

SMART DATA ROOM TO TRANSFORM LABOR AND PAPER INTENSIVE PROCESSES

REPLY specialises in the design and implementation of solutions based on new communication channels and digital media. As a network of highly specialised companies, Reply defines and develops business models enabled by the new models of AI, big data, cloud computing, digital media and the internet of things. Reply delivers consulting, system integration and digital services to organisations across the telecom and media; industry and services; banking and insurance; and public sectors.

The entire NPL lifecycle is highly dependent on the completeness and quality of data: the deployment of the NPL strategy, indeed, places great pressure on data management and recovery in order to gain efficiency and improve strategic decision making. To face this challenge, Reply has developed a “Smart Data Room” solution, designed to be implemented to support the onboarding process for NPL management.

THE IMPACT OF DIGITIZATION ON THE BANKING ECOSYSTEM

In 2020, as a result of the COVID-19 pandemic, the economy has come to a sudden halt¹: this is likely to bring about high levels of non-performing loans (NPLs) in 2021 and onwards. How the banking system will deal with the surge will become clear in the coming period.

Another result of the Covid-19 pandemic is the acceleration of digitization, in terms of application evolution, dematerialization, exploration of new technologies to become more resilient and more efficient, overcoming the effects of the economic and physical shutdown.

This document explores the challenges of managing NPL portfolios, and the opportunities that a digitization boost can bring to NPL servicing companies and banking sector, assisting them in the most significant operational steps. In our opinion, ML and AI technologies are able to support and transform the operating processes, and should be explored to cut processing times, assist human labour force and provide additional insight and information.

A recent case study concerning Reply's delivery of such an asset illustrates the potential benefits of applying new technologies and solutions to NPL management.

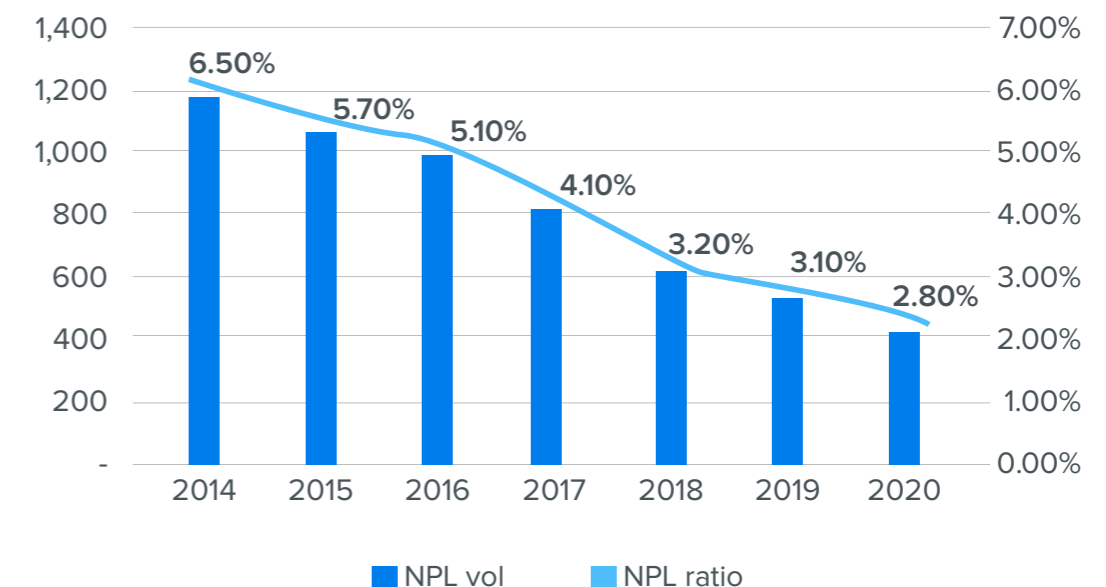
¹ COVID-19 and non-performing loans: lessons from past crises (www.ecb.europa.eu)

AN INTRODUCTORY LOOK AT NPLS IN EUROPE

In the European context, credits quality has improved considerably, and reductions in future NPLs target positions with a high vintage level.

Since 2014, the stock of non-performing loans has more than halved, reaching 435 billion euros with a 2.8% NPL ratio (see 2020 Annual Report ECB).

