Cyber Secure Light

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Map of KET and R&D alliance partners for SMEs

Short Description	Joint multi-faceted prospect map of target clusters regional, national and EU complementary industries and KET centers providing innovative solutions of IoT digital security for the companies operating in the smart building context, aimed to track strategic business and R&D alliance partners for project clusters SMEs
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Summary of contents

1. Introduction

This document aims to establish a multi-faceted prospect map, elaborated jointly by all partners, of their regional, national and EU complementary industries and KET centres providing innovative solutions of IoT digital security for the companies operating in the smart building context, in order to track strategic business and R&D alliance partners for their SMEs.

This mapping process has been carried out with an analysis of technology solutions and transfer opportunities offer by our own R&D/academia members, to encourage and strengthen internal cooperation within their networks. Afterwards, it has been extended to national and European level.

2. General concepts

Smart lighting is playing a pivotal role, unlocking the power of the IoT and smart building applications. Lighting is ubiquitous throughout all buildings and every luminaire is connected to a source of power. It is the perfect conduit for collecting data on what is happening in the building at any given time. Sensors are embedded in the luminaire making each light point a data node on the network.

What is driving adoption of smart lighting systems?

- Energy and operational savings - [1]According to IBM, the day-to-day operation of a building represents over 70% of the total cost of that building over its lifespan. The immediate impact of IoT in commercial buildings is to lower operations costs, particularly in the form of energy savings.
- Building Efficiencies – By creating a digital version of a building and its internal operations including systems (lighting, HVAC, security, etc.) and occupant activities, you can visualize what is actually happening in the building and use those insights to make better decisions. The granularity of data within a lighting system from different sensors can be analyzed to create a detailed picture of a space. These new insights enable facility executives to centrally manage systems in the building or group of buildings while improving efficiencies.

[1] IBM - 4 BIG ways IoT impacts building management [+]

- Occupant Health and Well-Being – [2]According to Navigant Research, "In recent years, there has been a growing shift toward occupant health and well-being as a driver in commercial buildings. Lighting has been a leader of building technologies within this overarching goal, allowing for increased controllability. Within commercial offices for example, the increased controllability through an IoT lighting system, can help occupants improve productivity, and stay awake and more focused on tasks."

a. Linkage between Internet of Things and Smart Lighting Cybersecurity

Connectivity allows LED lighting to go beyond lighting and energy saving to deliver revolutionary new capabilities and value for users, for cost reduction, quality lighting and considerable improvement in business processes.

By networking luminaires and lighting control points in a centralized architecture, the lighting system becomes programmable and capable of generating data. This data can be applied to strategies such as optimizing space utilization, tracking inventory or providing location-based services. These strategies, in turn, can have tangible impacts on cost reduction, process efficiency, brand reputation and user satisfaction.

While connecting devices for a variety of business purposes can produce extraordinary value, it can also entail data security and privacy risks. These risks can take many forms, with two notable attacks being tracking and vectorizing. Tracking is when a hacker intercepts data between devices and takes control of the device. A vectoral attack occurs when a hacker uses a network building system to penetrate a more secure connected corporate network for data theft.

Cybersecurity is a major challenge to the Internet of Things (IoT) as a whole (and corporate information networks beyond that), and lighting is not immune. The challenge is serious enough to be the subject of legislation like California's SB-327, which requires manufacturers of connected devices to design them with certain security features by 2020.

While the cybersecurity industry has a wealth of experience in handling potential threats, it is a new problem for many construction industries, including the lighting industry, which is now working hard to ensure that networked lighting systems are a strong link in the IoT.

[2] Navigant Research - Focus on Occupant Health and Well-Being Is Transforming the Commercial Buildings Market [+]

While all this is being developed, specifiers and designers must evaluate connected lighting systems with some basic knowledge of cybersecurity. In terms of security, what constitutes a "good" system for a given application depends on the way it is designed (security features) and the configuration (how it communicates), as well as the risk tolerance and level of technical knowledge of the owner.

For example, while IP-based systems allow lighting devices to be connected, monitored and controlled on an Internet-based network, which may facilitate remote support, the ability to access data and an enhanced function for lighting on the IoT, they may require greater security.

