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Suggestions from a Marine Economist to Make One's (Shipping) Company… Digital!

Alexandros M. Goulielmos[1,2]

[1]Faculty of Maritime and Industrial Studies, Department of Maritime Studies, University of Piraeus, Piraeus, Greece
[2]Business College of Athens, Athens, Greece
Email: am.goulielmos@hotmail.com

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Abstract

We showed how digitalization can improve the **quality** of companies' decision-making by moving towards more *efficient*, *effective* & *timely* decisions. Our work proved to be more difficult than expected, however, because we had first to **define** more than the 2 *fundamental* terms, which were: the **Cloud** & the **Platform**. Important for the reader is to understand an old principle in management: "what we do in management, is to bring-in money", meaning to "*make*" our customers willing **to pay** for company's any new services supplied! The "holy grail" of digitalization is to enable managers to **decide "exclusively" on data**. "**Data**" are the valuable *competitive advantage* of the companies of the years to come! **Data** are, however, products which have to have certain accurate specifications, as well quality etc. Digitalization "does" exactly that, as better as it can! Future management is going to be evaluated, not anymore, on its knowledge, experience, past achievements, & on whether one has graduated from Harvard or not, but **if he/she has obtained** the **suitable data** to **take** the **decisions emerged subsequently! The research aim and method were to review the international bibliography as well as current research, on digitalization, as close as to 2023, and to present the current digital services available to Greek, at least, shipping industry by leading digital maritime houses. We believe that the majority of the Hellenic Shipping Industry is not aware of the benefits of digitalization, and this paper may open-up their eyes!**

Keywords

The Meaning of Digitalization, The "Calculating Cloud", The "Digital Platform", The Recent Maritime Technologies Based on Satellites, The Agonies of the EU-28 & the World, The Fuel Cells, Ammonia, Green Hydrogen & Other Sources of Maritime Fuel

1. Introduction

The companies have, long ago, realized that what places them among the **champions** is their more **effective** and **efficient** decision making (**Graph I_1**).

The above rules are also valid for shipping companies, if their managers apply additionally an activity known as "**best timing**" (Goulielmos, 2021a)! The "best decision-making" stage, however, comes after **an** important **1st stage**, which is the "**preparation"**! The purpose of the "preparation" is "to *supply*" company's management with the (required) **information,** for him/her to be able to take the **best** decisions! *This can be done better… the* ***digital way****, as we will show.*

Moreover, management *defined* who the manager is! He/she is company's person **who decides** (Robbins & Coulter, 2018), including the sentimental female-managers! Moreover, the decision-making, almost always, *solves a problem*! *Thus*, ***"decision making"*** *is the* ***main function*** *of* ***management***! *In addition, any technology, which enables managers to improve this endeavor, is welcome.*

Moreover, managers, often, try to make a **choice** between 1 or 2 minimum *alternatives. Management, naturally, is a profession facing a number of "obstacles". The obstacles are usually related to manager's effort to achieve a desired* ***goal***, a purpose, or to implement a *directional* plan (Shipping)!

To defend, however, the value of a "competitive ***decision****-making, in business", including the* ***efficient*** & ***effective*** *timing for shipping, we believe, is like* ***bringing coal*** *to* ***Newcastle***!

✓ ***Classical*** *management versus* ***digital*** *management*

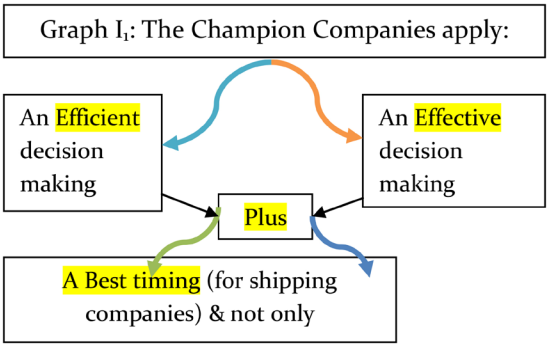
Is ***classical*** *management different than the* ***digital*** *one*?

✓ *Has digital management to… handle "Big Data" -BD*?

There is the case where the sales, on line, can be 175,000 **per second**$_{2016}$ (in "Alibaba"-China)! How a manager can make sense of that? But what are BD?

✓ *BD are the "****vast****", "****quantifiable****" information,* ***analyzable*** *only by highly sophisticated* ***data processing*** *means".*

It is **desirable**, at the individual company's level, for a small number of ships, say from 30 to 50, to be **displayed** on a map, in actual time, replacing the "pin-manual-plastic world map" of the old days…?



Graph I_1. The champion companies apply. Source: author.

The above paradigm of "Alibaba" showed, however, exactly the need of **handling** BD! *Worth noting is that* ***this*** *area is where the mathematical models, the predictive algorithms & the AI software, in* ***measuring*** *&* ***monitoring*** *people & machines, are used*!

It is true that Management did not rush into adopting digitalization in all its crucial functions: Leading, Organizing, Controlling/Feedback, Basics of Managing in today's Workplace, but Planning, by 2018. Digitalization holds only a part in what are identified as "contemporary issues in planning" (Robbins & Coulter, 2018, p. 300-304), and of course in communications.

2. Aim and Structure

The central aim of this work is to show how "***digitalization",*** offering *11* (*5* + *6*)[1] so far$_{2019}$ **services**, can help (shipping) companies to ***decide*** more *effectively & efficiently*! This, tantamount means, to show how managers ***solve a problem****, the digital way*!

The paper is cast in 9 parts as follows, after literature review & methodology. Part I dealt with an axiom: "*the knowledge increases one's power & the suitable data raises one's knowledge*"*;* Part II dealt with the "*Cloud*" *Computing*; Part III dealt with the recent technology in the service of shipping; Part IV dealt with what Shipping Companies are doing now$_{end2023}$; Part V dealt with certain agonies of the World economies; Part VI dealt with the fact that EU-28 falls back in innovation-expenditure vis-à-vis its competitors; Part VII dealt with the Agonies of USA & China; Part VIII dealt with an important question: "Does digitalization mean transformation & adoption of the digital technologies? Part IX dealt with an epilogue. Finally, we concluded.

3. Literature Review

Goulielmos (2020a, 2020b) dealt with the "digital revolution" & its impact on the management of the sipping companies as well its perspectives. **Calderon-Monge & Ribeiro-Soriano (2023) argued that, in 2018, the digitally transformed firms covered $13.5 b of the global GDP & by 2023 this increased almost 4 times to $53.3 b! Based on 119 publications between 2018 & 2022 the emphasis has been placed on Management, Marketing, Finance & Accounting.**

Calderon-Monge & Ribeiro-Soriano (2023) argued further that Europe leads the way in the number of published review articles on digitalization, over 28 global countries between 2018 & 2022, with the 50% to belong to England, Italy, Germany & France.

Australia & N Zealand followed with 15%, while N America & Canada held 13%, India 8.2% & China 5%! One cannot be specific about digital management because 7 areas have to be added together: supply chain management, logistics, manufacturing, human resources management, knowledge management, business management & entrepreneurship.

[1]**S**ocial media, **M**obile, **A**nalytics, **C**loud & the **I**nternet of **T**hings = SMACIT.

Methodology explaining the technical jargon[2]

Our first feeling, with *digitalization,* is the obvious need[3] for a glossary! Here, we presented in some depth only 2 terms, given the space we have: the "**Platform**" & the "**Cloud**[4]"!

✓ The "Cloud" refers to **storing** & **accessing** data on the **Internet**.

✓ The cloud is also an "Internet metaphor" (https://www.pcmag.com/, 17/04/2015).

The cloud, in its first reading, leads one's mind to meteorological phenomena, connected perhaps with how to cause… rainfalls!

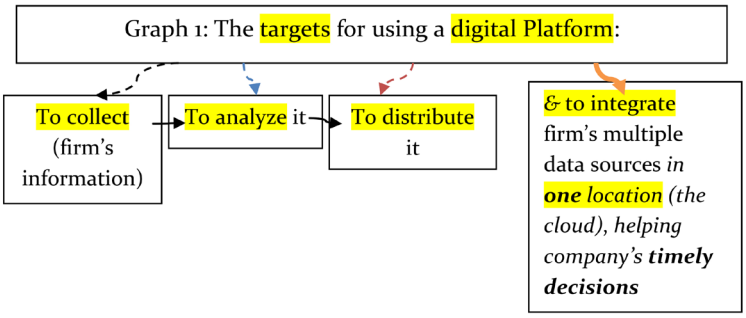
✓ A "platform" is a combination of "*software* & *technology*" for the companies to **unify** & **streamline** their *business operations*, & their *IT systems* (***Graph 1***).

