, IoT, 4G/5G, Big Data, blockchain, edge computing, cloud computing, AI, and software analytics come together to create this concept. Digital Twins help understand how any design is behaving in the real-world.

The digital twin is a digital representation of a physical object, process, or service that offers a realtime view in a human-friendly 3D visual format. A digital twin can be a digital replica of an object in the physical world, such as ships or engines, or even larger items such as buildings or whole cities.

A digital twin design is made by gathering data and creating computational models to test it. This can include an interface between the digital model and an actual physical object to send and



receive feedback and data in real-time. This is data that can be applied to a digital product profile so you can monitor how your customers choose, use, accept or reject your product as you update or tweak it to better meet their expectations.

As well as physical assets, digital twin technology can be used to replicate processes to collect data to predict how they will perform. In short, creating one can allow the enhancement of strategic technology trends, prevent costly failures in physical objects, and also, by using advanced analytical, monitoring, and predictive capabilities, test processes, and services.

### 1.3.7. Advanced manufacturing and additive production

Advanced manufacturing and additive production are facilitating the personalization of products, easing and shorting the conventional production process. The management of large volumes of manufacturing, obtaining customized products tailored to the customers' needs, is possible thanks to the incorporation of technologies based on AI, IoT, Big Data, cloud computing, and Virtual Reality. This essentially implies new ways to create products, and interact with the market, connecting machines, processes, systems, and customers.

Specifically, additive manufacturing is the process of joining material according to 3D digital data, most often layer by layer. It allows quick production, even of complex shapes and customization at a lower cost. These kinds of technologies are fast evolving existing multiple types such as selective laser sintering, fused deposition modeling, direct metal laser sintering, laminated object manufacturing, 3-D printing, or lased metal deposition, among others [16].

### 1.3.8. Warehouse Logistics

Logistics 4.0, is as well a key part of the commercialization process by providing in advance insights and prediction about delays, breakdowns, and interruptions to the stakeholders involved in the supply chain.

Different innovative solutions are already coming into play in the logistics sector: smart labeling, use of ICT, GPRS and 3G modems, RFID... Other examples are the use of low power networks (which allow to sensor the pallets), web browsers or applications simplifying the interconnection of



the supply and transport chain service coupled with IoT, AI, Advanced Analytics, and Blockchain. These technologies allow, among others, the following innovative processes powering the commercialization process of many industries:

- "Smart" shipments and transports, such as smart pallets and containers, will be able to transmit all the relevant shipment data, and, through this data, it will be possible to obtain end-to-end visibility of the occurrence of events such as slowdowns, failures, and interruptions. The access to this data allows minimizing the impact of any inconvenience on processes.
- B2B Monitoring and Tracking web-based monitoring and message tracking capabilities that allow business users to view whether message transactions are executing correctly. A critical element of a B2B integration solution is the ability to have real-time visibility into all activities, as well as the capability to notify the process owner immediately when problems occur.
- Cross-docking is a logistics procedure where products from a supplier or manufacturing plant are distributed directly to a customer or retail chain with marginal to no handling or storage time. Cross-docking takes place in a distribution docking terminal; usually consisting of trucks and dock doors on two (inbound and outbound) sides with minimal storage space. Three main technological steps are involved [17]:
  - a. production scheduling,
  - advance ship notices, consisting of an electronic notification that a product is due before it is received;
  - c. transportation management systems, and execution software system that plan freight movement, oversees freight rating, select the route and carrier, and manages freight bills and payments.

More in detail, cross-docking strategies can involve the following systems and operations. At the warehouse execution level, Warehouse Management Systems (WMS) perform daily planning and





execution. A WMS is an execution system that manages the operations of a warehouse or distribution center, including receiving, cross-docking, put-away, inventory control, order picking, replenishment, packing, and shipping.

Also, supply and demand chains are coupled and synchronized by cross-docking, which replaces or greatly minimizes inventory buffers. By providing visibility to all dock and yard storage locations, a yard management system is also a key component in the process. This execution system manages yard operations, including receipt of carriers, dock scheduling and spotting, and operator activities related to receiving and shipping, paving the way to better, and advanced cross-docking planning.

Finally, at the demand or customer level, point-of-sale software is an important tool, along with order management systems to perform order entry, inventory management, order processing, and customer service. It prepares the shipping and delivery execution program, which is then transferred to a WMS, and, in some instances, vendor-managed inventory (VMI) systems.

Several cross-docking scenarios are available to warehouse management. Companies will use the type of cross-docking that applies to the kind of products that they are shipping. The most popular are [18]:

- Manufacturing Cross-Docking: This procedure involves the receiving of purchased and inbound products that are required by manufacturing. The warehouse may receive the products and prepare sub-assemblies for the production orders.
- Distributor Cross-Docking: This process consolidates inbound products from different vendors into a mixed product pallet, which is delivered to the customer when the final item is received. For example, computer parts distributors can source their components from various vendors and combine them into one shipment for the customer.
- **Transportation Cross-Docking:** This operation combines shipments from several different carriers in the less-than-truckload (LTL) and small-package industries to gain economies of scale.