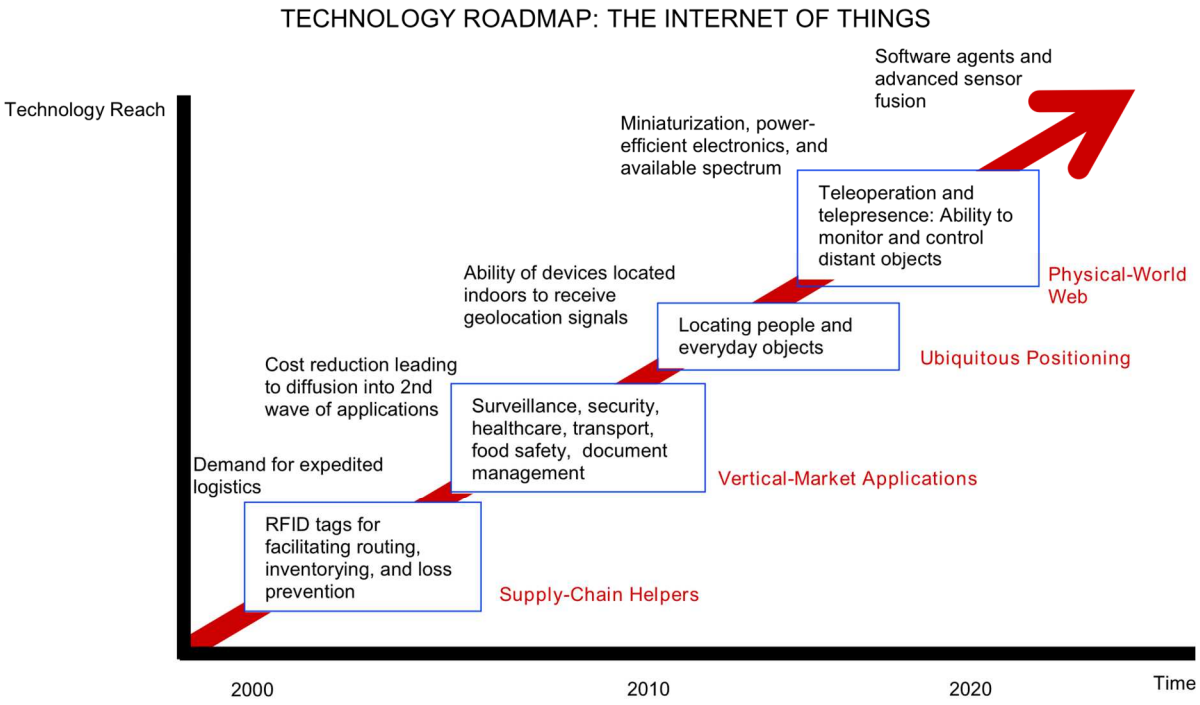
Many major manufacturers are prioritizing the problem with initiatives, based on standards and best practices such as ANSI / UL 2900-1, IEC standards, ISO 27000 and the NIST IoT Cybersecurity Framework. Over time, manufacturers will ideally optimize methodologies around best practices and design products with good integrated cybersecurity tools, making security transparent to professionals who want to focus on lighting.

IoT is likely to drive the standards-based demand for connected lighting security by involving different stakeholders as IT professionals in the decision-making process.

Grid-connected lighting and IoT are a new world, presenting exciting opportunities for end users, but requiring new skills and creating new potential risks. Experienced construction professionals will be educated on the basics, demand a good safety methodology from manufacturers and engage with the right people in the customer to ensure that all requirements are met.

b. Key Enabling Technologies for IoT and Smart Lighting

Prior to the analysis of the KET of the Internet of Things it is necessary to know the roadmap of this technology foreseen by different experts. Once we have seen these forecasts, we will be able to analyze the different KETs that will affect the IoT and more specifically the smart lighting.



Source: SRI Consulting Business Intelligence

The following is a list and description of the different KETs that must be taken into account for the optimal development of this technology linked to smart lighting.

i. Big Data

As more things or smart objects are connected to the IoT, more data is collected from them in order to perform analytics to determine trends and associations that lead to insights. For example, an oil well equipped with 20-30 sensors can generate 500,000 data points every 15 seconds, a jetliner with 6,000 sensors generates 2.5 terabytes of data per day or the more than 46 million smart utility meters installed in the U.S. generate more than 1 billion data points each day. Thus, the term “big data” refers to these large data sets that need to be collected, stored, queried, analyzed and generally managed in order to deliver on the goals of the IoT.

Further compounding the technical challenges of big data is the fact that IoT systems must deal with not only the data collected from smart objects, but also ancillary data that is needed to properly perform such analytics (e.g., public and private data sets related to weather, GIS, financial, seismic, map, GPS, crime, etc.). Thus, as more smart objects come online, at least three metrics ("the three V's") are typically used by IoT operators to describe the big data they handle: volume (i.e., the amount of data they collect from their IoT sensors measured in gigabytes, terabytes and petabytes); velocity (i.e., the speed at which data is collected from the sensors); and variety (i.e., the different types of structured and unstructured data collected, especially when compared to video and picture files as is typical within the consumer Internet).

ii. Digital Twins

Another consequence of the growing and evolving IoT is the concept of a "digital twin,". The concept refers to a digital copy of a physical asset (i.e., a smart object within the IoT), that lives and evolves in a virtual environment over the physical asset's lifetime. That is, as the sensors within the object collect real-time data, a set of models forming the digital twin is updated with all of the same information. Thus, an inspection of the digital twin would reveal the same information as a physical inspection of the smart object itself – albeit remotely. The digital twin of the smart object can then be studied to not only optimize operations of the smart object through reduced maintenance costs and downtime, but to improve the next generation of its design.

