

A Methodology for Modeling Digital Transformation of Organizations to Integrate Automated Decision-Making Tools based on Artificial Intelligence

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Abstract

AIDA is a research project seeking to promote the dissemination of artificial intelligence techniques in companies by proposing a methodology and tools facilitating the integration of automatic decision-making tools into business processes. In this paper, we present the model-based organizational transformation methodology that was proposed to and adopted by the consortium of AIDA to represent the evolution of existing information systems through the integration of process automation and optimization driven by artificial intelligence.

Keywords

Information Systems Transformations, Model-Driven Engineering, Data-Driven Evolution, Method Engineering

1. Introduction

The Artificial Intelligence for Digital Automation project (AIDA) project aims to develop a combined approach to integrate Artificial Intelligence into the daily operations of companies, with confidence, to improve the quality of their operations and interactions with their customers.

Funded by BPI France², the AIDA project, which began in early 2020 for a period of 4 years, involved partners belonging to both the academic world and the industrial world. On the academic side, we find Central Supélec³, ENS Paris Saclay⁴ and the CEA⁵. From the industrial side, we find IBM France⁶, DecisionBrain⁷, Softeam⁸ and STET⁹.

The approach proposed by the project is to develop, for business requirements presented by industrials partners, Intelligent Operational Agents who integrate Machine Learning and Artificial Intelligence techniques. An Intelligent Operational Agent (AOI) can be seen as a virtual employee of the business operational in charge of the function: industrial pilots controls and manages its Intelligent Operational Agents, and these assist it by offering recommendations, or even by automating all or part of its tasks, thus freeing it up time to devote itself to activities at highest added value (intellectual, in particular).

The methodological framework aims to help and support the transformation of company's information systems and modernization of their business processes by integration of decision-making tools based on artificial intelligence. The methodology has been built to help company to define targets

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² <https://www.bpifrance.com/>

³ <https://www.centralesupelec.fr/>

⁴ <https://ens-paris-saclay.fr/>

⁵ <https://www.cea.fr/>

⁶ <https://www.ibm.com/fr-fr>

⁷ <https://decisionbrain.com>

⁸ <https://www.softeamgroup.fr>

⁹ <https://www.stet.eu/>

for the evolution of the Information System and ensures the formalization of transformation trajectories allowing this evolution.

The AIDA outputs can be summarized as:

- A platform for the development and deployment of Intelligent Operational Agents (AOI).
- An ecosystem of academic partners, presented above, who will develop a catalog of AOIs and instantiable patterns of AOIs 'integrating into the platform, environments, compatible with the platform, development and deployment of AOI for specific needs, and an offer of services around the platform.
- A methodological framework which allows the deployment of AIDA and the use of AI with confidence.

It is this methodological framework that we will present in this paper. The Research Challenges in Information Science conference topics covered by the paper are the following: Information Systems Transformations, Model-Driven Engineering, Data-Driven Evolution, Method Engineering.

After this short overview on the AIDA project, this paper presents one of its major current results, namely a methodology for the transformation of organizations in order to integrate automated decision-making tools based on artificial intelligence. We also present the implementation and evaluation of the methodology, as well as our future directions.

2. Methodology goals and perimeter

The AIDA methodology seeks first and foremost to assist organizations in the modernization process of their information and administrative systems by helping them to discover the key processes to be improved by integrating automatic decision-making system based on artificial intelligence. It is therefore a practical methodology aimed at facilitating the integration of artificial intelligence in the business processes through the intermediary of the AIDA solution.

To build this methodology, Softeam and IBM have collaborated to define an inventory of all the conceptual models, rules and information that should be represented within the AIDA Platform. Afterwards, Softeam proposed a BPM/DCM Augmented Meta-Model (BDAMM). This metamodel allows architects to represent an enterprise or organization's objectives, KPIs, business functions, services and processes, information system and technology architectures, as well as AI mechanisms that may improve and optimize its business processes. After that, Softeam proposed a step-by-step methodological guide that presents the detailed process of applying the methodology on real life enterprise scale architectures and information systems.

The methodology is based on an "As-is/To-be" line of action. It consists on analysing the current situation of the company's information system from the perspective of expression of needs, enterprise architecture, business processes and data , then outlining the new target organization to be put in place, and finally identifying the work that must be carried out to reach this new organization, by comparing the current situation and the targeted situation.

These three stages are better detailed as follows:

1. Capture the current situation: The as-is state of an organization is the "now" state. It documents how the current processes operate before making any changes or improvements.
2. Re-design to enhance the current organization: The analyzed organization is redesigned in collaboration with functionals managers to capture new objectives and target KPIs, as well as new processes, services and solutions allowing to reach them. This new "To-be" organizational model designates the future organization's state that is desired to be reached in the future.

3. Identify improvements goals and trajectories: The redesigned organization is compared to the actual organization in order to plan the implementation tasks required for the transformation of the existing information system.

