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COGNITWIN – Cognitive plants through proactive self-learning hybrid digital twins

Deliverable number

D 8.5

Deliverable name

Risk Assessment and Management Action Plan

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Publishable summary

This report presents key information about the project, a management action plan and risk assessment.

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1 COGNITWIN Project Information

Table 1 provides key information about the COGNITWIN project.

Table 1: COGNITWIN project information

Acronym	COGNITWIN
Grant Agreement No	870130
Starting date	1 September 2019
Duration	36 Months
Project total cost	€ 8 653 170,00
EC contribution	€ 6 982 431,38
Project Officer	Eleftherios BOURDAKIS

2 COGNITWIN Objectives

While the concepts of digitalisation and Industry 4.0 are making rapid inroads into the European manufacturing sector, there are several aspects that can be still incorporated into the system to strengthen the goal of optimal process operations. One such aspect to the digitalisation vision is the "cognitive element", where the process plants can learn from pattern recognition in historical data and adapt to changes in the process, simultaneously being able to predict unwanted events in the operation before they happen. Through this project, COGNITWIN (Cognitive Digital Twin), we aim to add the cognitive elements to the existing process control systems and thus enabling their capability to self-organise and offer solutions to unpredicted behaviours.

Our strategic, high-level objective is to establish the fully digitalized concept of self-learning and proactive next generation of Digital Twins, which operate in the hybrid world and can i) recognize, forecast and communicate less optimal process behaviour well before these occur and ii) adjust itself in order to keep the process continuously close to or at optimum.

Specific Objectives:

COGNITWIN for Industry Process Excellence: Show improved performance in cognitive production plants by a technology demonstration of fully digitalized pilots.

Cognitive Digital Twins for Cognitive Retrofitting: Enabling an efficient and well-defined approach for “cognitive augmentation” of physical assets, processes and systems for Cognitive Digital Transformation in Process industry.

Hybrid Twins for Optimised Process Performance by hybrid models that combines first principle and data-driven models and use machine learning, AI and the connected data bases

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to pro-active forecast and communication, as well as self-learning by recognition of patterns in the data.

COGNITWIN Interoperability Toolbox as a Service: A reference architecture for the cognitive elements including of Big Data, Databases, IoT, Smart Sensors, Machine Learning, and AI technologies that realizes hybrid modelling, self-adaptivity and cognitive recognition, leveraging/extending the existing work into relevant communities.

COGNITWIN for increasing European Technology Dominance: Ensure the dominance of the Europe in technologies related to cognitive plants, thereby influencing the further development of Big Data, Databases, IoT, Smart Sensors, Hybrid Modelling, Machine Learning and AI technologies in relevant communities, focusing on the capabilities of the developed technologies for creating new generations of self-adaptive and cognitive algorithms and models.

COGNITWIN for SPIRE: Ensure the knowledge transfer of results and experiences from the COGNITWIN project to the SPIRE Process Industry community, focusing on active participation in the new SPIRE DG7 Digitalisation group and in SPIRE organized events.

COGNITWIN for boosting European Industry: Provide competitive advantage to the European industry, esp. SMEs in the global market, through better exploitation of the synergies between Big Data, Databases, IoT, Smart Sensors, Hybrid Modelling, Machine Learning and AI technologies for an efficient resolution of complex process industrial challenges.

Effective dissemination and ensuring transfer of knowledge and experience generated in the pilots to the wide (European) audience in different industrial sectors by providing practical experiences from large-scale pilots to hundreds of companies through associated DIHs.

3 Management

Annex 1 (Description of the action – DoA) in the Grant Agreement and the Consortium Agreement (in preparation) are the main guiding document of COGNITWIN project.

Part A of Annex 1 presents a list of beneficiaries, workplan tables, list of work packages, deliverables and milestones, critical implementation risks and mitigation actions, summary of project effort in person-months and tentative schedule of project reviews. The management structure, milestones and procedures are described in detail in part B of Annex 1.