As more builders create "digital twins" of properties, it eases labor costs related to the facility management. If an air condition system needs repair- using a digital twin the technician can not only find the fault location on smartphone or tablet but can also better troubleshoot the problem using data captured in the twin. In cases where on-site visits are costly a digital twin provides remote access and more transparency than an actual site visit. Owners can send a digital twin to vendors who can then create models based on its data and reduce the needs for costly visits.

iii. Cloud Computing

As the word "cloud" is often used as a metaphor for the Internet, "cloud computing" refers to being able to access computing resources via the Internet rather than traditional systems where computing hardware is physically located on the premises of the user and any software applications are installed on such local hardware.

Cloud computing – and its three service models of Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) – are important to the IoT because it allows any user with a browser and an Internet connection to transform smart object data into actionable intelligence. That is, cloud computing provides "the virtual infrastructure for utility computing integrating applications, monitoring devices, storage devices, analytics tools, visualization platforms, and client delivery… [to] enable businesses and users to access [IoT-enabled] applications on demand anytime, anyplace and anywhere."

iv. Sensors

Central to the functionality and utility of the IoT are sensors embedded in smart objects. Such sensors are capable of detecting events or changes in a specific quantity (e.g., pressure), communicating the event or change data to the cloud (directly or via a gateway) and, in some circumstances, receiving data back from the cloud (e.g., a control command) or communicating with other smart objects. Since 2012, sensors have generally shrunk in physical size and thus have caused the IoT market to mature rapidly. More specifically: "Technological improvements created microscopic scale sensors, leading to the use of technologies like Microelectromechanical systems (MEMS). This meant that sensors were now small enough to be embedded into unique places like clothing or other [smart objects]."

v. Communications

With respect to sending and receiving data, wired and wireless communication technologies have also improved such that nearly every type of electronic equipment can provide data connectivity. This has allowed the ever-shrinking sensors embedded in smart objects to send and receive data over the cloud for collection, storage and eventual analysis.

The protocols for allowing IoT sensors to relay data include wireless technologies such as RFID, NFC, Wi-Fi, Bluetooth, Bluetooth Low Energy (BLE), XBee, ZigBee, Z-Wave, Wireless M-Bus, SIGFOX and NuelNET, as well as satellite connections and mobile networks using GSM, GPRS, 3G, LTE, or WiMAX. Wired protocols, useable by stationary smart objects, include Ethernet, HomePlug, HomePNA, HomeGrid/G.hn and LonWorks, as well as conventional telephone lines.

vi. Analytics Software

Within the IoT ecosystem, Application Service Providers (ASPs) – which may or may not di er from the companies who sell and service the smart objects – provide software to companies that can transform "raw" machine (big) data collected from smart objects into actionable intelligence (or insight).

Such software performs data mining and employs mathematical models and statistical techniques to provide insight to users. That is, events, trends and patterns are extracted from big data sets in order to present the software's end-users with insight in the form of portfolio analysis, predictions, risk analysis, automations and corrective, maintenance and optimization recommendations. In many cases, the ASPs may provide general analytical software or software targeting specific industries or types of smart objects.

vii. Edge Devices

Any device such as a router, routing switch, integrated access device (IAD), multiplexer, or metropolitan area network (MAN) and wide area network (WAN) access device which provides an entry point from the global, public Internet into an ASP's or other enterprise's private network.

In Industry 4.0, these edge devices are becoming smarter at processing data before such data even reaches an enterprise network's backbone (i.e., its core devices and cloud data centres). For example, edge devices may translate between different network protocols, and provide first-hop security, initial quality of service (QoS) and access/distribution policy functionality.

3. Map User Manual

a. General description of the tool

The tool developed jointly by all the partners for this phase of the project is a prospect map whose main objective is to track strategic business and R&D alliance partners for their SMEs.

In order to achieve this objective and ensure that all users are able to use it profitably and in compliance with their expectations, this tool has been developed which, while being open, accessible and very intuitive in its use, greatly facilitates filtering and the selection of possible partners to provide solutions or technologies considered to be enablers of the Internet of Things and, more specifically, of smart lighting.

To achieve this simplicity and accessibility for any type of stakeholder of the project we have decided to do this mapping using Google My Maps. Working with this base allows us to use customizable layers with different styles and labels with name, location and description. It also contains a wide variety of objects that function as points, such as the point of city, train, bus, hospital or school, with modifiable parameters. In addition to these features it should be noted that it can be used with most devices with Internet connection and can even download an offline version on smartphones or tablets.

One of the highlights of this tool is its life cycle, as it is an agile and dynamic tool that will be updated by all project partners including new profiles that may be interested in forming part of the future partnership that will continue to work beyond the scope of this project.

