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Activity Deliverable

BLOCKCHAIN BASED TRACING AND TRACKING (B2T2)

Early Bird Activity Report

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Executive Summary

This document is the deliverable of the B2T2 project due by the end of 2020. The project started in the Month of September of 2020 under the Early Bird mechanism and will last up to the end of 2021.

In this first quarter the Consortium held five official meetings to define the plan of the activities, to refine the roles of participant and to establish the mechanisms for partner interactions, as well as several private meetings between SIS, the coordinator, and the activity partners. The Covid pandemic forced the consortium to meet only in remote modality, and this was an evident obstacle to integration, considering that project participants had not worked together before. However, the Consortium surmounted such an obstacle by means of an intense meeting plan, both plenary and at a peer-to-peer level, in which the members of the Consortium had the possibility to introduce themselves, to present their activities and to get acquainted with each other.

The project includes companies operating in two port communities, namely Genova (Italy) and Valencia (Spain), through SIS, a company that has been serving the category of Freight Forwarder of the Port of Genova for decades, Fundacion Valenciaport, a Research Institution of the Port of Valencia, and Infoport, a private company that has been providing products and services to port operators in Valencia for decades. In addition, the project also includes Telecom Italia, the incumbent Italian telecom operator, which has an extremely solid background in research and innovation in the area of networking and distributed systems. The partners belonging to the port communities contribute their process knowledge to the project while Telecom Italia on the one hand serves as a general reference technology partner and on the other hand brings its specific telephone operator point of view to the project.

We decided to start the activities by analysing the state of the art of Blockchain and Port/Transport digitalization both from the point of view of technology and from the point of view of processes. The analysis of technology was carried out both in general terms, by looking at the literature, and in specific terms, through a collection of information on ongoing Blockchain projects in the area of ports and transportation.

The distinctive characteristics of B2T2 is that of coupling an advanced technology like Blockchain with a complex scenario such as that of ports and transportation. Our ambitious goal is to deliver local/global innovation by designing and implementing a prototype of a platform able to compete at a global level with the other initiatives currently proposed. The critical point is to identify the requirements of the application domain that appear to match the solutions offered by Blockchain technology. Unfortunately, the hype generated by Blockchain technology does not help, as Blockchain has become a sort of meme. On the contrary, B2T2 must identify real use cases where Blockchain technology, or Blockchain-like technology, actually give a competitive advantage. We realize that Blockchain technology is in its infancy and was developed to support electronic payments. It will take years or decades to converge to concrete and disruptive applications in domains different from cryptocurrency.

Section 1 of this documents includes the information on the Activity Management.

Section 2 summarizes the contribution of activities carried out in 2020 under the early bird mechanism to the project. More specifically, Section 2.1 describe the application context, i.e., the nature and the processes that take place in ports and modal shift nodes and more in general in transportation, the type of operators involved, and the flows of information and services that accompany transportation, whereas Section 2.2 focuses on technology, with specific reference to the Blockchain based projects developed or under development in Genova and Valencia, as well as to international Blockchain based projects such as for example Tradelens, backed by IBM and Maersk. With specific regard to Tradelens, it is hard to tell whether the direction that they have chosen to follow is appropriate. However, no matter whether that is the case or not, Tradelens is raising the awareness of the transport operators on Blockchain technology and, in a sense, is establishing a market.

We need to understand to what extent Blockchain will be a disrupting port digitalization technology and to what extent, on the contrary, it will be "yet another technology" that will drive a smooth evolution of port and operator information systems. The consortium is in an ideal position to clarify such an issue, thanks to its competence on port/transportation processes and digital solutions to support transport digitalization.

Section 3 describes the activities carried out to create the startup company that the project promised to create. Immediately after the kickoff meeting, SIS started an intense activity of promotion of the B2T2 project aiming at attracting the attention of market-oriented partners. SIS realized that the presence of a market-oriented partner able to reach customers and the presence of an academic partner able to guarantee the high profile of the initiative were the key factors to guarantee success, both in the short-term and in the long-term. SIS decided to activate two lines of activity in the startup, the first aiming at capturing the market as soon as possible, possibly in 2021, through advanced solutions to local transport companies, and the second aiming at creating a disruptive innovation on a longer term.

SIS identified the market-oriented partner in one of the largest associations of Truck Fleet Management companies, Trasporto Unito, which decided to activate a partnership with B2T2, and identified the research-oriented partner in Docspace, a spin-off company of the University of Genova which is active in document sharing and synchronization technology.

SIS held several meetings with EIT Digital, both at the national level (Trento co-location center) and at the central level, to validate the structure of the new company. The meeting eventually led to an agreement which in turn led to the creation of the startup, names TUIT, on Dec. 11, 2020. TUIT, a spinoff of Sis, Trasporto Unito and Docspace, is now active and includes two lines of business, one characterized by fast time-to-market, and one characterized by long-term ambitious goals.

1. Activity Management

1.1.1 Completion of the workplan milestones and tasks

The early bird activity started in September 2020 regularly and was completed at the end of December 2020 as planned. All the tasks were completed with contributions to the 2021 activity as detailed in the following sections of this deliverable.

1.1.2 Role of partners and IPR share agreement

The following roles are confirmed:

1. Telecom Italia, as a leading ICT company in Italy, contributes a strong expertise in digital services and Blockchain technologies. In the Product Development catalyst TIM will offer platform modules through its 5G Digital Business Platform, designed to support Blockchain functionalities. TIM will also spend effort in the product experimentation, contributing in pilots with potential Italian customers. The new start-up will be supported through TIM WCAP Working capital start-up accelerator.
2. SIS initially acts as a business champion. It has taken care of the creation of the startup which will act as business champion in 2021. SIS manages the activity and contributes to the development of the platform. SIS will also provide support for the pilot demonstration with customers to be selected in the port of Genova through Trasporto Unito, one of the main associations of read transportation companies, and through the Associations of Freight Forwarders and Shipping Agents, which already agreed to provide such a support.
3. Fundacion Valenciaport leads the connection of Blockchain technology to ports and logistics. In addition, it will disseminate the result of the project through the Association of Mediterranean ports (www.medports.org).
4. Infoport Valencia contributes to the development of the platform. More specifically it will provide support for pilot demonstrations with customers to be selected in the area of Valencia.

About the IPR share agreement, the partner are currently finalizing a specific agreement which is based on the following principles:

1. the results shall belong to the partner by or on whose behalf it was generated.
2. if, in the course of carrying out the B2T activity, two or more partners have contributed to a result and if the features of such joint result are such that it is not possible to separate each of their contribution for the purpose of applying for, obtaining and/or maintaining the relevant patent protection or any other IPR protection, or – in case of a copyright protected Result – the contributions to such result cannot be used independently from each other the concerned parties shall own the joint result in equal shares unless otherwise agreed.

The agreement will be signed early in 2021.

1.1.3 Activity meetings

B2T2 was managed through an informal pre-kick-off meeting and four official meetings where all the partners were represented:

1. An informal pre-kick-off meeting held on 29 July 2020, before the kick-off meeting, aimed at allowing participants to introduce themselves and to finalize the meeting procedures.
2. A kick-off meeting, held on 9 September 2020, in which first of all the activity was officially started. In addition, the application domain participants (SIS, FV, Infoport) described their application domains, whereas the technology partner (TIM) presented its offer to support the application of Blockchain in transportation, logistics and port operation. A joint activity between SIS and FV was started to collect documentation of current Blockchain projects.
3. A second meeting, held on 8 October 2020, aimed at checking the status of the joint activity started at the kick-off meeting. SIS and FV presented and discussed the preliminary results of their analysis and received feedbacks from the other partners. All partners were invited to provide written contributions.
4. A third meeting, held on 19 November 2020, in which the project team discussed the written contributions provided by the partners and planned the activities aimed at the preparation of the deliverable, to be discussed and validated at the fourth meeting.
5. A fourth meeting, held on 17 December 2020, aimed at the validation of the 2020 deliverable, which was prepared by SIS by assembling the contents provided by all the partners.

In addition to these Activity Meetings, attended by all B2T2 partners, and to the numerous personal meetings that took place between the coordinator and each partner, SIS held several meetings with EIT Digital on the creation of the startup. More specifically, two meetings with Antonio Garcia Hortal took place respectively on 15 October 2020 and on 11 November 2020, and several meetings with Diva Tommei and Federico Menna, respectively Director and Administrative reference person of the EIT Digital Trento node, took place (the last one on 27 November 2020). In these meetings SIS and EIT Digital discussed both the Startup Sharing Agreement, agreeing on a 20% EIT Digital participation in the startup, and the extension of the B2T2 consortium both to the startup and to Docspace, the spin-off through which the University of Genova participates in the activity.

1.1.4 Risks mitigation

The risks identified at project submission and the mitigation actions adopted are the following

1. Resistance to change at Business level
   This risk will be faced through the involvement of end users and through the realization of two pilots. The fact that an Association of Transport Operators has been involved as founder of the activity start-up (Trasporto Unito, see section 3.6 about start-up creation) is an important result in such a regard.
2. Not enough money to pursue start-up objectives

The startup was created with a significant initial share capital and the business plan currently under development envisages the creation of services to be marketed starting from the first year in order to guarantee sustainability.

3. Lack of regulation about Blockchain technology
   The technology providers will monitor the evolution of standard definition, in particular the ISO and IEEE Blockchain initiatives.
4. Integration with existing Port community Systems
   The partners have already activated links with the Port Authorities of Genova and Valencia to smooth integration with the existing PCS platforms.
5. Finding appropriately skilled people
   The involvement of the University of Genova through its DocSpace spinoff company will allow the startup and the partners to be exposed to highly skilled people in the Academic Research ecosystem. A senior software architect with 6 years of experience on research projects has just been hired by the startup.
6. Scalability
   Appropriate solutions will be evaluated with the support of TIM.

1.1.5 Activity contribution, support and impact to the Knowledge Innovation Triangle integration

B2T2 is strongly addressing knowledge triangle integration. Research, the first angle, is central in Blockchain based activities. Currently, the Blockchain concept is evolving rapidly. The original Proof of Work mechanism, propose by Blockchain and by the first version of Ethereum, is being challenged by the Proof Stake mechanism, which is still under investigation. In the context of B2T2 we are addressing this issue along with the University of Genova. Innovation, the second angle, is central too. The point here is to understand to what extent Blockchain enables the development of Port Digitalization in general. This is the core issue of B2T2, which is strongly rooted in the Port Communities of Genova and Valencia. Finally, Education, the third angle, is explicitly addressed by the activity. The activity leaders appointed by SIS under an agreement with the University of Genova have permanent appointments at the University of Genova, where they teach Software Platforms and Distributed Systems in the Computer Engineering Bachelor and Master courses. Both Blockchain technology (Research) and Port Digitalization (Innovation) will influence and are already influencing the curricula of the two courses and will be the basis for Master and Ph.D. projects. In 2021 the project will complete the description of internships and finalize the proposition of projects to students.

2. Contribution to 2021 Activity

2.1 Context from the Application Domain Point of View

2.1.1 Introduction

Modelling the application domain of intermodal transportation is outside the scope of this document, considering both its complexity of its speed of evolution. However, to frame the application of Blockchain technology in intermodal transportation we do need a reference model. We propose a simple one, which distinguishes two complementary angles, namely **Origin-to-Destination Transportation** and **Port Operation**.

Origin-to-Destination Transportation focuses on consignment (see Fig. 1). A Producer of goods needing to ship a container to a Receiver submits its request to a Freight Forwarder. The Freight Forwarder organizes the Origin-to-Destination Transportation service as a chain of segments operated by Carriers between terminals operated by Terminal Operators. In other words, a Freight Forwarder provides an integrated service obtained through the integration of services provided by Carriers and Terminal Operators as well as by a variety of other operators.

Fig. 1 – Origin-to-Destination Transportation

It is worth noticing that Freight Forwarder is an abstract role, sometimes played by an independent entity, other times played by the Producer or by one of the Carriers, if they have a freight forwarding department.

The evolution of such a role is one of the most relevant transformations that affect intermodal transportation. Notable examples of such an evolution are that of ship companies that extend their activities to new lines of business, typically in terminal operation and freight forwarding, and that of logistics operators that incorporate terminals, warehouses, and transport operators to control the whole distribution chain (e.g., Amazon, FedEx, DHL).

