HABILITATION THESIS

Thesis Summary

Innovative Technologies and Approaches for Data Management and Information Security in Organizations

Valerică GREAVU-ŞERBAN

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In the context of the rapid transformations brought about by the digital revolution, contemporary scientific activity is profoundly influenced by the convergence of massive data volumes, artificial intelligence, and the imperative of responsible information governance. This habilitation thesis aims to highlight both the evolution and coherence of a research trajectory focused on integrating emerging technologies to address critical contemporary challenges: the efficient management of large-scale data, the automation of software processes, and the mitigation of human vulnerabilities within digital ecosystems.

The main objective of this thesis is to demonstrate the coherence and evolution of a research agenda centered on the application of emerging technologies, such as distributed infrastructures, the current security risks affecting these data infrastructures, and the pivotal role of education in managing these challenges as well as in the development of information technologies. This work is firmly situated within the landscape shaped by the digital revolution, where massive data volumes, artificial intelligence, and the need for responsible information governance are essential.

A secondary objective of the thesis is to formulate a strategic vision for developing an integrated framework to support responsible, sustainable, and secure digitalization of organizations, with a particular focus on the public sector and small and medium-sized enterprises (SMEs). Future research directions target the expansion of Big Data applications in organizational behavior analysis, the integration of large language models (LLMs) into automated decision-making processes, and the development of institutional resilience frameworks to address information risks.

The structure of this thesis reflects four major research directions, each supported by validated scientific results: (1) the analysis and mitigation of risks associated with social engineering and misinformation; (2) education in the context of IT service outsourcing; (3) the use of low-cost distributed infrastructures for data processing; and (4) digitalization and collaboration in public institutions through a multidisciplinary approach integrating organizational models and digitalization indicators. **The first part** of the thesis provides an extensive description of contributions to the development of business informatics and information technologies, detailing the three main research directions identified. **The second part** presents the author's perspective on future research and teaching activities. The medium-term research agenda focuses on identifying vulnerabilities and digital threats to digital services offered to citizens by local and central public administrations. In continuing the research in the field of information security, future work will deepen the analysis of the role of artificial intelligence in techniques for manipulating and influencing public perception regarding current socio-economic and political events. **The thesis concludes** with a presentation of the list of references.

From a methodological standpoint, the research presented in this thesis has employed a diverse range of methods: computational experiments and benchmarking in distributed environments (for the performance analysis of Big Data systems), case studies and empirical validations (for low-cost infrastructures and system evaluation), meta-analysis and

bibliometric analysis (for systematic reviews regarding NLP in requirements engineering), as well as conceptual and descriptive analyses (for phenomena such as social engineering, manipulation, and organizational change).

Overall, this thesis demonstrates not only a consolidated capacity for independent research, but also a clear readiness and aptitude for training future generations of researchers in the field of Business Informatics, within both national and international academic settings.

The thesis is grounded in the author's and co-authors' principal scientific works, which innovatively outline the current field of information and communication technologies, as well as the new security threats arising particularly in the context of large data volumes and cloud computing implementations.