In the following points we will explain the possibilities offered by this tool, both on the type of profile that is intended to use it and the different ways of use that has the tool itself.

b. Mapping Possibilities

Once the tool that we will use to manage this prospect map is generally known, in this section we will deal with the possibilities that Google My Maps offers to the different stakeholders of the project and to the users that interest them for the development of their businesses.

The first thing that stands out when we access the mapping is that we can see in a panoramic way all the stakeholders that have shown interest in the project's subject matter distributed in their own locations in each region represented in the project and classified by the type of entity. This makes it much easier to search for partners as they can be quickly located and filtered.

Thanks to the existing filter system in which you can exclude or include different types of entities, it can be very useful for the different projects carried out by our members, because if, for example, in a project they need a partner that must be SME or that must be a University, in the mapping you can quickly filter and get the desired contact through the participants in the project. The process to be followed will be explained in the following section in detail to facilitate interaction with users of the tool.

Thus, the above-mentioned layers refer to the potential stakeholders of the project. In the mapping we will be able to find the following layers that differentiate the entities:

- **Companies**

  Included in this mapping are SME and large companies that have shown interest in participating both in the activities of the project itself and in those that derive in the future from this own initiative.

- **Complementary clusters & business networks**

  The mapping will also include other sectoral clusters or business networks that would be considered complementary and could generate synergies that foster more competitive relations between different sectors and promote best practices in terms of cybersecurity related to smart lighting industry.

- **Public initiatives and Public Administration**

  The mapping will include Public Administrations or other public initiatives whose scope of

work is the sectors related to and complementary to cybersecurity in connected lighting systems.

It is important that they are represented so that they can be at the forefront of private initiatives carried out by SMEs to learn about good practices that may inspire future regulations or potential supporting policies.

- **Universities**

  Universities are entities with a wide experience in knowledge transfer and should be included in this prospect map.

  SMEs play a very important role in the EU economy. Boosting direct knowledge transfer from universities to SMEs can improve an SME's business excellence and substantially contribute to EU competitiveness. SMEs have particular requirements from any intervention. The methods used need to be resource- and time-efficient and SMEs usually need to see a direct financial return on any investment. If these criteria are met, this classical open innovation approach can be successfully applied.

- **R&D Centers**

  R&D Centres are private, non-profit research organisations that have the material and human resources necessary to carry out activities aimed at generating technological knowledge and facilitating its exploitation, either by existing companies or by generating new business initiatives. Their success is measured in terms of the competitive improvement of companies and their contribution to the economic development of their environment.

  With different legal forms, the Technology Centres act as strategic partners of the companies. They constitute an agile and effective link of support to R&D directed specifically to the productive sector, especially to the SMEs, although they also collaborate with the Public Administrations in the performance of activities related to technological innovation.

  Among the main services offered by the Technology Centres are research and technological development, consultancy for innovation, technological services such as homologations and certifications, and technological dissemination.

  They are strongly involved with the business environment:

  - Acting as an advisor and instrumental agent at the service of the technological

policy of the Public Administrations.

- Promoting joint actions and exchanging knowledge and experiences, so that this activity benefits the productive fabric of the country.
- Cooperating actively in the strengthening, efficiency and coordination of the Spanish and European system of Science, Technology and Enterprise.