In this document we do not focus on these transformations, although they heavily influence the deployment of Blockchain technology in logistics and transportation. We neglect the issue and focus on Freight Forwarder as an abstract role, that someone is supposed to play.

Port Operation focuses on modal shift and more in general on what happens in ports (see Fig. 2). In a Port, the set of organizations that participate in operation, called Port Community, includes private companies as Terminal Operators, Shipping Companies and Agents, Freight Forwarder Companies and Agents, Train and Multimodal Transport Operators, Truck Operators, and public institutions as Port Authority, Coast Guard, Customs Authority, and Police. In addition, other service providers indirectly participate in Port operation by providing services in a variety of domains, among which for example infrastructure management, mechanical repair, security and surveillance, insurance, waste management, etc. All these organizations cooperate to Port Operation through physical operations, e.g., container handling, as well as through administrative operations, e.g., document exchange.

Fig. 2 – Port Operation

In summary, we distinguish two angles, namely a global angle, focusing on Origin-to-Destination transportation, and a local angle, focusing on Ports and more in general modal shift. In both cases we have a set of cooperating actors that exchange information and services.

The case of Origin-to-Destination transportation refers to a classical integration scenario and is naturally hierarchical, being concerned with a situation in which a Freight Forwarder, acting as a prime contractor, integrates the services provided by a set of service providers, i.e., the Carriers and the other organizations that operate transportation segments, acting as subcontractors (Fig. 3). Service integration needs appropriate support from information system integration to improve effectiveness and efficiency. Information system integration requires the identification of the services exchanged among participants and the definition of the software interfaces associated to such services. Service description tools can be used to describe these interfaces to improve readability and maintainability as well as to generate client and server components automatically.

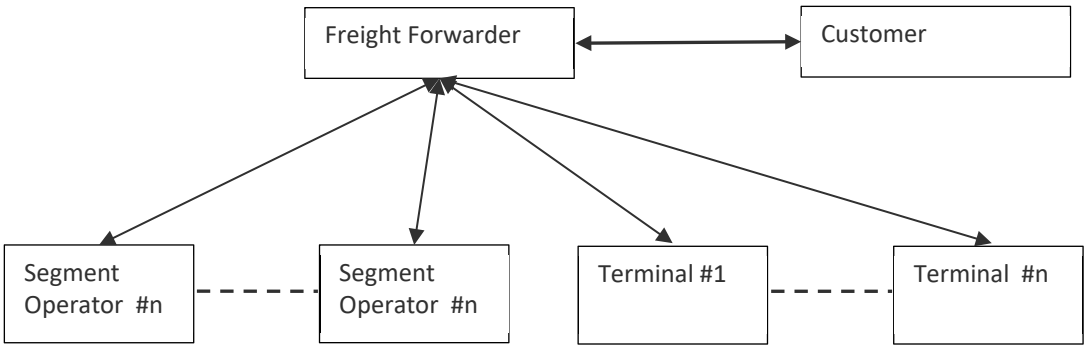

Fig. 3 – A Freight Forwarder coordinating multiple Segment Operators and Terminals

While in principle a hierarchical relationship between a service integrator and its service providers does not need standardization while it only requires a private agreement among the parties, the complexity of the logistics domain, in which multiple Freight Forwarders interact with multiple Carriers and more in general multiple operators, makes software interface standardization a primary issue. Standardization on the one hand allows Freight Forwarders to use the same interface with different Carriers of the same type and on the other hand allows Carriers to expose the same interface to different Freight Forwarders, thus improving integration among all the participants in the transportation ecosystem. Standardization is at the basis of the evolution toward the Web 2.0 paradigm, for example automatic service composition and mashup, as well as of the introduction of mechanisms and tools to share underutilized assets, according to the sharing economy principle.

The case of Ports is more complex mainly because it is concerned with a business community, called the Port Community, where a plurality of actors cooperates as peers (Fig. 4). In Port Communities, the interaction patterns among participants are not precisely defined, considering that although it is evident that ports share the basic principle of operation, they follow different rules due to local regulations, traditions, and more in general culture. In addition, the interaction patterns among Port operators are in permanent evolution as the rules change over time. Finally, Port operators do not only exchange services directly while they also do it indirectly through centralized platforms called Port Community Systems. The complexity of Port Operation, and more specifically the lack of a widely accepted reference model makes the identification of such a reference model, rather than software interface standardization, a priority.

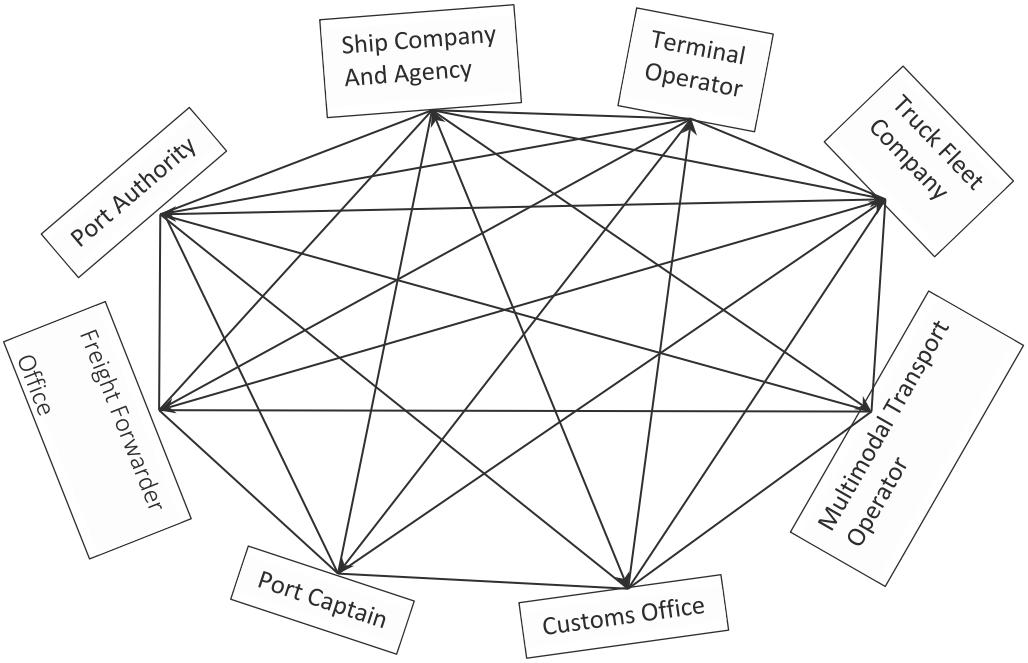

Fig. 4 – Multiple cooperating organizations in ports

2.1.2 Transportation: Processes, Operators, and Interactions

The notion of modern maritime transport is based on the existence of regular routes, better known as sea routes, that connect sea-land interface points (ports). Sea routes are created according to the obligatory passage points such as physical constraints (e.g., coasts, winds, sea currents, depths, rocks, ice), political boundaries and obviously according to the commercial exchanges between different economic areas.

Fig. 5 shows a general and simplified scheme of transporting goods in different ways, highlighting the existing need in transport (and logistics in general) to optimize the flows of the points of departure and arrival through the aggregation and disaggregation of goods. To meet the needs of customers with different requirements for the goods sent, a modern transport system must reconcile parameters of cost, time, safety, distance, and route.

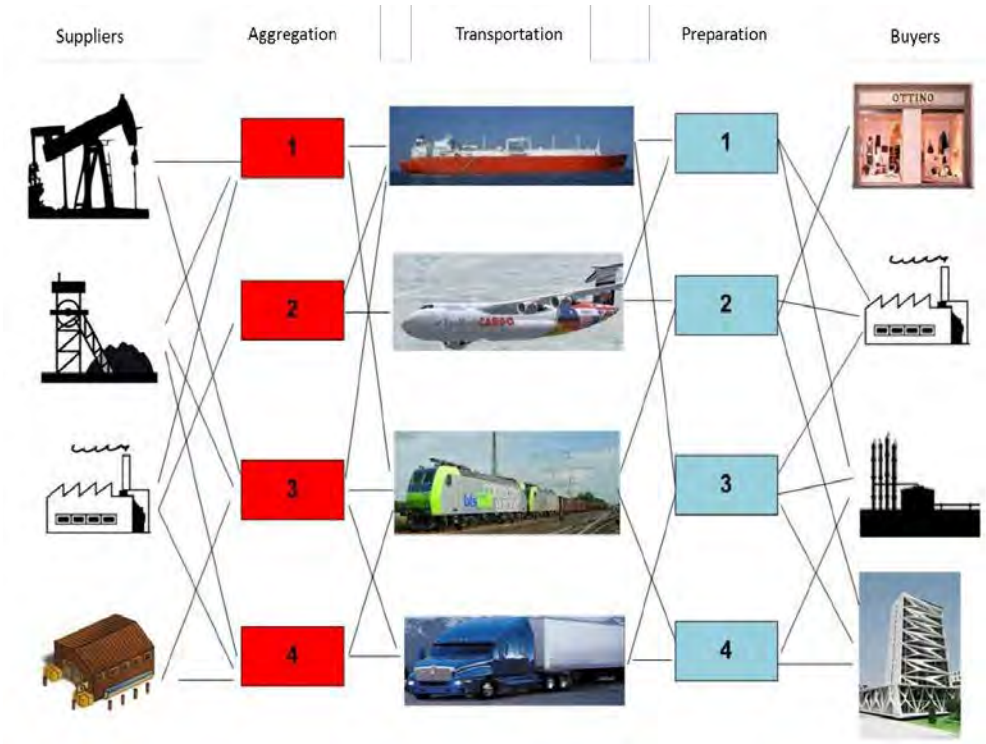

Fig. 5 - General transportation Scheme

Suppliers make use of intermediaries for the transport of goods, who can optimize transport costs by choosing the most suitable mode of transport (according to customer needs). The intermediary in charge of transport (in the absence of constraints) may also decide to use a single container or means of transport for multiple items with different origin but same destination: this operation, that causes several Suppliers to share the same container without their knowledge, is called Consolidation or Groupage and the operator is called Consolidator or Consolidation Warehouse.

In this context, only transport by ship, plane or train are considered actual transportation: the difference with road transport consists in the fact that, for a freighter, it is possible to make the collection of goods directly at the manufacturer's delivery dock and the delivery directly to the customer who ordered the goods. In all other cases, an intermediate transportation by other means is required between the Supplier and the Recipient. These intermediate transports are carried out under the responsibility or by the agent in charge of the transport but by means of specialized operators.

Upon arrival at the sorting point, the goods will be prepared for delivery to the customer (for example, in the case of a shared container, the various shipments will be separated).

The process illustrated in Fig. 5 does not consider the fact that international trade is subjected to regulations and that therefore a significant part of the transportation process is represented by the documentation accompanying the goods which, in large part, serves to verify that both the transport and the goods comply with the laws of the countries of origin and destination.

Another important element of transportation by ship is the port itself, as the goods on board ships must be loaded, unloaded, and maintained by the departure or arrival Terminal.

A simplified version of the steps of goods through the process that connects Supplier and Buyer is shown in Fig. 6; each step can also be divided into several sub-phases: for example, in port goods can be subjected to health checks (e.g., for foodstuffs) and safety checks (e.g., for dangerous goods) or can be kept in specialized warehouses (e.g., refrigerators). It is worth noting that each operation into which the process is divided has an economic effect, due to the fact that operations are carried out by entities that offer paid services; it is also important to underline that each payment process has an impact on the actual progress of the goods from the producer to the buyer: therefore, in addition to strictly bureaucratic steps, even those relating to the payment of fee (e.g. taxes, duties, services fees) are part of the transportation process. All these phases make the process complex and critically dependent on the available infrastructures and services.

