

A Truly Sustainable Digital Transformation Model for the Naval Sector

Un Modelo de Transformación Digital del Sector Naval Realmente Sostenible

DOI: <https://doi.org/10.25043/19098642.97>

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Abstract

This document aims to show the meaning and real implications of implementing a Digital Transformation in the naval sector, explaining its three components (People - Processes - Technology), as well as the consequences of the bad practices of its application through real cases of global resonance. Subsequently, an approximation to the requirements to carry it out in an adequate and sustainable manner are stated, by understanding the concepts of the executive level that will help strategic alignment and the application of tools to achieve it, and then explain how to design and execute a Digital Transformation Strategy in any organization. Finally, a model to create a sustainable Digital Naval Industry is offered, leveraged by Industry 4.0 technologies, presenting mechanisms such as the creation of a national and regional naval cluster, which allows free exchange of data and open information in real time, whose enabler will be the Unified NameSpace (UNS).

Key words: Industry 4.0, Digital Transformation, Naval, Digitalization.

Resumen

Se pretende mostrar el significado e implicaciones reales de implementar una Transformación Digital en el sector naval, explicando sus tres componentes (Personas - Procesos - Tecnología), así como las consecuencias de las malas prácticas de su aplicación mediante casos reales de resonancia mundial. Posteriormente se hará una aproximación a los requisitos para llevarla a cabo de manera adecuada y sostenible, mediante el entendimiento de los conceptos del nivel ejecutivo que ayudarán al alineamiento estratégico y la aplicación de herramientas para poder conseguirlo y, seguidamente explicar cómo diseñar y ejecutar la Estrategia de Transformación Digital en cualquier organización. Finalmente, se presentará un modelo para crear una Industria Naval Digital sostenible, apalancada por las tecnologías de la Industria 4.0, exponiendo mecanismos como la creación de un clúster naval nacional y regional, que permita un libre intercambio de datos e información abierta en tiempo real, cuyo habilitador será el Espacio Nominal Unificado (ENU).

Palabras claves: Industria 4.0, Transformación Digital, Naval, Digitalización.

Date Received: November 23th, 2022 - *Fecha de recepción: 23 de noviembre de 2022*

Date Accepted: January 18th, 2023 - *Fecha de aceptación: 18 de enero de 2023*

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Introduction

Currently, Latin America is one of the least competitive regions globally, as evidenced in a study conducted by the IMD (International Institute for Management Development) World Competitiveness Center (see Fig. 1). In this sense, the naval sector in Latin America has great opportunities to generate high value in economic growth and increase the competitiveness of the region in general.

Digital Transformation is called to be the main enabler to allow the constant exchange of reliable, real-time, and valuable data and information across and along all the national and regional naval clusters, to allow the integration of all the efforts inside the sector and pursue a higher global competitiveness.

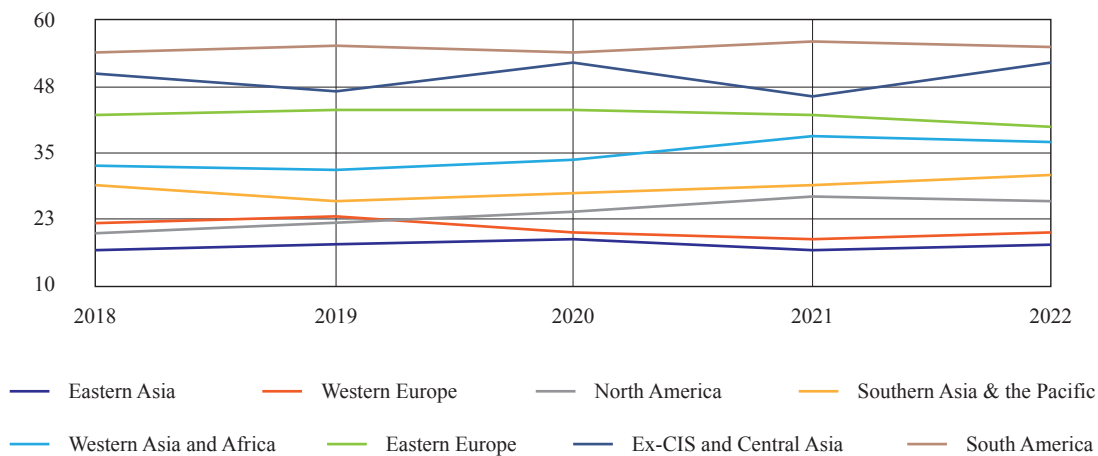
The naval sector is one of the most complex in the world because of its dependencies, type of projects, need for high investments, highly qualified human capital requirements, highly complex technological solutions, and the need for a global supply chain. This sector is made up of several companies that perform naval architecture, engineering, design, different types of services, economic and sustainable exploitation of the seas, construction and maintenance of ships and vessels of all types, including the design and construction of floating platforms, offshore vessels and systems, naval weapons, propulsion systems