- Retail Cross-Docking: This process involves the receipt of products from multiple vendors and sorting them onto outbound trucks for several retail stores. They would procure two types of products, items they sell each day of the year, called staple stock, and large quantities of products that are purchased once and not usually stocked again. This second type of procurement is called direct freight, minimizing any warehouse costs with direct freight by using cross-docking and keeping it in the warehouse for as little time as possible.
- **Opportunistic Cross-Docking:** This can be used in any warehouse. It involves transferring a product directly from the receiving dock to the outbound shipping dock to meet a customer sales order.

All these innovative applications allow logistics chains to make information and their flow efficient and verifiable all along the way, guaranteeing transparency, security, and accountability, so that users have accessible, accurate, and reliable information.



















### 2. Success story - Bodegas Martín Códax

### 2.1. Description of the company

Bodegas Martín Códax was founded in 1986 and was named after the most known Galician troubadour whose medieval poems, the oldest in the Galician-Portuguese language, have survived to the present. The Martín Códax winery was founded as a cooperative with about 50 local grape growers in Galicia in the northwest corner of Spain.

From the first vintage, the wines were very well-received, and the winery expanded to meet the expectations of wine lovers at home and abroad. To maintain a supply of top-quality Albariño grapes, the winery acquired vineyards of its own and crafted long-term agreements with many family grape growers whose grapes met the winery's exacting standards. Today, Martín Códax oversees more than 2,500 small vineyard parcels farmed by 300 families in the Rías Baixas region around the town of Cambados.

The wines of Martín Códax have won international acclaim and are sold in over 40 countries around the world, where they have come to symbolize Galician culture at its finest.

### 2.2. Adoption of 4.0 technologies

Martín Códax maintains its quality through continuous investment in research, innovation, and talented, creative people.

The winery is adapting its processes to the Industry 4.0 principles, both in vineyard and winery. In vine-growing, for instance, Martín Códax has been working more accurately for the last years thanks to the use of new technologies – such as the system for remote sensing – and tools as drones or satellite images.

Another example is the new bottling line. It has a wide capacity to bottle different styles of wine sparkling wines- and it allows to use of new and diverse bottle sizes which are demanded by the market. Moreover, at the end of the line, palletization is fully automatized hence optimizing its performance.





Martín Códax's commitment to R&D development was rewarded on different occasions, such as "Best R&D Management" within the X Business Awards MVD by the specialized publication <u>Mercados del Vino y la Distribución</u>.

### 2.3. Marketing maturity

Martín Códax has been in business for more than 30 years, implementing a marketing strategy for more than 15 years. The marketing strategy has been created internally, and the marketing department is currently comprised of between 5 and 10 people, directly pending from the CEO. Around 8% of the overall budget of Martín Códax is allocated to the marketing department.

The winery has an e-commerce platform since 2014. Sales through this channel have significantly risen since then. But, even if internet sales are an overall upwards trend in the Spanish wine sector, it is difficult to measure the total value of electronic sales because it is implemented through multiple platforms and distributors, rendering the access to overall data unmeasurable.

As part of his marketing strategy, Martín Códax has a website and an active presence in the following social networks: Facebook, Twitter, LinkedIn, and Instagram. They do also perform commercial promotions, email marketing campaigns, search engine marketing campaigns, media campaigns, and work with brand ambassadors.

To date, 50% of Martín Códax's marketing efforts are based on traditional marketing, while the other 50% have evolved with the adaptation of 4.0 technologies to their activities.

### 2.4. Technologies 4.0 part of Martín Códax marketing strategy

To be adapted to the new 4.0 times, the main changes made with an impact in their marketing strategy are summarized in:

 Modernization of the bottling line to foster traceability. Consumers are becoming increasingly interested in knowing how their foods are produced. As such, Martín Códax is amplifying his traceability technologies and capabilities to provide consumers with a better understanding of how their wines are produced, as well as to drive transparency.



- Increasing customer knowledge by the use of customer relationship management (CRM) tools and integration of 4.0 technologies in the supply chain.
- Improving the presence and image of the Brand through social media channels. Technologies of the 4th industrial revolution such as AI, Big Data, Blockchain, cloud computing, etc., play an important role in social media today. Martin Códax has revolutionized the relationship with customers by fostering digitalization through social networks. For instance, during the COVID-19 restrictions, the winery organized online wine tastings maintaining a strong relationship with its customers.

In particular, the following 4.0 technologies are part of their innovative bottling line and marketing strategy:

### 2.4.1. Artificial vision

Martín Códax has introduced an artificial visioning system on the bottling line. The artificial vision machine controls the labeling process to ensure traceability. The final aim is to come up with a smart label in which the winegrower tells his story to the consumer.