- **CSL Partners**

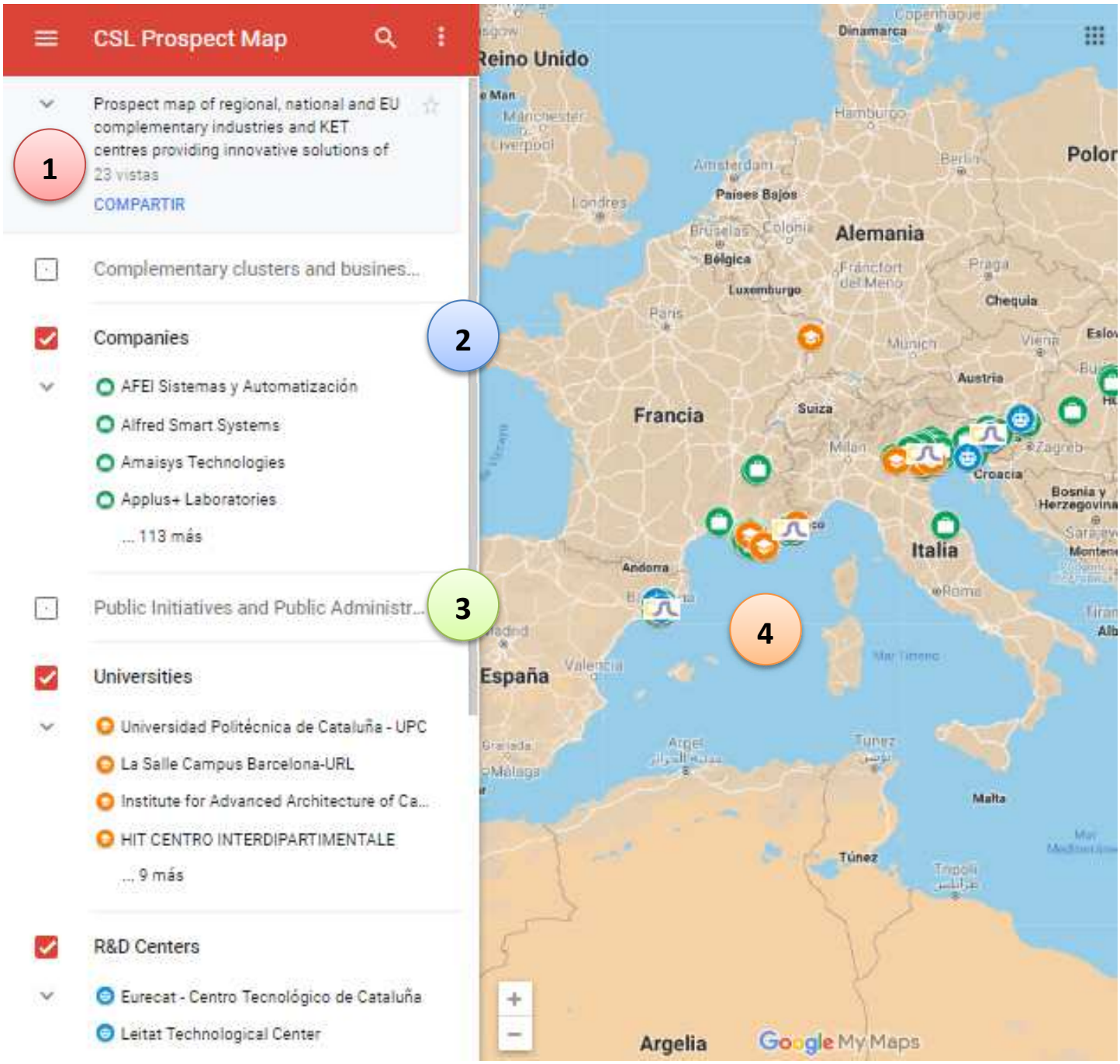
  The participants of this project will appear prominently as they will act as a regional contact point to connect supply and demand and facilitate access to KET or other SME needs by promoting effective networking.

All the profiles that have been described have more information included in this prospect map as a description of each entity with its strengths and main business, website or its location.

c. Use of mapping

In this section we will proceed on the one hand to identify each item that we will find in the mapping and on the other hand we will include a tutorial or user manual both for stakeholders who want to use it to find partners, and for the project participants themselves to update it.

Identifying the different items



1. Information about the tool and the project.

2. Selected profile for filter
3. Unselected profile for filter
4. Interactive map

Once the different items of which this tool is composed are known, we will explain the different ways of use of the mapping.

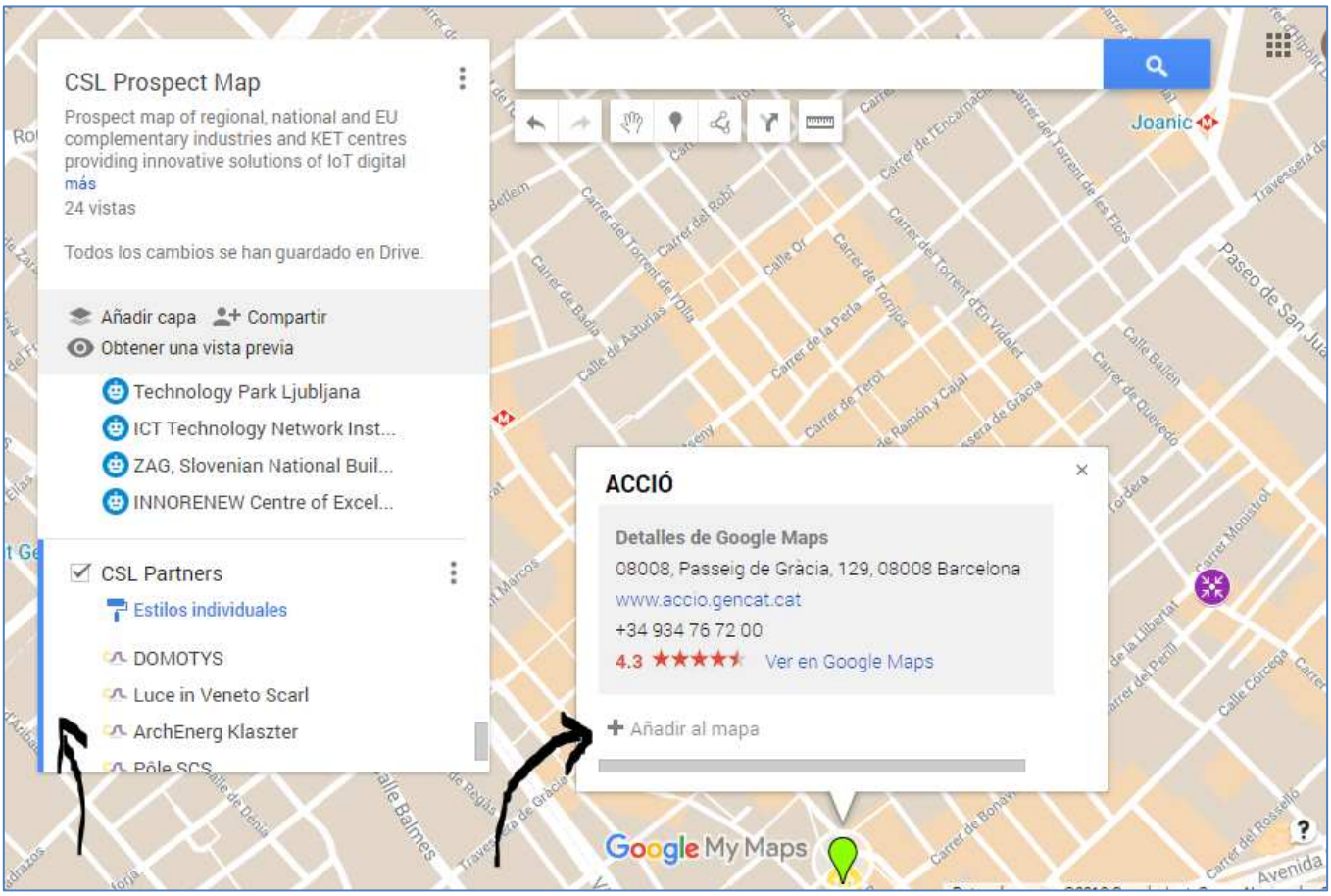
We will start with the part that corresponds to us the participants of the project and that must be known in order to be able to update this mapping with new profiles.

