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Digital Innovation Hubs boosting European Microelectronics Industry

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DIATOMIC DIHs Guidelines and Evaluation process

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Abstract:

This document is the DIATOMIC guidelines to set up adequate mechanisms for establishing a common foundation for the operations of each DIH, and tools to collect and evaluate information.

This deliverable is linked with the Management and Synchronization of DIH Services. The scope of this document covers the methods needed to (i) collect existing services in a DIH; (ii) position the services across the value chain; (iii) establish channels between service providers and the application experiments responsible; (iv) evaluate the adoption of the different services.

In this document we present tools (i.e. concept definitions, document templates, etc) in order to attain standardisation, which must be used in the actions carried out in each hub.

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List of Abbreviations

AE	Application Experiment
AME	Advanced Micro-Electronics
CC	Competence Centre
DIH	Digital Innovation Hub
IT	Information Technology
JSON	JavaScript Object Notation
KOL	Key Opinion Leader
KPI	Key Performance Indicator
MOOC	Massive Open Online Course
NDA	Non Disclosure Agreement
OI	Open Innovation
QFD	Quality Function Deployment
SME	Small & Medium Enterprises
SSI	Smart System Integration
VC	Value Chain



1 Concept Definitions

1.1 Open Innovation

Formally introduced in 2003, open innovation has changed the way companies interact with clients, suppliers and other stakeholders. It is claimed that "Open innovation means that valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well [1]. By implementing open innovation strategies, the generation of ideas and the routes to the market are no longer limited by the internal capabilities of a company, but can also come from external sources [2]. Consequently, the open innovation approach, which breaks the boundaries of the traditional "closed" approach and creates new opportunities to innovate and market existing and new assets, has become one of the most studied research topics in the business networking literature. Among these studies, Table 1 presents an overview of four of the more recent research articles found in the literature. In all, the literature seems to be focusing on examining the factors that affect the effectiveness of open innovation strategies; and consequently, in the development of frameworks and tools that can support companies in the implementation of these strategies.

AUTHOR	RESEARCH TOPIC	METHODOLOGY
Çubukcu and Gümüş (2015)	To design an open innovation portal structure using Quality Function Deployment (QFD) method	Literature review and implemented by a company named innoCentrum as an innovation management system software
Cui et al. (2015)	To develop a model that explains the alignment between IT strategies and the openness of open innovation strategies and its outcomes	Data from 225 firms in China
Stanislawski and Lisowsk (2015)	To determine the relationship between openness to innovation and innovation potential	Telephone interviews with 103 companies that practice innovation and 85 with a close environment
Lisowska and Stanislawski (2015)	To identify and assess the cooperation of SMEs with business institutions in the context of open innovation	103 SMEs from three Voivodeships countries

Table 1: Overview of most recent research published on Open Innovation

The application of open innovation has largely been studied in the context of large firms. The application of open innovation in SMEs is seen as important but there are few case studies in the literature. Additionally, there seems to be agreement among the literature on the types of open innovation and the measures used to evaluate the degree of openness of these strategies. In this respect, the two types of open innovation recognised in the literature are:

• **Inbound Open Innovation**, which refers to the collection, acquisition and integration of ideas, knowledge and/or technology from various external sources such as customers, suppliers and experts, research institutions, and competitors, with the intent of exploring and exploiting innovation opportunities [1][2]. This type of innovation can be achieved through various practices such as by creating alliances or innovation competitions, by forming joint ventures, or by licensing technology [5].

- **Outbound Open Innovation**, which means that unused or underutilised internal ideas, knowledge, and/or technologies are taken outside of the company for their external commercialisation through licensing out, spin-offs, joint ventures, or alliances [2].
- The coupled process, which is defined as "integrating external knowledge and competencies while externalizing the firm's knowledge and competencies." Hence, this last type of open innovation can be understood as the combination of the inbound and outbound approaches. This can be achieved by implementing co-creative processes through partner alliances, cooperation and joint ventures [3]. This will be the core OI focus area for DIATOMIC.

On the other hand, the degree of openness search can be measured by:

- The *Breadth*, which is the number of external sources that a firm taps for innovation.
- The *Depth*, which is the extent to which a firm deeply draws from external sources.

Rather than implying that partner diversity should be avoided as it obstructs the effectiveness of the innovation, the companies should be aware of this diversity and manage their projects accordingly. In line with these results, the Quality Function Deployment (QFD) method assures that all stakeholders' needs are identified and satisfied throughout the different phases of the innovation process. Therefore, rather than limiting the diversity of partners, it is important to assess each partner's needs in order to respond to them accurately and achieve all the advantages these alliances can offer. Moreover, open innovation strategies should be reflected in their business model. In other words, to enhance innovative performance, companies need to re-organise their business model to accommodate their open innovation choices. Apart from pointing out the importance of business model design for open innovation, a framework with four distinct business models can be adopted [5]. The description of these business models is summarised in Table 2. In all, breadth and depth measurement are again used to define differences between open innovation business models, and consequently to direct focus on the aspects that need to be considered based on the open innovation strategy selected.