The new bottling line is also coupled with innovative software (SCADA) for data capture and analysis of all the information offered by this machinery. The objective of the application of SCADA (Supervisory, Control, and Data Acquisition) systems in industry are to monitor and control production processes and the full operability of plants in real-time. They can be accessed through digital communication with different field devices (autonomous controllers, programmable automatons, etc.) and, using a graphic interface (touch screens, cursors, computers, etc.), the operator can control the process automatically, react to alarms and change the configuration.





















#### 2.4.2. Remote sensing

Remote sensing is a methodology for the analysis and classification of vineyards through the images captured by drones. This method is mainly used in 'precision viticulture', enabling different types of wine to be produced with grapes that share the same characteristics from different vineyards parcels. Precision viticulture utilizes the latest technology in infrared satellite photography to measure vine vigor.

Precision viticulture depends on 4.0 technologies such as global positioning systems (GPS), meteorological, and other environmental sensors, satellite remote sensing, and geographic information systems (GIS) to assess and respond to variability.









The use of these technologies has a direct link to consumers because allows a better understanding of the grape's typologies and characteristics. All this information is exploited to produce wines to suit individual consumer tastes. The introduction of 4.0 technologies allows the efficiency and quality of production to be improved and minimizes the environmental footprint.

### 2.4.3. Electronic Data Interchange (EDI)

Electronic Data Interchange (EDI), is the automated computer-to-computer exchange of business documents between business partners in a standard electronic format over a secure standardized connection. EDI services facilitate electronic commerce and improve business relationships between partners by the standardized transmission of orders, invoices, delivery notes, and the integration with ERP systems. Thanks to its implementation, Martín Códax enjoys process optimization and reduced waste and errors.





### 2.4.4. Shipment Tracker

Martín Códax incorporates technologies enabling customers real-time tracking of their orders. Thanks to shipment tracker technologies condition and location of products are trackable and controllable, in a way that customer orders can be timely attended improving customer satisfaction.

### 2.4.5. Cloud computing

Moreover, Martín Códax works with different SaaP: WordPress, Shopify, Prestashop, or Wolf, among others. Below we share some of the characteristics of the last two:

- Prestashop: PrestaShop is one of the world's leading e-commerce software providers. Its open-source shopping cart solution is used by 270,000 merchants worldwide. The platform provides data and insights from the store activities, facilitating new sales strategies creation. The tool is synchronized with Google Analytics to facilitate information about customers, products, orders, and the check-out process, purchase history. By doing so allows the creation of marketing campaigns with flash and private sales, referral and loyalty programs, re-marketing, and abandoned cart reminders and newsletters. Moreover, PrestaShop connects easily to local and international marketplaces.
- Wolf: Wolf CRM started more than 10 years ago as one of the first cloud version CRMs in Spanish. It is an operational tool from where you can manage agendas, business opportunities, budgeting, the achievement of objectives, and monitoring of commissions, all supported by the generation of reports and KPIs that will make commercial monitoring more profitable.

It is a multi-departmental tool, including all the departments that are related to the client, from the sales force, such as the marketing and communication department through the management of campaigns and newsletter shipments, customer service with incident tracking, quality, with satisfaction surveys, financial management, controlling the profitability of clients and general management with the control and monitoring of the company's





evolution. It can be also integrated with other tools, such as agendas, social media, online stores, switchboards, etc.

### 2.5. Investment in Industry 4.0

Bodegas Martín Códax has been the beneficiary of a Galician investment program aimed at boosting the implementation of 4.0 technologies. The investment mobilized by the Galician Economic Promotion Agency (IGAPE) together with the support of the Galician Food Cluster achieved the amount of 50.683,25 €.



















### 3. Success story – Congalsa

### 3.1. Description of the company

Congalsa is a Galician company dedicated to the manufacture and elaboration of frozen foods based on fish, seafood, and other high-quality raw materials. Congalsa started its activity in the early 1990s.

The company processes, prepares, and packages a variety of breaded, battered, baked, and plain fish, squid, and other seafood products, and serves customers throughout Europe.

Congalsa has several production plants with a total capacity that reaches 60,000 tons per year, which are marketed in 30 different countries, becoming a trustable supplier for both foodservice and retail international partners.

The company has always been characterized by promoting an international strategy. The intense import and export activity has led them to maintain relationships with more than 50 countries.

The innovation in Congalsa is embodied in the creation of an R & D department, which actively works in the development of new products and in the continuous improvement of existing products to meet customer needs and expectations.

### 3.2. Adoption of 4.0 technologies

Congalsa is immersed in a digital transformation process. The company is aiming at implementing a more flexible, automatized, social, collaborative, connected, and intelligent factory. This smart factory should respond in an agile way or even anticipate market demands with sustainability, transparency, and personalization. A task that will be achieved through the following specific goals:

 Design and development of a business model 4.0 where all the processes are interconnected and management, production, or any other process in Congalsa's value chain converges.