and their components, military and civilian communications, radar, sonar and other electronic systems, simulation and modeling systems, and the design and construction of ships, maintenance and repairs of shipyards, and much more.

To be a leading player in this sector, it is essential to be able to count on a high level of integration and collaboration between the different actors. A Digital Transformation of the naval sector is the only way to achieve this goal. A Digital Transformation is based on the use of new technologies to transform the way companies and organizations interact with their customers, employees, and between companies (Business to Business or B2B) inside the cluster. This transformation implies a change in the way companies and organizations work, think, behave, and use technology to do so. It also involves a change in data and information management to make decisions and improves the quality of the products and services.

The approach to this study is carried out through the description of what a successful Digital Transformation process means, through the study of a few failure cases of global resonance and the presentation of statistics and studies of both naval and Digital Transformation aspects. For this reason, the research methodology used is considered a qualitative, descriptive and explanatory study, with a non-experimental, transversal and descriptive design.

Fig. 1. Average ranking positions by region in Overall Competitiveness 2018-2022. (International Institute for Management Development IMD, 2022).



Digital Transformation

What Digital Transformation is not.

It is very common to hear people and even read documents, in which the term "Digital Transformation" is carelessly used to describe the adoption of platforms, applications, hardware, software or any other type of initiative, without understanding what it really means, especially in Latin America. It is often confused with other terms such as Digitization or Digitalization. However, the most important thing to know is that there is no Digitalization or Digital Transformation without Digitization of paper, procedures and processes.

Digitization in its most basic meaning, is creating a digital version (bits and bytes) of analog or physical elements; It commonly refers to the transformation of the analog to the digital, whether material or immaterial, such as paper documents, photographs, audio, among others. Schallmo and Williams (2018) define this term in the context of the business process as "... digitally enable analog or physical artifacts to be implemented within business processes, with the ultimate goal of acquiring new knowledge and creating value for stakeholders." (Pag. 36).

Regarding digitalization, the first use of this term was in the essay "The Digitization of Society", published in the North American Review in 1971 by Robert Machal, referring to the limitations and potential of computer-assisted research. The large amount of theory that exists regarding the confusion of this term with digitization, forces to establish the definition for the purposes of this document as "... the fundamental changes made to operations and business models with the new knowledge acquired via high added value digitization initiatives" (Schallmo and Williams, 2018).

An example of what digitalization means under this approach, corresponds to the use of technological tools, applications or platforms that renew, transform, facilitate, or replace old processes or procedures, creating an environment in which digital information is the core.

What Digital Transformation is.

Regarding Digital Transformation, there are endless definitions that, at their base, are not incorrect. For some people (unfortunately the vast majority), it is related mainly to technology; for others it is the way to get new clients and business opportunities in companies, and others relate it also with a new way of developing their business model. But normally this difference in concepts occurs within the same organization, revealing problems that affect corporate leadership, as they show a misalignment and lack of common vision regarding the future of the companies (Dorner & Edelman, 2015).

The most appropriate definition of Digital Transformation, corresponds to what the researchers at Massachusetts Institute of Technology (MIT) Ross, Beath and Mocker (2019) define in the book "Designed for Digital" as Digital Business Design: "... the holistic organizational configuration of people (roles, accountabilities, structures, skills), processes (workflows, routines, procedures), and technology (infrastructure, applications) to define value propositions and deliver offerings made possible by the capabilities of digital technologies" (Pag. 36).

In some circles, Digital Transformation is mistakenly handled as a project since, among other differences, a project has a start and an end. Digital Transformation must be seen as a permanent process and a constantly evolving strategy, thanks to rapid technological changes, which are already beginning to make obsolete the Moore's Law¹. The implementation of the Digital Transformation should be managed as a project, but the Digital Transformation itself should not.