As shown, there are 4 targets, very **important** for management! The question now is:

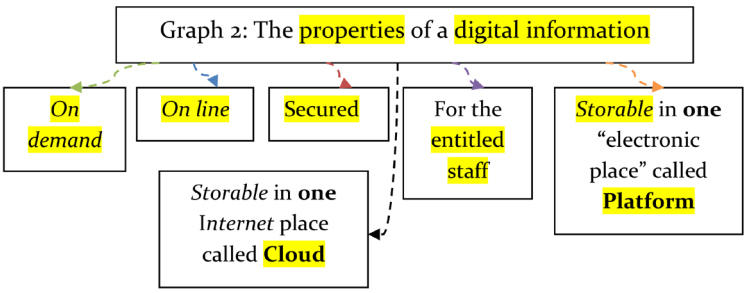
✓ To be, or become, digital?

A company can be **digital** by **design** or **transformed** into one. In both cases the **"digital software** & **hardware**" are **required**! The "letting" company can decide, in advance, from a **menu**, *what information* needs, **provided** that this has the **following properties** (Graph 2).

The above capabilities clearly enable management to make **a big step forward**!



Graph 1. The targets for using a digital platform. Source: author; data from Ross (2019).



Graph 2. The properties of a digital information. Source: author.

[2]This part has greatly benefited by the work of Ross et al., (2019).

[3]The difficult technical terminology, etc., mentioned above, is one apparent reason to **train** both office's & **vessel's** staff! This, apropos, is "undertaken" by the specialized companies in the digital business.

[4]**Worth noting** is that a number of companies let Cloud's services & provide their knowhow in the building of a (digital) "platform" for a shipping company.

The further big advantage, we believe, is that the *digital services* can be "rented" (& stopped), **one** by **one**! The scope of the "renting" company is to be able to **offer**, (to its **customers/charterers**), a number of what are called (**digital**) **offerings**[5].

For **shipping** important areas are also ship's **safety** & **security**! In a[6] Greek shipping digital transformation **roadmap,** a ship-owner has to manage digitally both: **ship's Quality** (covering: ships'/tankers' safety, risk assessment, international safety management code-ISM & ship's operations) & s**afety** (covering also: crew management plus the 3 first items from quality)!

✓ By DO it is meant "*information-enriched*" *solutions* (*Graph 3*)!

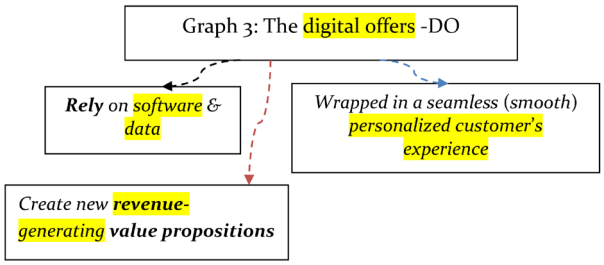
As shown, this points-out clearly that DOs are used towards achieving **efficiency**.

✓ Understanding the digital philosophy!

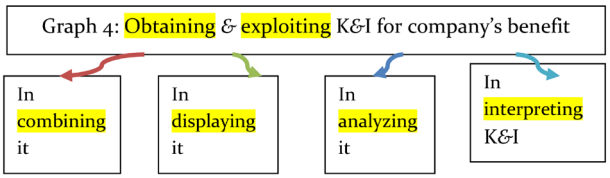
For a company to benefit from the *digital* "*revolution*", it is useful to *understand its philosophy*. This takes first into account the **fact**-unnoticed till certain years ago, that "*knowledge*[7] & *information-K* & *I*", are continuously **piling-up** out there! K & I are indeed produced by hundreds of relevant **doers**[8], worldwide every moment.

But, the operational K & I **are** also "laid-up" **surely** inside the company & **certainly** inside the vessel! The question that cropped-up was, naturally, how to **obtain** & **exploit** K & I for company's benefit? In other words (Graph 4):

& with a final view to enable managers to **take better decisions**!



Graph 3. The digital offers, DO. *Source: author; data from* Ross et al., 2019.



Graph 4. Obtaining *&* exploiting K *&* I for company's benefit. Source: author.

[5]Since we do not like this term, we used the term "digital offers"-DOs.

[6]The most digitalized shipping companies in Greece are on average medium sized of 10 vessels each…

[7]Worth noting is that the digital data has to be ubiquitous & **free of guesses**! We **do not** assume **what** our charterers/customers want, or who they are or whether they were loyal… the *data collected will inform us*. A shipping company e.g., may contact its big charterer & agree extra safety precautions, (beyond ISM Code), write them-up in the cloud to be seen by all companies' tankers!

[8]From companies, customers, clients, politicians, users, investors, authors, scientists, organizations, people in doing & saying things on Internet, the press, the news…

✓ The "Lego" philosophy

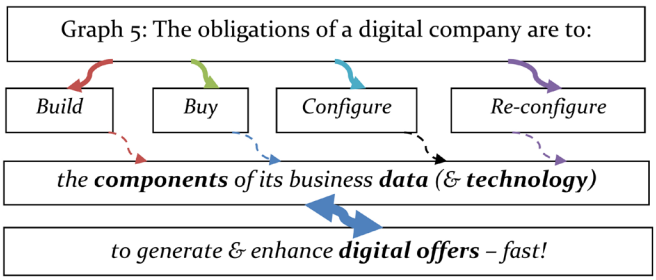
Ross et al., (2019), mentioned, a "LEGO movie" (p. 57), to explain how a company has to understand a *digital platform*! Their paradigm is of course a *metaphor*, where the various "*Lego*" *bricks* carry data/information etc., which a **manager** can **obtain**.

Thus, a new term has appeared called "*componentization*" closely related to *digitalization*! Without *components*, surely nothing can be built-up, & without *digitalization*, no rapid, new, results can be ever derived… **Even** by using the **same "**bricks", which we already **have**, but arranged differently, as the case may be, so that to achieve **more efficient** & **effective decisions**! So, t*he digital companies* ***have*** *really to* (***Graph 5***)*:*

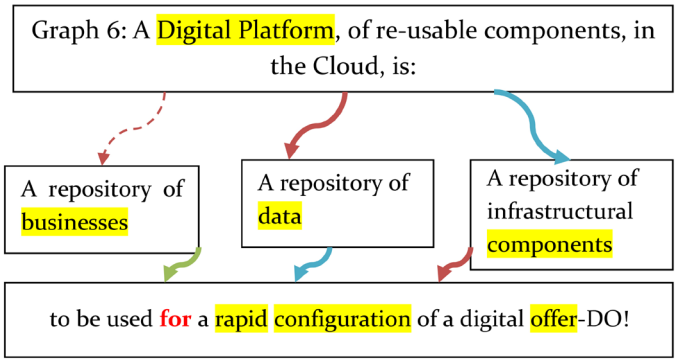
Thus, a solution can *quickly* be **assembled**, from existing **re-usable** parts, given that a **track** of **them** is kept-up. Where? Naturally in… company's "digital platform" (**Graph 6**)!

✓ Company's digital platform

As shown, a digital platform **is**, **nothing more** than, a company's … **warehouse!** But the ***components***, we mentioned, are, really… **slices** of a **code,** having specific[9] tasks! The digital platform-DP has to provide (**Graph 7** and **Graph 8**).

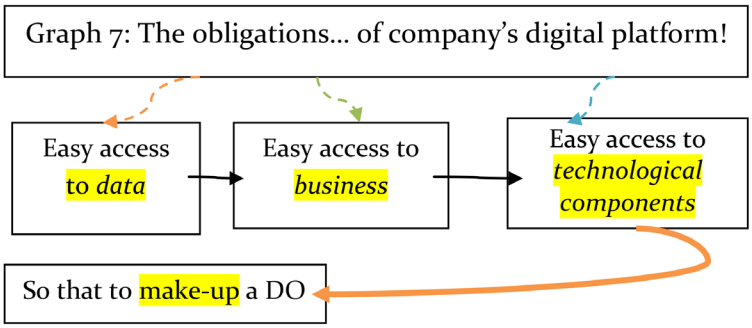


Graph 5. The obligations of a digital company are to. Source: author; data from Ross, op. cit.