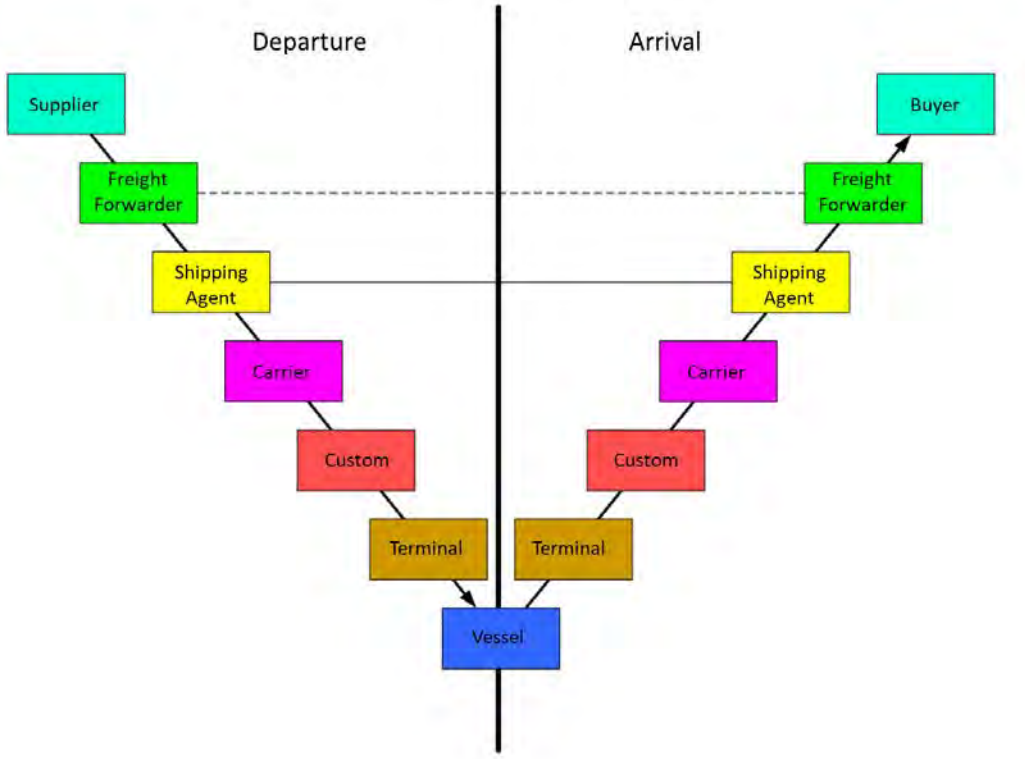

Fig. 6 - Simplified version of the steps of goods from Origin to Destination

Each transition of the goods through the transport process must be accompanied by documents that allow to overcome the interfaces between the various structures that carry out the tasks represented in the process. Unlike other forms of transport, in the maritime one the waybill (called Bill of Lading in this context), that is the document describing the goods, does not accompany the goods themselves: in fact, the Bill of Lading is a document with legal effects, that represents the property of the goods themselves and that is delivered to the one who will collect the goods upon landing in the port of arrival.

A less simplified list of the actor involved in the real process is reported in the following table:

Shipper	A Shipper is an individual or a company who has a full ownership of any cargo onboard to be transported overseas either by cargo plane, vessel, or any other unit of carriage. A Shipper is usually an exporter, a trader, or a manufacturer of goods.
Freight Forwarder	A Freight Forwarder is a third part company or an agent who undertakes freight management on behalf of the Shipper. A Freight Forwarder must be licensed in order to be able to undertake such an obligation.
Shipping Agent	A Shipping Agent is the designated person or agency held responsible for handling shipments and cargo, and the general interests of its customers, at ports and harbors worldwide, on behalf of ship owners, managers, and charterers.
Customs Agent	A Customs Agent is a person or company that is paid to make sure that all necessary taxes are paid, and rules are followed so that goods can be imported into a country.
Cargo Agent	A Cargo Agent is a person or company who handles the shipment and helps to monitor the cargo. Most Cargo Agents are Freight Forwarders who have an in-house Custom Agent and provide all-inclusive and integrated services for the import and export of the cargo.
Consignee	A Consignee is a person or company to whom goods or documents are officially sent or delivered. Since the person who receives the goods in a consignment is always a consignee, generally, the consignee is the same as the receiver, but it is not always true.
Notify Party	A Notify Party is the contact person to be notified when the shipment arrives at destination.
Shipping Line	A Shipping Line is a company that operates the cargo vessels that deliver goods from the load port to the destination port.
Rail Carrier/Operator	A Rail Operator is a company that owns or is otherwise responsible for the control, management or operation of rolling stock or track.
Road Hauler	A Road Hauler is a person or a company that transports goods by road as a business.
Container Terminal	A Container Terminal (also called Container Port) is a facility where cargo containers are trans-shipped between different transport vehicles, for onward transportation.

Container Depot	A Container Depot is a storage area for empty shipping containers.
Inspection Bodies	Inspection Bodies conduct assessments on behalf of private clients, their parent organizations, or the authorities, for the purpose of providing them with information on compliance with legislation, standards, specifications, contractual commitments, etc.
Customs	Customs is an authority or agency in a country responsible for collecting tariffs and for controlling the flow of goods into and out of a country.
Porth Authority	The Port Authority is the official organization that controls and manages the activities in a port.

2.1.3 Port Community System

It is simplistic to regard Port operation just as a component of Origin-to-Destination transportation and, as such, as a simple contributor of a more complex process. On the contrary, Port operation is to be regarded as a central element of intermodal transportation as it is concerned not only with efficiency of operation but also with sensitive issues as border protection, people security and safety, Customs fees and duties, traffic, energy, pollution, and more in general with the impact of transportation on local communities. The variety of actors, public and private, that operate in Ports makes the local dimension much more relevant and complex than the global dimension, which can be modelled as an integration of transportation services and as such can be managed using traditional integration paradigms and tools.

The private actors that operate in Ports directly match the three categories of operators that take care of transportation at a global scale, namely Freight Forwarders, in charge of planning and coordination of the different segments, Carriers, in charge of transport in each segment, (more specifically Truck Companies, in charge of road transport, Ship Companies, in charge of sea transport, and Multimodal Transport Operators, in charge of train transport), and Terminal Operators, in charge of storage and modal shift. In ports, Freight Forwarders and Carriers have a presence, either through a branch or through a local agent, while Terminal Operators have their operational structure. All operators cooperate to Port operation according to their respective role and capacity. Freight Forwarders manage process coordination at Port level, Ship Companies manage ship arrival/departure, Truck Companies manage truck arrival/departure. In addition, public actors as the Port Authority, the Customs Authority, the Coast Guard, the Port Captain, the City Administration, and the like maintain and enforce the regulatory framework and contribute to Port operation through document validation, freight inspection, import/export authorization, security enforcement, etc.

Port operators typically exchange documents to accompany container modal shifts. Documents are concerned with private commercial relationships as well as with the public authorization process. While in the past documents used to be exchanged in physical form and to slow down the modal shift process, the latest decades have witnessed the diffusion of document dematerialization and migration to process

automation. However, although a revolution has taken place in Ports, as in any other domain, unfortunately the concepts of original document and manual signature still influence some of the business relationships among operators and hamper the evolution of Port operation to full digitalization.

The Port Community System is a natural reaction of the Port Community to digital transformation, as it aims at helping ports to shift from paper-based interaction to digital interaction. While in the early days the Port Community System mainly used to take care of interface standardization and adaptation among the information systems of the Port operators, it recently evolved to its current status, which is that of a centralized platform that provides a one-stop shop, or a Single Window, through operators interact. However, the debate is currently open, as there are Port Communities that prefer to maintain decentralization and Port Communities that heavily depend upon Port Community Systems. The issue is in part technical and in part political, as the development of a Port Community System creates an autonomous competence center that may leverage its role to impose practices and to control port operation. In such a regard it must be pointed out that the Port Community System administrative nature is a central issue as the propensity of port operators to endorse a Port Community System depends on the degree of control that they have on it.

In addition, there are cases in which the presence of a centralized platform acting as a trusted third-party is a need rather than a choice. Services like proof of communication, timestamping, document notarization and in general certification, need to be provided by a third-party which is to be decoupled from operators. The Port Community System is a natural candidate to play the trusted third-party role. It may either maintain the documents subject to certification in its administrative domain or maintain just unique document references (typically based on hashes) in its administrative domain, leaving the actual documents under the control of the interested parties.

2.1.3.1 Analysis of the Port Community System activities

For the writing of this chapter, the Port Community Systems of the two ports involved in the project have been analysed in detail in order to identify the main features of a PCS and its most important activities.

A Port Community System is an open and neutral electronic platform that allows the connection of multiple systems, permitting the safe and smart exchange of information between public and private stakeholders. It enables the management, optimization, and automation of port and logistic processes in an efficient way through a single data transfer as well as connecting transport and logistic networks. A PCS provides typically better transaction efficiency, resources optimization, process automation, error reduction, better client support, and it usually saves costs and time for the actors involved in the processes. Moreover, the PCS often provides integration with external platforms as additional source of data. Specifically, ValenciaportPCS is integrated with INTTRA and GT Nexus technological platforms, thereby offering a single gateway to the world's most important ocean carriers (Fig. 7).

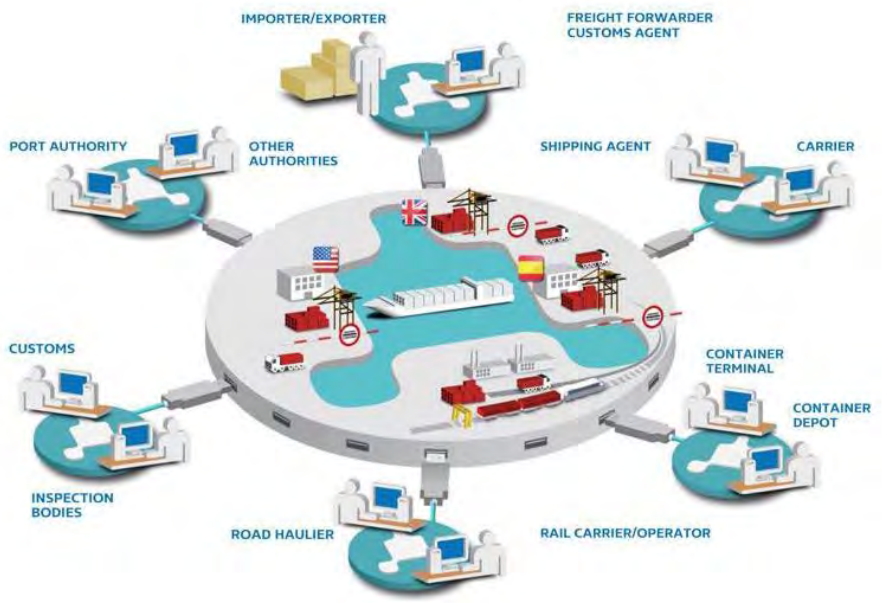

Fig. 7 – Port Community System

Port Calls Management

The PCS allows direct integration with the Port Authority and the National Single Window[1], allowing to process port call and mooring authorisation requests directly with the Port Authority and the Harbourmaster's office and to receive the corresponding authorizations for such requests directly.

Specifically, the Shipping Agent sends the necessary information to the Port Authority (e.g. port of arrival, vessel name, carrier, previous and next port of call). Once the port call is accepted, information relating to passengers and crew, waste and other relevant data is sent. Sending the call automatically opens the Customs ID for the customs clearance of goods to be loaded or unloaded from the vessel.

Dangerous Goods Management

The PCS allows Shipping Agents to submit authorization requests for loading, unloading and transit of dangerous goods directly to the Port Authority and the Harbourmaster's office; the service also makes possible to submit the related notifications, necessary to allow dangerous goods to remain on the ship during a call.

Specifically, the Shipping Agent electronically requests admission, and the Port Authority can reject or accept the request. In the authorization, interested parties are provided with the mandatory provisions to be respected while the goods are in the port. A copy of the authorization must be submitted to the Cargo Agent, who will ensure that the information contained in the notification and authorization is in the possession of the Terminal Operator responsible for the operation and of the driver of the vehicle making land transport of goods (if presents).

[1] https://ec.europa.eu/transport/modes/maritime/digital-services/e-maritime_en

Loading and Discharge Orders

The PCS allows Shipping Agents to send the vessel loading and discharge lists to the Container and Car Terminals and to obtain from the Terminals the respective confirmations of the loading and discharge of containers and cars appearing in the lists.

Specifically, the Shipping Agents can obtain data relating to the export Single Administrative Document (SAD) of the containers declared in the loading list through the PCS, thus being able to compile the export cargo manifest without the need to introduce the SAD data by hand. This service allows Shipping Agents to guarantee their customers in advance that the goods will be loaded on the ship or to communicate in advance any problems in the departure of the goods.

Road Transport Management

The PCS allows agents engaged in the road transport to generate and manage transport orders, cargo acceptance and delivery orders required for the transport of such goods through the port facilities managed by the PCS, and to notify the delivery and acceptance of containers in Container Terminals or Depots.