Components of Digital Transformation

In summary, a successful Digital Transformation carries out a strategy in which the three general components to be transformed are intervened in a sequentially and organized manner: people

¹ Moore's law is the empirical observation that component density and performance of integrated circuits doubles every two years. (Gustafson, 2011).

(mind and culture), processes (what the company does) and technology (the enabler). Each of these components has a series of methodologies and tools to use that guarantee that it is considered within the Digital Transformation strategy to obtain the greatest possible benefit, as shown in the following table:

Table 1. Digital Transformation components and intervention methodologies.

Digital Transformation Component	Component Intervention Methodology
People (mind and culture)	Organizational Change Management (OCM)
Processes (what the company does)	Organizational Process Reengineering (OPR)
Technology (the enabler)	Organizational Apps. (Apps.)

Statistically, only 30% of companies that embark on their Digital Transformation journey achieve expected value and sustainable change in what is considered the “winners zone”. 44% get some value, but do not reach their goals, or achieve a lasting transformation over time; this area is known as “the zone of concern”. The remaining 26% are in the “affliction zone”, those that obtained little or no value and the change was limited in time, (see Fig. 2). The main reason for this high rate of failure, is the fact that many organizations and people

consider that the application of technological tools is the component to which they should dedicate the greatest amount of resources, leaving aside, or giving less importance to people and processes, essential aspects to achieve success. (Forth, Reichert, De Laubier, & Chakraborty, 2020).

Greatest Digital Transformation failures

As an example of the given statistics, important Digital Transformation failures have been studied, establishing that the most common root cause across these cases is that the companies didn’t make an adequate plan to impact the three components previously described (see Table 2).

This list corresponds to a study carried out by two important Digital Transformation consulting firms. The parameters that were ranked were the severity of the failure and the possibility of it having been avoided (Kimberling, Third Stage Consultant Group, 2022).

An example of a Digital Transformation success

Unfortunately, there is currently no real information available about a successful Digital Transformation in the naval sector. However, there have been some notable examples in other industries. One such

Fig. 2. Digital Transformation success statistics. (Forth, et. al., 2020).

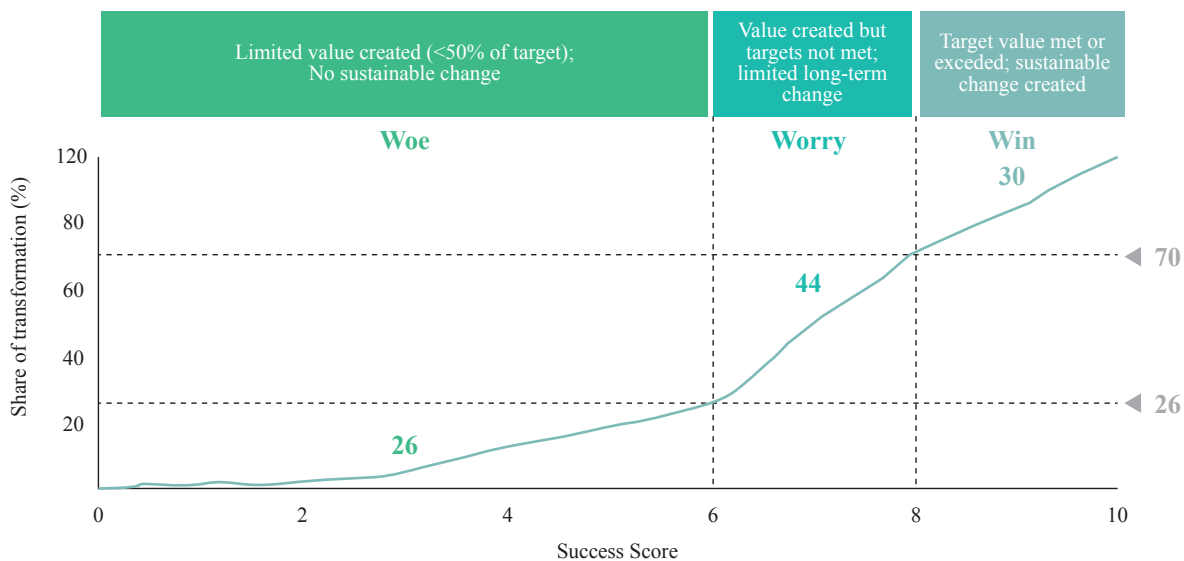


Table 2. Digital Transformation biggest failures.