- Digitalization. Implantation of technologies and standards that allow the extraction and analysis of information in real-time.
- Development of novel data analytics techniques aiming to improve decision making.
- Cybersecurity. Implementation of mechanisms to detect and minimize risks.

### 3.3. Marketing maturity

Congalsa has been in business for 30 years, starting the implementation of a marketing strategy in the last 5 ones. The marketing strategy has been created internally, and the marketing department is currently comprised of 5 to 10 people, as part of the sales department. 5% of the overall Budget of Congalsa is allocated to the marketing department. At present, Congalsa does not have an e-commerce platform but they are expecting improvements in frozen food logistics to boost the online Marketplace of these products in line with the broad trends in the food sector.

As part of his marketing strategy, Congalsa has a website and an active presence in the following social networks: Facebook, LinkedIn, Instagram. They do also perform commercial promotions, email marketing campaigns, search engine marketing campaigns, and media campaigns.

To date, 50% of Congalsa marketing efforts are based on traditional marketing, while the other has evolved with the adaptation of 4.0 technologies to their activities.

### 3.4. Technologies 4.0 part of Congalsa's marketing strategy

To be adapted to the new 4.0 times, the main changes made with an impact in their marketing strategy are summarized in:

- Increasing customer knowledge by the use of a CRM tool.
- Improving the presence and image of the Brand through social media channels.
- Using AR to present their products in an innovative and distinguishing way.





In particular, the following 4.0 technologies are part of their marketing strategy:

### 3.4.1. Augmented Reality

Congalsa has developed an AR application: Ibercook Food Service AR, to present its products visually and easily. Through this tool, clients, consumers, salesmen, and distributors can consult a three-dimensional catalog featuring all the company products and new releases. Moreover, the app provides further information on the products and features: cooking mode, allergens as well as different recipes or recommendations to set the dishes. The tool has its website and is available on Google Play and App Store.



### 3.4.2. Cloud computing

Congalsa works with two SaaS Platforms:

• Salesforce: a CRM platform. This tool helps businesses connect with and get more information about their customer base. The software helps businesses track customer activity. The cloud-based software allows companies to track (in real-time) analytics, customer success and support, customer complaints, and a variety of other CRM functions with the ease of cloud storage and access wherever the users are.



 Monkey Markets: Congalsa, through a Galician accelerator program -Business Factory Food (BFFood)- is mentoring the innovative tool Monkey Markets, a SaaS platform specialized in agri-food export to Asian markets. This B2B solution in marketing processes responds to the challenge of marketing and interaction with customers and consumers. Through the use of Big Data, analytics, web scraping, business intelligence, and metasearch engine technologies, Monkey Markets collects, processes, and transforms multiple sources of information and integrates them into its system to facilitate the internationalization of food companies.

### 3.4.3. Computer simulation

Congalsa is currently developing a Digital Twin. This ambitious project is expected to end by 2022 and it will cover all production lines to be able to make cost simulations, improve future investment decisions, and product profitability with simulated EBITDA per product and line. It includes a detailed per product and process description in which every machine, flow, and worker is digitalized with an image and with all relevant information. This information can be modified for simulation purposes to make the best possible decisions for growth, profit, customer service, etc.

#### 3.4.4. Artificial Intelligence

Pepe, Congalsa's innovation ambassador. Congalsa has a robot, as an interaction tool used in visits, trade, congresses, and exhibitions. Pepe is now in charge of asking visitors if they are visiting the company for the first time, he requests data and notifies the corporate manager to receive the visits.

### 3.5. Investment in Industry 4.0



Congalsa is the beneficiary of a Galician investment

program aimed at boosting the implementation of 4.0 technologies. The Congalsa 4.0 project has started in August 2019 and will run until June 2022 with an investment of 4.8 million euros.





Congals4.0 is co-financed by the Department of Economy, Entrepreneurship, and Industry and the Galician Innovation Agency -through the 2nd edition of the Industrias do Futuro 4.0 - Smart Factory program 2019-, and has the support of the European Regional Development Fund (ERDF) within the framework of the ERDF Galicia 2014-2020 Operational Program.

The company will contribute 2.4 million euros and public administration will collaborate with 1.6 million euros, the technological partner Gradiant, which will help Congalsa to develop the project, will contribute with 0,8 Million to round up to the 4 million total investment.





















### 4. Success story – Krack

### 4.1. Description of the company

Krack Zapaterias SL distributes a wide range of footwear. The Company provides trainers, shoes, boots, ballerinas, sandals, and other products. Krack has more than 40 points of sale, the bulk of which are located in Spain, besides, to have a presence in three marketplaces.



The company, employing more than 200 workers, has its own branded footwear (Krack and Bross), mostly manufactured in Spain and Portugal, and franchises in Galicia, like Geox, Clarks, and Pikolinos, growing as a major national player in the fashion footwear industry.

The business model of Krack is customer-oriented to create the best purchasing experience.