Templates for meeting minutes and deliverable are prepared for Internal Communication.

The following aspects are currently being defined to ensure highest quality standards of the project outcome.

- The management structure in terms of different roles and responsible persons
- Work processes (delivery process for project deliverables, risk management, milestone approval, meetings, reporting, review preparation, document naming conventions, routines for submission of publications etc.)
- Administrative processes (reporting of person-months, project costs etc.)

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A collaborative project web-platform and an external website for COGNITWIN project is established.

3.1 Management Organization

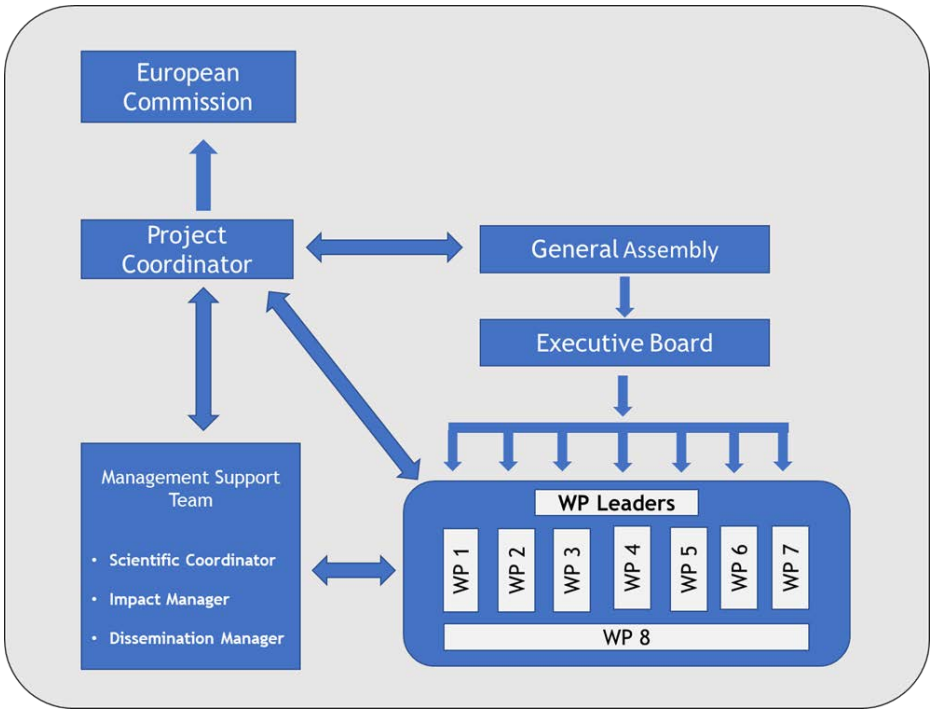

Figure 1: Management organization of the COGNITWIN project.

The governing bodies of the COGNITWIN project are as follows:

- Project Coordinator
- General Assembly (GA)
- Executive Board (EB)
- Management Support Team (MST)

The Coordinator is the legal entity acting as the intermediary between the Parties and the Funding Authority and shall perform all tasks assigned to it as described in the Grant Agreement and the Consortium Agreement.

General Assembly is the ultimate decision-making body of the consortium. It will be chaired by the Coordinator and attended by one representative of each partner. The GA will be responsible for the overall strategic orientation and policy of the project.

Executive Board, chaired by the coordinator, is the supervisory body for the execution of the project which shall report to and be accountable to the General Assembly. During the kick-off meeting, some partners have mentioned their wish to include pilot leaders and management support team also into the EB. This suggestion was approved by GA members during the 1st GA meeting.