Rank	Company	Cost in Million USD	Applied Methodology		
			OCM	OPR	Apps.
1	U.S. Air Force	\$ 5.000	No	No	Yes
2	U.S. Navy	\$ 1.870	No	No	Yes
3	National Grid	\$ 1.300	No	No	Yes
4	Nike	\$ 900	No	No	Yes
5	Revlon	No data	No	No	No
6	Miller Coors	\$ 163	No	No	No
7	Hershey's	\$ 100	No	No	No
8	Waste Management	\$ 500	No	No	No
9	Hewlett Packard	\$ 160	No	No	Yes
10	Washington Community College	\$ 13	No	No	Yes
11	Haribo	No data	No	No	Yes

is Avis Rent a Car. Avis implemented a variety of digital technologies to improve customer experience, such as online booking and mobile check-in. These technologies have allowed Avis to streamline their operations and increase efficiency, resulting in a better experience for its customers.

One of the main reasons for this success, is focusing on improving customer experience, not only implementing a technology (unlike Hertz, its main competitor). By implementing online booking and mobile check-in, Avis made it easier for customers to rent a car and get on the road. This increased convenience and efficiency led to a better customer experience, guaranteeing loyalty. Additionally, by allowing customers to book online and check-in through a mobile app, Avis was able to reduce the time they spend at the rental location, making the process more efficient and convenient.

Another example of a successful Digital Transformation is Amazon. The company has used digital technology to revolutionize the way in which people shop. From their early days as an online bookstore, Amazon has grown to become one of the largest retailers in the world. They have done this by leveraging digital technologies such as data analytics, machine learning and automation

to optimize their operations and improve customer experience. They have also expanded into new areas like streaming content and grocery delivery using digital technologies.

This success can also be attributed to several factors. One of the main reasons is the company's focus on data-driven decision making and their use of data analytics and machine learning. Amazon has been able to use data to optimize their operations and improve its customer experience, which has helped them to stay ahead of the competition. Additionally, their use of automation and other technologies has helped to make shopping more convenient and efficient, which has attracted new customers and retained existing ones. Additionally, their strong logistics and delivery network allows them to provide fast and reliable delivery services which helps them stand out in the market. Furthermore, Amazon's willingness to invest in new areas like streaming content and grocery delivery, has helped them to diversify their revenue streams and become a leading player in multiple industries.

Culture, processes, and technology aspects were visibly intervened. Avis focused on improving its customer experience through technology,

while Amazon focused on data-driven decision making and automation. Both companies were able to streamline their operations and improve efficiency, which led to a better customer experience and growth in the business. This shows that a successful digital transformation requires a combination of technology, process improvements and cultural changes to drive growth and improve customer engagement.

Naval Cluster

The region requires a high level of collaboration between the stakeholders of the naval sector. This is achieved through a real integration of public, private, and non-governmental organizations that add value to its development. For this, the creation of naval clusters within each of the Latin American countries is fundamental, and then, a great regional naval cluster should be created, which will contribute significantly to increasing continent's competitiveness.

For these clusters to be effective, it is imperative that the actors begin an adequate Digital Transformation process, optimizing the impact of the three components mentioned above. This will enable the exchange of real time, reliable and high value data, and information between actors, both within the cluster and among the national naval clusters. This is a great challenge, since it requires a total change of paradigms; but if done with the right tools and the right partners, it is possible to face this great challenge and obtain the expected benefits, positively impacting on the competitiveness of Latin American countries, and contributing to the continent's economic and social growth.

The organizations called to be part of this cluster should be: the country's Navy, customs and shipping agencies, storage and warehousing, maintenance, spare parts and accessories, engineering certification and inspection, maritime and naval consulting firms, shippers, port companies, exporters and importers, maritime terminals, nautical companies, fishing companies, shipyards and dockyards, transportation, tourism, and any

other company that generates value within the maritime sector. The real benefit will be visible after a high level of collaboration and trust is achieved across the cluster, enabled by real-time, reliable, and quality data and information exchange, as a product of the Digital Transformation initiated by each one of the actors.