### 4.2. Adoption of 4.0 technologies

Krack is a striking example of digitalization, coupling traditional business models and new technologies. The brand has managed to increase the number of physical stores while also increasing the number of online sales, proving that classical stores and the digital world can successfully coexist. To achieve this, the company adopted the concept of a lean manufacturing





mindset combined with 4.0 technologies. The lean manufacturing approach is about the elimination of waste or activities which add no value to the process, providing a basis for operational excellence by standardizing processes and creating a culture of continuous improvement by monitoring, proactively maintaining equipment, and empowering employees.

In 2016, the company was awarded the prize Smart Commerce by the Industry, Labour and Economy Bureau of the Galician government. These awards seek to value the work of traditional businesses in innovation through technological innovation and enhance the visibility of new business strategies.

### 4.3. Marketing maturity

Krack has been in business for 20 years, starting the implementation of a marketing strategy in the last 5 ones. The marketing strategy has been created internally, and the marketing department is currently comprised of 2 to 4 people, as part of the sales department. 5% of the overall budget of Krack is allocated to the marketing department.

As part of his marketing strategy, Krack has a website and an active presence in the following social networks: Facebook, LinkedIn, Instagram. They do also perform commercial promotions, email marketing campaigns, search engine marketing campaigns, and media campaigns.

Since 2012, Krack collaborates with fashion leaders. The ultimate goal of the company is to become a "love mark", giving clients personalized attention and adapted to their needs.

To date, only 20% of Krack's marketing efforts are based on traditional marketing, while the remaining 80% have evolved with the adaptation of 4.0 technologies to their activities. Online shopping represents 12% of total sales. An increase in this percentage is expected by the company.

### 4.4. Technologies 4.0 part of Krack's marketing strategy

To be adapted to the new 4.0 times, the main changes made in their marketing strategy are summarized in:



- Offering virtual assistance encouraging online purchases. Krack's online store has been developed using tailor-made modules, to ease the customers' experience. Moreover, to promote online purchases, a Wi-Fi connection is available in all the stores, and customers can be virtually attended using WhatsApp (see section 4.4.2.).
- Logistics 4.0. Different solutions have been adapted by Krack to reduce costs, reducing tears for stocked goods both online and in-store. The company is shifting the strategy to minimize inventories and allow market demand to drive production and supply chain processes. Its production philosophy is based on the shortest possible design and development cycles, producing small amounts. They work with online and decentralized stock by using the innovative systems/technologies described in 4.4.1. section.
- Improving the presence and image of the Brand through social media channels. In particular, Instagram has proved to be a very efficient tool for Krack to engage with customers.

The following 4.0 technologies are part of Krack's marketing strategy:

#### 4.4.1. Warehouse management systems

WMS are software-based systems for the management of logistics centers (warehouses and distribution centers) - from the receipt of goods to the management of the storage areas for items, in automatic or manual high bay warehouses, small container storage units, or shelves goods, issue and dispatch to support and optimize warehouse functionality and distribution center management. This method enables replenishment of merchandise to be triggered automatically by the system for stores or customers and real-time sales monitoring on each of the stores.

These systems facilitate management in their daily planning, organizing, staffing, directing, and controlling the utilization of available resources, to move and store materials into, within, and out of a warehouse while supporting staff in the performance of material movement and storage in and around a warehouse.









With this method, Krack assures proper inventory levels, avoids out-of-stock situations, and can also immediately locate the products in the different physical stores. The use of new technologies allows them to improve every step of the marketing chain as well, because thanks to the data, they can predict consumer behavior, anticipate and meet all the all consumers' needs and expectations. In particular, Krack works with the following solutions:

- **Cross-docking**, a logistics procedure where products from a supplier or manufacturing plant are distributed directly to a customer or retail chain with marginal to no handling or storage time. The name 'cross-docking' explains the process of receiving products through an inbound dock and then transferring them across the dock to the outbound transportation dock. See section 1.3.8 for a broader description. The main benefits of this are:
  - Labor cost reduction, as the products no longer require picking and putting away in the warehouse





- Time reduction from production to the customer, which helps improve customer satisfaction
- Reduction in the need for warehouse space, as there is no requirement to store the products
- **Put to light** solutions are the best option for picking small items. For sorting processes, which are so common in e-commerce environments, Put to Light systems guarantee a fast, intuitive, scalable, and error-free process.

In a Put to Light system, the displays visually guide the operator to the containers in which to put the articles that make up each order. Each location or container assigned to the order will have an associated luminous display. Sorting is performed on an item-by-item basis. After identifying an item, the displays will visually show the operator the locations to be put and the quantity demanded for each order.

So, Put To Light solutions are used to allocate items to specific locations from transported containers (product-to-person principle), from previously selected containers (batch picking or two-stage picking processes), or from Picking Carts with multiple orders, for example.

This type of solution leads to a reduction in the costs of reverse logistics, inventory updated thanks to direct communication, an increase in the number of orders picked per day, and a reduction in operating costs.