i. Instructions for project participants

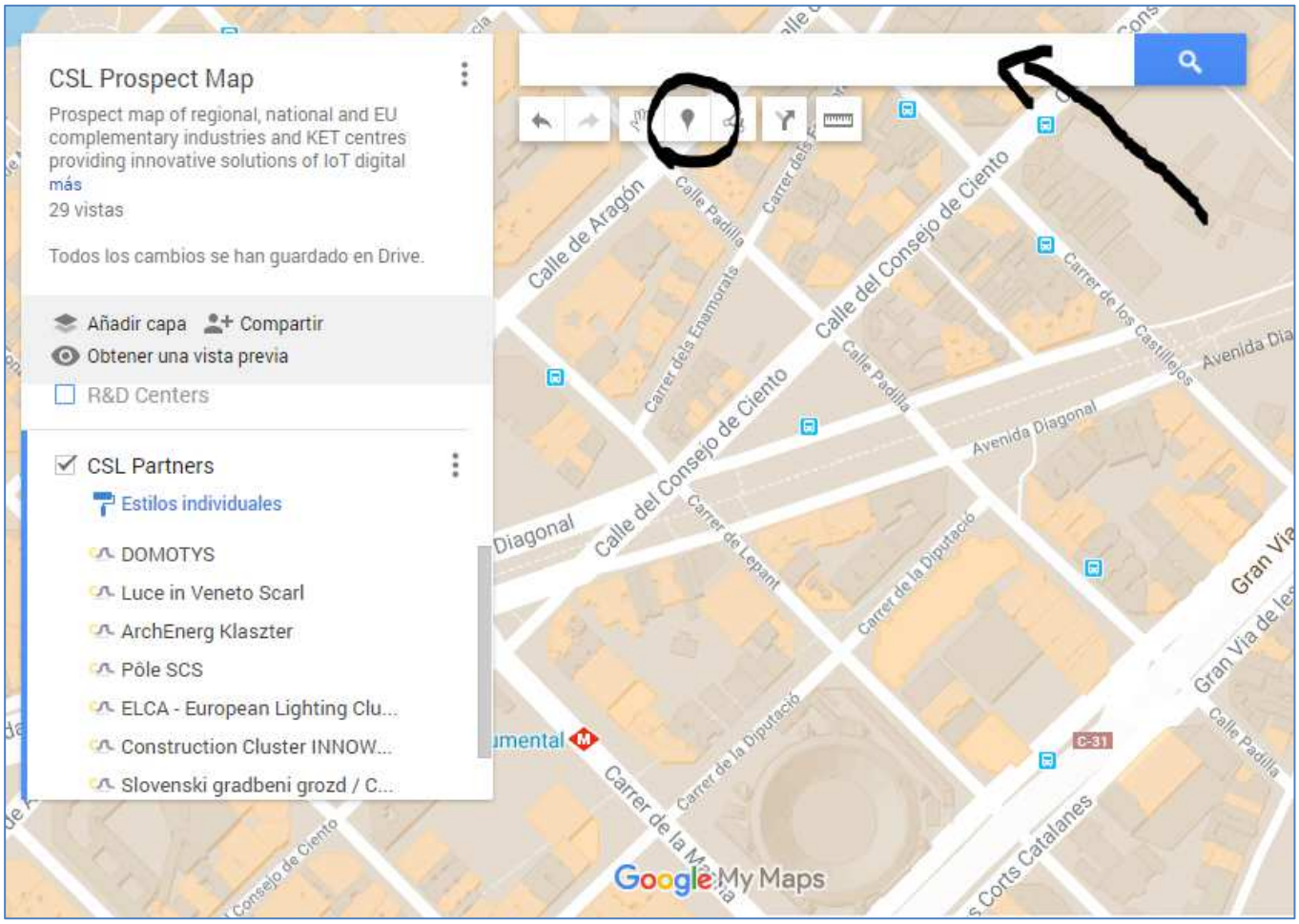
Once the tool base is created, it will be easy for the different partners to add new profiles to the mapping. Below are indications for the correct use:

