



# FVLLMONTI

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*Deliverable D6.3 – Plan for dissemination of the results – Y2*

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1.2	28.02.2022	Initial version from Year 1
1.3	28.02.2023	Updated version for Year 2

## DOCUMENT ABSTRACT

This Dissemination strategy gathers together all information regarding the dissemination of the FVLLMONTI project. The strategy helps conducting the dissemination and communication activities throughout the project by acting as a practical and regularly updated guide for the project members.

The objective of the Dissemination strategy is to help FVLLMONTI to reach its goals. All dissemination and communication activities aim to raise awareness about the FVLLMONTI project, its results and creating a community involved in 3D electronic architectures among identified target groups, and to encourage them to use the products and solutions developed by the project while engaging them in discussions, to ensure that the products and solutions are relevant and suitable for their requirements.

The overall purpose of this document is to specify the scope, vision and means of the project's outreach and communication, including its target audiences, content of the information to be disseminated and communicated, the mechanisms to do this effectively within the constraints of the available budget, and the metrics for assessment of its impact.

Dissemination activities over the first two years of the project are summarized and quantified by the metrics defined in deliverable D6.3.



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## LIST OF ACRONYMS / GLOSSARY

AB: Advisory Board
AI: Artificial Intelligence
ASR: Automatic Speech Recognition
AVF: Architectural Vulnerability Factor
CNN: Convolutional Neural Network
DTCO: Design-Technology Co-Optimization
D&E: Dissemination and Exploitation
EDP: Energy-Delay-Product
e-NVM: embedded Non-Volatile Memory
EC: European Commission
EU: European Union
ICT: Information and Communication Technology
IPR: Intellectual Property Rights
KPI: Key Performance Indicator
LB : Logic block
GA: General Assembly
JL: Junction Less
LiM: Logic-in-Memory
M: Month
MT: Machine translation
N2C2: Neural Network Compute Cube
NLP: Natural Language Processing
NN: Neural Network
PC: Polarity Controllable
PEDR: Plan for the Exploitation and Dissemination of Results
PU: Public
VNWFET: Vertical Nanowire Field-Effect Transistors
WER: Word Error Rate
WP: Work Package

## I. PROJECT OVERVIEW

In the context of the fourth industrial revolution along with unprecedented growing global interdependencies, an innovative, inclusive and sustainable society is a sound European priority. For many people, the way towards inclusive and sustainable daily life can be achieved through a lightweight autonomous in-ear device allowing speech-to-speech translation. Today, pocket-talk devices integrate IoT products requiring internet connectivity which, in general, is proven to be energy inefficient. While machine translation (MT) and Natural Language Processing (NLP) have greatly improved, an embedded lightweight energy-efficient hardware remains elusive. Existing solutions based on artificial neural networks (NNs) are computation-intensive and energy-hungry requiring server-based implementations, which also raises data protection and privacy concerns. Today, 2D electronic architectures suffer from "unscalable" interconnect and are thus still far from being able to compete with biological neural systems in terms of real-time information-processing capabilities with comparable energy consumption. Recent advances in materials science, device technology and synaptic architectures have the potential to fill this gap with novel disruptive technologies that go beyond conventional CMOS technology. A promising solution comes from vertical nanowire field-effect transistors (VNWFETs) to unlock the full potential of truly unconventional 3D circuit density and performance.

### 1. Objectives

The FVLLMONTI vision is to develop regular 3D stacked hardware layers of NNs empowering the most efficient machine translation thanks to fine-grained hardware / software co-optimization. This will be achieved through actual VNWFET fabrication by setting up a design-technology co-optimization (DTCO) approach. More specifically, FVLLMONTI is organized around 4 specific objectives:

- **Compactness** From fabricated low-complexity hardware to minimal neural network compute cube (N2C2). This objective concentrates on the compactness of the elements in the FVLLMONTI value chain from low-level logic blocks up to a critical compute function in N2C2 to ensure the computation resource footprint.
- **Performance** Energy-delay-product assessment of the computational layer, the embedded Non-Volatile Memory (e-NVM) and interconnects. This objective is designed to quantify the conventional figure-of-merit energy-delay-product (EDP) towards fast and ultra-low-power data transfer between the e-NVM using ferroelectric-gated VNWFET and the computing layer, thereby addressing the whole FVLLMONTI value chain from low-level logic blocks up to a critical compute function in N2C2.
- **Validation** of the VNWFET technology for live English-French streaming speech recognition to text. Here we focus on exploring the use of VNWFET-based 3D logic cells and e-NVM blocks in multiple layers of NNs enabling ultra-compact and energy-efficient Transformers NNs for Automatic Speech Recognition (ASR) and Machine translation (MT). Their compactness and EDP will be compared with general-purpose architectures with CNN accelerators. To validate the approach, the target application is live English-French streaming speech recognition to text.
- **Robustness** of the 3D NN Architecture. The objective is to assess the reliability of VNWFET devices at the early step of their development. The impact of the identified wear out failure mechanisms will be appraised on the whole FVLLMONTI value chain: N2C2, 3D NN architecture and up to the ASR and MT application. Beyond the specific translation application, the final intent is to demonstrate the intrinsic 3D NN architecture robustness.

## 2. *Technical results*

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In line with the above objectives the present project achievements will be measured based on the following technical key performance indicators (KPIs):

- **KPI1:** Functional logic blocks (LB) using junctionless (JL) VNWFET with two stacked-gate layers and polarity-controllable (PC) VNWFETs with one stacked-gate layer
- **KPI2:** Functional e-NVM cell using hafnium oxide ferroelectric-gated VNWFET. Data retention and endurance suitable for Logic-In-Memory (LiM) Applications
- **KPI3** Area assessment for 1-bit full adder designs featuring reconfigurable and/or non-volatile functionality
- **KPI4** EDP assessment for JL VNWFETs,  $I_{ON}$  of at least  $300 \mu A/\mu m$  at a supply voltage below 0.9V with scaled gate length
- **KPI5** EDP assessment for PC VNWFETs,  $I_{ON}$  of at least  $10 \mu A/\mu m$  at a supply voltage below 2 V
- **KPI6** EDP assessment for read and write operation of a single transistor ferroelectric VNWFET cell with 3 V write voltage and 2 V operation voltage or below
- **KPI7** EDP assessment of 1-bit FA designs exploiting reconfigurability and/or e-NVM function
- **KPI8** NN compression size
- **KPI9** For ASR and MT, EDP assessment
- **KPI10** Word Error Rate (WER) on read English and French
- **KPI11** Bi-Lingual Evaluation Understudy (BLEU) score
- **KPI12** Intrinsic 3D NN architecture robustness, irrespective of the application: Architectural Vulnerability Factor (AVF)