### 4.4.2. UCaaS (Unified Communication as a service)

Video calls, powered by WhatsApp, are among the measures taken by Krack to facilitate endusers' access to personalized attention comparable to the experience they would have when visiting a physical store. One of their employees responds to the call and guides the customer throughout the purchasing process. Once the client has made the choice, the instructions to complete the order and payment are sent to the mail. Finally, the service ends with the sending of the chosen products to the address given by the customer. Online sales are also an option in Krack's shops.





### 4.5. Investment in Industry 4.0

Krack was awarded in 2018 by the Galician investment program aimed at boosting the implementation of 4.0 technologies. The investment mobilized by the Galician Economic Promotion Agency (IGAPE) helped the company with the creation of a flexible and cloud-based digital system under the name "Project K2020".



















### 5. Application in other sectors

Technology 4.0 has reached every sector, presenting new and innovative ideas which transform the product and service offered to the public. To complete this study, in this section we will deepen into other economic areas not analyzed before, their specific application of technology 4.0, with their characteristic technologies, and the consequent transformation of this sectors.

Three different sectors have been selected in order to examine the wide application of new technologies into all sectors: railway sector, construction and healthcare. In this study stand out companies from the Interreg Atlantic region and contributions from partners such as BPN or Cork Institute of Technology.

### 5.1. Railway sector

Railway 4.0 is a major trend marked by the digitalization of the railway industry leading towards the automation of railway operations. This digital transformation, through the adoption of new technologies, is vital to enabling new passenger experiences, improving security, and optimizing operations.

The railway industry is embracing disruptive technologies such as Internet of Things (IoT), Artificial Intelligence (AI), big data analytics, connectivity, and cybersecurity.

Digitalization is focused on specific areas of the rail sector such as mobile applications to improve the passenger experience and staff operations, including e-ticketing, train control, signalling, traffic management, and assisted and predictive maintenance.

Thanks to digitalisation, rail companies have widened the range of services they can offer their passengers considerably, notably through: more informative websites, mobile applications providing reservation, ticketing, timetables and real-time information, onward journey planning, and an onboard combination of information and leisure. Digitalisation of reservation and ticketing has many benefits. On the one hand, passengers get an easier access to their travel details, which can be electronically stored on their smartphones or tablets. On the other, the cost of providing tickets is



significantly lowered for operators since they do not have to produce individual disposable tickets for each journey. Moreover, rail operators can use stored travel data to assess travel patterns and then modify existing services or plan new ones.

The development of Information and Communications Technology (ICT) solutions based on electronic platforms and applications has resulted in 'mobility as a service' (MaaS). MaaS incorporates multimodality, including in urban areas. In addition to booking and ticketing services, it can monitor online traffic, road works, accidents and takes into account travellers' preferences in terms of costs, time or carbon footprint.

In the field of marketing, 4.0 technologies are using to promote the passenger experience, driven by user-centric services offering digital transport services using mobile applications that allow passengers to stay connected and ease their journey.

Some examples of new solutions applied by the transport sector are:

### 5.1.1. Ticket Booking via Chatbot

Online purchases became the normality when talking about purchase habits for trains or buses, but when support request volume is high, customers still have to wait to confirm a booking or process a refund. To simplify the process and speed up the waiting time to book a ticket, chatbot solutions have been developed. Chatbots improve customer experience, as well as reduce the workload for customer support departments.

One frequent solution suitable for ticket ordering for train, plane, and bus travel through chatbots. In addition to booking, the chatbot's interface allows users to receive reminders and check the weather at their destination to make transportation and overall travel a pleasant experience.

### 5.1.2. In-Train Entertainment

To help passengers enjoy traveling by train, start-ups offline entertainment solutions and in-vehicle Wi-Fi connection services have been developed. These solutions allow passengers to watch a movie, browse the news, as well as check the weather and live location, or even work on longer





trips.

### 5.1.3. On-Board Virtual Reality (VR)

The duration of a train journey provides passengers with ample time for inquiring about the status of the ride, learning about the destination, and explore on-board entertainment. That is why entertainment solutions based on Virtual Reality technology were developed by many enterprises.

An example is GoMedia, a British start-up which provides on-board VR solutions for the railway industry. Using the start up's app on their own devices or a VR headset available on-board, passengers can watch a virtual glass roof when traveling under the Channel Tunnel, for example. Additionally, the start-up offers movie and TV streaming, as well as offline digital rights management.

#### 5.1.4. Personalised services

The French national company *Société nationale des chemins de fer* (SNCF) added new digital services on numerous high-speed trains. In addition to the usual travel services, it provides meals at the passenger's seat, e-concierge services and an automatic modification of tickets in case of early arrival at the station, detected through geolocalisation. Moreover, the SNCF has set up a collaborative platform to enable customers to rent a private car, make use of a carpooling service, or arrange taxi hire with driver services to get to a station, airport or home.