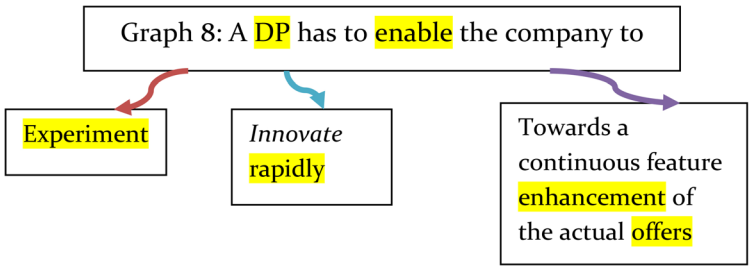


Graph 6. A Digital Platform, of re-usable components, in the Cloud, is. Source: author.

[9]E.g., retrieving charterer's account balances; specifying directions to a location (e.g., a port); calculating the probability of an **equipment failure-**from sensor readings, important for shipping; accumulating a customer's order in a shopping cart; confirming a user's identity, important for ship's security; & presenting performance results in a *dashboard*! These components are placed in company's DP to become available to those developing the new **offers**, using certain APIs!



Graph 7. The obligations… of company's digital platform! Source: author.



Graph 8. A DP has to enable the company to. Source: author.

Also:

Of course the *purchase* & *the collection of data from sensors*, *smart devices* & *other web services*, (*very important for shipping*), *will have to*[10] *be done*, *so that to* ***build***, *or* ***buy***, *certain re-usable APIs* (→ *applications of programming interfaces*).

✓ *The APIs are* **enabled** *software components having a code* (***Graph 9***) *in:*

4. Part I: "The Knowledge Increases One's Power & the Suitable Data Raises One's Knowledge"

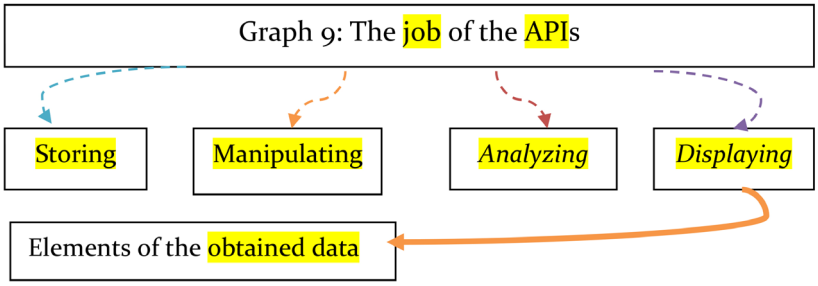
Companies, increasingly, the last 6 years at least-have **based** their **strategy** for **change**-including their **planning function**-on **data** (Robbins-Coulter, 2018, p. 302). Such a **strategy relied on** what is known as "**business intelligence**" (Graph 10).

The BI has focused on: 1) *what is going-on* ***inside*** *the* ***company***, including the important area known as "employees' **motivation"** & 2) in what exactly one's **competitors** is doing! The adoption e.g., of a new technology by one's competitors, perhaps digital, is a **main indication** of a *potential threat*, & of an effort of them to improve their performance!

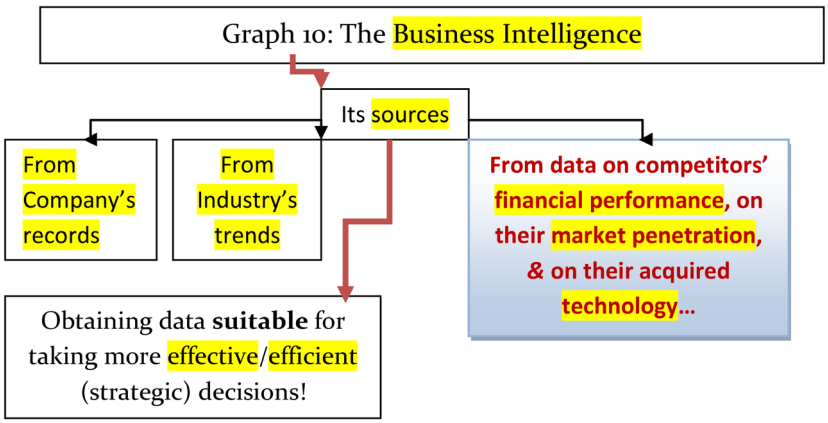
Technology nowadays provides: "3 digital tools[11]" (Graph 11)!

[10]It is obvious this task for Captain & Chief Engineer.

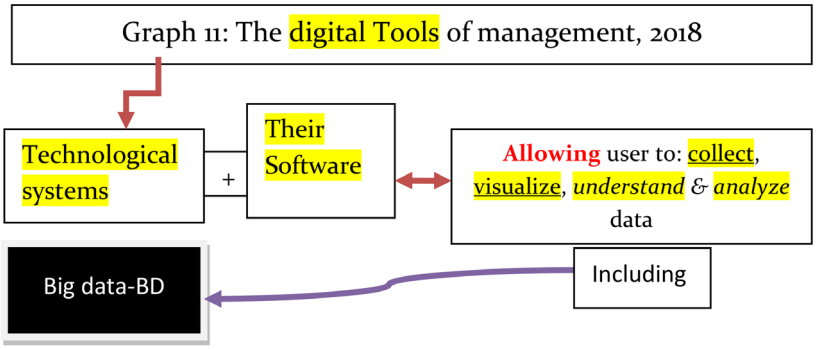
[11]For management, digital tools are also: the **Excel**; the (on line services known as) **analytics;** & the "**social media**" (→networks connecting computers & people together)! In about 1995 managers were unaware of the fact that the "e-mail", the "smart phone" and "the Internet" will be used during work! By 2018 managers were also pre-occupied seriously with the "social media" → meaning "the **electronic communications,** which **create online** ***communities*****, sharing ideas, information & exchanging messages, etc."**



Graph 9. The job of the APIs. Source: author.



Graph 10. The business intelligence. Source: author; idea from Robbins & Coulter, 2018.



Graph 11. The digital tools of management, 2018. Source: author; idea from Robbins & Coulter (2018).

The digital tools, which were applied first by management, were destined to support company's **planning** function.

"The internet of things" also emerged, really, something of another rather very **strange** term! → *This means that certain "things", from one's everyday life, can provide, as well, store, data, concerning one's "performance", in the Internet.*

5. Part II: The Cloud Computing

According to "Eurostat", the % of the Greek companies using "Cloud"$_{2023}$ was 22%, vis-à-vis 17%$_{2020}$. In the EU-28, the % was almost double: 42%$_{2023}$ compared

with 36%$_{2020}$! The "Cloud computing[12]", as this is its proper name, is → "*a rentable internet application,* i.e., *a service, using hardware* & *software, in a set-up information center providing a place for storage*".

Such software services are called apropos → "*software, for sale, as a service*" –"**SaaS"**, as this is what really is. The cloud-center need not be **near** the final user, but it has to be equipped so that to serve its user(s) ***automatically, fast*** & ***easy***.

Always the **business world** realized the importance of information, & its technology, although "computerization" initially was not easily understood by the top managers, who were also reluctant by its rather high cost & complexity! The importance of the **flexibility** of the "original vast computing systems" to *change* was not as desired & the so called "Enterprise Resources Systems" ERS[13] i.e., the software systems handled the entire functions of a company.

The first & widespread applications were, and still[14] are, in the areas of Accounting, Human resources management-HRM, including crew, the payrolls, the MGA, etc., in an area called "MRP[15], manufacturing resource planning".

The personal computers diffused indeed the advantages of technology to almost all middle managers/operators & eventually to ship's officers, providing to them their own "computer personal station", adding speed to their actions & other benefits.

The Cloud computing & its benefits, presented above, depends entirely on having full access to the Internet. This creates problems, if connectivity is impossible, difficult or discontinuous, through the existing communication system of the satellites. We come to this now as far as shipping is concerned.

6. Part III: The Recent Technology in the Service of Shipping

Vessel's difficulty to enjoy digitalization **in full**, as in her shore office, was & still is, we believe, but to a lesser degree as time goes-by, her degree of ***accessibility*** **to Internet**, *beyond the e-mail service*. The e-mail remains still central of course, as well the AI-pin… If our generation wishes to be proud for something, this is the area of **communications**!