## II. Dissemination overview of the FVLLMONTI Project

The Plan for the Exploitation and Dissemination of Results (PEDR) presented here is one of the compulsory reports that H2020 projects are required to submit to the EC. The PEDR summarizes the consortium's strategy and concrete actions to disseminate, exploit and protect the foreground generated by a project and should serve as a guideline to the Consortium for the Dissemination and Exploitation (D&E) activities to be carried out in the context of the FVLLMONTI project.

This report is the second PEDR release. It gives overview of the planned dissemination activities, as well as their status until M26. It highlights the dissemination channels and targeted stakeholder groups as planned for the subsequent period and summary of most promising achievements, exploitable opportunities and identification of target segments for FVLLMONTI project and perspective business opportunities of involved enterprises. The report it will be up-dated again at M38 and M56.

FVLLMONTI consortium recognizes that dissemination activities are an essential part of the project throughout its duration and also vital for the future sustainability of its outcomes. Dissemination and outreach are therefore integrated across all of the FVLLMONTI work packages (WPs).

Coordination of the dissemination and communication activities is included in WP6. WP6 collaborates closely with all WPs, but particularly with WP7 which coordinate the project management.

This dissemination strategy and the associated work plan is a living document that will be reviewed and updated during the project's lifetime in order to adapt to the changing needs of FVLLMONTI and its stakeholders. The planned dissemination activities may therefore change during the course of the project based on its performance metrics, experiences and lessons learned.

Dissemination activities outlined in this strategy will help to further build the FVLLMONTI community, engage and ensure the community is sustained after the end of the project.

### Scope

The Dissemination Strategy is the third deliverable (D6.3) for WP6 of the FVLLMONTI project. While D6.1 was dedicated to the project website and social network accounts, D6.2 was the precursor was this particular report. The dissemination strategy and associated implementation plan outlines the scope of FVLLMONTI outreach and communication. It defines the key objectives, identifies target audiences, elaborates on the tools and channels that best suit the needs of these groups, and defines the approximate timelines and responsibilities for the planned actions. Finally, the document outlines Key Performance Indicators (KPIs) to assess the impact and success of the strategy and planned actions.

This deliverable outlines the FVLLMONTI dissemination strategy in terms of identification and description of the key dissemination elements:

1. The objectives of the dissemination (mission, vision),
2. The subjects of dissemination (what will be disseminated),
3. The target audience (to whom it will be disseminated), as well as
4. The dissemination methods (how it will be disseminated),



5. The distribution of responsibilities for dissemination (who will perform the dissemination) and rules for planning and performing of dissemination activities are described here.

The following general subjects of dissemination have been identified:

1. The FVLLMONTI project itself (general scope, coverage, goals and milestones and plans to reach them)
2. Interim results (reached objectives and achievements)
3. Techniques and methodologies (in respect of IPR issues)
4. Technologies (in respect of industrial IPR issues)
5. Innovation aspects (in line with the 'European innovation radar' <https://www.innoradar.eu/> )

## Objectives

The Dissemination plan in FVLLMONTI's project represents the strategic vision of the consortium in terms of communication of the FVLLMONTI project itself, and of its achievements and outputs as well.

The main objective of the planned dissemination activities is to increase the visibility of the FVLLMONTI project focusing on selected communities and target groups at both European and international level and to further enhance the project impact. In order to maximize impact, special attention will be given to specific stakeholder groups such as (I) Policy makers (EC, EU...); (II) consultation groups; (III) academics; and (IV) investors. Through this interaction, we anticipate that valuable feedback will be provided by stakeholders interested in the FVLLMONTI outputs and exploitable results.

In more detail, the objectives of the dissemination are:

1. To raise public awareness about the project, its expected results and progress aiming at specific target groups using effective communication means and tools;
2. To exchange experience with other projects and groups working in the field in order to join efforts, minimize duplication and maximize potential;
3. To disseminate the fundamental knowledge, the methodologies and technologies developed during the project;
4. To pave the way for a successful commercial and non-commercial exploitation of the project outcomes.

## Strategy

The definition of the dissemination strategy is based on the identification of the following subject:

1. The subject of dissemination (what will be disseminated),
2. The identification of target audience (who will most benefit from the project results and who would be interested in learning about the project findings),
3. The definition of methods and tools (what is the most effective way to reach the target audience)

The dissemination strategy and activities will follow principles and best practices successfully tested by the partners in other projects and in line with the EC Guidelines for successful dissemination:

- All research results/reports will be duly reviewed and a copy will be sent to relevant partners involved in the project before these are published or disseminated. When appropriate, the reports will refer to other research projects and build on the existing results and literature.
- Research will be conducted following scientific practice principles, taking into account as much as possible policy requirements and needs.
- All partners who will contribute to the project activities will be duly informed about the final outcomes and the implications stemming from project results.
- All public results will be accessible from the project website and usable from all parties who may benefit from them.

The Consortium attaches great importance to dissemination. All partners will contribute to that effort and will strive to maximize use of all existing dissemination channels, such as high-quality papers describing world class scientific achievements, as well as oral and poster contributions in relevant international and European conferences.

### III. Target Audience

The overall aim is to maximize the dissemination potential of FVLLMONTI and broaden the utilization of project outcomes. Dissemination activities then must be tailored in such a way to reach targeted audiences more efficiently through appropriately selected dissemination channels and dissemination tools. This section describes the different kinds of stakeholders that the FVLLMONTI consortium will target within the context of the project's dissemination and communication activities. Table 1 provides an overview of the target audiences that were identified as the target audiences for the FVLLMONTI D&E activities with the related communication actions, specifying which communication tools are most suitable for the different target groups.