STRATEGY	MODEL CRITERIA	MODEL
Market-based innovation strategy	 Low depth/low breadth Knowledge is acquired through the market 	Efficiency-centric open business model
Crowd-based innovation strategy	 Low depth/high breadth Knowledge is source from a large numbers of authors 	User-centric open business model
Collaborative innovation strategy	 High depth/low breadth Knowledge is obtained by entering collaborative agreements with a few knowledge-intensive partners 	Collaborative open business model
Network-based innovation strategy	 High depth/high breadth Knowledge is obtained through deeply integrated external partnerships with various partners 	Open platform business model

Table 2: Open Innovation business model framework [5]

In the literature, besides the methodologies, frameworks and tools used to create open innovation strategies, the approach selected to execute these innovation strategies is considered. A common approach is the creation of platforms known as open innovation web portals, which are online platforms for solving problems and needs of enterprises through the generation of ideas. These platforms can grant access and promote the participation of many actors such as employees, customers, experts, designers and intermediaries. Thus, their aim is to proactively search for ideas in the external environment that can lead to innovation opportunities [5].

Among the contributions made on this topic in the literature, five different stages of the cocreation process where open innovation portals can be applied have been defined [6]. These five stages are presented in Table 3 with examples of different open innovation portal approaches. In conclusion, there are various approaches to open innovation such as joint ventures, licensing, and spin off; nevertheless, open innovation web portals are valuable resources for bringing high external inputs in a cost-effective manner.

PHASES	OPEN INNOVATION OBJECTIVE	EXAMPLES
Co-ideation	Companies open the idea generation phase to an external network actors such as consumers, fans, professionals and intermediaries.	 BMW (Co-Creation Lab), Starbucks (My Starbucks idea)
Co-valuation	Companies seek to involve actors for the appraisal of proposals.	 Dell (Idea Storm), Mulino-Bianco (Nelmulino-chevorrei)
Co-design	Companies aim to bridge the gap between identified ideas or needs and the possibility of finding a solution.	 Lego (Mindstrorm), PandG (Connect+ Develop)
Co-test and Co-launch	Companies use it to support the improvement of prototype products/services before going to market.	Xerox (Open Xerox),Threadless

Table 3: Phases of the co-creation process [6]

Lastly, although some firms must have a higher propensity to search for open innovation strategies, specific firm characteristics, such as size, age or industry, do not constrain the application of such strategies. For instance, **in the case of SMEs**, the application of open innovation is less seen as a tool for innovative development and more as an opportunity to improve and gain additional resources [4]. **Hence, for these enterprises open innovation can determine their long-term survival**.

Therefore, open innovation practices have the potential of boosting the **competitive advantage** of an SME by granting and facilitating access to new ideas and knowledge that lay in the external environment. For example, web portals can enhance the relationship of companies with clients by developing a relationship of co-creation between the two parts, where the client can communicate its needs and desires more directly, and consequently, the company can gain anticipated knowledge that contributes to the creation of new products and services that are to a degree accepted by the market. Still, as with all the collaboration approaches reviewed previously, specific factors can determine the success of these strategies in enhancing innovative performance. Such factors include the diversity of partners or rather how they are managed, the alignment with the business plan, and the approach taken. All of these factors must be selected based on the depth and breadth desire.

1.2 Digital Innovation Hub

A Digital Innovation Hub (DIH) is a "support facility that helps companies to become more competitive by improving their business/production processes as well as products and services by means of digital technology. DIHs act as a one-stop-shop, serving companies within their local region and beyond to digitalise their business. They help customers address their challenges in a business-focused way and with a common service model, offering services that would not be readily accessible elsewhere" (WG1, 2016). [7]

According to Cécile Huet, Deputy Head of Unit Robotics & Artificial Intelligence, DG CONNECT, EC The Digital Innovation Hub needs to "shape ecosystems covering the entire value chain - from the scientific basis, up to deployment - in order to benefit the citizens, the service sector and the industry. Nevertheless, to take full advantage of such technologies, regions should team up and learn from their experiences, and exploit both expertise and value chain creation complementarities"

The services available through a DIH enable any business to access the latest knowledge, expertise and technology for testing and experimenting with digital innovations relevant to its products, processes or business models. DIHs also provide connections with investors, facilitate access to financing for digital transformations, and help connect users and suppliers of digital innovations across the value chain. These services are of particular relevance to companies which currently have a relatively low level of digitisation and which do not have the resources or personnel to address the digitisation challenge, for instance SMEs and mid-sized companies. Key technologies driving the digitisation agenda, to which Digital Innovation Hubs may provide access, include: robotics, photonics, high performance computing (HPC), data analysis, simulation, Internet of Things, cyber-physical systems, and cyber security.

In addition to their focus on digital technologies, DIHs in DIATOMIC focus on specific industrial sectors, namely manufacturing, agrifood and healthcare. DIHs are considered the first point of contact for SMEs in those sectors. These DIHs enable SMEs to get the support they require and ensure that the associated competence centres provide the required solutions according to SMEs' needs.

DIATOMIC's vision is to establish a sustainable ecosystem to facilitate digital innovation in the health, agrifood and manufacturing sectors, all of which are under-digitized [8] and of prime importance for society and the economy. The majority of SMEs and midcaps in these sectors are characterised by a low Digital Innovation Index (we name these enterprises "non-tech" hereafter).



Figure 1: The Digital Innovation Hub Model [9]

At the heart of the DIATOMIC ecosystem, three interconnected sector-specific Digital Innovation Hubs (DIH) pulsate to accelerate digitization in-beat with sector-specific needs, and to enable delivery of AME/SSI based applications to a critical mass of customers.

The implementation needs to assure know-how on the following topic to deliver solutions:

- Sector specific expertise
- Technology expertise
- Business model expertise

DIATOMIC DIH will:

- Offer concrete technological and business services tailored to the design and delivery of innovative AME/SSI based product/process for a specific sector;
- Use a DIH-specific portal as the front-end of the one-stop-shop they represent;
- Use appropriate DIH management tools to support networks of hundreds of members
- Are interconnected to enable best-practices and resource sharing, task undertaken by the DIH-Committee.