Specifically, the Shipper/Freight Forwarder sends the transport instructions to the Shipping Agent and the truck company in charge of carrying out the transport. The Shipping Agent issues the delivery and admittance orders to carry out the transport. Terminals and Depots receive up-to-date information on delivery and admittance orders and then confirm operations.

Rail Transport Management

The PCS allows agents engaged in the rail transport to generate and manage transport orders, cargo acceptance and delivery orders required for the transport of such goods through the port facilities managed by the PCS, and to notify the delivery and acceptance of containers in Container Terminals or Depots.

Specifically, Rail Operators send the loading and unloading lists to the Terminals based on the documents previously generated by the Shipping Agents and Freight Forwarders.

Cargo Tracking

The PCS allows its users to obtain track and trace information about their shipments (for example the current status of their cargo, the transshipments made, and the documents processed). In addition to data provided by the other services of the PCS, the system is also powered by data provided by Shipping Lines directly or through the external platforms INTTRA and GTNexus. A more detailed description of this service is provided in the following Chapter.

Goods Declaration

The PCS allows Shipping Agents to submit import and export cargo manifest directly to the Port Authority of Valencia (PAV) and the Spanish State Tax Agency, and to modify these documents when necessary, according to the procedures established.

Specifically, before the vessel arrival, the Shipping Agent sends the information of the Summary Declaration via the IFCSUM message[2]. The message is received by the Port Authority which forwards it to Customs through the Customs Single Window. After the departure of the vessel, the Shipping Agent sends the IFCSUM message with all the cargo shipped (Export Manifest). Customs verifies this information with the Terminal gate in messages and the export declarations.

The Goods Declaration service is integrated with the Road Transport service to allow the automatic generation of transport orders and release and acceptance orders. The service is also integrated with the one that manages the Loading Lists to allow the control of the customs status by the Shipping Agent and the Customs Police, and of the containers and vehicles for export and transhipment, in order to avoid delivery on paper of different customs documents, improve control and security, and save time in data management.

Customs Information

The Customs Information service extracts the data necessary for the customs clearance of goods from the import cargo manifests (which are loaded thanks to the Goods Declaration service). Thanks to the connection with the traceability service of the Tax Agency, the PCS provides the Shipping Agents with information on the customs clearance of containers and on shipments declared in the cargo manifest that must be cleared by the customs office. The system cross-checks data from Entry and Exit Authorizations and other services to offer more useful information to platform users.

Equipment Status

The PCS allows its users to know the status of their containers and vehicles during the loading and discharge operations. This service provides users with automated and paperless customs control of containers and vehicles for export and transhipment.

Departures and Arrivals – Schedule

The PCS represents a single source of information regarding the departures and arrivals of the vessel of the world's largest Shipping Lines in the ports managed by the PCS.

Specifically, users have access to real-time information on port calls (both planned and current). The vessel port call number (or Customs Manifest Number) makes it possible to identify and manage the operations linked to the permanence of ships in the port in an integrated manner, allowing users to better control and plan maritime and port operations.

Bookings

The PCS allows users to send bookings via electronic messaging and/or using the PCS application. After submitting the booking, users immediately receive the Ocean Carrier booking numbers and can also check the status of their shipments in real time.

Shipping Instructions

The PCS allows to automatically carry out the documentary processes for the compilation of cargo manifests and the creation of Bills of Lading with the major Shipping Lines in the world. This service eliminates the need to use faxes and/or emails, in many cases requiring confirmation via phone calls. The

[2] https://service.unece.org/trade/untdid/d05b/trmd/ifcsum_c.htm

platform provides information on the exact time each document has been processed, when the documents were sent to Shipping Lines, and when they were confirmed by them.

2.1.3.2 Cargo Tracking

As already mentioned in the previous section, the PCS allows its users to obtain track and trace information about their shipments thanks to its service of cargo tracking.

To be more specific, in Valencia the Track & Trace (T&T) services obtain all the possible data related to cargo tracking processing the information of the events generated by the rest of the PCS services as well as provided by agents external to the PCS, such as aggregators (i.e., INTTRA[3], GTNexus[4]), local shipping companies or public bodies like Customs. In other words, the system captures and registers T&T events both from the PCS services and external shipping agents that provide cargo tracking information through their own applications or the external aggregators (see Fig. 8).

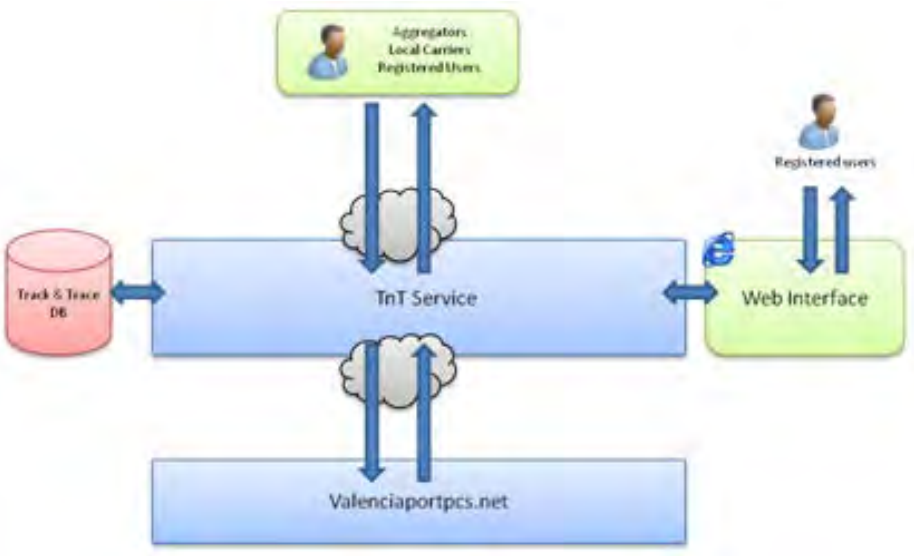

Fig. 8 – High level schema of the T&T service

The system uses the booking number and the container code (BIC) as entity for traceability to associate the tracking information. Currently, events provided by other services of the PCS are sent via the UN/EDIFACT IFTSTA message (International Multimodal Status Report Message[5]), while aggregators and local shipping companies deliver ocean events information through other formats (EDI, XML).

In order to provide information to the user, the T&T service offers a user web interface and a public interface through web services, accessible only to registered users. As regards the main functions, the system makes it possible to:

[3] https://www.inttra.com/about/ https://www.inttra.com/inttra-global-trade-platform-for-carriers-and-nvoccs/
[4] https://www.infor.com/products/infor-nexus
[5] https://service.unece.org/trade/untdid/d99b/trmd/iftsta_c.htm

- Obtain cargo tracking information from the PCS services (for example Bookings, Shipping Instructions, Inland Transport Management, Rail Transport Management).
- Obtain cargo tracking information of the oceanic events received from external shipping agents through aggregators (INTTRA and GTNEXUS) or from other systems.
- Allow unregistered users to conduct basic searches through the use of the web graphic interface, restricting the displayed information.
- Allow registered users to conduct basic and advanced searches through the web interface, showing all the events and detailed information of some of them, based on the user authorizations.
- Allow registered users to create and manage subscriptions to events, also choosing the preferred method (mail or message).
- Allow a registered user to create and delete bookmarks, both basic and advanced.
- Manage subscriptions and notify users by the chosen method (mail or message) every time a T&T event is generated and meets the conditions of the subscription.
- Allow companies to integrate the T&T services into their systems through the use of the public interface, having access to information about the events and the status of their containers, without having to access the web.
- Provide online help for the web front-end and the web services.

Access to Track & Trace information is granted both to registered and unregistered users, with the following limitations: a registered user (i.e., a user registered in the PCS, with an assigned profile) has access to the information depending on his role and whether he has been indicated as a party involved in the event or not; an unregistered user (i.e., a user that is not registered in the PCS) has only access to the information that is defined as public (without data details). Specifically, the T&T roles to configure for organizations and their users are the following:

- IFTSTA T&T Transmitter, that can send IFTSTA messages to the PCS.
- Tracking Supervisor, that can access all events, both public and private.
- Tracking User, that can access the specific events for which they are authorized.
- Porth Authority of Valencia (PAV) User, that can access all the events, both public and private.
- Customs User, that can access all the events, both public and private.
- Owner of the Merchandise User, that allows companies that have no roles in other services and are not identified within the flow of PCS, to be able to see detailed information about their transport (for example in Land Transportation).

As regards public search (i.e., search allowed to all users), queries or searches of events can be made to the platform through booking number, Bill of Lading and Container code. Referring to the search reserved for registered users, it is possible to conduct a basic search also through the Freight Forwarder Reference; moreover, the system allows to perform an advanced search by the following fields: Involved Parties (i.e., Shipping company), Locations (i.e., origin, loading or discharging, destination places), Transportation details (i.e., trip number, name of ship or scale), Type of Operation (i.e., Export, Import, All), Events (i.e., Type of event, date). Searches are not available on transshipments or transfers, because they are considered stages within an Export or Import procedure and not a separate operation. Dates will be those initially provided by the Booking or the B/L and will be updated according to the evolution of the procedure in which the merchandise is involved, always from the container point of view.

2.1.3.3 Use Case - VGM

The VGM is the Verified Gross Mass of a container and corresponds to the total weight of cargo, loading aids, dunnage, and tare of the container.

From July 2016, a SOLAS amendment makes it mandatory to verify the weight of the gross mass as a requirement for accepting the container at loading. The aim of this regulation is to obtain the correct stowage and stacking to avoid the collapse of containers piles and to prevent accidents caused by incorrect weight distribution on board. The shipper is responsible for obtaining the VGM of a full container and communicating it to the Shipping Company.

The regulation prescribes two methods by which the Shipper can obtain the verified gross weight of a full container:

1. Weighing of the container after cargo loading: the Shipper weighs the container (or arranges for a third party to weigh it) with regulatory instruments after having sealed it, and provides the Shipping Company with proof of this weight.
2. Weighing of the load/calculation: the Shipper sends the company a formal declaration certifying the total weight of the shipment by weighing the goods (including packaging, pallets and dunnage) with certified and calibrated instruments, and then adding the tare of the equipment.

The VGM is usually sent via the UN/EDIFACT VERMAS message (Verified Gross Mass Message[6]) and can arrive before or after the arrival of the container. Sometimes it is sent via Loading List or Download Order instead.

As regards those which actually weigh containers, large manufacturers often bring out already weighted containers, while exporters typically use third-party company for this purpose (Scale Operators).

Currently, at least for the Port of Genova, access to the port should not be granted without a VGM. However, the VGM often suffers delays: in these cases, as the VGM is not yet available when the container arrives, it is not easy to verify its real existence; therefore, the verification cannot be carried out correctly and it happens that some Shippers never present the VGM, without however being sanctioned.

2.1.4 Blockchain in Ports, Logistics and Transportation

We consider the adoption of Blockchain in Origin-to-Destination transportation and in Ports and modal-shift nodes. In Origin-to-Destination transportation each consignment is associated to a Blockchain, activated at order and closed at finalization. The container, or more in general the load unit, is the reference Blockchain element. Each event related to a container traveling from origin to destination, e.g., modal shifts, payments, position, delivery, etc. generate the submission of a transaction to the Blockchain, which consequently logs the evolution of the container lifecycle along its journey. The transactions are submitted by the organizations that cooperate in the execution of the Origin-to-Destination transportation (Fig. 8) through appropriate service interfaces.

[6] https://www.unece.org/fileadmin/DAM/trade/untdid/d16a/trmd/vermas_c.htm

In such a scenario Blockchain can be used as a reference technology in the information system of the Freight Forwarder to trace consignment progress. The service interactions between the Freight Forwarder and its providers, namely the Carriers and the Terminal Operators, expressed using Web Service technology, can be implemented by Blockchain transactions. The need for Blockchain technology is not evident, considering that trust support and distributed access do not seem to be applicable, as the Freight Forwarder, at the vertex of a hierarchical organization, provides services to customers by integrating services provided by trusted subcontractors. The Blockchain infrastructure, operated by the Freight Forwarder, maintains a Blockchain as a digital twin of every active Origin-to-Destination consignment.