Target groups	Content	Used Channels	Targeted Channels
Scientific community	General information about the project Scientific results Technological innovations New findings	Project website Workshops Conferences Publications in peer-reviewed scientific journals	Factsheets Summer school
Industry leaders / Industrial end-users	General information about the project New findings Technological innovations Scientific results	Project website Conferences and other dissemination events Publications in peer-reviewed scientific journals Advisory board meetings	Factsheets Policy briefs Trade fairs Workshops
Private investors and public funding organizations	General information about the project Technological innovations Scientific results	Project website European Innovation Radar Database	Factsheets Working groups and events of EU associations Trade fairs
FVLLMONTI partners	Publication Project Reports Deliverables	Project netboard Audio/video conferences Live meetings Project website	-
Public	General information about the project Scientific results	Project website Press and social media Public Science Events	TED Talk Podcasts/Video content

Table 1 - Overview of FVLLMONTI target groups for project dissemination

## IV. Dissemination to target audiences

This chapter describes an organization and management of the FVLLMONTI dissemination activities. Focused on the project's results these activities will:

- Ensure that project objectives and outcomes reach the relevant groups of stakeholders.
- Facilitate the exploitation of the FVLLMONTI framework.
- Ensure the visibility of the project activities to acquire the needed support from key stakeholders.

The dissemination of the FVLLMONTI results will be performed on three different levels:

1. Scientific/Technical dissemination aimed at scientific community in the field of FVLLMONTI research. This includes scientific papers, publications, conferences, and workshops.
2. Dissemination to microelectronics industry leaders (IBM, TSMC, STMicroelectronics, Synopsis, CEA-LETI, GlobalFoundries, Infineon), industrial end-users (META, IBM, Huawei), and professional networks (IEEE, Silicon Saxony e.V., Compact Model Coalition) by attending large sectorial events and presenting the project to a wide range of potential end-users.
3. Dissemination to private investors and public funding organizations by participating in working groups and events of EU associations and trade fairs.

### FVLLMONTI partners

Communication between project partners will take place both live and through virtual means:

1. A project management tool is based on the Absiskey project netboard platform. This platform has restricted access and every FVLLMONTI member has its own username and password. Partners can obtain access and password via the project manager. All FVLLMONTI documents will be available on the project platform.
2. The audio/video conferences will take place using the Zoom platform. Electronic meetings of general interest (for example training sessions) will be recorded and published on the project platform. Notifications on upcoming calls will be sent to each partner directly by email or through the project platform.
3. Live and virtual meetings.
  - 3.1. General assembly meetings: there will be monthly meetings of the members of the GA, dedicated to overview of project targets, needs and any other information necessary to maintain and monitor the overall quality of the project. Monthly calls will take place every first Monday of the month, 2PM CEST.
  - 3.2. Progress meetings: every three months, the management of the project will require a progress meeting involving representatives of each partner. As many meetings as possible will be organized as in person full day meetings, at least one member from each partner institution (two from the coordinator) will be expected to participate.
  - 3.3. Executive Advisory Board meetings. A first advisory board meeting was hold online on Monday June 21, 2021. A second meeting is planned for March 2023.

## Scientific community

Knowledge transfer to the scientific community is dominated by two channels: the publication of peer reviewed scientific journal articles and the presence at scientific conferences. After they have undergone IP screening by the project partners, scientific results will be distributed via those channels after careful selecting the target medium based on the following criteria:

1. Scientific reputation and wide appeal attention, typically measured by Journal Impact factor
2. Rapidness of publication
3. Possibility of publication via open access

Until M24, the following 8 papers have been accepted in for publication in scientific journals:

Publications (journals)	
1.	B. Neckel Wesling, M. Deng, C. Mukherjee, et al. "Extraction of small-signal equivalent circuit for de-embedding of 3D vertical nanowire transistor". <i>Solid-State Electronics</i> , Elsevier, 2022, 194, pp.108359. 10.1016/j.sse.2022.108359.
2.	C. Mukherjee, A poittevin, I. O'Connor, G. Larrieu and C. Maneux, "Compact modeling of 3D vertical junctionless gate-all-around silicon nanowire transistors towards 3D logic design", <i>Solid-State Electronics</i> , <a href="#">Vol. 183</a> , pp. 108125, Sep. 2021
3.	M. Thesberg, M. N. K. Alam, B. Truijen, B. Kaczer, P. J. Roussel, Z. Stanojević, O. Baumgartner, F. Schanovsky, M. Karner, H. Kosina, "On the Modeling of Polycrystalline Ferroelectric Thin Films: Landau-Based Models Versus Monte Carlo-Based Models Versus Experiment," in <i>IEEE Transactions on Electron Devices</i> , vol. 69, no. 6, pp. 3105-3112, June 2022, doi: 10.1109/TED.2022.3167942.
4.	Ponzina, F., Machetti, S., Rios, M., Denking, B.W., Levisse, A., Ansaloni, G., Peón-Quirós, M. and Atienza, D., 2022. A hardware/software co-design vision for deep learning at the edge. <i>IEEE Micro</i> , 42(6), pp.48-54.
5.	T. Mikolajick, G. Galderisi, S. Rai, M. Simon, R. Böckle, M. Sistani, C. Cakirlar, N. Bhattacharjee, T. Mauersberger, A. Heinzig, A. Kumar, W.M. Weber, J. Trommer. « Reconfigurable field effect transistors: A technology enablers perspective ». <i>Solid-State Electronics</i> , 108381 (2022)
6.	T. Mauersberger, J. Trommer, S. Sharma, M. Knaut, D. Pohl, B. Rellinghaus, T. Mikolajick, A. Heinzig. « Single-step reactive ion etching process for device integration of hafnium-zirconium-oxide (HZO)/titanium nitride (TiN) stacks » <i>Semiconductor Science and Technology</i> 36 (9), 095025 (2022)
7.	Rios, M., Ponzina, F., Levisse, A.S.J., Ansaloni, G., Alonso, D.A., Amirshahi, A., Klein, J.A.H., Orlandi, M., Zanghieri, M., Schiavone, D. and Donati, E., 2022. Bit-Line Computing for CNN Accelerators Co-Design in Edge AI Inference. <i>IEEE Transactions on Computers (TC)</i> , 2022, pp.12-09.
8.	Ponzina, F., Ansaloni, G., Peón-Quirós, M. and Atienza, D., 2022. Using Algorithmic Transformations and Sensitivity Analysis to Unleash Approximations in CNNs at the Edge. <i>Micromachines</i> , 13(7), p.1143.