However, a further hopeful innovation came from the so called "MICE-1", the

[12]The cloud is also distinguished in public, hybrid & private: *public*, being a *utility* available to the wide public for a rent, & in private, when one refers to the "in-house" cloud computing & in hybrid if this is both private & public.

[13]The ERS adapted.

[14]The Greek maritime digital market provides$_{end2023}$ a transformation roadmap with hardware & software, etc., for the following 21 functions→: "Company's management & performance; vessel's utilization; compliance; emissions control (*) - de-carbonization (*) - blue shipping (*); quality & safety; risk management; crew welfare/management; collaboration - transparency - procurement; maritime KPLs & new-building management". & the digital: "business intelligence, analytics, cloud migration/security, information management, on board communication". (*) concerning sea environment. **A quite serious body of applications following also IMO's legislation. This menu surly can be expanded.**

[15]There was the "large computer batch system" in a dedicated, and of a proper temperature, room! The ERS were destined to be supplemented by the "personal computers", certain years afterwards, **not without resistance**.

"nano-satellite" or "CubeSat"$_{2023}$! This "nano-satellite" provides not only the capability of *communication* from/to ships, everywhere, including in the so called "**blind spots**", but also shows *the route* of the vessel…!

In addition, one "nano-satellite" is able to communicate with another, using the **laser** technology. Given the small size of a "CubeSat", (**10** × **20** × **40** cm), there may be as many as 16, at the same time, (requiring from 16 to 24 m Euro of course), so that their broadcasting to be **continuous**, i.e., in every few minutes!

Moreover, the "DUTHSat-2" can spot a "sea pollution" caused in a marine accident &/or by ship's "bilge waters". In addition, the "Optisat cube sat" uses a laser "***flying*** terminal" for a faster than hitherto data transmission! Another innovation, which is mentioned below, concerns *ship's main engine alternative-**fuel*** (Goulielmos, 2021b).

Shipping, hopes by 2027, & by using vessel's "high frequency data collection systems", BD, AI, "the smarter class notations", (in all new buildings), & the new platforms, (plus taking into account the "CII" & "ETS" rules; & the "flow meters"), to **reduce ships' greenhouse gas emissions**. This project to a certain degree is based on the degree of the connectivity of office with vessel, & in the possibility to give orders from a distance & see also their implementation!

7. Part IV: What Shipping Companies Are Doing Now-End 2023?

This part shows what exact initiatives certain pioneering shipping companies have taken in end 2023, their planning time & thus to form an idea what is going on now among shipping companies, their digital consultants & their Class. We expect of course the rest of the companies to follow those that took the first steps. We know from experience that the adoption of new technologies by maritime companies is slower and appears first in the multinational companies in the country.

A shipping company has first to ask the help of one *provider of digital technologies*, and why not & of its Class. Classes have worked-out new "notations" now, following the recent developments in the so called "shipping digitalization"!

As mentioned above, the first step is to have better/improved **data,** so that the effectiveness of the shipping companies to increase -with a view to reduce gases' emissions due to the **greenhouse effect**, **which is the urgent part of what we have to do!**

Such a project as the above, as mentioned, needs a **platform** of data collection, monitoring certain ship functions & subsystems, & using technologies of the type of the "**Internet of things**". Obviously, from the above, we need **sensors on board** in order to know in real time at least:

Ship's fuel oil consumption	Main Engine's production/work	Electric power production/work

The above data has to be analyzed, using also "artificial neural networks" & a (relevant) **platform**, providing also **suggestions** so that to improve the situation, & to make certain prognoses, **inside** the IMO regulations!

The targets are: the energy effectiveness of the vessel; improving ship's speed; having weather prognoses, & emissions' follow-up; improving the connectivity ship-office, & to give orders from a distance & follow-up their execution, as mentioned; high frequency data, till 2027, & analytics, as well **flow meters**, are required. One's charter parties to have rules for the CII & the ETS!

We have next to digress! This is so because a company, & even more, a shipping company, needs a peaceful international environment to grow where no local wars will be present like the Russia-Ukraine or Israel-Palestine one or attacks from Hufi Jordanian pirates.

8. Part V: Certain Agonies of the World Economies

The **agonies** of the global economies are **not** about how to connect **ships** to the **Internet**, but how to **save** the planet from its **aggressive climate** & from the cropping-up, one after the other, of local wars/**&** terrorism!

Many, however, look forward for the coming "Paradise on Earth", to be **created** by… "Artificial Intelligence", AI, our new God or devil! One must admit that "Eva", an AI application for detecting COVID-19, helped Greek authorities to spot a double number of travelers of high risk, showing no symptoms! The world spent already more than $23 b for the applications of the AI.

Of course, the robots, *another digital service*, will no doubt "**steal**" working positions from humans, but there are, out there, *many dangerous* & *automated* tasks to be assigned to them, *including tasks on board the vessel*! Remember that a number of crew members, & *people from* the repair yards personnel, died, by entering in closed spaces, where the forces of the "explosion triangle" were present!

Apropos, a Greek start-up company, embarked in making "things" from "carbon-fibers" using the robots! The idea is to make things from **lighter** materials, stronger, & cheaper, **if possible**. The **lighter dimension** means to use more efficient materials. We believe that the research in replacing older building/manufacturing/chemical materials, etc. **with new,** is one of the important developments of the human ingenuity. Imagine a ship madE, in whole or in parts, by ***carbon fibers*** how lighter is going to be… & how cheaper!

Robots work also in the old textile works, & not only, & in **all hand-made** old professions using the 3D printers/3D scanning & laser & 3D knitting! Furniture can also be produced by robots. Here is the human brain to excel in all types of handcrafting!

We return, however, to the agonies of our "home" → Europe.

8.1. The Agonies of the EU-27

Today, the EU-27 has 7 agonies: 1) to **diminish,** by 2030, the further **destruction** of its **climate;** 2) to **stop** the **loss** of **its competitiveness**! 3) To manage the

immigration flows. 4) To "see" the end of the "Russia-Ukraine" war & that between "Israel & Palestine". 5) To reduce inflation to 2%. 6) To become independent from the Russian gas, & *7) to re-introduce the pre-COVID-19, "stability agreement" for members' debts, even if certain expenses for defense and natural disasters are going to be excluded*!

IMO, the international maritime organization, is also in line with the above 1st endeavor, by adopting, in 2023_{07} (80th MEPC), the GHG strategy towards **de-carbonizing** international shipping by 2030 for ships of over 5000 GT (IMO DCS).

8.2. The "Green Transition"

The **prime** & **urgent** endeavor today in EU-27 is to **save** Europe, and then to **save** the Planet! This is identified with the reduction, or even **future elimination**, of the consumption of the *polluting fuels*-like those of oil, coal (and lignite) & gas! EU-28 wishes to **start urgently** its so called "**Green Transition**".

The COP28–as expected-provided no drastic solution/decision on the climatic destruction, which takes place in various forms now & for some time. Worth noting is that the convention recognized who is the responsible for the climatic destruction! Of course we are aware that no country, producing an energy, mean is going to decide to give-up its production, unless its price falls & stays to zero. The COP28 decided: 1) the building-up of a fund of $700 for the support of the climatic sensitive countries – an amount which is considered inadequate. 2) All countries to increase 3 times the energy production from RSE in next 7 years. 3) To go away from fossil fuels (transition away from, but not phasing out). The most pessimists do not expect the global temperature to stay at an increase of up to 2.8% C, but emissions must be reduced by $43\%_{2030}$ & $60\%_{2035}$ vis-à-vis_{2019} (where CO_2 emissions = 0).

Extremely strange is that nobody mentioned the way Sun produces energy! As we all know USA, followed by Europe, have taken the first steps towards the above endeavor & when this will become effective, no other fuel is going to be needed! Very interesting is the fact that the entire initiative is controlled by the USA government and is not sold as yet to a private company…

8.3. Is ammonia the Fuel We Expected?

The "Marine engine manufacturers" announced, "a voice shouting in the desert", however, that they *constructed "a dual-fuel engine", operating on…* ***ammonia***! *Worth noting is also that the "China Merchant Energy Shipping" ordered the 1st VLCC in "Dalian Shipbuilding Co" built to use* ***methanol*** *as her fuel.*

8.4. Is the Green Hydrogen the Fuel We Expected?

One major target for saving the EU-28 climate… is the use of the "**Green Hy-**

drogen-GH". The progress here is quite hopeful. In the EU-28$_{2022}$, hydrogen produced as non-green, using natural gas, & satisfying only 2% of the energy needs, (used also in chemical products-in plastics & fertilizers). In 2023 & thereafter, ***the effort*** *is towards using* ***more*** *GH*.