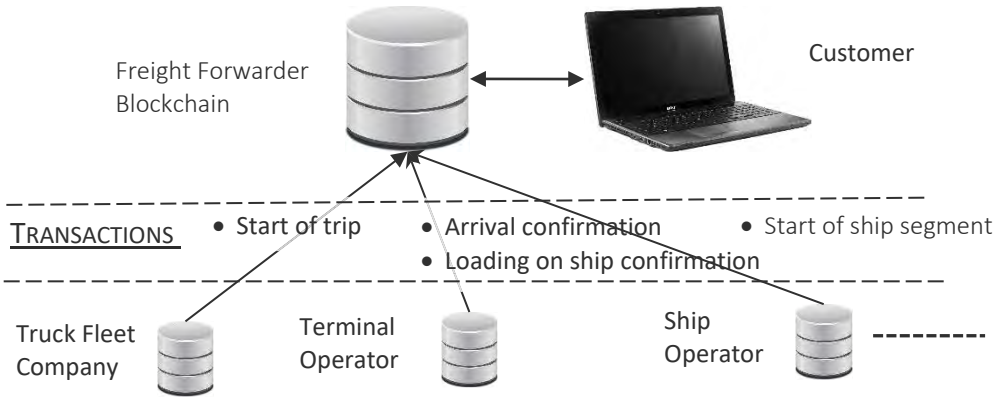

Fig. 8 – Blockchain as a technology for Freight Forwarder Information Systems

Blockchain technology better suits Ports, where the cooperating entities interact in a peer to peer fashion rather than in a hierarchy. In the same way as in Origin-to-Destination transportation also in Port operations Blockchains can be associated to containers (Fig. 9). The earliest container notice, e.g., notification of arrival, activates the Blockchain whereas the latest container notice, e.g., notification of departure, closes the Blockchain. Like in the previous case, all the events associated to a container, e.g., loading/unloading, Customs clearance, Delivery Order issuance, Bill of Lading submission, payments, transit through gates, etc., induce the submission of transactions to the Blockchain, which consequently logs the evolution of the container lifecycle within the Port domain. The transactions are submitted by the cooperating Port operators.

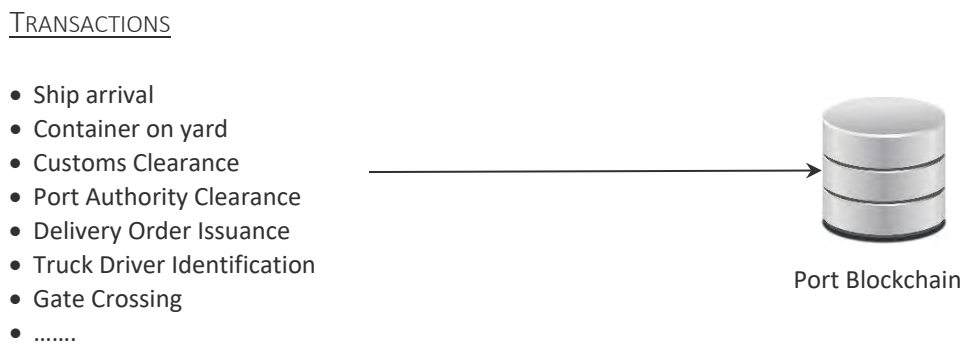

Fig. 9 – Blockchain Transactions in Ports

In such a scenario Blockchain is used as a reference technology for the Port Community and so finds its natural application as it supports peer-to-peer cooperation among a set of autonomous operators with limited mutual trust. Such a limited trust makes identity verification, document timestamping and immutability primary requirements.

2.1.4.1 An example: Blockchain in the VGM Use Case

The introduction of the Blockchain technology in the VGM context could be a way to force the application of the rules relating to the presentation of the VGM. In other words, such technology could introduce rigor in VGM procedures and support it through transparency. The benefits for the actors involved would be different.

As regards the Shipper point of view, it would be possible to:

- Know the network of available scales and services and the offered prices.
- Select the most convenient scale based on the price and on the path from the place of container loading to the port.
- Book a scale operation.
- Manage all VGMs regardless of the method used to obtain them.
- Lower operating and management costs of the weighing operation and the transmission of information.

At the same time the Shipper must:

- Submit to the Blockchain system the result of the weigh and automatically send it to any interested party or authority.

As regards the Scale Operator, it would be possible to:

- Increase the income statement since it will be always visible to every Shipper. Moreover, every Shipper would be obliged to actually carry out the operation, as verification by the Port at the entrance would be simple and always possible.

- Optimize the schedule of weighs in order to serve a greater number of containers.

The Road Hauler could:

- Use the scale that represents the least deviation on the container route.
- Reduce the time and paperwork necessary to weigh the containers.
- Predict the duration of a transport with greater simplicity, as there would never be the risk of being blocked at the entrance to the port due to the absence of the VGM, and therefore optimize the schedule of transports.

Finally, from the point of view of the port, it would be possible to:

- Obtain the VGM easily and recognize any fraud.

2.1.5 Use of Cellular-IoT and role for telco operators

IoT technology can help in the automation of creation, collection, and propagation of data. IoT devices improve and facilitate the way data are collected from the object environment, providing a more automated way to manage data and processes.

Using Cellular networks together with IoT (a scenario normally mentioned as Cellular-IoT) can play a crucial role in this scenario. This is due to the fact that if a SIM is used to collect IoT data related to a container or load unit, data can be enriched by other meta-data obtained from the mobile network, for example related to position or ID of the SIM or cell-towers information when data was collected. Data becomes more trustable as the meta-data can guarantee the origin of the data from that particular IoT device and from a particular location. This minimizes the risk of data eventually created by a malicious behaviour.

It is not just a matter of understanding if a data arrives from a particular device and/or place: logistic port activities are also characterized by the numerosity of actors involved in the process and this underlines the fact that trust among actors is another fundamental aspect. By using Blockchain, every transaction or update about data coming from sensors is notarized and promptly available forever to all the parties involved in the process. Data written on BC are solid, trustable, and assured against any type of modification.

A telco operator can play an important role in logistic-port sector by providing the technological building blocks, namely Cellular IoT and its integration with Blockchain, to offer trusted data collection to interested actors.

In this context, a telco operator can consider the following use-cases: certified tracking using Cellular-IoT, certified load integrity, operators' safety monitoring.

2.1.5.1 Example: Certified Tracking using Cellular-IoT

One of the main problems of large ports is to trace the position of every container arrived or to be shipped, inside the port area. The idea is to use a positioning sensor on every container. These sensors, with an embedded SIMs, store and forward location information using the cellular network and the operator's IoT

platform to write information on a Blockchain. Every time the sensor detects a change in the position, it creates a new transaction on the Blockchain. Raw information (container position) is enriched with other meta-data able to certify the data itself. A dashboard can be provided to port actors to access the stored information. Cellular-IoT based tracking could also be applied at single load unit whenever a more granular tracking is required.

2.1.5.2 Example: Certified Load Integrity

Another use case is related to the monitoring of the status of the container (or load units) to address the problem of tracing the integrity of container and its contents, using Cellular-IOT. This can be done using motion sensors in the container (or even in some internal box) connected via Cellular-IoT to register in a Blockchain the jolts suffered by the container, a crucial information in case of verified problem with the integrity of container and its content after, for instance, a truck accident. Container weighing is another characteristic that can be worth tracing. By connecting the port scales (physical or embedded in tower cranes) to the system, it is possible to record all the changes in the weight of a container and use this info for a double check with the information present in the container document.

2.1.5.3 Example: operators' safety monitoring

A mobile-connected wearable IoT device can be used to detect accidents and speed up emergency intervention in case of problem to a port operator. The wearable device traces information about the operator activity and his biometric data: it can recognize a dangerous situation (fall of the operator, no movements, irregular heartrate) and send alert to a rescue team. An emergency button is also available for the operator on the wearable to ask for help in case of problems. The device uses a NB-IoT SIM that is connected to the operator's IoT platform, recording information in an encrypted database, storing in the Blockchain the hash of the data in order to certify the operator's movements and biometric data. Blockchain certification can be helpful to provide trusted data about the accident in case of investigations.

2.2 Context from the Research/Innovation Point of View

2.2.1 Introduction

Blockchain is an innovative and emerging technology and its spread is ever increasing both in academia and business organizations. Since it was first proposed to support cryptocurrencies like Bitcoin, cryptocurrency Blockchains and related applications are often labelled as Blockchain 1.0. Because Blockchain technologies are uniquely suited to verifying, securing, and sharing data, they are particularly useful for managing multi-party, inter-organizational, and cross-border transactions and consequently, many other more complex applications can be built on top of this disruptive innovation. Therefore, after an initial period of application to cryptocurrencies and to the financial world, Blockchain technology has been successfully exploited in many other different scenarios, also including supply chain management. The key exploited concepts in the application of the Blockchain technology to this context are visibility, transparency, immutability, auditability, accountability, and traceability: using a Blockchain to digitize a digital asset (for example by associating them a unique tamper resistant code) and to record all the information associated with them,

as well as their passages between links in the supply chain, it is possible to obtain a secure and transparent supply chain management system on top of the Blockchain. Furthermore, since all information stored on the Blockchain is immutable under Blockchain security assumptions, it becomes impossible to tamper with the system.

2.2.2 Analysis and Assessment of Existing Blockchain Initiatives in Logistics, Transportation and Supply Chain Management

As regards the existing Blockchain initiatives in the supply chain management sector, a number of real examples can be found in industries in which provenance is fundamental. For example, in the diamond industry the tracking of diamonds along the supply chain is relevant to reconstruct the origin and authenticity of the asset, but also to ensure that it has been produced or obtained with ethical methods (to avoid the so called blood diamonds). Systems that use Blockchain to track diamonds are already used alongside the traditional methods, for example, Tracr[7], that is a working prototype developed by the De Beers Group (the world's leading diamond company), and Everledger[8], that allows to store arbitrary valuable goods but strongly advertises its adoption with diamonds.

2.2.2.1 Food Supply Chain

As one can probably imagine, the food industry is a particularly suitable scenario for the application of Blockchain technology, on one hand to attest that goods are authentic and ethically produced (e.g. fair trade or organic certification), on the other to track down products to the farms or treatment plants that produced them in case of disease outbreaks or dangerous contamination or pollution. An example of the use of Blockchain technology to allow industries to communicate the origin and impact of their products to consumers is Provenance[9]: the company offers a Blockchain-based generic supply chain management system to allow traceability and transparency and their pilot experiment consisted of the tracing of tuna in Indonesia to prevent the exploitation of fishermen and illegal overfishing.

Another important contribution is the one provided by Walmart and IBM, that have collaborated to developed different solutions: in October 2016, they announced two POCs to trace the origin of mangos sold in Walmart's US stores and pork sold in its China stores[10]. In September 2018, Walmart launched its Food Traceability Initiative after a large outbreak of E. coli in romaine lettuce and Salmonella in various products, from eggs to breakfast cereal, giving its fresh leafy green suppliers a year to enable visibility into produce tracking from store back to the farm[11]. Walmart now traces over 25 products from 5 different suppliers using IBM Blockchain including produce (e.g. mangoes, strawberries, and leafy greens), meat and poultry (e.g. chicken and pork), dairy (e.g. yogurt and almond milk), and multi-ingredient products (e.g. packaged salads and baby foods).

[7] https://www.tracr.com/
[8] https://www.everledger.io/
[9] https://www.provenance.org/
[10] https://www.hyperledger.org/learn/publications/walmart-case-study
[11] https://corporate.walmart.com/media-library/document/blockchain-supplier-letter-september-2018/_proxyDocument?id=00000166-088d-dc77-a7ff-4dff689f0001

The initiatives, carried on in collaboration with Walmart, are not the only ones developed by IBM in the food industry sector: IBM Food Trust[12], first introduced in 2017 and built on Blockchain, allows the digitization of transactions and data related to the food supply chain, providing a more efficient way of working across the supply chain, benefiting all network participants (including growers, processors, shippers, retailers, regulators, and consumers) with a safer, smarter, and more sustainable food ecosystem. The solution provides authorized users with immediate access to actionable food supply chain data, from farm to store and ultimately the consumer. The complete history and current location of any individual food item, as well as accompanying information such as certifications, test data and temperature data, are readily available in seconds once uploaded onto the Blockchain.