1.3 Competence Centre

DIATOMIC will operate a network of competence centres associated with each DIH. Competence centres are R&D entities that operate in some particular area of focus such as a technology, skill or discipline. Competence centres connect partners from the industry and research sector in order to strengthen the capacity to advance and exploit new technologies in new products, processes, and services. Competence Centres (CCs) have proven their importance in helping SMEs address the challenges that digitalisation poses. The service that CCs offer can range from providing access to technology infrastructure and expertise, to supporting the creation of new product prototypes.

Therefore, the CCs can vary in nature, so it can be for example:

- **Research Institutes** specialised in utilising technologies to address existing problems faced by the companies;
- **Demonstration facilities** that exhibit advanced and innovative technologies being deployed/integrated in business process;
- **Test environments** that are open to potential customers/users to help them and accompany them through the overall digitalisation process, such as hospitals, factories, or farms.
- **FabLabs** that provide courses and training to help SMEs recognise and grasp the new technologies, as well as offer particular services for utilising their specialised infrastructure.



Figure 2: Digital Innovation Hubs vs. Competence Centres

1.4 Value Chain

Value chains (VC) are product and technology driven, where each new radical innovation in product design or technology development initiates a new cycle of connectivity called a value chain.

The value chain describes the entire range of activities that companies engage in to bring a product from its conception to its end use and beyond and ranging from design, production, marketing to distribution and support to the final consumer. The activities that comprise a value chain can be contained within a single company or divided among different companies. Value chain activities can produce goods or services, and can be contained within a single geographical location or spread over wider areas. Value chains can be divided among multiple companies and dispersed across the globe, thus, resulting in global value chains.

Modern value chains are so dynamic that they are better described as value networks, or interconnected companies and value added activities that integrate resource flows across manufacturing and service providers, pushing final outputs to markets [10].

1.5 Value Constellation Concept

Value constellations are "value creating systems...within which different economic actors work together to co-produce value." Though the literature on value constellations is more scares when compare to the other business network concepts, this might just be because there is no consensus among researchers on the difference between terminologies. For instance, some authors use the term service system when referring to value constellations [12][13], while others consider them to be distinct but closely related terms [14]. Regardless, value constellations form when different companies in a network work together to achieve greater value.

Furthermore, the main argument for the creation of this constellation is that consumers perceive value as a combination of interdependent services or products that complement and support each other [15]. For example, the university experience is not solely dictated by the

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quality of the course; additional factors such as the environment in the city, the range of extracurricular activities, the distance between the university and home, and even the diversity of classmates, can dictate the satisfaction an individual perceives with the overall experience. Therefore, creating constellations that can bundle all or some of the interdependent elements of a service can increase the value consumers perceived of an individual service or product inside. Therefore, the traditional view of value chains, where suppliers provide inputs for other companies to add value and then pass them to the next actor in the chain, is no longer aligned with how companies interact in today's competitive environment or even with how consumers make purchasing decisions [12][13][15]. Hence value constellations offer companies a more effective way of creating value and strengthening their competitive position, by not only enhancing internal resources with external inputs but by promoting and facilitating co-creation initiatives that entail longer bonds between the participants.

Moreover, though networks often form with the intent of promoting collaboration and knowledge sharing, different network configurations can materialised where co-creation is not present; for instance, licensing technology entails knowledge sharing, but it does not require the two companies to collaborate. Moreover, Doubters (presented earlier) can be part of a network without intending to form relationships inside that network [16]. Hence, constellations develop as companies align to co-produce products or services. This means, co-production alignments are not exclusive to manufacturing firms but include service providers who can co-produce a bundle of related services with each other, or manufactures and service providers working together. Hence, service constellations defined, as "the combination of multiple interdependent services that provide complementary value to consumers" are constellations that form with a main focus on services. On the other hand, this could also be extended to manufacturers that want to improve their offers by infusing services. Referred to as service infusion, manufacturing is increasingly incorporating services in their offers to enhance value creation and customer retention opportunities [17]. On this topic, nine types of value constellation created by SMEs with infuse services are identified [18](Figure 3).



Figure 3: Nine types of Values Constellations [18]

These value constellations can co-exist with each other in an individual SME. These means, a single SME can have various constellations to address different customer needs. Therefore, service infusion constellations can support SMEs manufacturers in the creation of new services that can improve their offering and consequently promote customer satisfaction

and retention. To add, enterprises need to create constellations that are congruent with their customer needs, but that also deliver mutual value to all the actors involved.

Nevertheless, value constellations tend to be complex systems, where multiple actors interact with each other in a direct or indirect way. Hence, the success of a constellation is not only dictated by gathering the right capabilities, but also by the ability to handle business relationships with the customer and the network [19]. In this sense, there are two main processes in a co-creation system. First: the process of coordinating activities among the entities at the value constellation level and second: the process of valuing the benefits at the individual firm level. Many factors can affect the effectiveness of a network and therefore of a constellation as well [12]. As a result, processes that can manage and monitor those factors are key.

Thus, value constellations can form within networks to purposely enable co-production between interdependent entities. This in turn, generates increased value for the customers, as individual elements that affect the perception of value are connected to improve the value proposition of the entire constellation. Consequently, as the value constellations generate added value, so do the firms inside it, who become stronger competitive players. Moreover, these constellations can form with any combination of manufacturing and service enterprises. This provides special advantages to manufacturers who want to infuse services. Lastly, the complexity of these systems present challenges for manager who need to develop and implement processes to manage the constellation as a unit and the relationships it creates.