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The day-to-day work will be dealt with in the Work Packages (WP). The WP is led by a Work Package Leader.
The management support team (MST) members are not entitled to make decisions but will assist and facilitate the work of the EB and the coordinator for executing the decisions of the General Assembly and carry out high level day-to-day management of the project. Four roles have been assigned in the MST:

- **Project Coordinator:** Frode Brakstad
- **Scientific Coordinator:** Arne Jørgen Berre
- **Impact Coordinator:** Peter Singstad
- **Dissemination Coordinator:** Ljiljana Stojanovic

Members of General Assembly and Executive Board of the COGNITWIN Project are provided in Table 2.

Table 2: General Assembly and Executive board of the COGNITWIN project

General Assembly	Executive Board
Frode Brakstad (SINTEF), Chair	Frode Brakstad (Project Coordinator)
Duncan Akporiaye (SINTEF)	Arne Berre (Scientific Coordinator)
Martin Segatz (HYDRO)	Nancy J. Holt (WP1 Leader)
Jenö Kovacs (SFW)	Ulrike Faltings (WP2 Leader and SAARSTAHL Pilot Leader)
Iñigo Unamuno Iriondo (SIDENOR)	Mika Liukkonen (WP3 Leader and SUMITOMO Pilot leader)
Aasgeir Valderhaug (ELK)	Nenad Stojanovic (WP4 Leader)
Michael Schäfer (SAG)	Stein Tore Johansen (WP5 Leader)
Tim Dahmen (DFKI)	Peter Singstad (WP6 Leader)
Peter Singstad (CYB)	Ljiljana Stojanovic (WP7 Leader)
Nenad Stojanovic (NISSATECH)	Akhilesh Kumar Srivastava (WP8 Leader)
Ljiljana Stojanovic (Fraunhofer)	Are Dyrøy (Hydro Pilot Leader)
Enso Ikonen (UOULU)	Kjetil Hildal (Elkem Pilot Leader)
Perin Unal (TEKNO)	Iñigo Unamuno Iriondo (SIDENOR Pilot Leader)
Korhan AKTULGA (NOKSEL)	Aylin Demircioglu (NOKSEL Pilot Leader)
Pierre Gutierrez (SCORTEX)	

3.2 Management Regulation

The Annex 1 of Grant Agreement and Consortium Agreement regulate all relevant issues concerning management (management bodies, roles, organisation, specific operational procedures for the consortium bodies etc.).

4 Work Plan

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4.1 Workflow

A detailed WP structure (and the interdependence of WPs`) of the COGNITWIN project is provided in Figure 2.