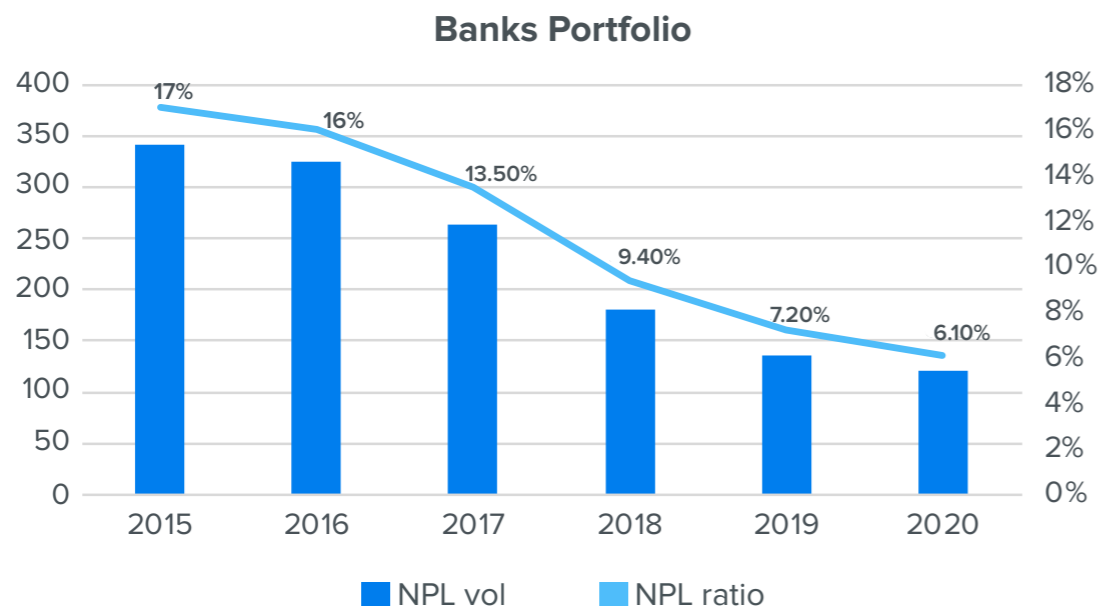
In the next years, a further reduction in NPLs volumes is expected, in line with the goals that banks have agreed with the Supervisory Authority. In the midst of the pandemic, banks in countries more affected by previous crises (Cyprus, Greece, Italy and Portugal) have managed to continue reducing their NPL ratios up to 9 percentage points. NPL ratios are highest for loans to small and medium-sized enterprises (SMEs) (6.7%) and lowest for mortgage lending (2.7%).



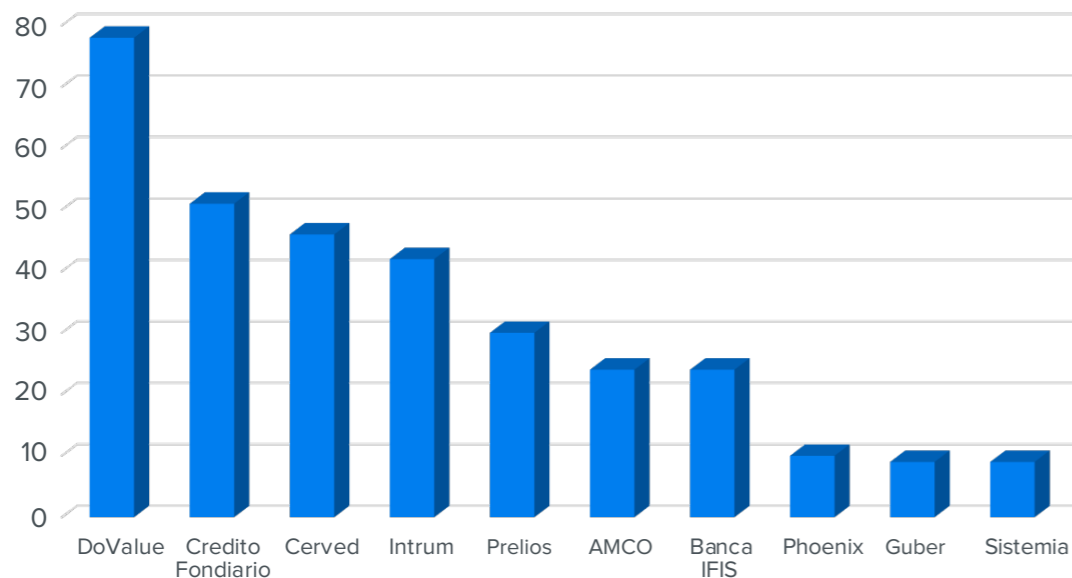
Among all EU countries, Italy shows one of the most significant reductions in the NPL ratio, thanks to efficient de-risking policies, despite its NPL ratio (6.1%) is more than double the EU average (also considering that the ECB has set a target of 5%). In line with Regulatory pressures in terms of NPL Level and ratio requirements, 2019 and 2020 saw an acceleration of **NPLs disposal as a primary strategic measure**. The main goal is to unburden banks' balance sheets by leveraging on consolidation of new market players with their **strategic role in NPL management**. The specialization has been driven by the growing needs of financial institutions for experienced third-party loan servicers