Table 2 – M24 List of journal publications as a result of the project

Technical conference attendance is another approach that allows FVLLMONTI partners to interact with the scientific community. Through oral and poster presentations in European and international events, the project partners will disseminate the latest project results and newly developed research to promote FVLLMONTI achievements. Furthermore, by attending conferences the project members will have an opportunity to get an understanding of current technology trends, so that project activities can be precisely adjusted during the project's duration.

Publications (conferences)	
1.	L. Réveil, C. Mukherjee, C. Maneux, M. Deng, F. Marc, et al. "Analysis of an Inverter Logic Cell based on 3D Vertical NanoWire Junction–Less Transistors", 30th IFIP/IEEE International Conference on Very Large-Scale Integration (VLSI–SOC 2022), Oct 2022, Patras, Greece. 10.1109/VLSI–SoC54400
2.	C. Maneux, C. Mukherjee, M. Deng, B. Neckel Wesling, L. Réveil, et al.. "Circuit Design Flow dedicated to 3D vertical nanowire FET" IEEE Latin American Electron Devices Conference (LAEDC 2022), Jul 2022, Puebla, Mexico. 10.1109/LAEDC54796.2022.9908233 ( <i>invited</i> )
3.	B. Neckel Wesling, M. Deng, C. Mukherjee, A. Kumar, G. Larrieu, et al.. "Extraction of small signal equivalent circuit for de–embedding of 3D vertical nanowire transistor", 8th Joint International EuroSOI Workshop and International Conference on Ultimate Integration on Silicon (EuroSOI–ULIS) 2022, May 2022, Udine, Italy
4.	A. Poittevin, I. O'Connor, C. Marchand, A. Bosio, C. Maneux, C. Mukherjee et al.. "A Logic Cell Design and routing Methodology Specific to VNWFET", 2022 20th IEEE Interregional NEWCAS Conference (NEWCAS), Jun 2022, Quebec City, Canada. pp.460–464, 10.1109/NEWCAS52662.2022.9842100.
5.	C. Maneux, C. Mukherjee, M. Deng, M. Dubourg, L. Réveil, et al.. "Modelling of vertical and ferroelectric junctionless technology for efficient 3D neural network compute cube dedicated to embedded artificial intelligence" 67th Annual IEEE International Electron Devices Meeting (IEDM 2021), Dec 2021, San Fransisco, United States. 10.1109/IEDM19574.2021.9720572 ( <i>invited</i> )
6.	I. O'Connor, A. Poittevin, S. Le Beux, A. Bosio, Z. Stanojevic, O. Baumgartner, C. Mukherjee, C. Maneux, J. Trommer, T. Mikolajick and G. Larrieu, "Analysis of Energy-Delay-Product of a 3D Vertical Nanowire FET Technology", EuroSOI-ULIS 2021.
7.	Medina R, Kein J, Ansaloni G, Zapater M, Abadal S, Alarcón E, Atienza D. System-Level Exploration of In-Package Wireless Communication for Multi-Chiplet Platforms. In Proceedings of the 28th Asia and South Pacific Design Automation Conference 2023 Jan 16 (pp. 561-566).
8.	Amirshahi A, Klein JA, Ansaloni G, Atienza D. TiC-SAT: Tightly-Coupled Systolic Accelerator for Transformers. In Proceedings of the 28th Asia and South Pacific Design Automation Conference 2023 Jan 16 (pp. 657-663).
9.	C Cakirlar, G Galderisi, C Beyer, M Simon, T Mikolajick, J Trommer « Challenges in Electron Beam Lithography of Silicon Nanostructures » IEEE 22nd International Conference on Nanotechnology (IEEE NANO), 207-210 (2022)
10.	Rios, M., Ponzina, F., Ansaloni, G., Levisse, A. and Atienza, D., 2022, June. Error resilient in-memory computing architecture for cnn inference on the edge. In Proceedings of the Great Lakes Symposium on VLSI 2022 (pp. 249-254).
11.	Ferretti, L., Ansaloni, G., Marquis, R., Teijeiro, T., Ryvlin, P., Atienza, D. and Pozzi, L., 2022, March. INCLASS: incremental classification strategy for self-aware epileptic seizure detection. In 2022 Design, Automation & Test in Europe Conference & Exhibition (DATE) (pp. 1449-1454). IEEE.
12.	Medina, R., Kein, J., Qureshi, Y., Zapater, M., Ansaloni, G. and Atienza, D., 2022, March. Full System Exploration of On-Chip Wireless Communication on Many-Core Architectures. In 2022 IEEE 13th Latin America Symposium on Circuits and System (LASCAS) (pp. 1-4). IEEE.

*Table 3 – M24 List of conference contributions as a result of the project*

Dissemination to young scientists is also important because it allows to foster new research and innovation capacities. Throughout the FVLLMONTI project this type of dissemination is planned by:

1. Interdisciplinary coaching of the PhDs and Post-Docs of the consortium.
2. Organizing the training sessions for local PhDs/Post-Docs outside the consortium (after M36, responsible partners: University of Bordeaux).

3. Co-hosting a 5-days Summer School open to young EU scientists on the topic Energy efficient embedded artificial intelligence (E3AI) in Bordeaux. Information currently available: <https://bss-e3ai.u-bordeaux.fr/en>
4. Participation in summer schools and science events organized by third parties

Workshop participations
<ol style="list-style-type: none"> <li>1. "First extraction of thermal contribution in 3D Vertical Junctionless gate-all-around Nanowire Transistors", by B. Burucoa, AVIC, Bordeaux, France, Sep. 2021.</li> <li>2. "Characterization and modeling of vertical junctionless silicon nanowire transistors for 3D logic circuits", by Y. Wang, GDR-SOC2, Strasbourg, France, June 2022.</li> <li>3. "Analysis of an Inverter Logic Cell based on 3D Vertical NanoWire Junction-Less Transistors" by L. Réveil, GDR-SOC2, Strasbourg, France, June 2022.</li> <li>4. "Methodology for thermal contribution extraction of 3D Vertical Nanowire Transistors", by B. Burucoa, GDR-SOC2, Strasbourg, France, June 2022.</li> <li>5. "Characterization and modeling of Vertical Si nanowire transistors (VNWfet) for 3D logic circuits", by Y. Wang, FETCH, Vaud, Switzerland, Feb. 2023</li> </ol>

*Table 4 – M24 List of 3<sup>rd</sup> party workshop participation as a result of the project*

## Industry leaders / Industrial end-users

Semiconductor manufacturing industries and industrial end-users are identified as an important target audience for the FVLLMONTI project, because they help to:

1. Obtain feedback to access technological opportunities for FVLLMONTI technology development.
2. Stir interest for the potential vertical nanowire transistors to pursue demonstration projects in industrial environments after the project ends.