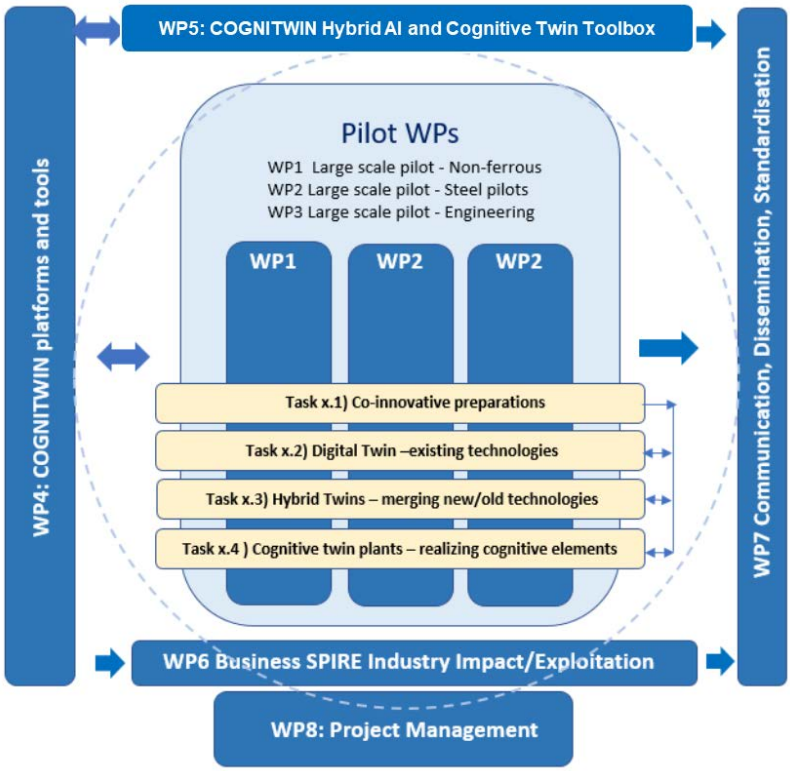

Figure 2: Work package structure of the COGNITWIN project

4.2 Gantt Diagram

The Gantt diagram of COGNITWIN project from Annex 1 of the Grant Agreement is presented in Table 3.

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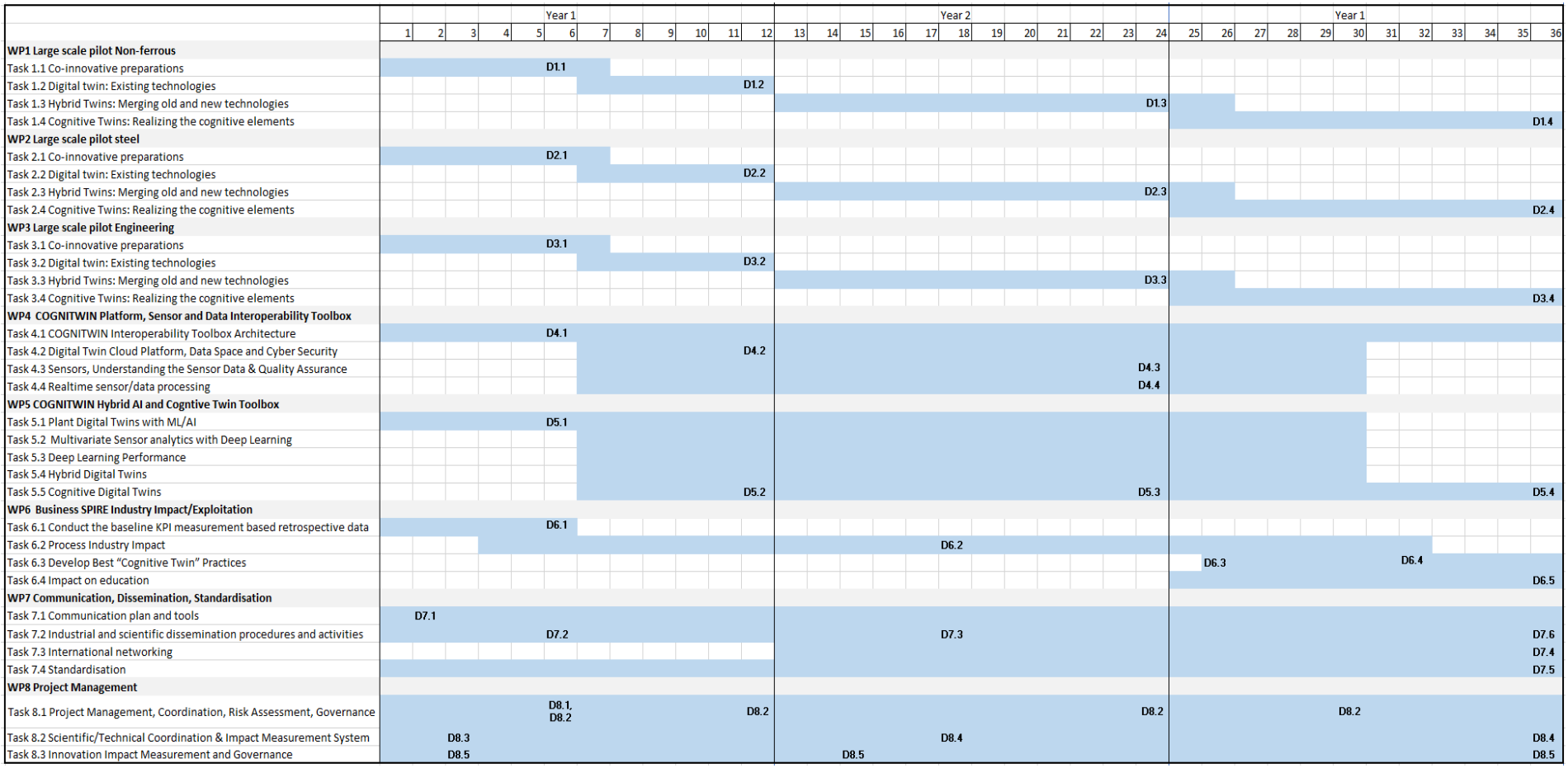
Table 3: Gantt diagram of the COGNITWIN project