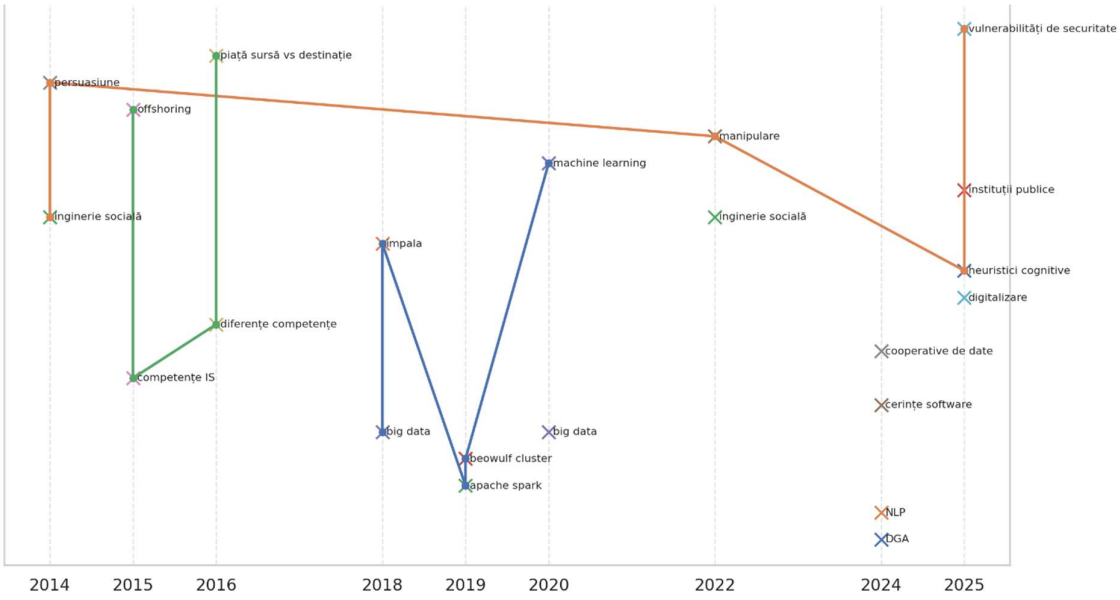

Figure 1 - The main concepts addressed in the research. Temporal approach. Own projection

Given the continuous evolution and maturation of prevention and information security protection technologies, I have identified that the weak link in the trust chain of information system security will increasingly become, over time, *the human factor*. While computer networks can be protected using a wide range of devices - where the classic security system represents only the foundation of today's security pyramid - humans remain autonomous individuals with their own capacity to process and filter information and actions. However, since antiquity, people have developed and refined specific techniques of manipulation, coercion, and/or persuasion to obtain information or access to various systems. In 2014 (Greavu-Serban & Serban, 2014), I introduced for the first time in Romanian literature the concept of *social engineering*, defining the field and its associated risks and providing a comprehensive presentation of their primary manifestations. Research in this domain continued, and in 2022, a synthesis of the main *methods for prevention and mitigation* was presented (Greavu-Serban & Constantin, 2022). With the popularization and increased accessibility of artificial intelligence tools, the techniques used to influence people's decisions

- leading them to act beyond the boundaries of institutional policies and regulations or simply misleading them - are either emerging or taking on new forms. In 2024, I conducted an in-depth literature review (Necula, Dumitriu, & Greavu-Șerban, 2024) on the use of *natural language in software engineering*, which also revealed the link between artificial intelligence and natural language processing (NLP). By extrapolating the field of social engineering and NLP, I identified a year later (Greavu-Șerban, Constantin, & Necula, 2025) a causal relationship between the propensity to fall victim to social engineering attacks and one's own biases or the *heuristics of individual cognitive systems*.

The development of IT technologies and the reduction of security risks to information systems are directly proportional to the quality of national - and not only national - education systems. In this regard, I consider that continuous monitoring of the evolution of university graduates in Romania is essential, both to identify directions for improving study programs and to assess their perceived usefulness and productivity in the development of the IT&C sectors at the national or regional level (Fotache, Dumitriu, & Greavu-Șerban, 2015). The investments of large IT&C companies have proven very important for Romania's major university centers, motivated by both the solid training of IT&C graduates and by fiscal incentives, integration into Euro-Atlantic structures, and, albeit with limited evidence, the regional context of stability. Research from 2016 (Fotache, Dumitriu, & Greavu-Șerban, 2016) reveals how the offshoring phenomenon shapes jobs both in developed and emerging countries.

With the exponential development of cloud computing services, offshoring and outsourcing have become more important than ever in ensuring the development of specialized applications, but especially for providing user support, a key element for the sustainability of businesses in this sector. Today, most companies use several types of cloud services both for their core business activities and for support functions (Greavu-Șerban, 2015). The shift in cost approaches - CAPEX versus OPEX - as well as the adoption of pay-as-you-go models, have made cloud technologies accessible to most businesses, particularly small and medium-sized enterprises. At the same time, investments in security conducted by major cloud industry players (Amazon, Microsoft, Google, IBM, Oracle, etc.) have improved the key indicators of the **C.I.A. triad**: data confidentiality, data integrity, and especially data availability. The elasticity of cloud systems, combined with unlimited computing and storage power, is highly attractive for research, implementation, and use of big data, machine learning, and artificial intelligence solutions. However, these functionalities come with considerable costs, which can be difficult to cover without adequate funding.