This group of stakeholders will be engaged via the external advisory board and will be asked to provide annual feedback.

Furthermore, the project outcomes will be disseminated to industry leaders at specific conferences such as HIPEAC or IEDM. HIPEAC is a European network of almost 2000 world-class computing systems researchers, industry representatives and students (more information at: <http://www.hipeac.net>). IEEE International Electron Devices Meeting (IEDM) is the world's preeminent forum for reporting technological breakthroughs in the areas of semiconductor and electronic device technology, design, manufacturing, physics, and modeling. IEDM is the flagship conference for nanometer-scale CMOS transistor technology and related topics (<https://www.ieee-iedm.org/>). In line with our dissemination strategy the partner GTS was present with a booth at the trade fair of IEDM 2021, highlighting FVLLMONTI innovations among other topics.

Invited Talks
<ol style="list-style-type: none"> <li>1. "Strategies for Characterization and Parameter Extraction of Vertical Junction-less Nanowire FETs dedicated to Design Technology Co-Optimization", 243rd <b>ECS Meeting</b> (Boston/2023) for Symposium: H02 - Advanced CMOS-Compatible Semiconductor Devices 20, Boston, USA (28 May - 2 June 2023).</li> <li>2. "Cross Layer Design for the Predictive Assessment of Technology-Enabled Architectures," Design, Automation and Test in Europe (DATE), Antwerp, Belgium, 17-19 April 2023</li> </ol>



3. 'Emerging technologies and new computing paradigms: How to reinvent the value-chain?' École d'hiver Francophone sur les Technologies de Conception des Systèmes Embarqués Hétérogènes (**FETCH**) 2023.
4. "3D compute cubes for edge intelligence : nanoelectronic-enabled adaptive systems based on junctionless, ambipolar, and ferroelectric vertical FETs," École d'hiver Francophone sur les Technologies de Conception des Systèmes Embarqués Hétérogènes (**FETCH**) 2022
5. "Circuit Design Flow dedicated to 3D vertical nanowire FET" IEEE Latin American Electron Devices Conference (**LAEDC 2022**), Jul 2022, Puebla, Mexico.
6. I. O'Connor, "Voyage au cœur des technologies de fabrication pour la réalisation des futurs systems of systems-on-chip, des systèmes embarqués et des objets connectés," Télécom, no. 205, pp. 8-10, June 2022.
7. "How novel technologies can boost neuromorphic computing? A view from European project consortia". Workshop **NEUROTECH**, 2021.
8. "Why neuromorphic computing needs novel 3D technologies? A view from FVLLMONTI European project consortium", High Performance Embedded Architecture and Compilation, Computing Systems Week, (**HiPEAC CSW**) Autumn 2021, Oct 2021, Lyon, France.
9. "Modelling of vertical and ferroelectric junctionless technology for efficient 3D neural network compute cube dedicated to embedded artificial intelligence" 67th Annual IEEE International Electron Devices Meeting (**IEDM 2021**), Dec 2021, San Francisco, United States.

*Table 5 – M24 List of invited talks at events with potential to address industrial stakeholders*

## Private investors and public funding organizations

The main goal of dissemination towards private investors and public funding organizations is to create willingness to invest in upscaling activities. Four key innovations have been identified that may lead to relevant commercial exploitation and are listed in the European innovation radar (<https://www.innoradar.eu/>). From the project start project partners are participating in working groups and events of EU associations (e.g. Neurotech; EIC Innovation radar ) to ensure integration of these innovations into roadmaps. Suitable future funding sources are monitored regularly. Private investors are approached in bi-lateral meetings, at trade fairs and in public networking events.

## Public

Non-technical audiences (public) will be engaged by demonstrating the FVLLMONTI contribution to solve the grand-challenge of modern society and support the UN Sustainable Development Goals. With the main contributions being analyzed to support goal 9 (industry, innovation, and infrastructure) and 10 (reduced inequalities). Communications highlight potential applications, social impacts, and economic opportunities. As the starting years of the project were massively influenced the Covid-19 pandemic, options for in-person dissemination to a public audience have been limited. Some actions have been taken, e.g. at the Dresden Science Night 2021 (<https://www.wissenschaftsnacht-dresden.de/en/review>). In addition, public communication focused on the social media channels, website and other online opportunities, like video interviews.

The following options for further public dissemination are currently under consideration:

1. Participation to a TED talk (TED Bordeaux, TED Lyon or similar events)
2. Recording of a podcast (e.g. EPRS Science and technology podcast)

3. Contribution to scientific blogs (e.g. AI Insider; AI trends; Next Web [AI section])
4. Cartoon visualizing the project results (e.g. via YouTube)
5. Promotion on future public science events (similar to Dresden Science Night listed above)

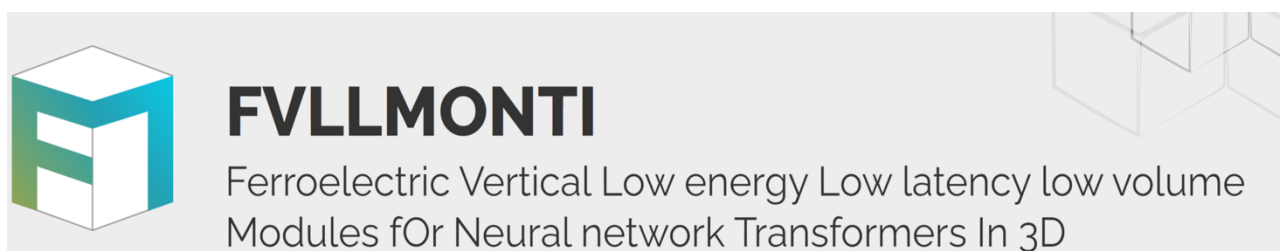


## V. Communication channels and tools

### 1. *Branding – Visual identity*

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The FVLLMONTI visual identity aims to achieve a strong visual appearance that stands out in digital and print applications. The project's logo is a significant element of the project visual identity. It should appear on project's website, social networks, promotional materials, and all public documents related to the project.