Following an iterative and incremental process, the methodology has been designed to allow the gradual modernization of most complex information's systems allowing to approach company's goal step by step, reducing resistance to change and risks by adjusting and tailoring the transformation process according to each organizational context. As complex systems imply the involvement of a large number of key stakeholders with specific expertise, the methodology addresses five knowledge management areas corresponding to the areas of expertise required to conduct the methodology: transformation management, vision management, enterprise architecture management, business process management, and finally data management. These management areas capture the major types of transformational issues that will have to be managed and involves the key concerned participants in the transformation process.

For its implementation, the methodology proposes a model-based approach. It relies on the use of a Modeling Workshop specifically configured and adapted to support it. This allows to capture the architecture of the studied information systems as a formal model, and to analyze the transformations trajectories of the systems with a view to integrate AI-based services.

3. Methodologies Overview

The methodology is organized around two axes allowing the application of the methodology on all the knowledge management areas identified previously: the process groups axes corresponding to the sequence of key stages of a transformation project and Knowledge Area axes corresponding to the different expertise required to perform the expected analysis. Process groups are composed of tasks linked together by a dependency graph. A task is characterized by its predecessors (tasks that must be completed before the current task grows started), its successors, documents used to accomplish the task and documents produced by it. The tasks are associated with the intervening actors, the roles, and responsibilities of the actor in relation to this task being specified by the relation (responsible, contributor, validator...). Each task is documented according to two axes: the description of the objectives of the task and the description of a set of tools and techniques necessary for its implementation.

The process resulting from this methodology is divided into six process groups which cover the entire life cycle of the enterprise information system transformation project. Each process group is characterized by its inputs, the tools and techniques that can be applied and the resulting output. We detail each group in what follows:

1. The **Initiation** process group is performed to define a new transformation project or a new phase of an existing project by obtaining authorization to start the project or phase, identifying key actors, and stating main goals of the project, enriches elements resulting from the transformation project preparation and providing a general representation of the baseline and target architectures. This group essentially covers tasks of project management and preliminary requirements analysis.
2. The **Initial situation map creation** process group allows to capture and document how the organisation operates before making any changes or improvements. It is therefore a question of capturing the present situation of the company's organisation. Documentation of requirements and business rules of the current organisation, modelling of the existing enterprise architecture, business processes and data sources will be the key output of this process group.
3. The **Model Targeted Organisation** process group aims at redesigning the company information system based on organisation's goals and requirements for the new system. This series of task will lead to defining the new enterprise architecture, business processes and data models of the target information system.
4. The **Transformation Trajectory Identification** process group aims to identify transformation of the information system that must be performed by defining a migration trajectory

for enterprise architectures, business process and data models. This transformation trajectory is built by comparing the initial and target situation maps.

5. The **Implementation and Deployment** process group brings together all tasks dealing with the implementation of the new organization of the company defined during the previous phase based on the identified transformation trajectory. This translates into project management aimed at adapting software applications and services to the new organization.
6. Finally, the **Monitoring and Improvement** process group brings together all the tasks relating to the monitoring and collection of runtime data of deployed software components and to the execution of business processes. This data will then allow to assess needs and opportunities for improvements of monitored process.

Complex systems imply the involvement of a wide variety of expertise and stakeholders. Each type of expertise requires a specific view of the system and will only be interested in a part of the model of the system, according to a specific representation. This angle of vision or these concerns being addressed, which target certain categories of stakeholders, constitute a Knowledge Area on the methodology. This leads to the identification of several Knowledge Area in the enterprise, which materialize both the principal groups of issues that will have to be managed and the participants concerned. Determining Knowledge Area provides real structure to the organization and the work to be carried out, by configuring the types of problems or be dealt with and the nature of the people who will be involved.

The **Figure 1** below presents the knowledge area involved in the current methodologies. Each task which composes this methodology is related to a Knowledge Area.