Summary of project effort in person months is provided in Table 4.

Table 4: Summary of project effort in person months

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	Total Person/Months per Participant
1 - SINTEF	12	12	10	20	18	9	9	22	112
2 - HYDRO	27	0	0	4	4	0	1	2	38
3 - SFW	0	0	48	0	8	7	4	2	69
4 - SIDENOR	0	30	0	3	3	1	2	1	40
5 - ELK	34	0	0	3	3	1	1	1	43
6 - SAG	0	40	0	3	3	1	1	1	49
7 - DFKI	0	6	0	6	24	0	2	2	40
8 - CYB	10	6	6	4	8	12	1	1	48
9 - NISSATECH	4	4	4	28	24	8	3	1	76
10 - Fraunhofer	3	3	3	12	18	6	18	3	66
11 - UOULU	0	0	6	20	20	0	6	0	52
12 - TEKNO	0	30	0	16	12	0	2	2	62
13 - NOKSEL	0	40	0	0	0	6	2	2	50
14 - SCORTEX	2	2	0	22	6	0	2	2	36
Total Person/Months	92	173	77	141	151	51	54	42	781

5 Reporting

5.1 Periodic Management Reporting

5.1.1 Reporting periods

The action is divided into the following '**reporting periods**' for short interim management reports will be delivered in M6, M12, M24 and M30.

- RP1: from month 1 to month 6
- RP2: from month 6 to month 12
- RP3: from month 18 to month 24
- RP4: from month 24 to month 30

5.1.2 Intermediate and official periodic deliverables

The Coordinator is responsible for submitting the following reports to the Commission, within 60 days after the last date of the reporting period:

- Periodic technical and financial reports: M18, M36
- Final report: M36

In order to enable an efficient workflow between tasks and to anticipate problems and delays, the coordinator will perform the following actions:

- Send a reporting template to all partners and remind them for timely completion
- Partners send their input to the Coordinator within a specified period

- The Coordinator will consolidate the input from all the partners, request for modifications if necessary and send the complete report to the EC

Technical and financial reports will present an overview of the activities and progress to reach the project objectives, the milestones and deliverables, problem identification and corrective actions, a statement on the use of resources. Any deviations between actual and planned person-months will be included in the report. A thorough explanation of the use of resources, a financial statement (see Annex 4 of the Grant Agreement) with detailed information on eligible costs and information from financial audits will be included in the periodic financial report.

5.2: Documents Confidentiality

The confidentiality of all the COGNITWIN documents will be maintained as per the Grant Agreement and Consortium Agreement.

6 Communication Tools

6.1 COGNITWIN SharePoint site

A SharePoint web-based platform named COGNITWIN is available for the project. This platform is administered by SINTEF. Figure 3 presents a screen shot of the platform.

This platform is being used as a tool to promote communication among the project participants. Easy and secure accessibility of technical and financial information related to the project and secure data exchange is enabled by this platform.