The problem is that while humans can produce "green energy" in a continuous manner & in increasing quantities, as time goes-by, & independently from its demand, they **have** somehow… to **store** it! One solution is the **batteries**, but they are too heavy, and not as many as needed; the past, or even the present, solution, is oil & gas, but everybody believes that their use is coming to an end, at least first for oil -in foreseeable future, & then for natural gas, in the distant future…

8.5. Will the "Fuel Cells" Save the Planet?

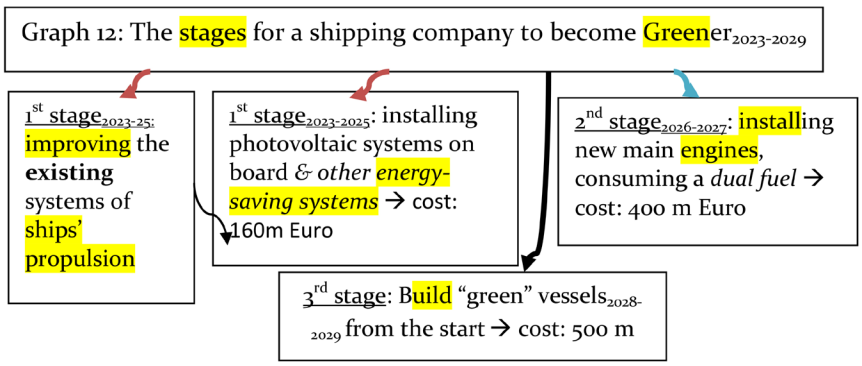
Hopefully, the "**fuel cells**", meaning "the **engines,** which transform hydrogen into *clean* electric power, using electrolysis", have appeared! These engines can be installed also on **ships** to provide the required amount of energy to move vessel forward & to supply the electric power she needs, making the cost of "fuel & diesel oil"… almost **zero**! Excellent!

Given that the "hydrogen engines[16]", of 120 MW power each, are *lighter* & *smaller* than the existing *fuel tanks*, & the *double electricity-generating* diesel ship *plants*, they will free **space** for cargo & thus they will provide more profit… ***Very interesting*** *for both* ***shipbuilding*** & ***shipping***!

But is the green transition inexpensive?

8.6. The Cost (of the Top 12 Ferry-Boat World Companies) to Become Greener

Shipping has to comply with the EU-28 target to become… "fit for 55", meaning to reduce the "carbon dioxide emissions" by 55% by 2030! A large company, managing 45 ships–ferry boats-connecting Greece with Italy & Morocco/Spain, estimated$_{end2023}$ to need Euro 1.06 b to become greener! The company's green transition was planned$_{end2023}$ in 3 stages, requiring 6 years as follows (Graph 12).



Graph 12. The stages for a shipping company to become Greener$_{2023-2029}$. Source: author.

[16]These engines use fuel-transmitters of oxygen, like methanol, derived from carbon-dioxide; or bio-methanol, produced from biomass; or green methanol.

As shown, the green transition is not without a considerable cost, requiring about 23,000 Euro per passenger, or the total proceeds for more than 1 year (which were 710 m Euro$_{2022}$). Given that the 12 top world ferry-boat companies transported 386,791$_{2022}$ passengers, they are going to need about 9 b Euro to become greener!

Equally important is the following issue.

9. Part VI: EU-28 Falls Back in Innovations Expenditure Vis-à-Vis Its Competitors!

The Director of the "European Investment Bank"$_{Oct.2023}$, stated his concern in a Greek press interview, for the EU "**reluctance**", quantified by the low (=2%) of the GDP of the EU-27, to invest in **innovation**, vis-à-vis its competitors in **N America** & **Asia!**

Figure 1 presents the number of the start-up companies$_{2020}$, usually in the *high technology* sectors, having a *capitalization* of $**1 b** & over, which spent about $149 b globally, from which 68 b (46%) by the Chinese & only 43 b by EU-7 (29%)! Worth noting is that the 70% of them (704 start-ups) emerged in USA (52%) & in China (243; 18%), while 12% only in EU-7 (146)!

The European more acute problem, however, is not so much *its fewer start-ups*, but the ***competition* exerted** from **USA**, which$_{2022}$ "donated" $369 b "tax exemptions" & "subsidies" for green investments, if they were carried-out there! As a result 2 grant EU-4 companies will invest $1.5 b in USA & one will get $1.3 b subsidy from the S Carolina state…

9.1. The Low "Time Deposits Interest Rates" in EU-20

Moreover, the APY interest rate in USA was 4.3%$_{28/11/2023}$, above all EU-20 interest rates (Figure 2)!

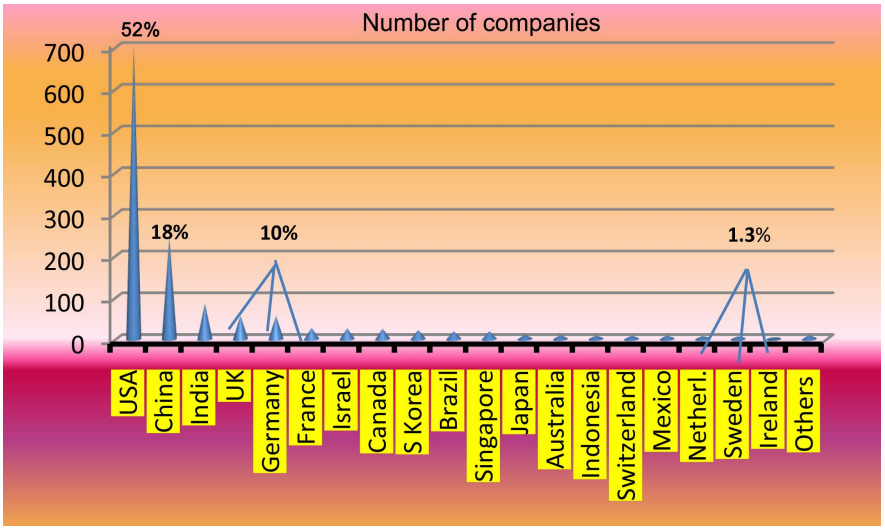


Figure 1. The number of the start-up companies of 1 b investment & over, globally$_{2020}$. Source: author; data from "Kathimerini" journal$_{19/11/2023}$.

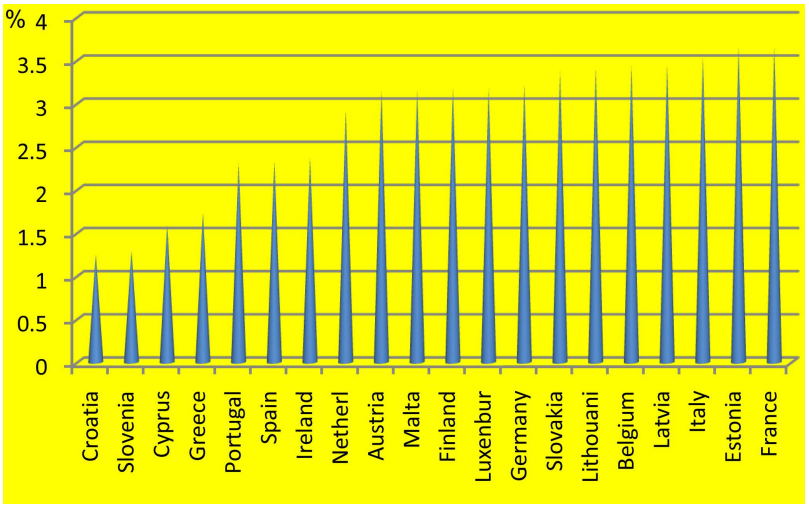


Figure 2. Average rate of interest of a time deposit up to 12 months, in EU-20$_{2022}$. Source: author; data from "Kathimerini", weekly journal.

The result of this low performance of the banking system, in EU-20, by offering lower interest rates than USA, will cause the European capital to be attracted by the USA banks, making the economic situation, even worse! One would expect the "rate of interest" policy to have been uniform among the EU-20, but it is not!