to manage their credit volumes under workout. NPL Servicers' main role is developing and maintaining an effective tracking of the recovery workflow from both the costs and collections points of view. The optimization assessment is critical for a Servicer, in particular for the treatment of acquired or managed credit portfolios, to guarantee high performance levels and highest recovery rate compared to the initial business plan.

The **de-risking policy** is producing positive effects on markets and on NPLs levels, with the consequent reduction of gross NPL ratio for banks, from 17% to 6.1% during 2015-2020.



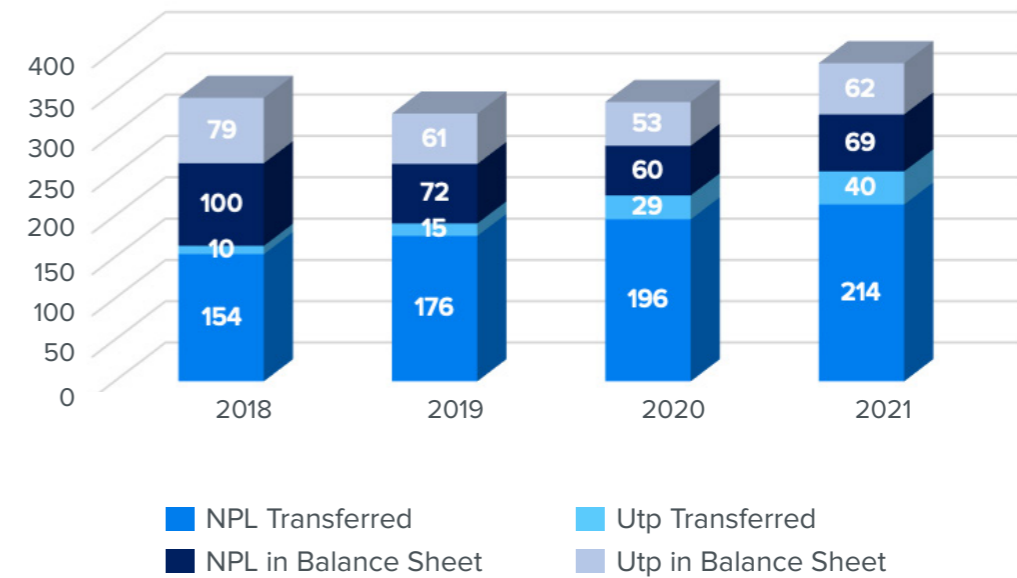
New Market Players



In this new context, the NonPerforming Exposures (NPE) volumes in Italy are expected to rise again, due to the effects of the Covid-19 pandemic on the economic landscape. The NPL volumes may have an increase that could lead **to an additional 100 billion in the coming years**, due to measures in response to Covid-19, such as lockdown periods for specific sectors, partially offset by moratorium on debt repayments and actions towards liquidity shortages to facilitate access to finance.

The total volume of NPEs (including non-performing, Unlikely To Pay (Utp) and past-due) is estimated **to have reached € 343 billion in Italy in 2020**, but in 2021 it could climb to € 385 billion and reach an all-time high of € 441 billion in 2022.

Total Amount of NPE in Italy (values in billions €)



The NPL market, characterized by the de-risking activities and the new wave of impaired loans, will see market players focusing their attention on Unlikely to Pay: they represent the new challenge for the Italian banking system. UTPs need a more granular position management, requiring industry expertise and legal skills, distinguishing between going and gone concern companies in order to pursue the recovery or support the back to bonis strategies through the identification of optimal financial solutions.

For these loans, quality of information and speed of retrieval are crucial to avoid that delicate underlying situation which can lead to a sudden state of default and thus to loss of the value of the operation.

HOW TO EXTRACT VALUE FROM NPL MANAGEMENT?