1. Access the tool edition using the link provided here. In addition to this link, all partners have received an invitation in their emails to access and include this mapping between their Google My Maps for faster and easier access.
2. To add a new profile, the first thing you need to do is to be clear about which of the existing categories that profile fits into. Once you have decided, you must select by clicking that layer from among all the existing ones.

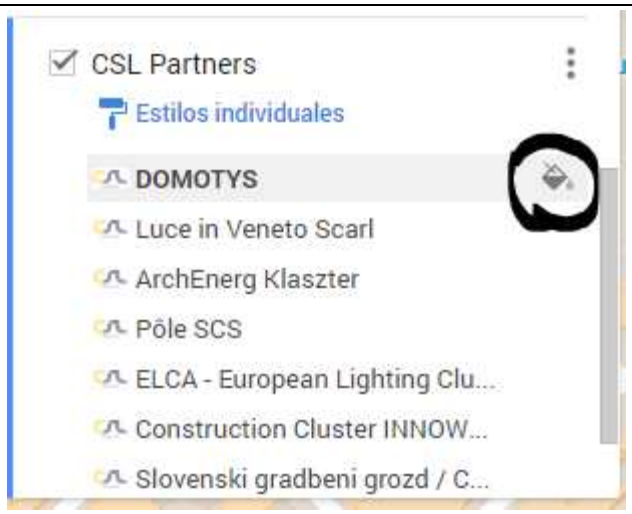
3. Once you have selected the correct layer you have two options to try in this order. First, we will introduce in the search engine the information of this profile to locate it in Google Maps. If they appear in Google Maps and we can locate it, we will simply have to add it with the "Add to map" button.

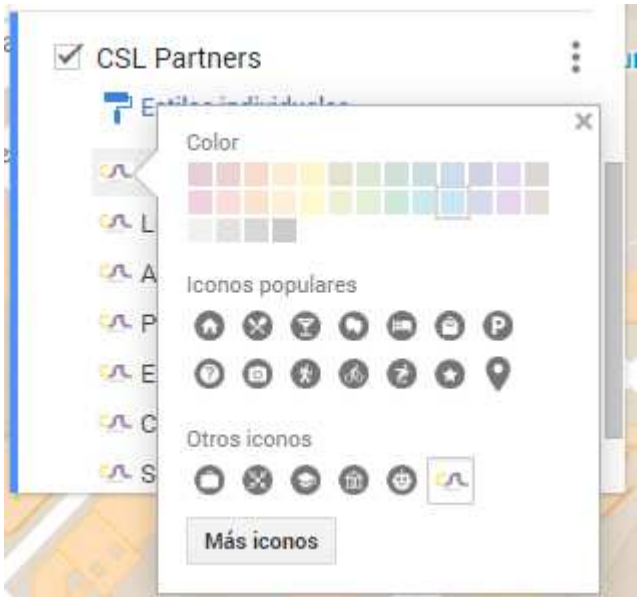


4. If it doesn't appear in Google Maps we have the option to add it to our map in another way that we explain in this point. Simply enter an address on the map or select the add marker button and select a point directly on the map.



5. Once you have added the desired marker, simply unify the format so that it matches the rest of the profiles included in the corresponding layer.