9.2. Is EU-28 Back to Its Austerity Program$_{01/01/2024}$?

The EC$_{Nov.2023}$ commented on the preliminary composition of the EU-27 Budget$_{2024}$! Twelve (44%) countries are expected to show a **deficit**, from 3.1%, (Latvia) to 6.5% (Slovakia), of their GDP, above the 3% maximum, which was set at the pre covid-19 period, 4 years ago. *Germany asks now for* 1% *p.a.* (*new*) *reduction in all debts*! Only 4 (15%) countries will have a surplus from 0.1% (Portugal) to 2.1% (Cyprus)! Eleven countries (41%) will fall inside the COVID-19 limit: 0.7% for Sweden & 3% for Bulgaria. France will have 4.4% deficit; Italy 4.4% deficit & Germany 1.6% surplus!

10. Part VII: The Agonies of USA & China

Their leaders were skeptical about AI during their recent meeting$_{Nov.\ 2023\ in\ San\ Francisco}$! The human brain can think of 1 idea per second, but the "ChatGPT", an AI product, can enable human brain to achieve 200 ideas per second! A recent conference, which took place 27th Nov. 2023 in Las Vegas, named "RE: Invent", a new branch of AI emerged called "Genetic AI". An assistant of this is the "Amazon Q", which permits to create content in the form of a text, sound, picture or video, in companies' service in the cloud, to reply to business questions!

About 7000 Chinese firms do business in USA, having invested more than $130 b, & supplied Americans with about 230,000 labor positions. Moreover, China dominated in the production of *nickel*, of *solar panels* & still holds a serious part of the *American debt*, while important is also the Chinese production

of *microchips*.

We have to congratulate the above 2 countries, in our opinion: 1) USA, for producing "food" & "clothing", at quantities & prices *attainable* by its **labor class**, at least at the time I visited USA, & 2) China, for producing products which the **world labor class can** buy! We may add here UK caring for, at the least at the time I used to write there my doctoral thesis, its citizens to be able to obtain a car & a house (on mortgage)!

Worth noting is that the direct Chinese foreign investment in USA-FDI, as well its capital inflow, peaked-up at about \$66 - \$68 b_{2016} (Figure 3).

Only one $year_{2016}$ can be considered the good one, & the last one, for the Chinese FDI & capital inflow into USA. The USA capital inflow in China, respectively, peaked-up $later_{2019}$ with \$13 b & the FDI peaked-up with \$30.5 b_{2018}. Then, both countries withdrew from these activities, affecting the whole world & Germany in particular!

Germany today has to find ways for its Government to be able to borrow to spend money for the "green transition"! Germans have put Euro 60 b aside, destined for the Pandemic, but not used, but their Constitutional Court did not allow Government in using them! The German infrastructure needs renovation, underlined that also by the IMF, long ago… Our personal opinion is to consider the decisions of the Courts, which have no "economists as judges", **irrelevant**.

Worth noting is that the planned German Green investments of Euro 104 b will not be carried-out by the German companies, if Government does not spend also the above amount! Germany will have a debt 65% of the GDP_{2024}, while the Euro zone has 90%, USA 121% & Japan $260\%_{2023}$! Germany is a victim of its debt policy, meaning the "iron maintenance" for the Government to **borrow** only 0.35% of its GDP!

We return now to digital reality!

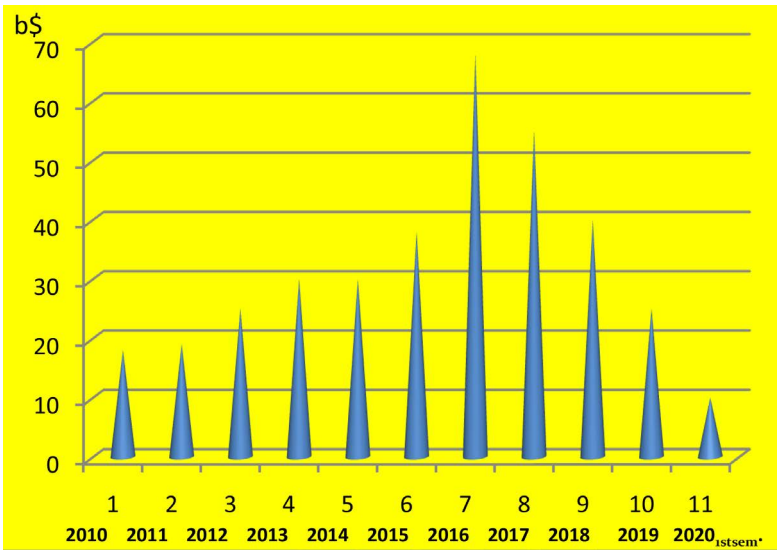


Figure 3. The Chinese direct investments in USA including capital $inflows_{2010\text{-}2020}$. Source: data from "Kathimerini" weekly $Journal_{26/11/2023}$.

11. Part VIII: Does Digitalization Mean Transformation & Adoption of Digital Technologies?

For a non-digital company to become digital, it has to **change**, & at the same time to **adopt** (rent) **all** or **part** of the, at the present eleven available, digital technologies (Graph 13).

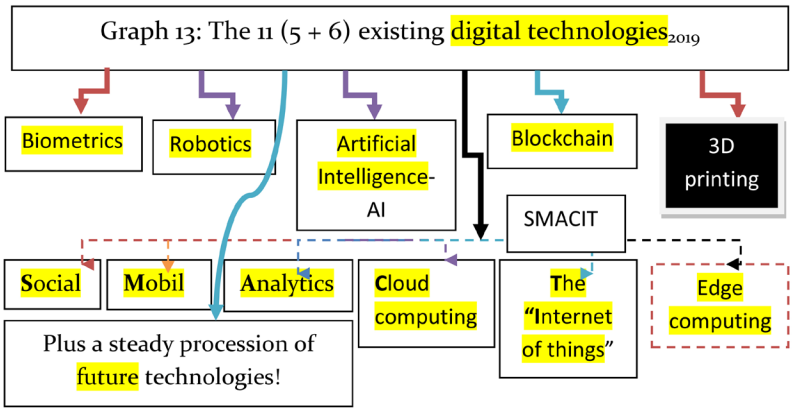
The digital menu, as shown, is *extensive*, & *is based on 3 capabilities* (Graph 14).

As shown, the data, which a shipping company needs, should be available **everywhere** & at the **moment** is needed! This includes the time when the vessel is travelling in the oceans, where communications cannot be equally feasible as at shore!

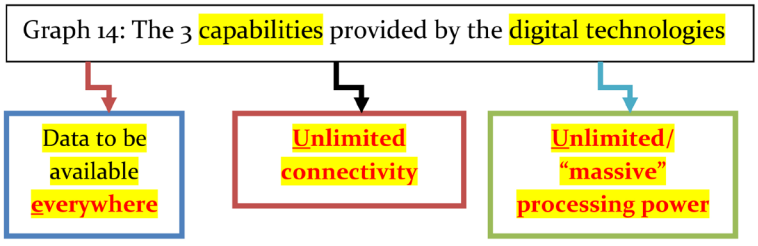
11.1. Connectivity

The **full connectivity** of the vessel mainly to shore office is an important *digital* maritime **target**! This is why we mentioned above the "cube sat MICE-1". In fact, connectivity means → *to be able to connect one's computer to the Internet, attaining at least 5 targets* (Graph 15):

The above 5 targets are planned to be achieved in full[17] in EU-28 by 2030 (https://digital-strategy.ec.europa.eu/en/policies/connectivity), given that the Pandemic (Goulielmos, 2020c) speeded-up this procedure… But apart from this,

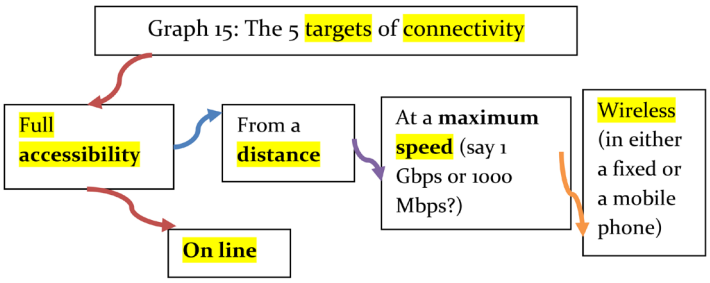


Graph 13. The 11 (5 + 6) existing digital technologies$_{2019}$. Source: author; inspired by Ross et al., 2019.



Graph 14. The 3 capabilities provided by the digital technologies. Source: author; inspired by Ross et al., 2019.