The whole NPL life cycle, from recognition to segmentation, strategy selection and back testing, heavily relies on the completeness and quality of data. In order to ensure high levels of performance against initial business plans, Servicers will be encouraged to improve efficiency in workout activities.

The deployment of the NPL strategy puts strong pressure on data management and recovery, in order to gain efficiency, reduce the probability of losses and improve strategic decision-making. The main focus will be on models and tools set up for risk assessment and performances

monitoring from onboarding to the portfolios management (e.g. due diligence, pricing, drawing up and business plan review). Then, what are the measures that players can activate to extract more value from NPL management, focusing on operating model, process model and technological stack? How can these three elements play their part to make the process more effective and efficient?

NPL Market players (Banking Institutions or Servicers) can activate several action plans to extract more value from NPL management, which can enhance the process making it more valuable. One

of the most important intervention area of action relates to the “recovery timing”. The effectiveness of the recovery machine in terms of timing and recoveries is crucial to extracting more value from the process. Recovery procedures tracking, collections monitoring, effective recoveries qualification are all elements that can be leveraged to increase value.

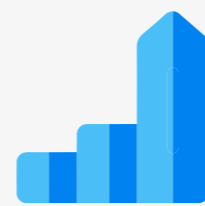
Another element relates to the governance and optimization of **recovery costs**, broken down by category (legal, auctions, advertising), lifecycle (supplier census, active billing, practices allocation, payments management) and recovery process stages. Legal costs, other third-party costs

(i.e., BPO players) and internal FTEs all contribute to the value equation. From a technology perspective, several elements can enable process transformation and value extraction. The first set of enablers, made available thanks to new AI and ML technologies, are so-called “smart” engines. Engines can be defined as “smart” when they rely on feeding data to improve performance each time they are used, or by applying Machine Learning.

There are also a number of IT enablers, from Cloud to APIs, to Workflows to open data, which can be integrated within the process to build a flexible infrastructure.