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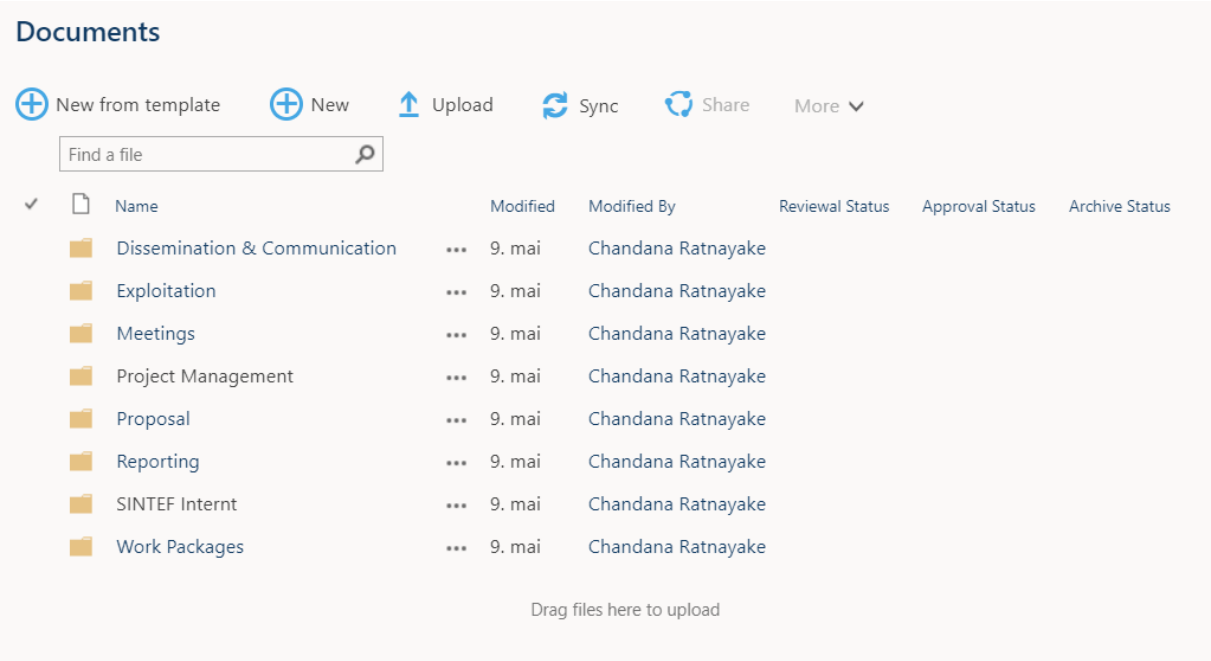

Figure 3: A screenshot of the COGNITWIN's SharePoint room.

An external project website (https://www.sintef.no/projectweb/cognitwin/) is also established. This website provides general project information such as introduction, objectives and consortium. It will be regularly updated with public reports, publications and News & Events. A screen shot of this website is provided in
Figure 4.

Figure 4: A screenshot of the COGNITWIN website.

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6.2 Meeting

Meetings will be organized to maintain and strengthen relationships among the partners, to promote information exchange. These meeting will also be used to make agreements and major decisions and planning for the execution of tasks and actions. Project and General Assembly meetings will be held every six months where each partner should be represented by at least one representative. Based on requirements, collaborative work group sessions will be organized among various WPs. During these sessions, coordination of activities and plans for next 6 months activities will be prepared.

A status update from all WPs, together with an updated risk assessment will be presented in these project meetings. Meeting minutes from each meeting will be prepared and distributed to all participants.

Recurring bi-weekly meeting plan to track administrative and technical progress of the project has been established. All GA members, Executive Board members and Pilot Leaders are invited in this meeting. These members are suggested to nominate other members to join the meeting based on the need.

Work Package meetings will be organised to discuss technical issues and to monitor and track the technical progress of the WP. The Work Package Leader coordinates the WP meetings and is responsible for the agenda.