2.2.2.2 Medical and Pharmaceutical Supply Chain

The pharmaceutical industry can be another important field of application of the new disruptive technology: in fact, Blockchain enables the traceability of individual pharmaceutical products and their ownership exchanges among supply chain trading partners, making it possible to recognize, for example, the manufacturer of a faulty drug to isolate it rapidly. In this context, in May 2020, Walmart, KPMG (a multinational professional services network, and one of the Big Four accounting organizations), IBM and Merck (a German multinational pharmaceutical, chemical and life sciences company) announced the completion of a pilot experiment aimed to work on the Federal Drug Administration's (FDA) program supporting the U.S. Drug Supply Chain Security Act (DSCSA) that addresses requirements to identify, track and trace prescription medicines and vaccines distributed within the U.S.[13].

Another example of the application of the Blockchain technology in this sector, is MiPasa[14]: it is a multi-parties and multi-source verifiable data sharing platform, that secures share information among individuals, hospitals, and authorities that will aid in public health analysis. It has been developed specifically for attested coronavirus data and it already draws data from the World Health Organization, the Centers for Disease Control and Prevention (CDC), and the Israeli Public Health Ministry.

Rapid Medical Parts[15] is another case of utilization of the Blockchain in the medical sector. It is a Blockchain-powered platform for buying and selling traceable 3-D printed parts and printing instructions for them, as well as traditionally manufactured parts that are scanned and assigned unique tracking identifiers. The system enables a decentralized manufacturing process in which customers can order and print parts, for example for medical devices, for use where and when they need them. Moreover, their design team can reverse engineer obsolete or hard to get parts and manufacturing team can build that parts quickly. In April 2020, due to the outbreak of the coronavirus pandemic, it received a Department of Defense DPA Title 3 cooperative agreement for the development of a novel emergency ventilation solution, leveraging existing CPAP and BiPAP machines and upconverting them to function as full emergency ventilators[16].

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[12] https://www.ibm.com/blockchain/solutions/food-trust

[13] https://www.merck.com/stories/merck-ibm-kpmg-and-walmart-successfully-complete-fda-pilot-program/

[14] https://www.ibm.com/blogs/blockchain/2020/03/mipasa-project-and-ibm-blockchain-team-on-open-data-platform-to-support-covid-19-response/

[15] http://rapidmedicalparts.com/

[16] http://rapidmedicalparts.com/evs4-press/

2.2.2.3 Logistic and Transportation

Blockchain can be a valuable technology for the logistic and transportation sector too: this is a complex and elaborate task, that includes the collaboration of many different companies and suppliers and the satisfaction of various standards and regulations, depending both on the different states and companies.

In 2018, ABN AMRO, Samsung SDS and the Port of Rotterdam Authority announced a collaboration to launch a pilot based on Blockchain technology with the aim of a complete, paperless integration of physical, administrative, and financial streams within international distribution chains, and of the removal of the necessity of a central authority for the certification of the transactions [17]. The adopted Blockchain-based platform has been called DELIVER. In July 2019, the group announced the completion of the Proof of Concept phase thanks to the successfully paperless and automated tracking and instantly financing of a shipping container, from Korea to the to the warehouse of Samsung SDS in Tilburg via the Port of Rotterdam[18].

Another example regarding this context is the CargoX Platform for Blockchain Document Transfer (BDT)[19], that allows to transfer original and confidential trade documents digitally: the Smart B/L is an electronic Bill of Lading, that can be sent through the CargoX Platform for BDT or any other electronic platform, whose ownership is unequivocally recorded into the Blockchain itself and can be transacted to a new owner, who can then legally claim ownership rights. In February 2020, CargoX BDT Platform has been granted approval by the International Group of P&I Clubs, becoming the first approved provider to use a public Blockchain network (Ethereum) for its platform [20].

2.2.2.3.1 TradeLens

Particular attention needs to be devoted to the Tradelens project, promoted, and carried out by IBM and Maersk. TradeLens is a proprietary Global Trade Digital (GTD) platform jointly developed by IBM and A.P. Moller-Maersk A/S, through its subsidiary Maersk GTD Inc. The platform was officially launched in August 2018, and currently has the participation of an important group of shipping companies, which represent 60% of the operating fleets. According to the information published in their website[21], the shipping lines subscribed to Tradelens are Aliança, CMA, Hamburg-Sud, Maersk Line, MSC, Seaboard, Safmarine, Sealand, SPIL and ZIM and it has more than 140 port terminals collaborating in the network.

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[17] https://www.portofrotterdam.com/en/news-and-press-releases/abn-amro-samsung-sds-and-the-port-of-rotterdam-authority-are-launching-a

[18] https://www.portofrotterdam.com/en/news-and-press-releases/first-blockchain-container-shipped-to-rotterdam?subsite=asia#:~:text=The%20first%20paperless%2C%20instantly%20financed,on%20Blockchain%2Dbased%20platform%20DELIVER.&text=The%20DELIVER%20concept%20fuels%20process,actors%20in%20the%20supply%20chain

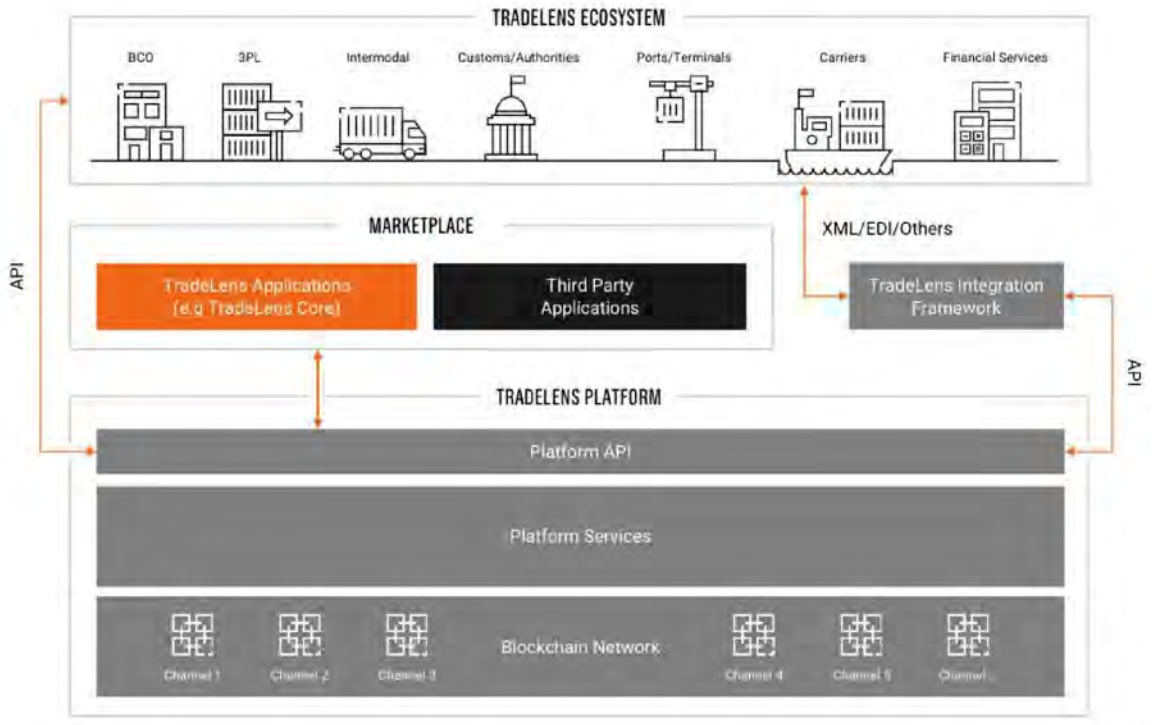
[19] https://cargox.io/solutions/for-transport-and-logistics/

[20] https://cargox.io/press-releases/full/cargox-becomes-first-public-blockchain-ethereum-bill-lading-provider-approved-international-group-pi-clubs/

[21] https://s3.us.cloud-object-storage.appdomain.cloud/tradelens-web-assets/TradeLens-Ecosystem.pdf

As a cargo flows from origin to destination through the supply chain, TradeLens participants involved in the transportation and logistics of that cargo provide data to the platform such as logistics milestones, movement information, and business documents. The TradeLens platform then enables or restricts access to this data to other participants through an authorization and permission model. The model promotes secure and rapid access to supply chain information and ensures that sensitive business information is not available to competitors or other unauthorized parties.

There are three fundamental components in the TradeLens solution, namely the ecosystem, the digital platform, and the marketplace.



As regards the **ecosystem**, the participants can be divided into two groups as follows:

- **Network members**, that provide and consume information. These can be in turn subdivided into Ocean Carriers/NVOCCs (providing the transportation plan, information about the status of shipments across the ocean leg, and critical documents such as the Bill of Lading), Ports/Terminal Operators (providing information about the disposition of cargo within the boundaries of the port/terminal), Intermodal Operators (providing transportation plans and information on the disposition of shipments carried on trucks, rail, barges, etc.), Government Authorities (providing information about the export and import clearance status for shipments into and out of the country).
- **Clients**, that consume information. These are can be in turn divided into: Shippers/BCOs (using the platform as a consumer of shipping information to improve supply chain management), Freight Forwarders/3PLs (using the platform as a consumer of shipping information), Financial Services (using the platform as a consumer of supply chain information for a variety of trade finance,

insurance, and other purposes to reduce the risk of fraud and increase speed and flexibility to customers).

The **digital platform** is accessible through an open API[22] and a Web UI interface, which links the ecosystem through open standards. The digital platform is powered by Blockchain technology in the cloud, using the Hyperledger Fabric solution (private and permissioned Blockchain network), which allows information to be shared and collaborate safely, providing visibility into movements of international container shipments. The API can be used to publish and subscribe to event data describing the physical progress of cargo through the supply chain, verify compliance with regulatory objectives, view events and objectives of previous points, manage users and access permissions. The IBM Blockchain Platform is used to address trust challenges, provide a shared view of the truth, and offer an immutable audit trail. TradeLens document handling provides seamless role-based access to structured and unstructured consignment information for all supply chain partners. Parties to the consignment can be notified when relevant documents or document amendments are published.

The **marketplace** supports the publication of authorized applications and services developed for specific purposes on the digital platform by third parties as well as TradeLens, which allows promoting innovation and the creation of value for the ecosystem. TradeLens will provide the technical foundation to enable parties to build and deploy applications. Service offerings can also be made available in the marketplace to support ecosystem members.

Communication and data sharing between TradeLens and a Platform Network Member

To become a Platform Network Member, it is necessary to sign an agreement with TradeLens. The generic description of this agreement is available on Internet[23].

The Port Authority of Valencia has become a Platform Network Member. Based on the signed agreement and the explicit authorization of the ocean/sea carriers, the following events are being reported by the ValenciaportPCS to TradeLens: empty container gate out from port terminal/depot; gate in fill at export terminal (actual); container loaded onboard on vessel; vessel departure (actual); vessel arrival (actual); discharge at import terminal (actual); gate out full container (actual); empty container gate in at destination terminal. All these events are being collected by ValenciaportPCS from the different container terminals and depots working in the port. ValenciaportPCS is configured to send only these events when the container is managed by a sea or ocean carrier that has explicitly agreed to send this information to TradeLens.

Within this agreement, TradeLens is providing the Port Authority of Valencia with the visibility of the consignment and container movements where the port of Valencia is involved. Information disclosed by TradeLens to the Port Authority of Valencia only contains some operational related data. There is not any commercial related data registered in the consignments and containers data that is being disclosed to the Port Authority. The information provided by TradeLens is intended only for the internal use of the Port Authority and it cannot be disclosed to third parties: data is not being used in the Port Community System

[22] https://platform-sandbox.tradelens.com/documentation/swagger/
https://docs.tradelens.com/reference/api_user_guide/

[23] http://www-03.ibm.com/software/sla/sladb.nsf/pdf/8226-03/$file/i126-8226-03_07-2019_en_US.pdf

as it is provided exclusively for the Port Authority internal use and cannot be disclosed to any port community member except for the terminal where the container was handled.

The Cloud Service provided by TradeLens includes APIs for publishing and subscribing to event data describing the physical progress of cargo through the supply chain and associated regulatory/compliance milestones including events related to documents; the solution also includes a user interface for viewing these events, milestones, and documents.

