The proposed research focuses on developing an intelligent decision support system utilizing natural language for monitoring digital event management. SPEE, a leader in certified digital monitoring, currently relies on human operators to make decisions following critical events at remote client sites. To enhance scalability, SPEE aims to integrate AI-based subsystems to assist human operators in making informed decisions with high precision and efficiency. The goal is to create a system capable of real-time data analysis and reliable recommendations.

The research will involve three main locations: DISIM-UnivAQ, the Computer Engineering Department at the University of Salamanca (DIUS), and SPEE. The candidate will spend her/his study and research over three years, including at least six months at SPEE and six months abroad at DIUS@UniSAL-ES. The remaining time will be at DISIM@UnivAQ-IT for training, literature review, and laboratory research. Annually, the doctoral candidate will produce a report on their activities and submit scientific papers to open-access journals and conferences starting from the second year.

The degree of innovation of this research is high, as SPEE has a history of pioneering advanced digital monitoring systems and methodologies that enable effective monitoring of complex remote installations on a national scale. The research aligns with the PhD program's disciplines, covering areas such as AI and multi-agent systems, cryptography, cybersecurity, distributed systems, and human-machine interaction. DI-Salamanca will offer training and internships on AI, natural language processing, robotics, and computer vision.

The research aligns with the goals of the PNRR, particularly SDG Goal 9, which emphasizes building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation. The proposed activities will also fall within the categories defined by the EU document "Key enabling technologies for Europe's technological sovereignty": AI as a Service, autonomous systems, security, and connectivity technologies.

Technically, the proposal is feasible, with a detailed timeline for implementation. The doctoral candidate will initially study the state-of-the-art and relevant background, focusing on the design methodologies and technologies related to intelligent multi-agent systems with natural language user interfaces and techniques for extracting structured information from distributed data. They will gather requirements for human-machine interaction based on company needs and use cases for intelligent systems in practical applications. The candidate will propose evolutions of the state-of-the-art and develop new models to meet the required specifications, producing theoretical and experimental innovations of academic interest. In the final year, they will complete the design, develop application prototypes, and apply theoretical and experimental validation techniques. This period will include six months at the University of Salamanca (UniSAL-ES), Spain, for complementary design and prototype development, followed by validation activities and doctoral thesis preparation.

Research activities at SPEE will focus on identifying best practices for efficient critical event management at remote installations, analyzing operator requirements in control centres, and ensuring exhaustive data representation of situations. The candidate will study existing integration interfaces, assist during the deployment and testing of prototypes, and collect validation data. The headquarters of SPEE is in L'Aquila, where the primary industrial research activity will be carried out.

The research activities abroad will involve techniques for integrating natural language interfaces (in English, Italian, and Spanish) in multi-agent systems and developing hybrid vision-text language models. The BISITE Research Group will host these activities at the University of Salamanca in Spain.

The training at the university will include periodic meetings with tutors from both the foreign institute and the doctorate headquarters, facilitated by online communication as needed throughout the PhD program. SPEE will monitor doctoral candidates' research progress during their stay abroad through periodic online meetings and webinar proposals.

Integrating AI-based subsystems to support human operators in managing critical events represents the future of SPEE's market. SPEE's control centre, certified under European standards, allows for international expansion, provided that scalability is ensured through innovative technological integrations as proposed in this doctoral project.

The selection of doctoral candidates is organized to ensure equal opportunities and accessibility for disabled students. The supervisor will ensure that a disabled student attends only accessible seminars, summer schools, and conferences. The proposers commit to strict adherence to current regulations on equal opportunities and accessibility during the candidate's time at the foreign university. Special attention will be given to the individual needs of the doctoral candidate through periodic meetings with the supervising professor.