6. Once the format is unified, this profile will be included in the mapping.

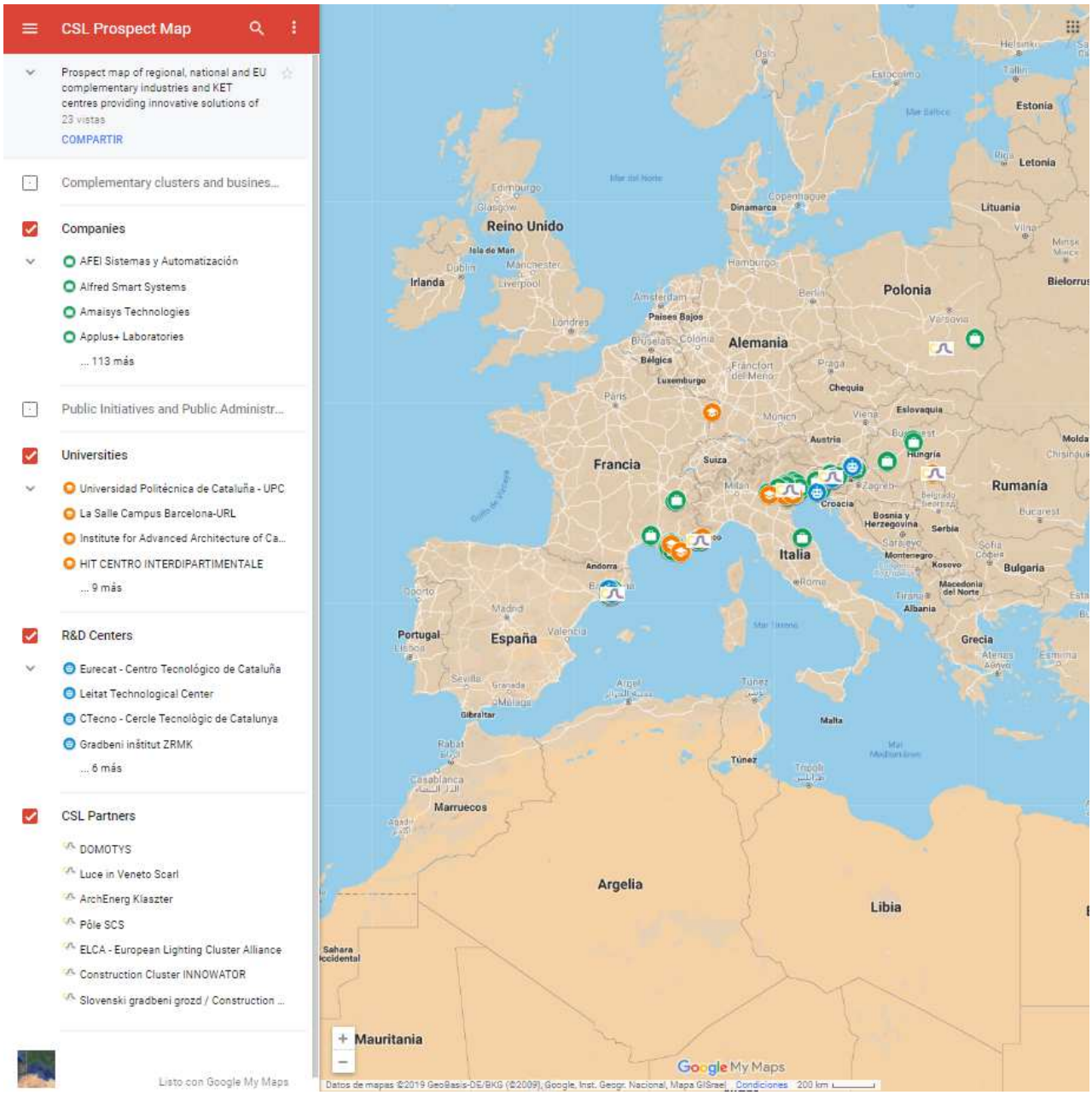
ii. Instructions for project stakeholders

The following instructions will be useful both for an entity that independently wants to look for a suitable partner, and for the project partners themselves who will be able to promote effective networking attending to the demands, needs or interests of their stakeholders.

How to find a partner?

1. The first step will be to access the elaborated mapping. This access can be done through the website or through the link provided here that can be shared by all project participants.

2. Once inside Google My Maps we will find the following screen:



3. In this screen the first thing you must have clear is what type of partner we are looking for or what type of KET we need to provide us.

   Once we have this clear, we proceed to apply the most appropriate filters to our needs. Each layer has a checkbox that allows you to include or exclude it from your search.

4. Once we have done the most suitable filtering, we will have to select which profiles we would like to contact in order to carry out a specific project.

   Once we have a reduced list of profiles, we will identify the Regional Contact Point that will correspond to the partner of each region, included

in the CSL Partners layer, and we will carry out the query. In the future, new RCPs may be added in response to other regions not included in this initial project.

In this consultation it is recommended to add some relevant information about the project or about the specific need so that the recipient is able to identify what it can offer to respond to this need.

5. Once the RCP receives the query, it will analyze it to see if more information is needed, and once it is complete, it will contact the requested profiles to obtain a response to the need expressed by the mapping user.

6. Within a maximum period of two weeks the consultation received will be answered with the indications of the partners contacted, facilitating the direct contact if the permission is granted and if it is considered convenient.

7. Last but not least, two weeks after the resolution of the consultation a new contact will be made with the aim of monitoring and knowing whether these contacts generated have come to fruition or if it has finally been withdrawn and what have been the reasons for this withdrawal.