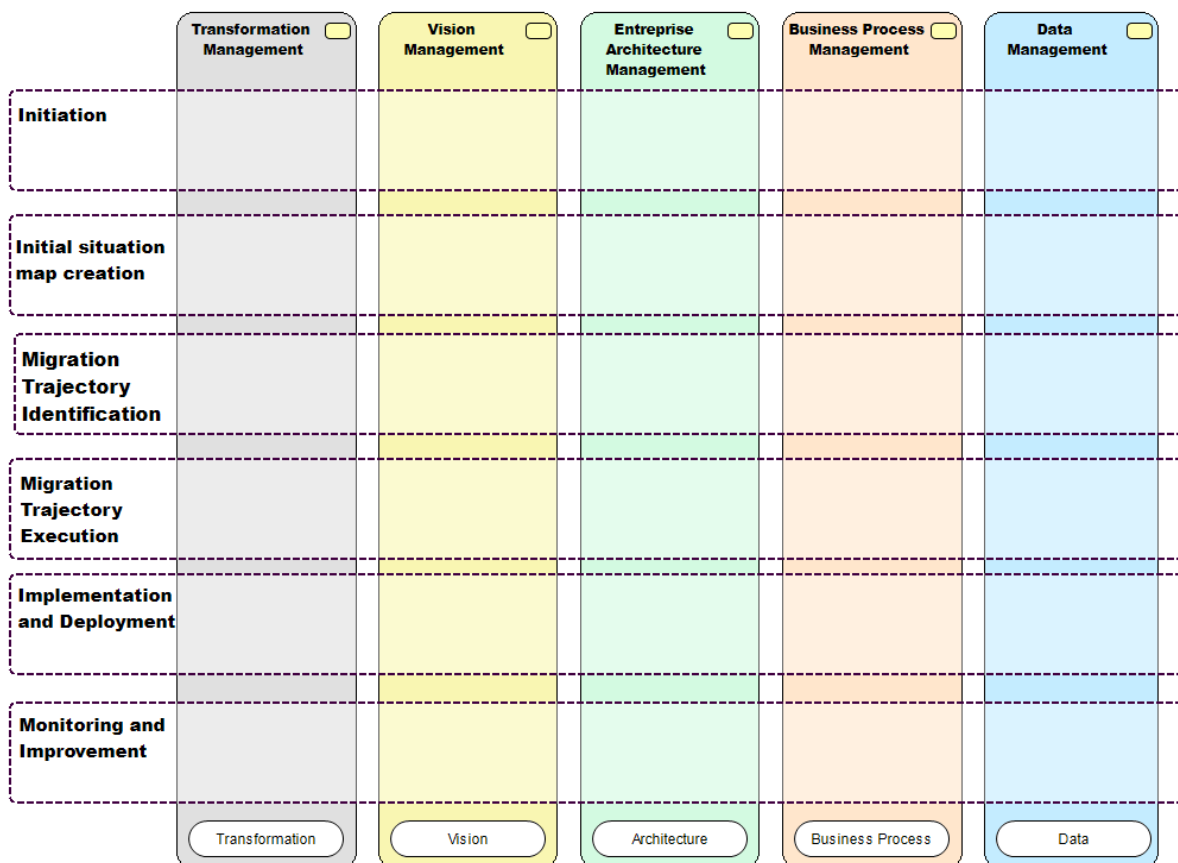


Figure 1 Process Groups and Knowledge Area in the augmented process modelling methodologies

The five Knowledge Area are involved in the Augmented Process Modelling methodology:

1. The Transformation Management area brings together all the tasks related to the management of the transformation project, from the identification of stakeholders to the management of

technical projects supporting organizational changes. The proposed project management approach is based on PMI [1] professional certification.

2. The Vision Management area groups of tasks related to the management of the company's objectives, requirements, and risks. It is also through this area that we will define the indicators to measure the success of the transformation project. This work is based on the Requirement Specification IEEE 830 [2] standard.
3. The Enterprise Architecture Management area brings together tasks aimed at mapping the organization of the company, its actors, applications, business processes and other components forming the information system of the company. The Togaf [3] and ArchiMate [4] standards are used during implementation of this Knowledge Area.
4. The Business Process Management area brings together the tasks related to identification, capture and formalization, transformation, and the inclusion of artificial intelligence-based decision system in business process of the company. The BPMN [5] and DMN [6] process modeling standards are proposed at this stage.
5. The Data Management area brings together tasks related to the identification and modelling of company data or data manipulated by the business processes of this organization. This area will also include tasks related to the GDPR and the management of personal data.

The detailed methodology is published as a web application and available at [7].

4. Implementation and Evaluation of the methodology

An evaluation of the AIDA methodology was conducted by looking at its applicability, its relevance, and its impact on a process of transformation of an information system with a view to integrating automatic decision-making systems based on artificial intelligence. The evaluation process was driven by a case study provided by the Softeam Consulting Business Unit. This case study addresses the transformation of one of Softeam main internal administrative systems: GDSRH, or the Human Resource Management System. This system is based on about twenty formalized business processes helps recruiters to establish and follow up the recruitment process of a new candidate and helps the Human Resource business unit to complete the administrative sections of a recruitment process by preparing the contract and other legal documents, and to follow up the integration of the newly recruited collaborator after signing the contracts. During this evaluation, several tools developed in the context of the AIDA project and supporting this methodology have been deployed and used, namely: the Modeling Workshop, the Personal Data Management Workshop, the Methodology Support extension, and the Impact Analysis Solution.

Towards the final stage of this evaluation task, Softeam was able to capture and formalize all of the requirements for the evolution of its GDSRH information system. This activity is spread over a period of three months and involves a dozen actors from the company. The framework elements relating to the transformation project were then supplemented by the production of a complete cartography of the information system as it currently exists. Softeam evaluated the models obtained with the stakeholders identified at the start of the project: the current users of a human resources management information system, the actors in charge of the administration of the corresponding technical platform, and the consultants in charge of the transformation project. By interviewing the stakeholders, we were able to highlight the methodology's ability to obtain a clear and complete cartography not only of GDSRH as a software solution, but also of a major part of Softeam's administrative services, particularly the Human Resources, Information Technology and Payroll services. This contribution has been used to validate the applicability of the AIDA methodology and the methodological guide on a real-life medium sized case study. The results prove the adaptability of the proposed metamodel and methodology to the context of the studied enterprise, organization, or system.

In conclusion of this evaluation, it appears that the proposed approach meets the initial specifications, as it could be evaluated during this intermediate phase. However, some points can be further improved, both at the level of the methodology and the level of the tools implementing it.

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