Figure 4: Value Constellation Concept



2 Setting up a DIH

2.1 Value Constellation within DIATOMIC DIHs

Within the last 20 years, the image of a constellation was being employed to describe value captured from a network of multiple points and not necessarily along a sequenced or linear "value chain"4. It was in the digital age, explicitly built on webs of interaction, that the idea of value constellations took hold in business-model design. The value constellation's persuasive power is in its expansive view of an idea's potential. Value constellations take a commercial idea beyond the binary buyer-seller value chain to more complex, symbiotic transactional webs among multiple participants, each of which may create and consume value. In these webs, the sources of value go beyond direct monetary exchange. The best example is customer data, which in the digital age is a kind of global currency. The ability to describe the value constellation helps the Digital Innovation Hubs understand how an idea might work as a sustainable business. It allows the SMEs to stress test the idea within the DIH, to develop a commercial strategy for it and to build the investment case for its launch.

2.2 DIH Services

2.2.1 Value proposition of a Digital Innovation Hub

The focus of a Digital Innovation Hubs should target the sector needs. This amounts to more than simply a list of solutions and services, it goes to the heart of the Hubs' mission and how they operate.

Digital Innovation Hubs need to be able to:

- Speak the language of SMEs and understand their needs;
- Market themselves and actively identify relevant customers for their services;
- Possess significant know-how in both technical areas and business management;
- Understand business models and business transformation and be able to help companies transform;
- Broker between the needs of industry and relevant technology providers in an independent and unbiased way;
- Work with companies at all levels of digital maturity, including offering low-tech transfer to companies lower down the maturity curve.
- Equip companies with the necessary skills, from technical training at various levels, to coaching and mentoring the workforce on how to deal efficiently with the newly digitised products, processes and business models.
- Provide a gateway to specialist platforms and infrastructures.
- Provide funding or facilitate access to funding from external sources.

DIHs will first assist non-tech companies to find and couple with counterparts from across the EU with complementary technological competencies. Then, acting as a one-stop-shop, they will offer the teams both *strong technological support* to accelerate design, development, prototyping and manufacturing; and *business support* to develop solutions with a robust product/market fit, and chart the path to market growth and investment.



2.2.2 So where do the Digital Innovation Hubs begin?

1. Capture Capabilities and Needs: Driven by the competencies of the Digital Innovation Hubs, the supported SMEs and the whole of the project ecosystem we source and evaluate ideas generated by internal and open innovation methods. These are used to identify key nodes from where new value constellations will be anchored.

2. Map the constellation. Make a list of each actor in the constellation -- who creates, buys, uses, pays for each element of the idea. For each player, the hub should note the value being exchanged (from whom, to whom), while thinking beyond the conventional exchange of money (such as user interests or geographical location) and then map these exchanges. The value constellation helps the local Hub figure out where a new business idea fits: Is it a facilitator of business services, for example, or a provider of business services? Or both? Which roles in the constellation is the organization playing? Which role is it monetizing? In today's data digitally-rich economy, companies able to push beyond being providers of goods and services to facilitating value exchange have a stronger chance of winning. As each Innovation Hub gains insights validating the business model, it begins to place each participant in the constellation.

3. Sizing the value constellation. Traditionally, at the outset of any innovation project, it is hard to talk about market sizing in a credible way. There may be no precedents -- no "rear-view mirror" data -- to validate even the strongest hunch/idea. There may be no revenue model let alone patterns of units shipped or subscribers signed up. Therefore, relying too heavily on past precedents, whose relevancy may have diminished, can relegate a big idea to instrumentalism.

Traditional research may be of use at this stage in exposing the market to a new concept and getting feedback to questions, such as sensitivity to pricing alternatives. Qualitative techniques – both traditional and non-traditional- gauge emotional reaction that tell whether value-constellation assumptions support real behaviour. This may be the beginning of insight into adoption rates, buyer, user and payer segmentation as well as price elasticity and so on. Discussing these insights with a reference to the value constellation helps explain how the economics of the business model create a market for something that is not yet part of anyone's awareness.

In the DIATOMIC project, sizing and evaluating the economic 'clout' of Value Constellations and their associated Business Models will be based on the use of existing traditional and new market assessment tools and mechanisms, such as Stress testing, Discovery-based planning, and competitors sizing.

4. The build-out. In established organisations, the value constellation makes the case for whether a profit model exists at the sales-unit level for a new idea. If it does, the Hub's attention should turn to whether the idea can scale to a business of meaningful size.

When innovating companies engage in external knowledge searches whilst seeking the help of Digital Innovation Hubs, they typically go through four phases: Orientation, exploration, selection, and engagement (Figure 5) [20]. In orientation, innovating companies join forces with Digital Innovation Hubs to formulate their technological needs and translate these needs into Requests for Proposals (RFPs). In exploration, innovating companies rely on Digital Innovation Hubs to retrieve interesting solution proposals that meet their needs. In the selection phase companies and Digital Innovation Hubs jointly determine the value of submitted proposals and decide which solution provider(s) (if any) to engage with. In engagement, Digital Innovation Hubs help their clients to set up meetings with solution providers and sign agreements with these parties (non-disclosure agreements (NDAs) or collaboration agreements). While each phase can result in valuable outcomes for innovating companies, the process of external knowledge searching is successfully completed once a beneficial agreement with a solution provider is set up.