In the same way, it is possible to create large value chains, where many smaller companies are connected to work and generate value together, taking advantage of technology, which allows them to be more capable and even more competitive. In addition to creating more competent supply chains, business clusters can be used to create more efficient and effective communication and coordination between companies, accelerating the development of new and better operational business models.

How can a naval cluster be created?

The only way for each stakeholder, is to implement Digital Transformation to guarantee new and innovative technologies that allow to share information in real time and in a secure way, so that their activities can be coordinated and generate new value. Technologies such as blockchain, Big Data and analytics, the Internet of Things, and the cloud can be used to connect naval actors and create new business models. In the end, this will generate a high degree of trust within the cluster, being a necessary factor for the joint growth of the entire naval sector. A high level of trust between naval cluster companies is highly relevant because companies often must work together to win tenders or develop new technologies.

The cluster will also contribute to the development of new markets and to the expansion of existing ones, to the development of R&D in the maritime sector by stimulating the investment of companies on this front, as well as to the training and knowledge development of human capital in the sector.

However, the creation of a cluster is not only about connecting companies through technology. The important thing is how the companies use technology and how they can work together to

create new value. In this way, each company will have to consider the following:

- How can we guarantee success in Digital Transformation?
- What technology should we use to connect to the cluster?
- What are the expected benefits from the implementation of this technology?
- Who are the other companies that we need to connect with?
- How can we work with the cluster to create new business models?
- What are the advantages of collaborating with the cluster and integrating digitally to create new business models?
- What are the risks of working with the cluster to create new business models?
- What are the risks we face when implementing new technologies?
- How do we ensure data security and data privacy when we share information with clusters?
- What are the policies, processes, and tools that we need to establish to be able to implement the technology successfully?
- How can we create a competitive advantage by collaborating with the cluster?

Making the naval cluster sustainable in an Industry 4.0 era

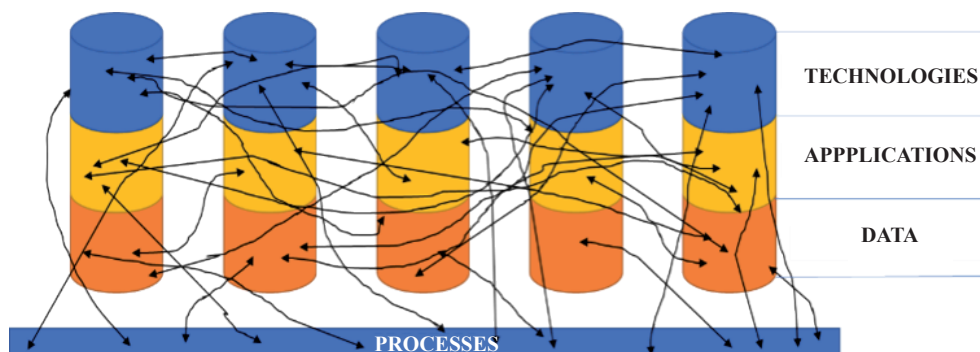
Every business has a unique way of gathering and using data. However, most business data is not accurate or timely enough to be useful for decision-

making. Many businesses experience a disconnect between the data they need to make decisions and the data they have at hand. Companies often rely on a colossal mix of unrelated data sources to make decisions. In fact, most businesses rely on multiple data sources that often conflict with each other. The most common data sources are spreadsheets, databases, and Enterprise Resource Planning (ERP) systems.

While these systems may contain useful data, they often don't share a central information hub that can be used to make quick and informed decisions. Even worse, data may be siloed within these systems, each one with lots of discrete connections with others, similarly to a spaghetti diagram, making it difficult to get a holistic view of the business (see Fig. 3).

The lack of a centralized data environment can lead to several problems as incomplete data (when data is siloed in different systems, it's often incomplete. For example, it is common to have customer data in one system and sales data in another. But without a way to link the two, it is impossible to get a complete picture of a customer's buying habits), due to inconsistent data (data inconsistency can lead to errors and inaccuracies). For example, having two different databases with different field names for the same data, will make it difficult to combine the data and get accurate insights), out-of-date data (data that's not up-to-date) can lead to decision-making based on outdated information. For example, using last year's sales data to make decisions about this year's budget, will lead to make least informed

Fig. 3. Siloed systems, data and applications. (Ross, Beth, & Mocker, 2019).



decisions), and difficulty accessing data (if data is siloed in different systems), it can be difficult to access. For example, if pulling data is done from a database that are not connected to the internet, it will be difficult to get it in a timely manner).