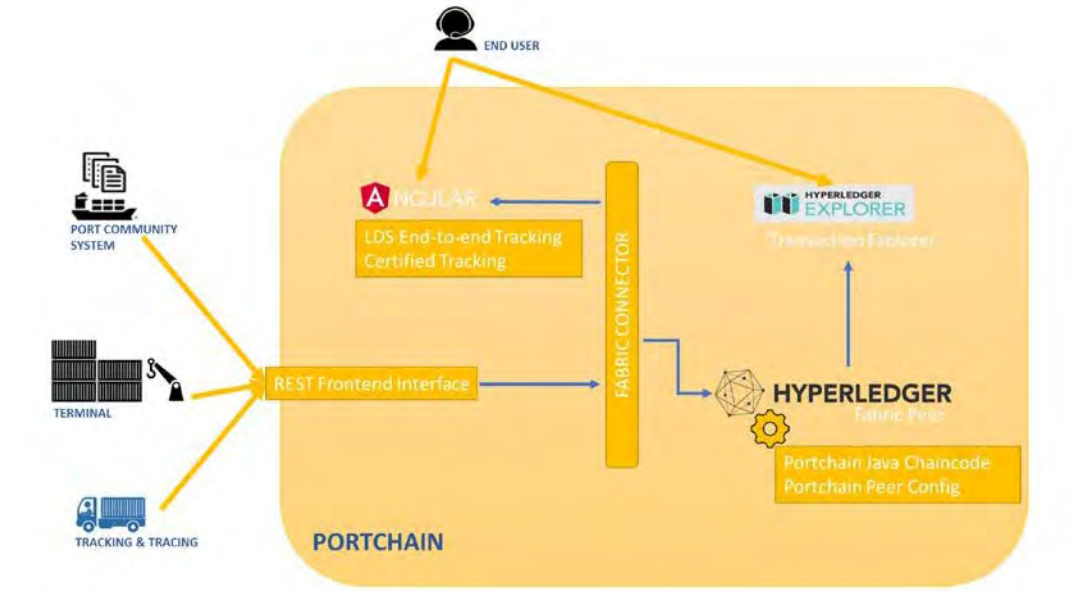
2.2.3 References to Blockchain initiatives in Genova and Valencia

2.2.3.1 Portchain

Portchain is a platform developed by Logistic DataSpace for the support of the digital exchange of data in the context of the logistic operation of the port of Genova. The project is proposed as an application for the collection of information and data related to the traffic of goods within a logistic node (specifically Genova): the system provides different services through the definition of specific smart contracts. Information and services can be provided and requested by any actor authorized by the access control policies of the platform. Despite what can be obtained with a traditional architecture (i.e. a centralized system managed by a third trusted entity), the infrastructure is manage by a community of subjects, defined as a consortium, which is therefore entrusted with the management of the Blockchain network.

The project consists of different phases: the initial and simplified version aimed to assess the potentiality of Blockchain in the management of container in port; this first step of the project is now ended and led to the creation of a PoC, that allows to submit documents representing events related to container to the system, and executing complex queries on them. The second phase of the project is currently under development and its main goal is to create a digital model that is as consistent as possible with the real model of a logistic node, with the definition of more specific assets too.

As regards the technological infrastructure, a private and permissioned Blockchain has been chosen and specifically, the PoC for the first phase of the project is based on IBM Hyperledger Fabric. Furthermore, an Angular frontend and a Spring Boot backend connected to the Blockchain have been developed in order to allow users to take full advantages of the system.



2.2.3.2 GESPORT 4.0

The GESPORT 4.0 - Container Port Management 4.0 project, was an industrial research project started in Valencia in 2018. It aimed to check the feasibility and capabilities to apply Blockchain technology to propose new solutions dedicated to improving the efficiency and security of the management and communication processes between the different agents that take part in transport logistics operations for the container management processes at ports. On this platform, all the parties involved can verify the origin and validity of the documentation provided by each one in a transparent way for all participating agents. The different project phases were the following:

- Redesign the container import sub-process of Valencia port under Blockchain technology, at a conceptual and technical level, focusing on integration with third-party systems, all with the aim of generating greater efficiency, resilience, trust, and competitiveness in this ecosystem.
- Analyse and select the best Blockchain architecture and solution to cover the business use case.
- Develop a Proof of Concept. The PoC was carried out with the support of a large shipping line and a container terminal at the port of Valencia.

As regard the first step of the project, the process has included different actions: replace manual processes that are waiting for certain events to occur; develop a way to allow notification of status changes; avoid duplication of information between Blockchain registries and achieving a single source of truth; include and model all the processes from discharging the container to delivering it to the end customer, including the return of the empty container; handle the generation of events that parties involved need to receive about the information of creation or updating in the distributed registries; establish access restrictions to registered information to guarantee the information privacy.

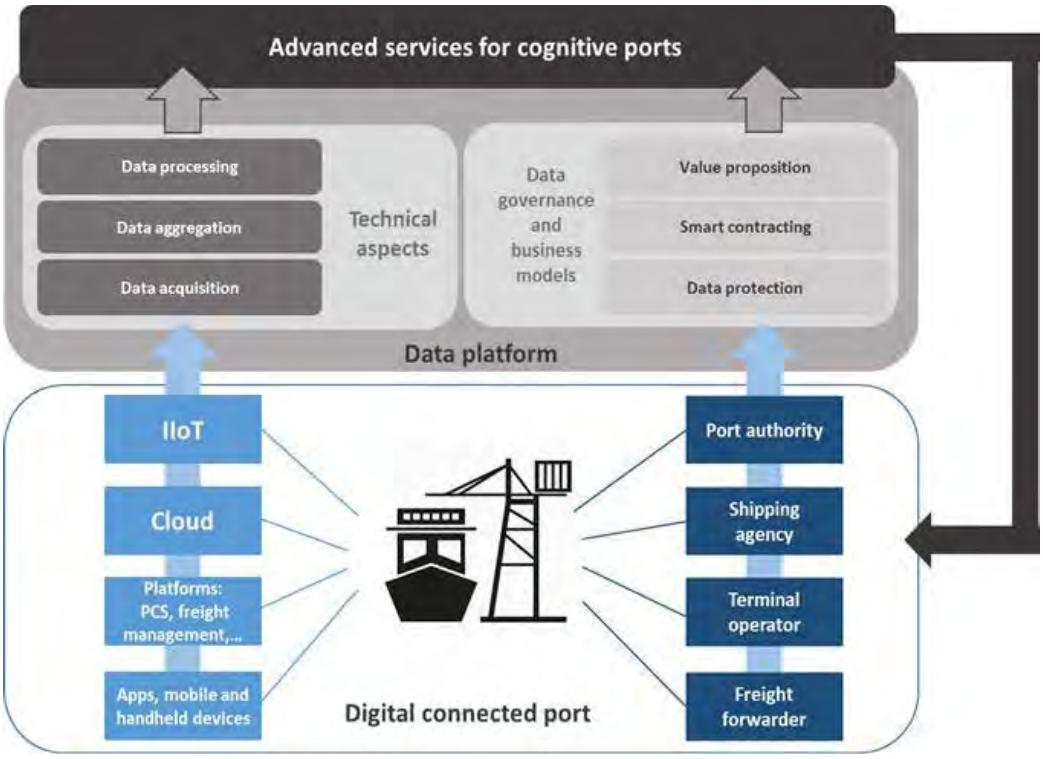
Referring to the technological infrastructure, a private and permissioned Blockchain has been chosen, specifically Hyperledger Fabric. Furthermore, Kubernetes was used as the deployment technology, and the

project was deployed on the AWS infrastructure (but it is no longer available, since the project is considered ended).

The conclusion of this research was that Blockchain technology could be relevant for designing the new generation of port community systems due to the characteristics of trust, resilience, immutability, and proof of origin that this technology can provide.

2.2.3.3 DataPorts

DataPorts: A Data Platform for the Cognitive Ports of the Future, is an ongoing research and innovation project developed by Valenciaport Foundation, approved in the H2020 programme. The aim of the DataPorts project is to take advantage of the large amount of data generated around modern seaports thanks to the high level of digitization, creating a data market in which companies in the transport chain can participate: this solution will allow users to connect and share data, thereby enabling the continuous tracking of goods along the supply chain through various ports, as well as the application of techniques based on artificial intelligence and global-level data to provide cognitive services, improve the efficiency of processes and reduce the environmental impact; in other words, this will enable the creation of Big Data solutions, using Blockchain to make the integration of data sources significantly easier, faster, and more reliable.



In the case of the Port of Valencia, the aim is to connect data from different sources such as the PCS, the port 4.0 platform, a freight forwarder system, a container tracking system, and a PMS (Port Management System). With this data, various applications can be created for freight tracking, container tracking, state control of freight transport, real time control of operations, streamlined decision making, prediction of future events and situations, prescriptive analytics.

To be more specific, some of the capabilities of the DataPorts platform will be the following:

- It will offer all the necessary services to provide security and protection features of data shared and traded between the various stakeholders of the freight transport chains, and easily plug them into different Port Community Systems, Single Windows and other government systems, for formalities and controlling trade and transport, ensuring a unique source of truth.
- It will ensure the needed anonymization or de-identification mechanisms while preserving the individual features that are required for effective big data analytics, and will also provide a better, more secure, and resilient environment to exchange data.
- It will provide a smart, secure, reliable and trusted ecosystem, a clear framework for the stakeholders to safely exchange and share data, and clear rules on where the data will be stored and how will be accessed, a flexibility of the policies on data distribution, different platform governance capabilities and interoperability among different platforms.
- It will enable the connection to external sources of data (including both internal and external freight movement business like banking, insurance, government, ocean shipping, ports, airports, international logistics and parcel industries), which will enrich the data-driven process in the Smart Freight Transport.

Valenciaport Foundation, with the support of different partners of the consortium, will establish and configure a private Blockchain network to be used for the experimentation and testing of the solutions that will be designed for the Dataports shared platform. The resulting Blockchain infrastructure could be leveraged and used for the development and demonstration of the B2T2 prototype.

2.2.3.4 Planet

PLANET: Progress towards Federated Logistics through the Integration of TEN-T into a Global Trade Network, is another ongoing research and innovation project developed by Valenciaport Foundation, also included in the H2020 programme. The project aims to assess the impact of emerging global trade corridors on the TEN-T network and ensure effective integration of the European Network to the Global Network by exploiting two approaches: on one hand, a Geo-economics approach, modelling and specifying the dynamics of new trade routes and its impacts on logistics infrastructure and operations, with specific reference to TEN-T, including peripheral regions and landlocked developing countries; on the other hand, an EU-Global network enablement through disruptive concepts and technologies (IoT, Blockchain and PI, 5G, 3D printing, autonomous vehicles/automation, hyperloop), aligned to the DTLF [24] concept of a federated network of Transport and Logistic (T&L) platforms. Furthermore, PLANET seeks to advance the European Commission's strategy for Smart, Green and Integrated Transport and Logistics by efficiently interconnecting infrastructure as well as to optimize the use of current and emerging transport modes and

[24] https://www.dtlf.eu/

technological solutions. The realization of this vision will lead to the so called Integrated Green EU-Global T&L Network (EGTN).

PLANET is also aligned with ALICE[25] Corridors, Hubs and Synchromodality Roadmap[26] based on Physical Internet (PI). As pointed out by the roadmap, network integration has been focused on interconnectivity and interoperability of transport processes and equipment, while important dynamic qualities of the transport system such as flexibility, resilience and responsiveness are still underdeveloped. Integration has not been achieved in the vertical sense, aligning transport services with supply chain requirements of manufacturers, distributors, and the wholesale sector. Freight services are, therefore, insufficiently customer-oriented to serve increasingly diverse client's needs. Information systems are key enablers for synchromodality, therefore the implementation of the roadmap will rely on the availability of ICT and other technologies supporting the PI concept. PI is pursuing an open global logistic system founded on physical, digital, and operational interconnectivity, through encapsulation, interfaces and protocols design, aiming to move, store, realize, supply and use physical objects throughout the world in a manner that is economically, environmentally and socially efficient and sustainable. Recently ALICE has created a working group for Logistics Nodes towards Physical Internet for building ports and hubs interconnectivity and digital platforms' ecosystems. The challenge will be to develop automated, standardized and connected processes and procedures in nodes belonging to logistics networks (the Physical Internet).

One of the use case of the PLANET project focus on import/export door-to-door transport chain of containerized cargo between China and Spain and it will evaluate how the combination of IoT (for real-time monitoring of logistics assets), AI (for better forecasts and intelligent decisions based on machine learning algorithms) and Blockchain (for paperless transactions and the register of transport events), can contribute to a better management of the transport chain. These scenarios will demonstrate secure and privacy-preserving logistics data sharing infrastructures for globally interconnected supply chains, to increase confidence in their use and to automate complex supply chain processes use case.