Figure 5: Value added by Digital Innovation Hubs in different stages of open innovation, value-adding actions by innovating companies, and key success factors related to each phase

2.3 Main activities of a Digital Innovation Hub and best practices

The activities developed at a Digital Innovation Hubs are designed to deliver outputs that address the specific needs of the stakeholders they serve and do not replicate existing service provision.

The activities offered by a DIH may be categorised under three pillars [21]:

1. Innovation activities

Support on the identification of needs for digitisation, and developing and validating innovative solutions based on cutting-edge technology. The methodology proposed to deliver this activity is:

- Value Chain definition of the sector: The Digital Innovation Hub works for the flow in the value chain or value network, and for that the first step to maximize the impact is to understand the markets and the actors by doing a value chain analysis.
 - Activity Analysis identify the activities that contribute to the delivery of the product or service.
 - Value Analysis identify the things that the customers value.
 - Evaluation and Planning what changes to make and plan how you will make them.
- Value Chain mapping: Actively searching for the stakeholders to better understand the value chain of a specific sector and their value details. This study will provide information of SMEs that may benefit from digitization, understanding their needs and showing them through success stories how they can digitise their processes, products or business models. Types of mapping:
 - Product Flow
 - Information Flow



• Relationships

Sources of information and Tools: Interviews with key chain actors, Literature review, Statistical review, Governmental offices, Associations, International Sources of Market information, Economic mapping, mapping of functions of actors, mapping of performance and added value at each stage, trends analysis, competitiveness analysis, rapid market appraisals (RMA) [22].

Example of Key topics for a mapping [23]:

1. Key Informant Interviews

- Identify and meet key stakeholders in the chain to understand any significant relationships among and between actors.
- Scoping study

2. In-depth interviews

• Develop a comprehensive picture of the value chain from the supply of farming inputs, via production, processing, logistics, retailing and finally to consumption.

3. Procurement

- What: Products & forms of product and volumes purchased
- Who: Number & types of sellers, proportions from each
- Where: Location of suppliers and purchases
- How much: Purchase price and other procurement costs
- How much: Risks (physical loss, theft, price change, etc)
- How: Technology of activity- maturity (vehicles, assets, methods)
- How: Degree of coordination or integration with suppliers
 - Credit, contracts, info exchange, resource provision, etc.
 - Sources of information about suppliers, search cost
- When: Seasonality and volatility
- When: Changes over past 5 years

4. Value Adding

- What: Value added activities & volumes
 - e.g. Transportation, storage, sorting, packaging, cleaning, processing
- How much: Composition of costs for each activity
- How much: Risks (physical loss, theft, prices etc.)
- Where: Location of activities
- How: Technology of activity and maturity
 - assets, machinery, storage facilities, methods
- When: Seasonality and volatility
- When: Changes over past 5 years

5. Sales and Marketing

- What: Products & forms of product & volumes
- Who: Numbers and types of buyers, proportion to each
- Where: Location of buyers and sales transaction



- How much: Sale price and costs of marketing activities
- How much: Risks
- Where: Location of activity
- How: Technology of activity
- How: Degree of coordination or integration with buyers
 - Credit, contracts, info exchange, resource provision, etc.
 - Source of information about buyers, search cost
- When: Seasonality and volatility
- When: Changes over past five years
- 6. Business Environment
 - Who is your main competition?
 - How do you compete?
 - What external threats do you face?
 - How do government policies, programs, and regulations affect you
 - What support from government would be useful?

7. Thinking About Market Structure

- Number of actors at each stage
- Type of actor (large, medium, small, vertically integrated?)
- Total volume that different actors handle
- Market power, i.e. who has bargaining power
- Has structure changed or is it changing?
- Awareness raising: Disseminating information on the opportunities and benefits of digital products and services. The communication should be targeted, in terms of sector, type of company, etc., and be delivered through both online and offline channels. At its core should be an online portal with readily accessible information on success stories, use cases, best practices, and business models, as well as a catalogue of competences and specialist services.
- Identification of digital needs: Diagnosing a company's needs and readiness in relation to digital technologies, providing feedback on its level of maturity in relation to digital technologies, and identifying potential solutions.

The diagnosing is done by:

- observation of processes, daily activity or management by an external to the company. Observation descriptions should include a description of the setting, any activities that occur in that setting, the individuals who were involved in the activities, and the significance of what was observed. Combining observation with photo-taking can lead to even richer information gathering about how learners use existing spaces. This activity, even being an out-of-the-box approach, should be regulated. The observer must:

1. Have determined the primary questions that will be the focus of your observation.

2. Develop an observation schedule that will allow you to capture data at different times of the day,



week, and the semester (or other time patterns relevant to your project).

3. Develop an observation template that helps you capture data for different sites / locations.

4. Use of different types of collection is a plus- draw, picture or others.

- Interviews can provide rich insight into individual users' perspectives on a space.

1. Use a script or guide which can be used to provide consistency between interviews and enable multiple researchers to conduct the interviews;

- The analysis data will be filtered to the identification of needs that can be solved by digitalization

- Visioning and strategy development for businesses: Having the needs, the next step is to work with the client to envision its digital future and develop a strategy for delivering this vision. This may involve working with the client directly or directing it to further tailored help and advice within the Hub's ecosystem.
- Access to specialist expertise and infrastructure: Support the technology providers and users to carry out experiments and to test whether the proposed approach would indeed be beneficial for the user. At the same time these experiments can be useful for the provider that has an early customer and can adapt the technology to the needs of a certain class of user. Learning from this experience and creating a best practice, which will be disseminated, further will be important. The support can be:
 - providing expertise;
 - providing technology building blocks on the basis of which the solution may be built.
 DIATOMIC will provide access to knowledge, development, prototyping and experimentation resources and will offer technological training and resources e.g. roadmaps, scientific papers;
 - providing facilities that are needed for testing;
 - providing access to living labs that can validate new products/business models. DIATOMIC will
 offer to its members access to a platform (based on IMAGINE) to accelerate innovative
 product design in a consistent manner, reducing error probabilities.