*Figure 1 – FVLLMONTI logo*

### 2. *Digital communication / Online presence*

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#### Website

The FVLLMONTI website (<https://fvllmonti.eu>) was launched to serve as an important communication tool to showcase online any significant information relevant to a wider audience. The website provides project's overview, workplan and other information on the project consortium, activities, results, events as well as information on other relevant issues. Direct access to the social media channels is integrated. All public documents will also be available on the FVLLMONTI website. The website targets both industrial/scientific stakeholders and the public.

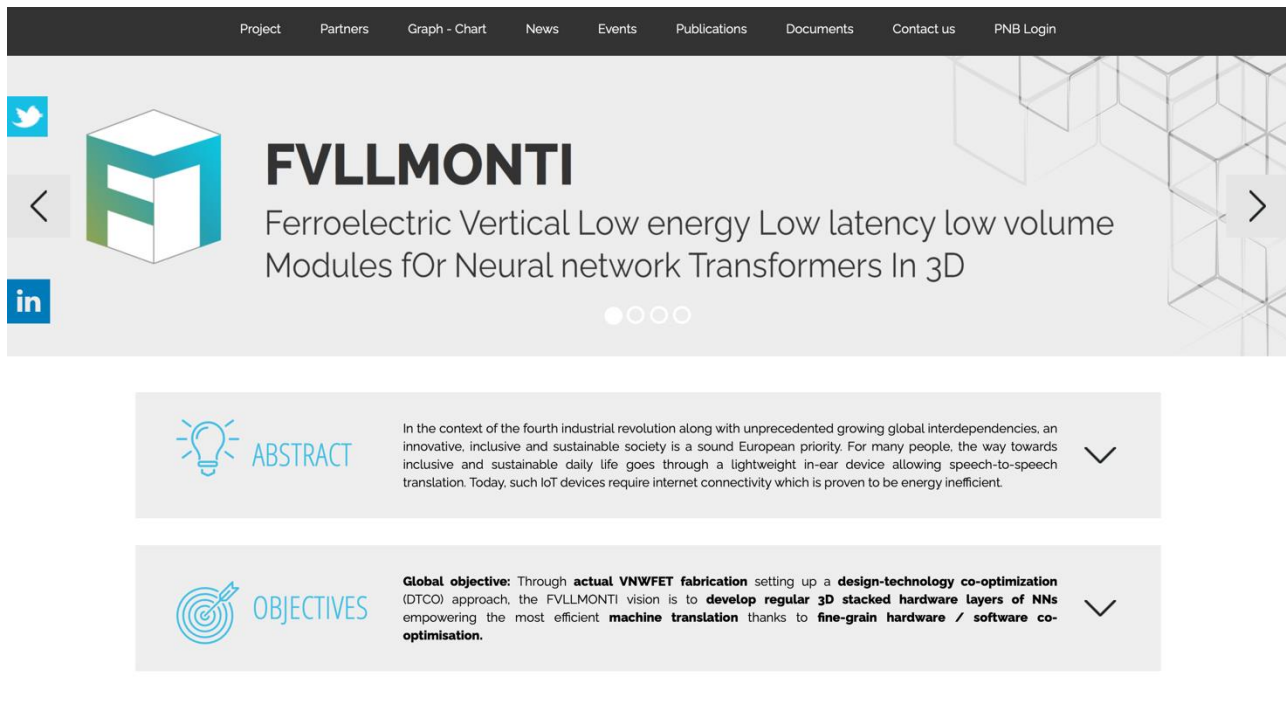


Figure 2 - Website home page

The website has been developed by University of Bordeaux and is managed by both University of Bordeaux and NaMLab. The contributions of all project partners are gathered regularly to continuously enrich the website with news and other relevant information. All partners are encouraged to submit news continuously to maintain the website vivid and spread the information about it.

## Project flyers

We have created a flyer for the project in order to disseminate the information during the conferences. Each partner will receive enough of them for their activities. The flyer can be modified during the life of the project.

## Social media

Over the lifespan of the project, the FVLLMONTI operates an active Twitter and LinkedIn engagement, which will build a network of interested followers. Video content will be made available for public via the platform YouTube, whenever possible.

Twitter	<a href="https://twitter.com/fvllmonti">https://twitter.com/fvllmonti</a>
LinkedIn	<a href="https://www.linkedin.com/in/fvllmonti-project/">https://www.linkedin.com/in/fvllmonti-project/</a>
Youtube	HiPEAC content: Talk: <a href="https://youtu.be/Ve1uXEr9kd8">https://youtu.be/Ve1uXEr9kd8</a> Interview: <a href="https://youtu.be/xMG6DLfwALQ">https://youtu.be/xMG6DLfwALQ</a>

Table 6 – List of used social media channels

The aims of the FVLLMONTI social media channels are:

1. Increase the visibility of the project, its results, and perspectives.
2. Reach and engage the targeted audiences by providing the latest information about the project, aiming to raise awareness, interact and communicate to exchange knowledge.
3. Establish a strong communication and interaction to support exploitation of the project results.

The social media posts are planned to be both factual, and clearly focused on the project objectives, but also entertaining and not necessarily science related from time to time. Featured topics and subject areas are likely to resonate with the FVLLMONTI target audiences:

1. Important news announcements about the project such as publications, milestones reached, public deliverables.
2. News on planned events such as meetings, conferences, industry events and exhibitions, workshops, summer school, etc.
3. Published articles, interviews, and videos within the context of the FVLLMONTI main topics.
4. Interesting developments in science in the area of FVLLMONTI or around the partners locations.