[17]In UK this is planned 3 years later, by 2033.



Graph 15. The 5 targets of connectivity. Source: Author.

the **access** to K & **I** is an **important service** of **connectivity**, e.g., for one to be able to listen to news, attending classes, acquiring skills, seeking advice, watching markets, selling products, having (free) Wi-Fi hotspots, and 5G networks (https://digital-strategy.ec.europa.eu/en/policies/satellite-broadband)!

11.2. Can There Be a Digital Vessel?

We know that the Captain, on board a commercial vessel, is in need of an important amount of *information*, concerning his/her "Voyage **Plan**" (Graph 16) → storable in the Cloud!

Ship's **loading** is ship's 1/2 *production*; the other ½, is **ship's unloading,** and the… **whole,** 1/1, is her efficient & effective **navigation**, which is *indeed assisted by the digital means*! Without the proper navigation neither loading, nor discharging, can ever be done, however!

11.3. The Maritime Digital Tools

The shipping companies letting digital services can have & use the following 9 digital tools (Graph 17):

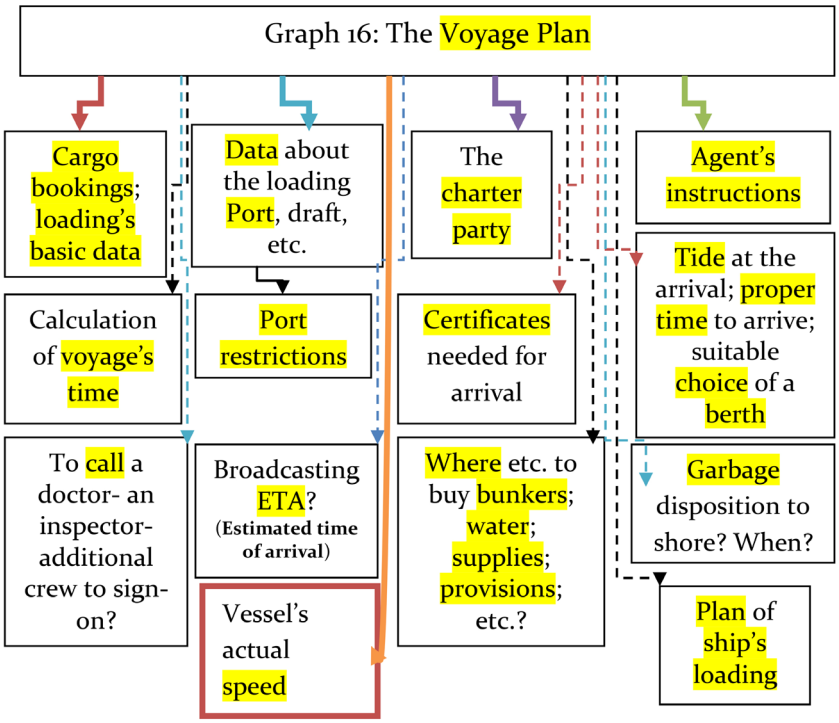
Te proper treatment of most of the above items are the result of a long maritime experience, expressed also in about 50 office circulars, (i.e., written instructions from the office to the vessel), which the digital means **can** *revitalize* & *present* visually, on demand & codified in the Cloud!

We will not fail to mention the important area of the "**charter party"**, which has to be presented *digitally*, together with all relevant warnings, accumulated there also by experience & by BIMCO's publication "check before fixing"! Shipping is an amalgam of a highly **empirical**, as well **theoretical**, knowledge!

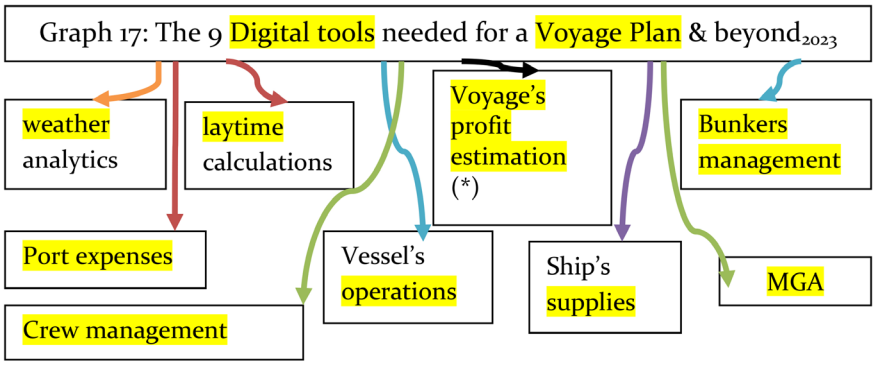
11.4. Vessel's Actual Speed

The **simple,** but essential, knowledge, e.g., of vessel's **actual speed**[18], derived accurately from data, using *digital* methods, will save a number of claims on vessel, and disputes between the ship & her charterer, given weather conditions. This will increase ship's reliability, if the speed stated is accurate & close to reality!

[18]Vessel's speed, which one may consider as fixed & well-known, is variable! This is determined by the weather/the winds, the waves, the bottom's ship condition, in ballast or not, on office instructions, on bunkers quality, on main engine condition & its performance, etc. The ship's speed is recorded down on the charter party, and any deviation from that, creates a claim.



Graph 16. The voyage plan. Source: author.



Graph 17. The 9 digital tools needed for a voyage plan & beyond$_{2023}$. (*) This is the most important of all. Source: author.

The "digital software houses" provide means to calculate also the *optimum speed* & *the voyage estimated loss or profit*!

11.5. Vessel's Expected Profit or Loss

Many believe that shipping is a very dangerous business, because a manager charters his/her vessel, ***hoping,*** *& crossing his/her fingers, for a positive result at the end of the voyage! This is not true, as the in-house brokers calculate carefully the profit that is expected to be derived & then they submit it to the ship-owner to decide, perhaps between 2 alternative charters! The experienced ship-owner will choose the one charter, which, most probably, will provide the higher net profit, within the "supply & demand" limits of course.*

The reliability of the above calculations is very important here, because the information entering in them concerns, e.g., what is the per day $ cost of the vessel? What are her fuel & diesel consumptions & what prices company has to pay (given an agreement)? How many days the vessel needs to unload & what are the port expenses, the canal dues, etc.

The digital means surely provide a positive & important service here & only for this particular service is worthwhile to rent it! In the past, many "voyage estimated results" were wrong, because the in-house broker had ***old*** *information about say, what are the Suez Canal dues, or what vessel's speed is after her delivery from the shipyard certain years ago!*

Many times the brokers miscalculated vessel's days in the sea, and at the port & the voyage result instead of being a profit, was a loss! Of course a digital comparison between the calculated profit & the actual one in the cloud still remains imperative for the in-house brokers to learn from their mistakes.

11.6. The Voyage Plan in the Cloud

The information (Graph 16), concerning 14 vital chapters of vessel's **loading** activity, and in particular her **best preparation** towards **it**, **has to** be **available** *on demand*, both to the office operator & to ship's officers… logically & safely, in company's **Cloud**! For the above, & *not only*, a growing number of companies, are$_{2019}$ *rely on* other companies to rent -among other services, & a number of what are called "simplified critical business processes", together with the relevant "data security".

In shipping, the **cloud connectivity,** has to be with **every** port, & with BIMCO, & with others, who provide vital "port information"; with Agents primarily, with tug & boat firms & providers of such services, together with their prices; with weather broadcasters & sea-condition reporters; with those informing about the ports strikes & days & hours of operation (& holidays), the port regulations & the cases of port ice, with those published the port ship guides on entry & so on…

Nowadays, the weather **to be met** by the vessel, in **next** 7, 10 days, is possible to be known in advance & her Captain can thus be prepared-knowing the **weak** points of his/her vessel, so that to **avoid** the risk of a potential marine accident, due to expected severe weather conditions (Goulielmos & Gatzoli, 2012), resorting, in time, to a refugee port!

It would be also much easier to choose, on cost & on efficiency grounds & on previous history, ship's Agent from among the many agencies existing there… & presented… in the Cloud … These data will **also** free shipping company from gathering & updating similar ones in-house as hitherto…

Moreover, the Cloud can **gather together** the many, as much as say 30, IT units in a large shipping company of say over 30 ships! Imagine having *on line*, & *on camera*, information, including *voice* & picture, live, about an **occurring** marine accident-transmittable to the company's marine engineers & insurance people by a "CubeSat"!