2. Business development.

Includes both Business Development concerned with helping companies to apply their solutions, assess the business implications, and manage the resultant changes; and **Skills creation**, concerned with building innovation capacity through enriching human capital.

- Matchmaking services: SMEs and mid-caps from the health, agrifood and manufacturing sectors are not generally familiar with AME and SSI technologies. DIATOMIC assists interested players (SMEs and midcaps from these sectors) in easily finding the appropriate technology experts from within its networks and outside them, if needed, which possess not only knowledge but also resources (products, experimentation and fabrication facilities) to ensure fast development of innovative products/processes. The matchmaking will occur online and/or through dedicated events and/or through the DIH matchmaking helpdesk.
- *Tailored business training services:* Training in innovation thinking, in lean business methodology, in investment readiness and dedicated sector-specific business consulting.

3. Access to funding support and guidance

Direct funding through open calls, continuous advertisement of funding opportunities, organisation of pitching events for selected SMEs and mid-caps.



3 Communication tools

The overall objective of this chapter is to give guidelines to develop a good strategy for communicating and disseminating the DIATOMIC digital innovation hubs, implementation and evaluation. What is the best way to organize all the actions in order to raise awareness in the DIATOMIC project and all DIH areas community and achieve the success?

In order to develop a communication plan for your DIH, you have to consider some basic questions:

- 1. What do you want to communicate?
- 2. How do you want to communicate it?
- 3. How will you actually distribute your message?
- 4. Whom do you want to communicate it to?

The action plan is based upon the answers to these questions, and the actions you need to do in order to successfully communicate with the audience. Every communication plan involves mainly three steps:

- 1. Development of an action plan (communication plan);
- 2. Implementation of the communication plan;
- 3. Evaluation of the communication plan, and adjusting the plan accordingly to the results.

Communication is a continuous activity for every Digital Innovation Hub, and defines the connection with the community. Always try to keep the relationship with the community, media and key people even if the audience, purpose, message and channels may have same changes during the process. **Every communication plan must be reviewed, based on the experience and the results that you are achieving.**

3.1 Goals

In order to have a very efficient and concrete communication "template" for every DIH, we must clearly define the goals. This is the best way to achieve good results. Regarding the DIATOMIC project, we can define, for example, the following goals:

- Disseminate DIATOMIC project;
- Disseminate the Digital Innovation Hub;
- Empower Individuals, Start-ups and SMEs;
- Raising potential users of DIH;
- Create an interactive network in the field of each DIH;
- Disseminate funding opportunities;

3.2 Target Audiences

Target audience is the group of people that you would like to communicate and you think that they would like to receive your information.

You can define your target audiences, grouping people according to a number of characteristics:



Table 4. Defining target audiences

Defining target audiences		
Demographics	Basic statistical information about people, such as gender, age, ethnic and racial background, income, etc.	
Geography	Focus in a country/region or man-made feature;	
Employment	People in a particular line of work, or in people who are unemployed;	
Interests	In this case you are trying to reach people interested which area? Health,	

After defining your target audience, you need to find some organizations/groups that fit your target group. By this way, you increase the probability to reach more audience in a very simply way. You can gently ask to the communication officer to disseminate your message through the group members.

3.3 Resources

Before you start to define your communication plan you must analyze all the resources you have, and ask yourself some questions like:

- How much money do you have to spend?
- How many people can make it possible?
- If you are going to spend money in publicity, what are the chances that the results will be worth the expense?
- Who will gain and who will lose what by your use of financial and human resources?

Actually, you must include in the plan costs like: digital/online publicity (for example: google Addwords, landing pages, etc), printing materials, merchandizing, journeys and stays, entrance in fairs, etc.

3.4 Key messages

When disseminating, you must identify the message you want to pass to the audience. When creating your message, please consider content, mood, language, and design:

Aspect	Explanation
Content	Write your message with your audience in mind; to make it effective, is necessary to plan the content of your message. In this specific project you can use some content related to "We can potentiate your project", "New funding opportunities", "Helping digitalization in EU".
Mood	Consider what emotions you want to appeal to. The mood of your message will determine how people react to it. Keep your tone positive because it will usually reach more people than evoking negative feelings such as fear or anger. If the mood of your message is too extreme – too negative, too frightening, trying to make your audience feel too guilty – people won't pay much attention to it. It may take some experience to learn how to strike the right balance.
Language	There are two aspects to language here: one is the actual language – English, Portuguese, German, etc – that your intended audience speaks; the other is the kind of language you use – formal or informal, simple or complex, referring to popular figures and ideas or to obscure ones. You can address the language people speak by presenting any printed material in both the official language and the language(s) of the population(s) you're hoping to reach,

Table 5. Key messages aspects



3.5 Engagement

The audience engagement is a very important step in your communication plan. Establishing relationships with Key Opinion Leaders and institutions in the community and/or the population you're trying to reach is an important part and also relationships with individual media representatives and media outlets.

Please feed your social media channels constantly. Define a timeline with relaxed, optimistic and DIH related content, always having in count the principal message you want to disseminate. Having a constant feed in your social media is half way to keep the audience engaged.