Starting in 2018, I began in-depth research into identifying alternative solutions to public cloud offerings in big data. In order to reduce costs, I explored **Beowulf cluster computing** technologies for the reutilization of existing hardware equipment within organizations, aimed at determining the factors that influence performance in processing **NOSQL** data specific to large data volumes, as well as developing case studies for university courses and research (Cogean, Fotache, & Greavu-Șerban, 2013). Since hardware equipment represents only the

basic layer of cloud service architectures, the processing dimension was subsequently approached through comparative studies across several open-source software solutions and platforms: Apache Impala (Fotache, Greavu-Șerban, Hrubaru, & Țică, 2018), Apache Spark (Cluci, Fotache, & Greavu-Șerban, 2019; Fotache, Cluci, & Greavu-Șerban, 2020). The results of these research activities materialized, starting in 2020, in the implementation and use in research and educational activities of the first private cloud at UAIC Iași, known as the **RaaS-IS platform** (Research as a Service – Iași). The project was funded through non-reimbursable European funds: POC – SMIS: 124759, Priority Axis 1: Research, technological development, and innovation (RDI) in support of economic competitiveness and business development; Investment Priority PI1a: improving RDI infrastructure and excellence capacities; Specific Objective OS 1.1: Increasing scientific capacity in the fields of intelligent specialization and health; Action 1.1.2: Developing networks of RDI centers, coordinated nationally and connected to European and international networks, and ensuring researchers' access to scientific publications and European and international databases; Field of intervention – 058 Research and Innovation Infrastructures (public).

With a computing power of 576 cores, 2 TB RAM, and a storage capacity of 0.5 PB, over which the OpenStack virtualization system was installed and configured, RaaS-IS has become an essential resource within the university and for institutional partners, enabling the identification and discovery of new dimensions within large data volumes specific to economic, medical, and other fields. Additionally, the platform provides practical support for specialized courses in cloud computing, big data, and machine learning.

Once the major research directions specific to this thesis had been identified, I considered it essential to go beyond the boundaries of academia and to undertake a *study of the digitalization process of Romania's public administration* - a key pillar in the modernization of the state and in bringing it closer to the needs of citizens in a society increasingly focused on efficiency and transparency. The implementation of digital technologies in public institutions is not limited to the automation of bureaucratic processes; rather, it involves a profound transformation at the organizational, legislative, and cultural levels. In this context, and building upon previous research, during 2024–2025 we conducted a comprehensive impact study on human resources and their training within city halls across Romania (Greavu-Șerban, Gheorghiu, & Ungureanu, 2025). Researchers play a fundamental role in supporting the digitalization process by developing models and solutions grounded in scientific evidence, which enable the optimization of bureaucratic processes, the increase of institutional transparency, and the improvement of the interaction between the state and its citizens. Such contributions help to assess the impact of digital technologies on governance, the efficiency of public services, and the protection of personal data, thereby providing a robust foundation for the development of sustainable, equitable, and well-founded public policies. The active involvement of academia and the research community in this field ensures not only the transfer of innovation but also the strengthening of an administration capable of responsibly addressing the challenges of the digital era with a future-oriented approach.

Our research places the individual at the center of analysis through the **ADKAR** model (Awareness, Desire, Knowledge, Ability, and Reinforcement), by emphasizing the importance of personal awareness of one's role within the organization, the willingness to participate in digitalization processes, the knowledge one possesses, the ability to implement new digital processes and technologies, as well as the capacity to consolidate and sustain change over time.

Beyond the human factor, our studies have identified an increasing need for open or shared data. Starting from Clive Humby's well-known assertion that "*Data is the new oil*", we argue that, alongside processes of collecting, storing, and analyzing large data volumes, there is a fundamental need for access to these data. Data and data access often extend beyond the technical realm; sharing data has legal, regulatory, and psychological implications (Ungureanu, Gheorghiu, & Greavu-Șerban, 2024). One final aspect worth mentioning in this section is the strategic component of implementing digital technologies at the level of a community, region, country, or union of states. Our studies have found that, while Romania has digital development and security strategies, their implementation and adoption (Greavu-Șerban, Păvăloaia, & Eșanu, 2024) remain at an early stage and lack an entrepreneurial vision for organizing services and sharing data with research institutes and beyond.