Internal review meetings will be organized to review and approve all the deliverables, technical reports, publications and press releases. Enough time will be planned to allow for corrective comments before the final release of deliverables or publications.

7 Risk Assessment

Identification and assessment of potential risks is of utmost importance in complex and large projects. The remedial actions of such risks will be prepared as and when identified.

The risk management measures will be taken as follows:

- Potential risks will be identified and assessed concerning their probability and level of (negative) impact.
- For those with medium to high probability and severe impact countermeasures and contingency plans are discussed, and they will be flagged throughout the execution of the project as “risk items”.
- Risks will be re-evaluated at the periodic consortium meetings.

The General Assembly continuously controls the project plan with its milestones and critical paths. In addition, the partners will report regularly in order to ensure that the management is made aware of any potential problems on a timely basis and can initiate countermeasures long before a problem becomes critical.

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Table 5 identifies the currently foreseen major risks. Their impact/consequences are estimated and in a proactive way a contingency approach is suggested.

Table 5: Major risks and proposed mitigation measures

Risk	Probability	Impact	Work Packages involved (main)	Proposed risk-mitigation measures
Underperforming partners or partners leaving the consortium	L	M	All	Conduct meeting with all pilot leaders to see how experiences from other pilots can be used to benefit underperforming partner in order to improve performance.
Synergy of data-driven & model-driven approaches	L	M	WP 4	The effort of reaching KPIs will be moved to other pilots
Delays in the data/model collection	M	M	WP 1-WP 4	Start procedure development at the time of the protocols related to each pilot (once the project is notified as approved by the EC). A replication of the public data base is currently being processed so once the project is approved, data providers have the data already available
Components are not available for integration in time	M	M	WP 1-WP 5	Re-planning of the integration and potentially reduction of the release features.
Delay in integration due to ambitious requirements	M	M	WP 1-WP 5	Identify category of requirements (mandatory, optional, negotiable), review the requirements status as the integration work progresses. Additionally, the COGNITWIN platform will adapt agile methodologies in order to iteratively create features identified by pilots.

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Critical needs measurement does not harmonize with existing available Sensor Technologies	M	M	WP 1-WP 5	Early in the co-innovative preparations parts this has to be clarified and solved by e.g. changes in the measurement strategies towards indirect measurements.
Multi format data/model integration more time consuming then expected	M	M	WP 4, WP 5	Test sample data from pilots already in the first project phases (M3-M12)
Total number of SPIRE members under presentations is lower than expected	M	L	WP 6, WP 7	We will utilize the large network of the partners and DIH (SINTEF) in order to contact SPIRE members in advance, and also European process industry Additionally, the project will not only prepare a commercialization and sustainability plan, it will also collect feedback regarding expectations from multiple target audiences. By analyzing and acting on this feedback, the project can take corrective actions and modify its focus and scope if required.
Chosen pilots are not generic enough for the development of the Best “Cognitive Twins technology” Practices	L	H	WP 1-WP 3	The risk is reduced by the expertise of the partners and know-how from their active involvement in the BDVA, IIC Digital Twins WG, IDSA and relevant R&D projects. We will possible redefine and specialize COGNITWIN output.
Low audience in activities and dissemination events	L	M	WP 6, WP 7	The current economic situation makes this difficult for organizations to attend due to costs. We will try to minimize these costs by bringing events close to its target audience and will use as much as possible on-line communication tools to

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				avoid these situations (e.g. webinars).
Competitor technology appears	L	M	WP 4, WP 5, WP 6, WP 7	Study technology and determine how COGNITWIN results can be improved
No retrospective KPI data is available	L	H	WP 1-WP 3, WP 6, WP 7	We will adjust the definition of KPIs to the data available and include additional means of measurement and validation

8 Conclusion

This report provides the project management and risk assessment plan for COGNITWIN project. The purpose is to establish a quality policy covering all aspects related the management of COGNITWIN project, including management, work plan and communication in the project.

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