3.6 Communication channels

The communication channels could be varied (physic, digital, etc) and with different messages. After defining you target audience you must analyse which are the best channel to reach them. To simplify, you can answer these questions:

- What does my target audience read/watch?
- What does my target audience listen to?
- What are the habits of my target audience?
- Do they follow any Key Opinion Leader (KOL)?
- What are they engaged in?

Following these questions, you can use one or more of the supports:

- Posters, Flyers, brochures you can leave them in places that you target audience attend;
- Promotional materials Items such as caps, T-shirts, and mugs can serve as effective channels for your message;
- Newsletters create a mailing list with users and potential users to keep them updated;
- News stories, columns, and reports (Reading material) use articles to disseminate, for example, good practices;
- Press releases and press conferences;
- Presentations or presence at local events and local and national conferences, fairs, and other gatherings;
- Public demonstrations;
- Social media: Facebook, Twitter, Youtube, Linkedin;

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- Webinars;
- MOOCs (Massive Open Online Courses);
- Organization of:
 - Bilateral Meetings sessions;
 - Brokerage events;
- Word of mouth;

3.7 Communication plan

At this time, your plan will be already essentially done. You've defined goals, audience, messages, resources, etc. Now, it is time to quantify the results in a calendar grid that outlines roughly what communication process will be accomplished and when.

How to elaborate it?

- 1. Please establish a timetable;
- 2. Separate objectives;
- 3. Separate action under the objectives, into logical time periods;
- 4. Allocate resources (human, costs and supports) to actions.
- 5. Under the timetable please explain each action putting the details together: explain the purpose, who you want to reach, what the message should contain and how it will look like (perhaps more than one, in order to use lots of channels), what you can afford, problems you might face, what channels can be used, how you can gain access to those channels, etc.
- 6. Evaluate your plan and, if needed, change it in order to achieve the success.



4 DIATOMIC portal

4.1 Platform architecture

The DIATOMIC platform is based on enterprise scale, open source technologies. For back-end data storage, we use PostgreSQL relational database management system. The PostgreSQL RDBMS is used for storage of various kinds of information from the platform middlewareand perfectly adapts to the needs of the project. PostgreSQL has been used by the developing team in several other projects with successful outcomes.

Middleware is built using Enterprise JavaBeans 3.0 and WildFly 10 application server as the host. Enterprise JavaBeans encapsulate business logic of the system. They connect to the RDBMS for data storage and retrieval and offer functionalities to external clients using RESTful web services and JSON format.

The platform supports various types of client devices like desktop and laptop computers, tablets and smartphones. Web application accessed by the clients is responsive - it provides optimal viewing experience depending on the device used to access the platform. Web tier design is based on Bootstrap framework. Communication with the platform middleware and web application control is developed using AngularJS JavaScript Model-View-Controller framework that supports exchange of JSON data through RESTful web services implemented on middleware. The matchmaking services of IMAGINE platform will be used in conjunction with the services described below. The user requests will be redirected to IMAGINE web services in a non-intrusive manner.

Above described is graphically presented on picture below:



Figure 6: DIATOMIC platform architecture

In the above-described architecture of the system, clients are completely decoupled from server components. Their communication is service based, implemented using RESTful web services (Representational State Transfer) and JSON (JavaScript Object Notation) format. Client server communication is encrypted using registered SSL certificate and secured using session based authentication using session token.



The DIATOMIC platform will be supported by following browsers:

	Table 6: Supported browsers	
Browser / System	Android	IOS
Chrome	Supported	Supported
Firefox	Supported	Supported
Safari	Not Supported	Supported
Android browser & WebView	Supported	Not Supported

Browser / System	Windows	Мас
Chrome	Supported	Supported
Firefox	Supported	Supported
Safari	Not Supported	Supported
Internet Explorer	Supported	Not Supported
Microsoft Edge	Supported	Not supported
Opera	Supported	Supported

4.2 Use-case diagrams and workflow

In the following text, the use-case diagram presented in Figure 7 will be described. Single use case describes how a user uses a system to accomplish a particular goal. It is supposed that this platform will be used by three different users: Innovation Actor, Enablers and Supporters. They will have common behaviour, which is represented by general actor called User.

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Figure 7: DIATOMIC use-case diagram

Use Case 1: BROWSING MATCHMAKING SERVICE

ACTORS: User, IMAGINE system

DESCRIPTION: The user is able to use IMAGINE system to perform matchmaking with user's data in mind. IMAGINE system will be embedded into DIATOMIC Web application for a seamless user experience.

The data which will be used for matchmaking purposes resides on both the IMAGINE system and DIATOMIC system -- Innovation actors will be able to fill a survey about their competences, capacities and expertise. (Use Case 2), while Enablers and Supporters will be able to search both the IMAGINE and DIATOMIC data store for services and other information. Matchmaking will take into account DIHs available infrastructure, available services, members, fields of expertise, geographical coverage and competencies.

Use Case 2: FILL A Form regarding CCs' CAPACITIES AND EXPERTISE

ACTORS: Supporters

DESCRIPTION: Innovation actors will be able to fill a form regarding their competences, capacities and expertise. Innovation actors will input their data into a web form, which is a part of the DIATOMIC Web application and their data will be saved to the database. Data asked of user will at least include: available infrastructure, services provided, fields of expertise, geographical position etc.

This data will later be used for matchmaking purposes and white spot analysis.

The form will have advanced form validation to ensure data correctness.