To **write** to the **Cloud,** instead of a "memo to file", as we used to d0, is… recommended to the Port Captains, the Superintendent Engineers, & all company's people attending, inspecting & visiting a company's vessel[19]! This includes vessel's construction or repairing & dry-docking. The relevant reports to be written to the cloud **immediately,** as the relevant action is taking place, so that to be available, with videos, pictures, plans, etc., to all interested in the company.

12. Part IX: The Epilogue

Companies, in general, & shipping companies -in particular, **have** by now **to** be re-designed… for a future success, called "digital success"! But the process, called "digital transformation", outlined above, is a **long** journey, because the re-design **concerns** the *manner by which the entire company has worked so far*!

It seems that the talents, the skills, the processes, the systems & the roles of an existing company, which have proved to be the means of its past success, are now, & thus tomorrow, **irrelevant** (Ross et al., 2019)!

A transformation process is thus, no doubt, required (**Graph 18**) as follow:

Four building blocks, however, towards a digital transformation are required (**Graph 19**).

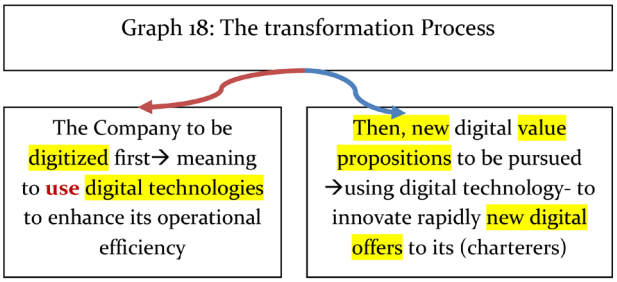
Vessel's Maintenance

An important maritime (*digital*) chapter is **vessel's maintenance**, we believe! The digital philosophy, we reckon, is apropos fit for this important side of the shipping business! The ship's items, which are maintainable, are indeed many, & are both operational like the main engine, the power stations, the boiler, the electric systems, and others, & non operational like ship's metal body, cargo spaces/holds, gear, ballast & fuel tanks, and other items subject to age's influence. Here, "Internet of things" & "the analytics" can improve maintenance, for all ship's equipments, following the digital "Planned maintenance system" (PMS).

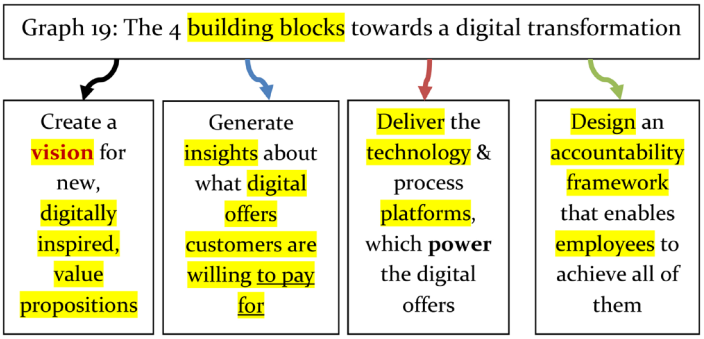
There is a good idea to allow vessel's charterers to "see" the "ship's maintenance strategy"/history, before fixing her, in the cloud! Planned maintenance adds confidence to ship's services & allows over-aged ships to trade (over 10 - 15 years of age)! The proper ship's maintenance deducts also the fear from the charterers for a probable marine accident. The "mobility" technologies can also allow crew to turn-on a light, or unlock a door, or unlock the medicine cupboard, the alcohol & cigarette lockers, or a refrigerator's door, or to allow entry into ship's kitchen, ship's laboratory & ship's spare parts, etc. remotely with an AI-pin…

Important, however, are the digital tools for the crew welfare & that of the office personnel, especially for those companies that provide loans, extra pension schemes, medical assistance & participation in company's profits.

[19]The older practice was to write a report after returning home, by also seeking a willing secretary to typewrite it, accompanied by a number of photographs of vessel's, usually her roasted parts, in an album.



Graph 18. The transformation Process. Source: author; data from Ross, op.cit.



Graph 19. The 4 building blocks towards a digital transformation. Source: author; data from Ross, op.cit.

When I was an office HR manager in a large shipping company, I proposed to management the "anti-cyclical life cycle treatment" of company's personnel! This policy meant, for company's personnel, after a number of years working in the company, to consider them say as a "**permanent**" staff. Then, given that when a person is young, round his/her 30 s-is lacking a car and a house etc., & when is old, over his/her 50 s, has already built an adequate property, which… however, cannot be… used, *I asked the company* to fill the "life gaps"…

In other words, to frame the financial needs of both crew & office permanent personnel, with long term loans in terms of their life events -buying a car, getting married, buying a house, having kids, planning retirement, being deployed, using mobile & other digital technologies!

13. Conclusion

Many have written about **digitalization**, but almost no one has defined it! Digitalization indeed uses *a better/faster technology; it provides a new type of communications* & *it means a new way of doing business*!

But a (digital) intervention has to be done after a **good judgment"** & "**always** to **protect…** humans from **technology"**, because the "technology & the machines should always be **servants** to humans[20], & never be, **or become**, **Masters**!"

[20]USA & China during the meeting of their top governors15/11/2023 talked about the AI dangers; the dangers from not reducing the use of fossil fuels, (releasing methanol), by 2030; & from not increasing 3 times the use of the RSE; &… **about** not reducing the use of the 2014-emerged drug, "fentanyl", in USA, alleged to be imported from Mexico, **China** and India…!

Table 1. Managers' demands from digital revolution the following services.

To handle data	To make sense of them	To provide the digital tools to manage data	Remarks: given the limited capability/time of the managerial human brain!
Provide methods to organize data	Provide methods to summarize data	Make data visual	→Using *charts*, *trend lines*, etc.
Provide software	Provide interactive dashboards	Provide graphics from spreadsheets	→In analyzing *&* visualizing data
Provide data imaging solutions			

Source: author.

Of course, *digitalization* is not an end in itself, i.e., to *make the internal shipping company* & *its vessels digital*. The target has to be mainly the company's **charterers**' … (digital) satisfaction, from vessel's services, i.e., those who pay!

The obvious advantage of the cloud is to have the required data on demand, *in real time* & *updated*, ***directly*** *from their authenticated/responsible sources*, *to* ***everybody***, *interested* & *entitled*, *in the vessel* & *in the company*!

For shipping is essential the "diffusion of information", as in the pre-cloud epoch information vital for someone was known by someone else & arrived to him/her, in great delay, if at all!

In management, one has to try to apply the **rule**: "whatever one does & whatever money one spends, as a manager, he/she **has to** achieve a **higher** *efficiency* & *effectiveness*" than hitherto! E.g., a perfect "digital organizing" is useless, if does not serve the above axiom. Moreover, digitalization may be remarkable in the eyes of both charterers & competitors, because this **show-off** surely brings external admiration, but it does not bring *profits*, but additional cost!

A manager understanding the digital philosophy, has clearly to go one step further than the stage of the "components' **accumulation**". → i.e., to **apply** lots of **imagination**… in **using** the components… as those are made suitable to build a lot of *different* solutions, as the case may be, in other words they are multi-purpose!

"Renting" the relevant K & *I* is like a manager, our metaphor, visiting an open market, where *digital services* are there, displayed, together with their **hardware** & **software** (& *their* rent). The shipping manager standing there is wondering: "if I let this service, I could know **how** & **when** & **why** one of my big charterers has been really satisfied, for **sure** (on data), from company's ship's services"! This is really something excellent!

The companies were, & are nowadays, in need of **more** & **better data**! The data thus became, without realizing it, a business coefficient of production! Managers need, however, specific services (Table 1), certain of which are provided.

The Russia-Ukraine$_{2022-}$ war caused… indeed a positive result for the EU-28, i.e., to try not to depend on "Russian natural gas", by 2030, by 45% on its total

energy needs! Russia of course does not care, as long as large markets for its gas, like e.g., the Chinese, remain open, despite the EU-28 further$_{Nov.2023}$ sanctions.

The mobile phone, no doubt, greatly improved communications. The operators are the first people, being the middle managers, in a shipping company, to learn what is going **on board** & what is happening in the **port**-information which has to be stored **at once** in the Cloud. "The prompt knowledge means prompt action, and the prompt re-action, means a better satisfied charterer, as well increased efficiency & effectiveness to the company!"

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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