### 5.2. Construction sector

Construction 4.0 brings the possibility to offer personalized, smart and connected building products and applies both to the technical building processes as well as the maintenance of those systems.

The major changes experienced by the building sector are driven by the use of the Buildings Information Management (BIM), but it also relies on Internet of Things, Digital Twin, additive manufacturing, cloud computing and Cyber-Physical Production Systems (CPS), including sensors, drones, embedded robotics and monitoring systems.





BIM models, serve as digital twins, enabling building plans to be easily accessible via digital devices and provide a route to the real time monitoring of the building progress. BIM also makes possible incorporate and annotate detailed information regarding every aspect of the project: colour, cost, size, material and even time.

It does not matter which type of construction we are talking about (an office building, a school, a road, or a bridge), a BIM model can map everything: geographic details, manufacturing specifications, the light a room will contain, and the environmental impact of the entire project.

It serves as the focal software platform for integrated design, modelling, planning, and collaboration This approach offers the possibility of reproducing a construction site virtually making possible to create and test any structure of a building before the actual implementation or the purchasing process. [19].

The Guggenheim museum was a pioneering piece of construction that tested the building information modelling (BIM) method already adopted globally. Nowadays there are many companies helped by this new technology. One example, in France, would be BuildingSMART – Media Construct; a company which plays a key role in BIM standardisation.

Some other examples of new solutions applied by the construction sector are:

### 5.2.1. Intelligent modular walls

An intelligent modular Wall section being manufactured is able to share data with the manufacturing process to ensure in time delivery of sub-components and assist with their insertion.

A modular wall section is able to relay data back to a house owner's intelligent hub. Data relayed include house temperature and humidity of wall section (perhaps to alert about water/damp ingress).

Provided consent is given, it might also be able to send data back to manufacturers. [20].

### 5.2.2. Predictive Analytics: A Talent Acquisition Tool

Construction sector embraces many risks when starting a new project. Predictive analytics, working







through learning machine and artificial intelligence, provide constructors information about the new project and predict possible outcomes and challenges it might face in the future, helping in the decision making process. This tool attempts to avoid risks and to lower costs, resulting in an increase of time and resources efficiency. In a complex construction project risks are higher, therefore predictive analytics have a key role analysing these risks and helping to establish a budget as well as the best distribution of efforts and resources [21].

### 5.2.3. Incidents prediction

Real time data analytics, both onsite and offsite, can help improve risk detection and assessment. It can provide new capabilities in terms of predicting incidents and issuing early warnings and alarms to workers via smart wearables. It can also support automated learning systems that can manage risks on site and in real time. Capturing data on the progress of construction projects, worker activities, vehicle activities, weather conditions and conditions onsite.

Architects design a building, contractors use the same model to construct it; when a building is finished, the owners use BIM to schedule maintenance and complete infrastructure updates. At each life stage, BIM automatically generates scheduling and logistics which reduces errors, makes cost predictions more accurate, and gets a project done faster.

### 5.2.4. 3D models generation

Novel uses of robotics within the construction industry include the use of UAVs (Unmanned Aerial Vehicle) and quadruped robots. They are commonly used to survey construction sites and for collecting data to generate 3D models of buildings.

BIM intelligent 3D modelling helps to create mock-ups and to represent a project to plan an efficient construction.







### 5.3. Healthcare sector

Healthcare 4.0 integrates the patient in the medical process through a more personalised and precise service, approaching the patient to healthcare professionals. Not only technology has impacted the relationship with patients, but has also transform medicine in a more accurate and complete service.

Technological innovation has transformed healthcare sector and its communication. Main changes have been possible through the implementation of barcodes, custom health software and Smart Factory (composed by sensors and Smart devices). These changes have increase patients trust on professionals and understanding of medical services, as well as their implication in their own healthcare.

Some improvements made in the healthcare sector:

#### 5.3.1. Telehealth

A better communication between health professionals and patients has increased efficiency of medical services as well as their quality, individualizing more the service according to the patient needs. This online interaction is held through a custom health software, and the creation of Health Portals to ease the use of communication channel. This platform also allows the interaction between doctors, which is determinant for the well-functioning of the medical service and the exchange of relevant information of patients. Telehealth brings closer medical services, having special relevance in rural areas and in those with less resources. This new method of healthcare has been already adopted in different medical areas as: teleradiology, telepsychiatry, telepathology, teledermatology.

An example of telehealth within the Interreg Atlantic region is the digital health company Babylon Health, from the United Kingdom. Through the application of new technologies this company aims to bring closer medicine to people worldwide. In order to do this, they base their work on a digital health service accessible and affordable for everyone.

### 5.3.2. Electronic Health Records (EHR)

Maintaining a streamlined patient flow is vital for healthcare systems since it allows the good



performance of healthcare staff, efficiency in the different stages of treatments and cures and reduction of costs. However, bottlenecks are often detected in the patient flow affecting efficiency, a problem solved by innovation such as the digitalization of health records: Electronic Health Record (EHR).