Another expected result will be to achieve Blockchain integration: as various implementations of Blockchain solutions are already available/developed, PLANET will focus principally on how one Blockchain system can integrate and interoperate with another in facilitating transport workflows and smart contracts across these actors. To this end, PLANET has established the objective to achieve the federation of more than three industry platforms and Blockchain.

[25] Alliance for Logistic Innovation through Collaboration in Europe
[26] http://www.etp-logistics.eu/wp-content/uploads/2015/08/W26mayo-kopie.pdf

3. Go-to-market. Dissemination and Outreach

3.1 Introduction

B2T2 aims at investigating the opportunity to create Blockchain Based Tracking and Tracing services. The fact that Blockchain is still in its infancy and, on the other hand, the need to come up with marketable products and services in the short term (e.g., order of magnitude of one year) suggested to split go-to-market into two lines, the first aiming at introducing innovative solutions at a local level leveraging the participation of the user communities in Genova and Valencia, and the second aiming at extending the innovative solutions to a worldwide level leveraging scientific research and advanced technology development.

The objective to provide a concrete answer to user needs in Genova and Valencia, which are two among the largest ports in the Mediterranean Sea, led to the need to develop a thorough analysis of requirements. The activity meetings held in 2020 and listed in Sections 2.2, mainly devoted to such an analysis, consisted of presentations aimed at sharing information on the business communities located in the Ports of Genova and Valencia and to discussions aimed at the identification of a common language and of a taxonomy of actors, problems, requirements, and services.

In parallel, SIS started an intense activity of communication of the B2T2 activity to port operators and companies, to attract their interest to explore the possibility to involve them in the startup through their associations (see Section 3.5). This activity led to the involvement of one of the largest communities, namely that of Truck Fleet Management companies, as a co-founder.

3.2 Created Outputs and Material in 2020

As a result of the activities carried out by B2T2 in 2020 we may report:

1. An internal document provided by FV entitled “Description of ValenciaportPCS”
2. An internal collection of project descriptions provided by FV related to “GESPORT”, “Dataports”, “Planet”
3. An internal document provided by FV on “Tradelens”
4. An internal document provided by Infoport entitled “Track&Trace Services in the Port of Valencia”
5. A document provided by SIS entitled “Blockchain for Ports, Logistics and Transportation”
6. A document provided by TIM entitled “Use of Cellular-IoT and role for telco operators”

These documents were summarized and integrated in Section 2 of the current Deliverable.

3.3 Co-Branding

B2T2 started in September 2020, under the early-bird scheme, to establish a framework of cooperation among participants, to collect and systematize information on the context both from the technology point of view and from the application point of view, to refine the go-to-market strategy, and to create the appropriate instruments to perform the activities in 2021.

Communication was not the main focus in 2020. However, communication was central to finalize one of the main early-bird activities, closed positively in December, namely the creation of TUIT, the start-up company that will market the activity results starting in 2021.

The process that led to the creation of TUIT started and proceeded with the presentation of B2T2 to the Genova Port Community and to the Genova Port Authority. Although no specific document was officially issued the presentations relied on slide sets in which appropriate credit was given to the European Union and more specifically to EIT Digital.

SIS took advantage of the level and of the relevance of the action to raise the awareness of the Genova Port Community on Blockchain technology and to attract the interests of the main port associations of operators that operate in the area of Genova.

In all presentations EU and EIT Digital were given appropriate credit on slides, speeches and communication. Of course, co-branding will become more intense and specific in 2021, as soon as TUIT will start operation and the B2T2 partners will start to issue official reports and papers.

3.4 Dissemination Plan

Dissemination started in the first week of September, before the beginning of the project. At that time dissemination addressed two issues, namely that of letting the port operators of the Genova Port Community know about the activation of B2T2, and that of collecting suggestions and requirements from such a community.

As a result of such an activity, Trasporto Unito, one of the largest associations of Fleet Management Companies, decided to support the startup that we were about to create and enter the group of founders. The startup, named TUIT, was created on 11 December 2020.

Currently TUIT is preparing its offer to truck drivers and truck fleets. It is working in stealth mode and plans to propose the first services before 30 June 2021. As soon as the offer reaches an appropriate level of stability, dissemination and promotion will start. This time dissemination will be about products and services, to attract customers and more in general users, to build proof of concepts and pilots and to start sales.

While the TUIT short-term business line works to finalize the products/services to be promoted and marketed in mid-2021, the long-term business line is undertaking a more general study aimed at investigating the application of Blockchain Technology to the domain of transportation, logistics and ports

and to study the evolution of Blockchain technology, focusing in particular on the evolution from Proof of Work to Proof of Chain. We expect to submit a couple of papers to conferences, journals and magazines by mid-2021.

3.5 Startup

3.5.1 Introduction

The original scenario presented in the B2T2 targets the ambitious goal of creating a reference Blockchain platform for transport digitalization and more specifically for goods tracking and tracing, both in the global origin-to-destination scenario and in the local inside-port scenario.

B2T2 targets the creation of a startup company to market the results of the project. SIS, the B2T2 coordinator, and Docspace, a spin off company of the University of Genova, were supposed to be the founders at project submission.

Since the B2T2 kick-off meeting, SIS has been developing an intense promotional activity to attract the interest of partners that can give the B2T2 startup a competitive advantage not only in the long term but also in the short term, considering that at the moment Blockchain technology is in its infancy and may take years to converge to a level of maturity that allows developing and marketing engineered solutions. On the other hand, B2T2 will span a short time frame, i.e., just one year, which does not appear to be compatible with that of Blockchain technology evolution.

The direction that we chose to harmonize these two different time frames is a diversification of the activity of the startup, based on the integration of the long-term high-risk ambitious goal with a short-term, lower-risk and less-ambitious goal. Such an evolution guarantees the survival of the company after the end of the B2T2 innovation activity and allows maintaining the long-term research line active in the future.

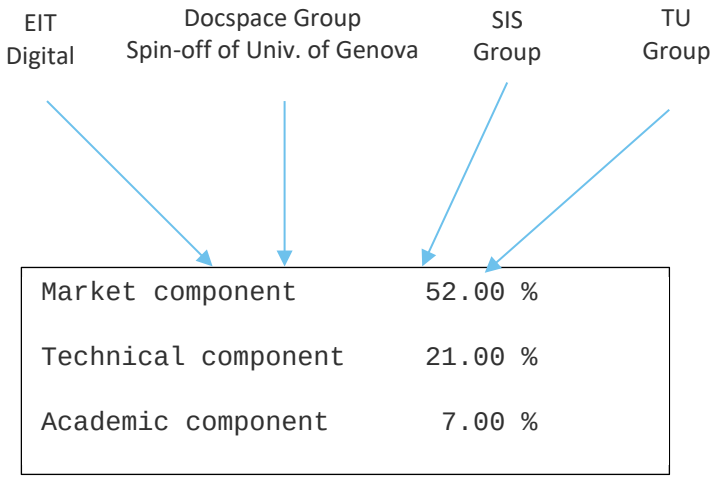
SIS received expressions of interest from many transportation companies operating in the area of the Port of Genova. In particular, one of the most powerful associations of Truck Fleet Companies in Italy, named Trasporto Unito[27], proposed to integrate an initiative of theirs, aimed at supporting the integration of Truck Fleets with Port Community Systems, with the B2T2 initiative, aimed at developing Blockchain based solutions for Tracking and Tracing. In these latest weeks SIS had several meetings with Trasporto Unito (more specifically with Giuseppe Tagnochetti, Director, and Pietro Teglia, Key Technical Person) and with EIT Digital (Antonio Hortal and Diva Tommei) to converge to a corporate structure which satisfies SIS, Docspace and Trasporto Unito and at the same time complies with the EIT Digital constraints.

The startup deriving from such an integration will have the activation of a new Short-Term Line of Business as a main result. That will lead the company to access market during 2021 and to become cash flow positive in 2022.

[27] https://www.trasportounito.net/

3.5.2 Corporate Structure and Founders

The TUIT Corporate structure is depicted below:



TU, which represents the driver to the market, holds 52% of shares, SIS, which represents the technical component, holds 36% of shares, and Docspace, which represents the scientific component, holds 12% of shares. SIS and Docspace took the commitment to release 20% of the company shares to EIT Digital, as agreed in these latest weeks.

The key founders are the Director of TU, Giuseppe Tagnochetti, through its service company named Gimado, the key technical reference person of TU, Pietro Teglia, Giorgio Cavo, CEO of SIS through its home company CGI, who is also the B2T2 coordinator, and Proff. Pierpaolo Baglietto and Massimo Maresca, through Docspace, the spin-off company that they have founded at the University of Genova.

Consequently, the key TUIT reference people are:

- Giorgio Cavo: He has been the key reference person of the Port Community System of the Port of Genova for three decades. He is the CEO of SIS and of Hub Telematica, the company owned by the Freight Forwarder Association and by the Shipping Agent Association of the Port of Genova that has been operating the Genova Port Community System since 2000. He is probably one of the most influential people in the Genova port community.
- Giuseppe Tagnochetti: He has been the key reference person for Truck Fleet Management companies, through Trasporto Unito and through a set of service companies that he leads as a CEO, for over a decade. Truck Fleet Management companies are one of the richest markets for Intelligent Transportation Systems, in particular in Italy where road traffic covers more than 90% of inland

transportation. Tens of thousands of Truck Fleet Management companies, in Italy and in Europe, suffer from the inefficiency of telematic integration with ports and logistic infrastructures.

- Pierpaolo Baglietto: He is an Associate Professor at the University of Genova, in charge of the classes of Computer Systems and Distributed Systems at the Polytechnic School. He has been leading research projects in the area of logistics and transportation for decades.
- Massimo Maresca: He is a Professor at the University of Genova, in charge of the classes of Computer Networks and Software Platforms at the Polytechnic School. He is also the Director of the Research Center on Computer Platforms, a research center that he founded in 2004 with the University of Padova (Italy) and with the University of Sassari (Italy).

3.5.3 Business Plan overview and Lines of Business

SIS confirms the original plan proposed. In 2021 TUIT will create a new Blockchain based platform for Tracking and Tracing in the logistic/transportation domain. Thanks to the inclusion of TU, the original plan is enriched through the inclusion of a short-term line of business to reduce time-to-market. TUIT expects to launch new services in 2021, initially introducing the main Blockchain principles in state-of-the-art technologies to develop innovative services, and then gradually evolving to a Blockchain based platform to enable the creation of more advanced services.

More specifically, the long-term line of business is concerned with the identification of the opportunities that ports and more in general the transportation domain offer for the application of Blockchain technology. TUIT expects to identify suitable business objectives by June 2021, so as to start the development of marketable solutions by the end of the year.

The short-term line of business targets the connection of Truck Fleets to the Port Community System. TUIT counts on the possibility to develop mobile tools for a wide number of potential users (typically truck drivers and related companies) who currently suffer from the rigidity of Port Community Access. The market space seems to be large enough to obtain significant revenues by the end of 2021.

In 2021 TUIT plans to activate new research projects and invest internal resources to fund long-term research in 2022 and beyond.

3.5.4 Status of the Startup Initiative and Administrative Issues

TUIT was created on Dec. 11, 2020. Its name emphasizes the connection of TUIT with Trasporto Unito.

SIS has just submitted a project amendment to EIT to include TUIT and Docspace as additional partners of B2T2, following the scheme indicated in the project submitted and approved. TUIT and Docspace has applied to become EIT Digital partners.

Trasporto Unito will start to coordinate the sales/marketing activities of TUIT starting in January 2021. It will take a leading role not only in sales and marketing but also in business development, to guarantee that the company become cash-flow positive at the end of 2021. Trasporto Unito will contribute to the definition of requirements and of specifications, leveraging its knowledge of market and of user needs. In addition, it

will act as a bridge to the community of customers and will favour pilot projects and sales to early adopters, some of which have been already identified.

SIS (through CGI) and Docspace will take a leading role to design, implement, deploy, and test the Blockchain Based Tracking and Tracing platform and services. They will maintain the technical-scientific leadership and guarantee a strong synergy between the short-term line of business and the long-term line of business. In such a regard, SIS and Docspace have stipulated an agreement with Trasporto Unito to guarantee that control of research/innovation activities funded by EIT remains under their control.

In addition, if EIT Digital decides to leave the startup company or to reduce its participation in it, the original founders will have the right to buy back the shares that EIT will release. A specific agreement with the new industrial partner has been recently stipulated in such a regard.