Due to a lack of results that could be shared openly with the public early in the project, the number of posts in 2021 has been very low. The social media activity was increased heavily in 2022 and is planned to further accelerate with the aim of having at least one post per week on average in 2023. At this point, effective and regular communication efforts are mainly carried out via the professional social network LinkedIn on a regular basis publication rhythm. The communities that he began to attract and gather around the various activities is steadily growing. However, the Twitter account meant to distribute results to a more wide non-scientific audience was not the most able to create a high number of responsiveness. This is most likely to a lack of 'trending topics' in our area of science and technology in the timeframe of reporting. However, the account it is not abandoned. Posts are synchronized with the outreach activities via LinkedIn. Its usefulness could be growing in the event of strong resonant social events around AI and new technologies, innovative science and its developments.

## Other digital dissemination media

Press releases are written by the University of Bordeaux and circulated to relevant online and/or offline media lists and to all partners. Popular science journals and blogs will be targeted to reach non-technical public and industrial journals and blogs will be targeted to reach industry representatives. Easy-to-understand visuals (e.g., short video clips and graphics) will target non-technical audience. Video content will be distributed via the platform YouTube.

## Partner projects

As one of the outcomes of scientific communication actions within the first two years, FVLLMONTI has established a network of partner projects. The partners involve each other in their dissemination activities, share social media contributions and organize shared events. Among them, the planned E3AI summer school in Bordeaux stands out (<https://bss-e3ai.u-bordeaux.fr/en>). The current partner projects (COMPRISE, WiPLASH, HERMES, RadioSpin, NeurONN, MISEL) are highlighted on the FVLLMONTI website. Links to their respective project websites have been established.



## Project Vision

Connecting the people of Europe via a lightweight in-ear device with direct speech-to-speech translation capability. The neural network compute cube (N2C2) will help us to empower speech recognition and translation. We aim to demonstrate the potential of this architecture based on emerging vertical nanowire transistor technologies. The project will help secure inclusive and sustainable life in Europe in the context of the fourth industrial revolution.

## FVLLMONTI partners

**namelab**  
a 100% academic partner

**XGT5X**  
with 100 partners

**Université BORDEAUX**  
**LAAS CNRS**

**CEVALATION**

**EPFL**

## More information

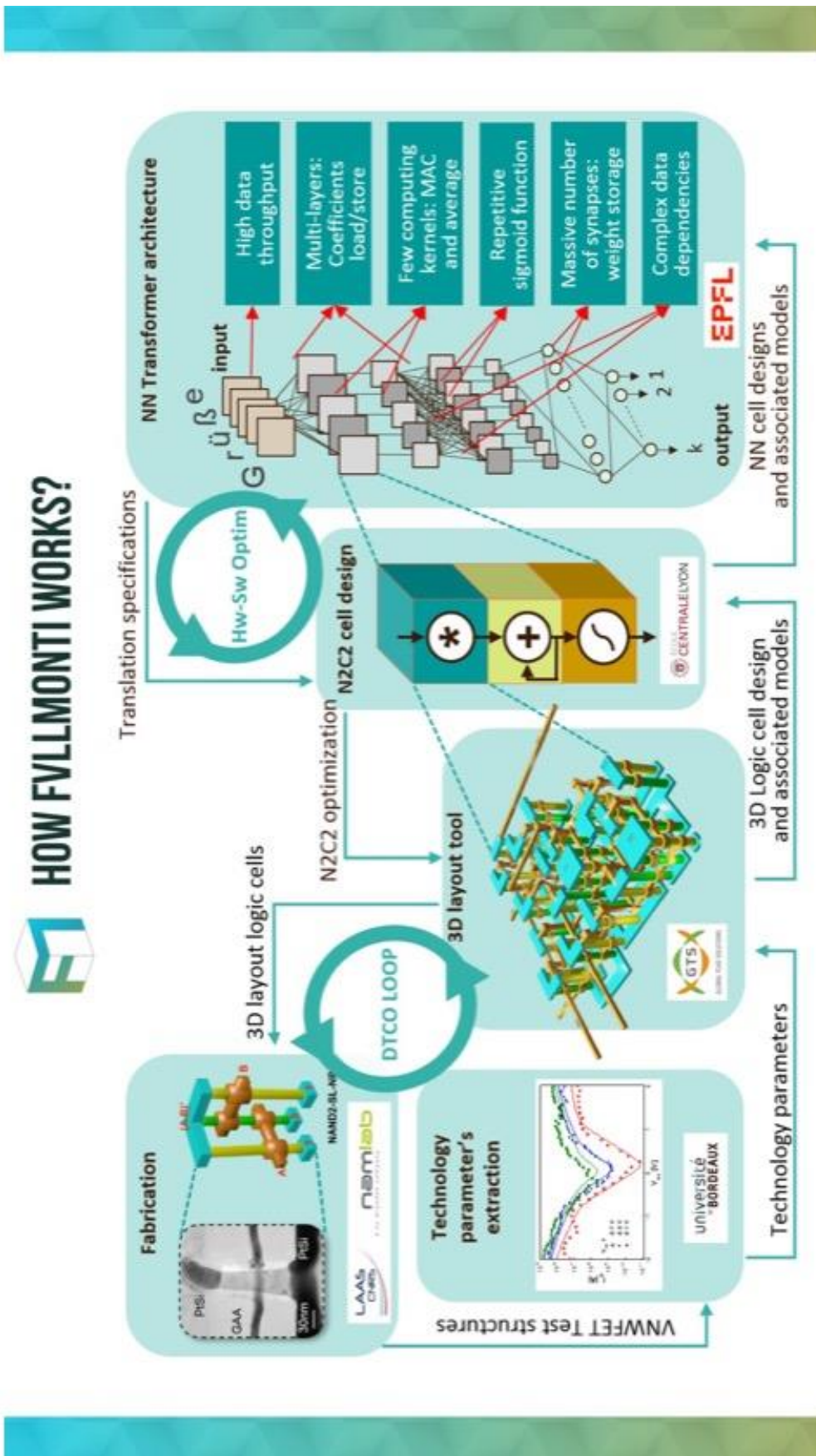
[www.fvllmonti.eu](http://www.fvllmonti.eu)

## FVLLMONTI

**Ferroelectric Vertical Low energy Low latency low volume Modules for Neural network Transformers In 3D**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101016776.