An example of this is the EU-funded <u>Tracworx</u> project, which is developing a data analytics system that works in real time indicating eventual bottlenecks and identifying efficiencies and true capacity of healthcare institutions. This project implementation is possible thanks to the data analytics tool EIC-SMEInst-2018-2020 – SME. It provides important information to healthcare staff and feedback on performance. It is designed to improve patient management, reduce delays and treatment costs. The system works in real time, communicating vital information to staff while also giving you feedback on how you are performing. Ultimately, Tracworx allows you to increase throughput, decrease average length of stay, improve the recording of treatment costs, and helps with achieving optimal process efficiency.

### 5.3.3. Smart Factory: IoT sensors and Smart devices

Hospital's process of sterilization, drying and storage of instrumentation can be monetarised employing IoT. This ensures the proper sterilization of medical instruments during the process and its correct storage, guaranteeing that everything is sterilised and that is not contaminated before its next use. Smart Factory implementation in the healthcare sector has reduce the margin of human error in cleaning and storage process, saving time and resources. This transformation in hospitals performance has increased the quality of their services and has impacted patient's trust, which has increased since the implementation of this innovative methods.

#### 5.3.4. Barcodes: tracking information and instrumentation.

Human mistakes are also reduced thanks to barcodes and the digital storage of data. These barcodes can continuously update information, and can be applicable within a wide range of healthcare sector areas. Barcodes for patients are located in a wristband, and facilitate access to the situation of the patient or medication needed, which ensures an accurate treatment for the patient. Regarding patient's treatment and quality of services barcodes play a key role to identify





blood tests or other medical test, avoiding their transposition. Another determinant quality of barcodes is their ability to control products regardless of where they, therefore, they have been adopted in hospitals in order to keep inventory, facilitating the access to material and equipment. This innovation has also been implemented at a commercial level, being used to follow the product and to prevent their falsification once they are in the market. The application of barcodes at a commercial level allows as well to track the product and to contact the end users of a defective lot if needed. Traceability of barcodes is therefore one of its main characteristics and the most useful when applied to products, medicines or instrumentation.



















## 6. Must have for the shipbuilding industry & conclusions

This analysis has shown that 4.0 technologies are very useful in the context of marketing and commercialization and can be adapted by companies of different sectors and sizes. There does not impede its adoption. On the contrary, they serve to optimize resources and to boost return on investment.

Among the wide range of possibilities available to boost productivity under the 4.0 technologies, in this chapter we include some of the essential tools from a marketing and commercialization perspective that every industry should incorporate, and which application is of particular interest to the shipbuilding sector:

 Website and social media channels. The vast majority of business purchase decisions start with a search engine of websites and nowadays searches come from different devices. It is therefore vital to have a responsive website and to boost the search ranking by using Analytics and SEO tools.

By having an online presence, through the website and social media, companies can reach more consumers and increase sales. It makes it easier for any interested person, wherever they are located, to find and read information about the company. The website acts as a salesperson and has the great advantage that thanks to 4.0 technologies, can act as a data center, facilitating all the insights for knowing better customers and prospects.

The data provided by tools like Google Analytics facilitates the measurement of any performed campaign or activity against the business goals. It helps also to improve customer support and as a result, improve your overall customer service thanks to solutions like **chatbots**.

On the other hand, social networks allow content promotion and direct interaction between customers and products. It becomes more important every day that users can share their experience with the products. Social media is offering a new medium to validate, confirm, and check the experiences of other customers building the brand reputation. This interaction provides



two benefits: first, the ability to meet the customer's experience, and second, to confirm, validate, and check the product's features [4].

Augmented reality: as mobile and wearable devices that enable digital content to be displayed over physical surroundings are becoming more and more common, the company's investment in AR increases exponentially leading to increased business opportunities and sales. By using AR, prospective customers can see and interact with any product or component without the need for a physical presence. It also facilitates customers taking an active part in the products' design. Customers can scan any product, QR code, or object to pull up a tailored AR experience either toward giving additional information about the product, in as much detail as the customer demands, or offering some form of supplemental brand-related experience. Moreover, from AR manuals to the possibility of remote support via AR, augmented reality offers the possibility to make customer services more interactive and responsive.

Furthermore, other technological tools could be used in the shipbuilding sector, depending on the characteristics of the specific services and/or products developed. All the technological options which, at first sight, improve the internal processes, will also improve the marketing management and other processes of any company. The decision about the adoption of tools framed in Industry 4.0 remains as a realistic, interesting, and also creative option for the shipbuilding sector, and, of course, as a strategic decision alternative oriented to the enhancement of productivity or profit increase. Last but not least, being part of Industry 4.0 answers to the vital need of being adaptive in this changing technological era, which implies new marketing "behaviors", as addressing to the new customer profile, well informed and willing to participate along the entire product life cycle.

















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