The optimal and sustainable way to share information within the naval cluster is for each of its participants to implement two aspects of business management as a result of the Digital Transformation: The Operational Backbone and the Unified NameSpace (UNS).

An operational backbone is a coherent set of enterprise systems, data, and processes supporting a company's core operations to replace the messy legacy systems, processes, and data generated by siloed business units with standardized and shared systems, processes, and data (Ross, Beth, & Mocker, 2019). It is the foundation of a company's Digital Transformation. It enables a company to move away from paper-based processes and manual data entry to automated, real-time processes and data, and enables companies to quickly respond to market changes and customer needs while maintaining high quality standards and compliance. It also reduces the cost of operations by eliminating duplicate and redundant systems and processes (see Fig. 4).

A UNS corresponds to a Platform As A Service (PAAS) solution that works as a central data repository, single source of information and context, or "Single Source Of Truth" (SSOT), where any device, application or user can publish

and consume the required information according to their needs. This technology uses the publish/subscribe protocol (PubSub), which allows each node to register with the UNS and receive updates only on the specific topics of interest. Under this model, there will no longer be a disorganized set of discrete connections between independent silos observed in current architectures, but there will be a single explicit connection between the nodes and the UNS (see Fig. 5).

The main benefits of this model are: increased efficiency (by having a central data repository, devices and applications will no longer have to search through multiple silos for the information they need), reduced costs (by eliminating the need for duplicate data storage and the associated costs of maintaining and updating multiple copies), improved quality (with a central data repository, the quality of data improves as there will be only one version of the truth. This reduces errors and inconsistencies), increased agility (the UNS enables organizations to be more agile as they will be able to connect new devices and applications quickly and easily to the central repository and access the data they need), and improved security (organizations will be able to control data access and information stored in the central repository. This will help protect sensitive data and reduce the risk of data breaches).

As the naval clusters are created under this scheme within each country, trust must be generated to share data and information among them under the same pub/sus protocols and then, achieve the

Fig. 4. Operational backbone. (McMahon, 2021).

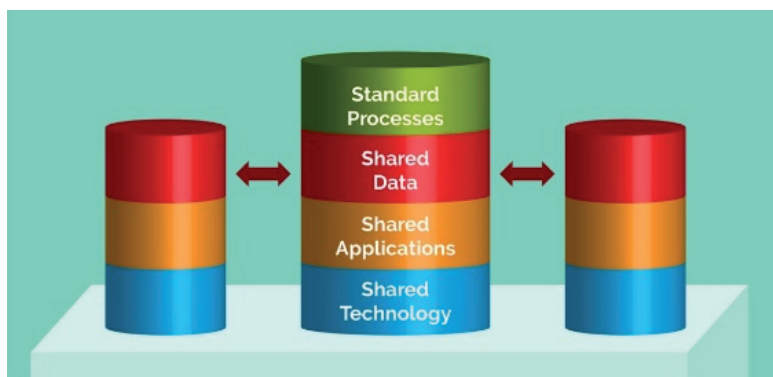


Fig. 5. Unified NameSpace architecture (Velandia, 2022).