Use Case 3: SHOW BENEFITS OF DIATOMIC PROJECT FOR EACH USER

ACTORS: User

DESCRIPTION: The DIATOMICWeb application will clearly state the benefits for every user type (Innovation Actors, Enablers, Supporters). The benefits will be split per user type. The text describing benefits will be concise and it should be a motivating factor for users to use the DIATOMIC platform. The text will be shown under or underneath a simple correspondent icon.

Use Case 4: SHOW THE SERVICES OF EVERY DIGITAL INNOVATION HUB (DIH)

ACTORS: User

DESCRIPTION: For every DIH, the services they provide will be easily accessible with inbuilt searching capabilities. Every DIH will have a "profile" page describing their competences, capacities, expertise and contacts. The profile pages will be clearly different for all three types of users already mentioned.

Use Case 5: DIATOMIC success stories/ the Application Experiments (AE)

ACTORS: User

DESCRIPTION: Descriptions of AE (Application Experiments) will be easily accessible. Both the three AEs embedded in the DIATOMIC project will be shown as well as other AEs. The following information will be displayed:

- 1. general description
- 2. implemented technologies
- 3. AE progress
- 4. partners, tech suppliers involved
- 5. KPIs
- 6. pictures of technologies and demonstration sites

Use Case 6: Service Search Bar

ACTORS: User

DESCRIPTION: the search bar has the scope to provide a fast access (short-cut) to DIATOMIC services that could be most suitable for the platform users. Questions regarding the domain of interest, the geographical position and the type of service required will be asked.

Use Case 7: Open Calls

ACTORS: User

DESCRIPTION: with the objective to maximize the reach of the open calls, a section will be dedicated to it. The section will show the selection criteria and the open call procedure. Moreover the section will include a direct link to the application platform provided by F6S.



5 DIH KPIs and assessment process

Each DIH activity should be evaluated to measure how much it contributed to the overall operation of the hub. Information can be gathered by tracking activities with compliments or complaints or direct feedback when in direct contact with your audience. Direct impact is related with each DIH goals. For example, if your goals were:

- 1. Empower Individuals, Start-ups and SMEs;
- 2. Raise potential users of DIH;
- 3. Create an interactive network in the field of each DIH;
- 4. Disseminate funding opportunities;

You can measure these by defining key performance indicators:

- 1. Number of Individuals, start-ups or SMEs empowered;
- 2. Number of potential users of DIH raised;
- 3. Number of people in the DIH network;
- 4. Number of disseminated funding opportunities.

To evaluate the results of each overall DIH performance, each DIH should prepare an assessment plan. This plan could follow these guidelines:

- a monthly report on work in progress,
- formalized department reports for presentation at staff meetings,
- periodic briefings of the chief staff executive and the department heads
- a year-end summary for the annual report.

DIH indirect impact should also be measured. For example, it might be important to keep track of the number of:

- website visualizations;
- likes in the social media;
- followers at social media;
- distributed flyers/brochures;
- presences at fairs/exhibitions/congresses;
- events organization (for example: raising awareness events);
- people in the linkedIn group;
- newsletter visualization and clicks;

Below we provide a minimalistic set of initial KPIs that each DIH should take into account during its setup. Please note, these are considered as the minimum requirements to establish a new DIH, and other may be identified during the DIH operation to accommodate different stages of its lifecycle.



Objective	Key Performance Indicators (KPIs)	
To setup and establish a DIH community and	Number of countries/regions addressed by the DIH	
SMEs, to push AME/SSI technologies	Number of actors attracted/aware of DIH	
	Development activities promoted for end-users adopters	
To setup and establish the DIH mechanisms and	Number of competence centres in DIH	
structure to provide services	Number of actors types/roles in the value chain	
	Competences/ disciplines represented in DIH	
To attract the most talented and knowledgeable	Capacity in accommodating competence centres	
experiments of high-quality with highly-innovative user-driven applications based on AME/SSI	Number of application experiments executed in DIH	
technologies	Number of SMEs and mid-caps being funded by the DIH financial mechanisms to develop AME/SSI based applications	
To ensure sustainability and growth of the DIH ecosystem	Average increase in productivity for technology adopters following DIH application experiments	
	Average rate of return for technology providers following DIH application experiments	

 Table 7. Digital Innovation Hub Key Performance Indicators



6 Tools and templates

6.1 DIATOMIC Competence Centres application

DIATOMIC Competence Centres					diatomic	
CC Name					••	
Adress:					-	
Contact Person	Name:					
	Tel.:			E-Mail	:	
Brief Description of the CC (Max. 250 words):						
In which area is the a	oplication focus?					
Smart Agricit	ure Sr	nart Health	Smart Proc	duction		
Competences						
Organisation	Hardwa	are		<u>Softwa</u>	are	
Business Models	Co	ommunication Te	chnologies	<u>р</u>	latform Development	
Process Manager	ment El	ectronics and Em	bedded Systems		Aiddleware / Semantic Systems	
Planning and Cor	ntrol Se	ensors		B	Benutzerschnittstellen	
Others:	Ad	ctuators and Cont	rol technologies	B	Big Data / Al	
	O1	thers:		s	imulation	
				Цг	T-Security	
					Others:	
What is the maximum Capacity the CC can provide?						
<10 Personer	n 🗌 <	25 Personen	<50 Persor	nen	>50 Personen	
What can you offer in your demonstration center?						
Seminars	Bu	usiness Training	Developme	ent and S	Simulations Workshops	
Are there any restrictions with the offered support? (e.g., temporal restrictions, NDAs, etc.)						



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What are your existing Demonstrators?

Demonstrator title	Brief Description

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