Figure 3 - FVLLMMONTI Flyer – Front page





## VI. Dissemination performance indicators

The plan for the dissemination of results and related impact to target groups, quantified performance indicators with target values during the whole project lifetime are defined in the table below.

Audience description	Dissemination channels & KPIs	Status	Feedbacks expected
Researchers & engineers specialized in electronics, neuromorphic engineering, NLP and cross thematic	Publications in international conferences and journals: Minimum 15 publications in conferences and 10 publications in journals	8 Journal and 12 Conferences publications	Transferring and adopting results, designing new collaborative research proposals, stimulating new research collaboration and train students.
End users' companies in speech to speech & industrial	1 workshop whereby FVLLMONTI results are showcased to electronics companies. Factsheet on FVLLMONTI for companies.	FVLLMONTI+MISEL dissemination event planned at ESSERC Lisbon 2023 - HiPEAC interventions 10/2021, C. MANEUX	Feedback during workshops, increase acceptance of the applications developed, and adoption from potential users.
Policy makers/Public institution	Policy briefs on FVLLMONTI	Suitable public institutions are screened.	Endorsement of public institutions
EU and international initiatives in the field of neuromorphic computing and embedded IA	Participation in Human Brain Project via two partners.	-Neurotech online event 26/04/2021 -IEDM 67/68 <sup>th</sup> anniversary participation or invitation -DATE22 interventions: Ian O'Connor 15/03/2022	FVLLMONTI outcomes integrated in Strategic Research Agenda of EU/international associations Set up a community of research/practices

Table 7 – Target dissemination by audience; giving used channels and expected feedback till end of project

To reach these overall goals the means used for all dissemination and communication activities will be monitored during the project runtime to assess the effectiveness of the approach and the tools used to support it. To evaluate the project's capability to disseminate and effectively communicate its results and achievements, the following dissemination's KPIs have been defined for each mean of tool created and used.

Tool/Mean	Key Performance Indicator	Status at M24
Scientific journal publications	More than 10 peer-reviewed articles in high-impact journals by M50.	8 peer-reviewed articles in journals with an impact factor between 1.99 and 4.17.
Training for local PhDs/Post-Docs	4 dedicated workshops for students, researchers, and engineers. 10 local PhDs/Post-Docs trained by University of Bordeaux and Beneficiaries in their locations.	5 Participation in summer schools and science events organized by third parties 9 members of the FVLLMONTI team currently undergo PhD supervision at their respective University.
Summer School	No less than 30 international attendees registered at the summer school.	Summer School planned for year 3, on June 19 – 23, 2023

Conferences	15 presentations in scientific conferences	12 presentations in scientific conferences
Dissemination to semiconductor manufacturing industries and industrial end-users	At least 1 business conference and expo and 2 bilateral meetings per year, from M12.	Participation IEEE IEDM expo via GTS Dez. 2021
Project website	Number of unique visitors. Target: < 500 – poor, 500-1000 – good, >1000 – excellent (by the end of the project)	Google analytics account to monitor viewer numbers was set-up
Social Networks	Number of followers. Target: >200 followers by the end of the project. Number of posts: >50 per year after M24 Number of views. Target: < 30 000 – poor, 30 000 – 50 000 – good, > 70 000 – excellent (by the end of the project)	LinkedIn-followers: 153 relations Twitter-followers: 23 followers Number of posts per year: 5 in 2021; 22 in 2022

*Table 8 – Dissemination KPIs*

The next update on this dissemination plan is scheduled at M38, a final version is planned for M50, covering all dissemination activities carried out during the project in either online or live fashion. Dissemination activities are led by UBx and supported by NaMLab.

### Quality assurance and best practices

The entire FVLLMONTI consortium is committed to publishing in leading scientific journals only, avoiding predatory journals.

## VII. Summary and Conclusions

The main output of Deliverable 6.3 is a status update for FVLLMONTI covering the specific dissemination actions of the project. This describes scientific dissemination such as journal articles, conference presentations, and scientific events as well as broader communication mechanisms such as branding, website, social media, and events designed for non-technical public. To date, the actions undertaken and expected within the framework of the dissemination and communication objectives, set in 2022 for the past year, in Deliverable D.6.2, are in a development and continuation phase.

Dissemination activities have been tailored towards the various target audiences (scientific community, public, industry leaders and end-uses, as well as private investors and public funding organizations). Especially, the spread of information in the scientific community goes well with more than 20 publications in peer-reviewed journals and renowned international conferences. A framework of partner projects in the area of neuromorphic computing and AI has been established to excel the scientific exchange. FVLLMONTI scientist had five participation in summer schools and science events organized by third parties and are regularly invited to share their vision about the project on industry-relevant meetings and events like NEUROTECH, HiPEAC or IEDM. An own summer school co-hosted together with two of the partner projects is in preparation.

Public dissemination to date has focused on the steady-growing community on the professional network LinkedIn. In addition, the project website is regularly updated with news regarding publications, deliverables and other highlights around the project. Another highlight is the video content placed on the platform

youtube. Future activities like podcasts, scientific blogs, or public speaking events such as TED talks are under consideration.

This deliverable will be updated two more times (M38 and M50) during the lifetime of the project.

## VIII. Partners responsibility

UBx acts for the implementation of the project as Project Coordinator, it represents the consortium in its relations with the European Commission, and it is responsible for the Project Management.

The European Commission recognize contractual links only with the Project Coordinator, that is the legal person with whom the Commission has contracted for the implementation of the FVLLMONTI Project and does not recognize contractual links with other Parties in the project, therefore any communication to the European Commission must be channeled through the Project Coordinator.

Each partner shall ensure that the activities for which it is responsible, as specified in the Project and in the Consortium Agreement, are carried out in accordance with the tasks described in the EC Contract.

To that end the partner shall mobilize all the financial, human and material resources required for the full implementation of the project. The partner must implement the work with the requisite degree of care, efficiency, transparency and diligence, as required by best practice in the field concerned, and in compliance with the contract.

Each partner shall report to the Project Coordinator the progress in the implementation of activities, as described above, and whenever requested by the coordinator.

## IX. Contacts

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