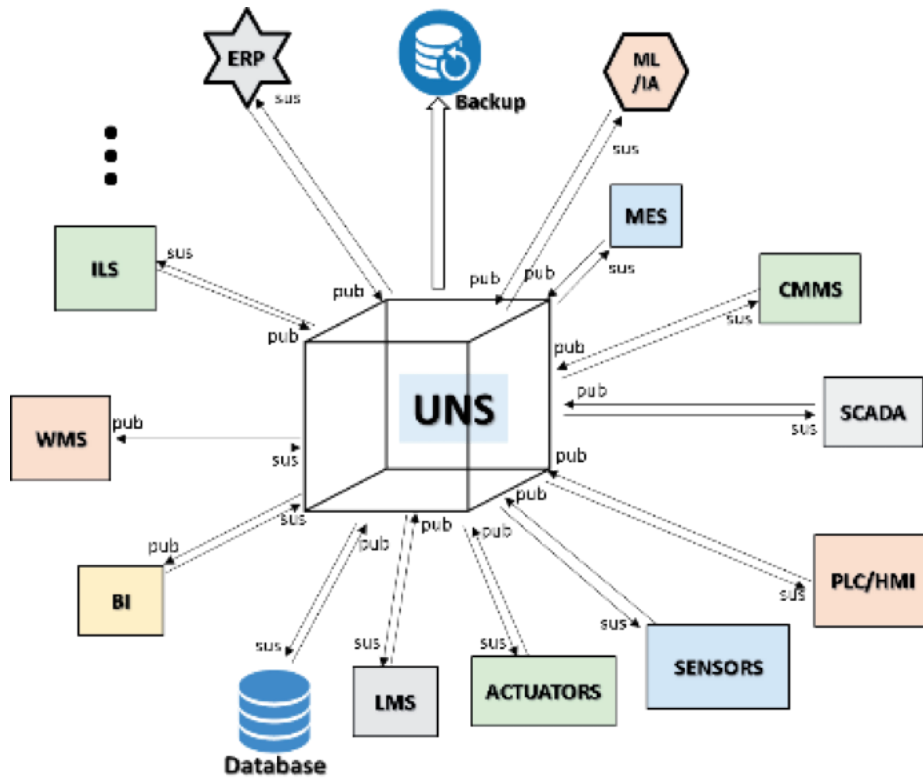
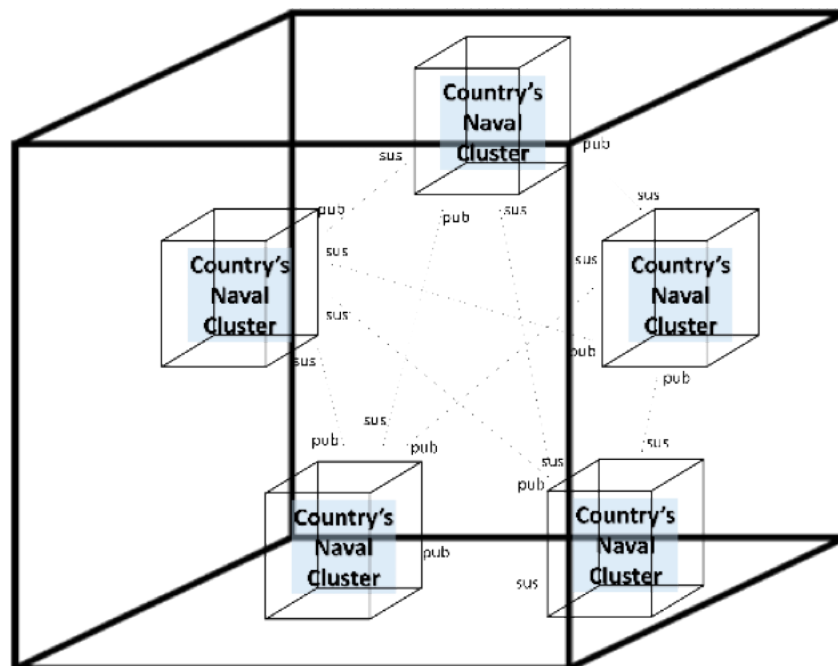


Fig. 6. Regional naval cluster architecture. Own elaboration.



creation of the great Latin American naval cluster (see Fig. 6). This will increase the competitiveness of the sector and, consequently, economic growth in the region.

It is important to consider that in this globalized world, there is no point in competing as separate countries, but rather to compete together. In this way, we build a whole that is stronger than the sum of its parts. The naval cluster is an initiative that shows the way to achieve it.

Conclusions

Digital Transformation of the naval sector in Latin America is a great opportunity to increase the competitiveness of the region. It is a transformation process that should be permanent and in constant evolution, and which requires the intervention of the three components: people, processes, and technology. This transformation will enable the creation of naval clusters within each country, which will contribute to the development of the sector and each country's economic growth.

The Digital Transformation of the naval sector should be based on the use of new technologies to connect the different actors and create new business models. Technologies such as blockchain, Big Data and analytics, the Internet of Things, and the use of the cloud can be used to connect naval actors and create new business models.

The main enablers to do so are the Unified NameSpace and operational backbone, which will allow users to share information in real time, and in a secure way, so that their activities can be coordinated and generate new value. This should be implemented by each of the companies that make up the naval sector, allowing the creation of a great Latin American naval cluster, which will contribute significantly to making the region more competitive.

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