GAIN
EFFICIENCY



REDUCE THE
PROBABILITY
OF LOSSES



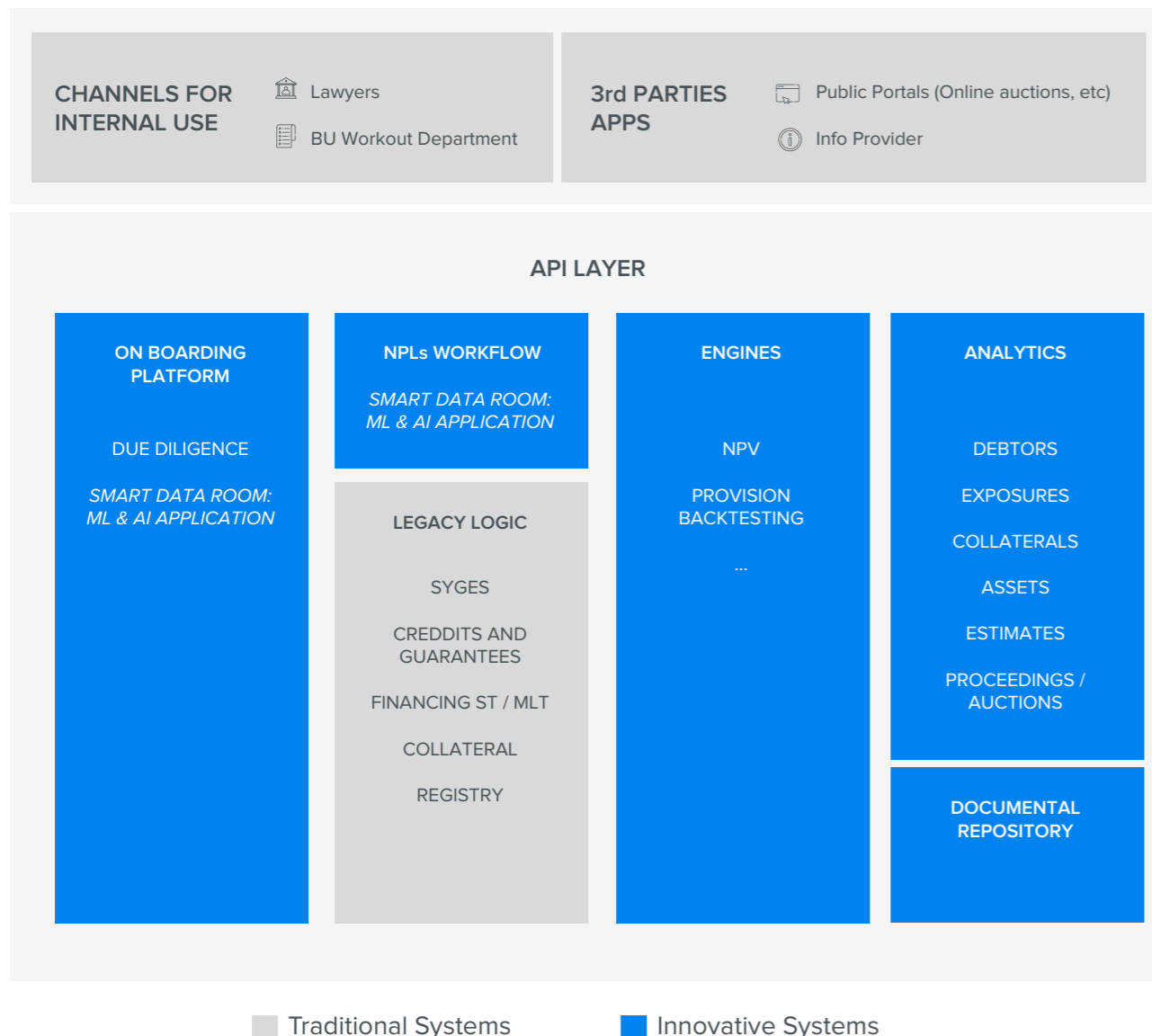
IMPROVE
STRATEGIC
DECISION-MAKING

THE SUPPORT PROVIDED BY THE SMART DATA ROOM

In the context of our analysis, we can summarize three main topics to focus on:

- Total cost of ownership related to the onboarding and workout process
- Workflow and tracking of activities
- Ability to interact within the NPL ecosystem

The platform for NPL management must therefore rely on a solid infrastructure that enables processes, seamlessly integrating third party actors and applications, and ensuring flexibility and cost-efficiency.



Within the IT architecture, we focus on a new “building block”, referred to as the Smart Data Room ML and AI application.

Given the considerable importance of data, Reply is experimenting with building NPL management applications using machine learning techniques, with a view to engineering data driven processes.

The ability to recover bad loans and UTPs, as well as the reduction of risks in management throughout the lifecycle, is based on an increasingly in-depth knowledge of the counterparty and the position. Artificial Intelligence and Machine Learning algorithms, as well as big data, are essential support tools for effective business decisions, especially in the strategic field aimed at recovering NPLs. Applications can be various across the main stages of the process.

Minimum checklist verification: documents are the building block of a day-to-day workflow: in a NPL Management workflow, they are central and need to be well organized. Traditionally, all of these documents would be reviewed by humans, who extract key data points and feed them into spreadsheets or other downstream systems for analysis: this is a time-consuming process. In particular, in an opening phase of a paperwork, the loan manager has to check that the available documents are complete and consistent with the minimum check list provided.

Due diligence process: Fast and easy access to data is intrinsic to any NPL operation, whether it is a standard NPL management, NPL sale transactions or NPL portfolio acquisitions. The profitability of the operation is critical to its success and that success largely depends on high-level data quality and its availability with a defined and consistency structure. Also relevant is the preparation of the internal documentation required for the investment approval process (both sell and buy-side) and for the negotiation of the contractual documentation.

Decision-engine document preparation. An intelligent decision engine would help the bank in several ways, since most banks now have manual processes. As a first step, the Intelligent Process Algorithm (IPA) tool could classify all documents, to ensure that all required documents have been filed. It could then “read” the documents and extract the relevant data points in order to establish a timely recovery strategy.

The ability of IPA tools to examine and understand documents as a human would changes that dynamic, making it possible to automate large portions of an AML program, leaving only the thorniest cases to human experts.

Onboarding process. Document Processing Technology takes human error out of the processing and improves the efficiency of document classification, allowing data to get where it needs to be quickly.

These documents can range from simple standard documents such as a debtor’s personal data, to more complicated documents such as contracts, legal documents, collateral documents, financial reports and many more. For example, in order to manage a NPL portfolio, there are multiple documents that need to be collected, sorted and processed at every stage, from the onboarding to credit decision strategy and closing of the NPL position, both on banking and on servicing side.

Applying Smart Data Room techniques based on ML and AI technologies allows the market players to save money, be faster and deliver timely and accurate data processing.

HOW TO APPLY ML AND AI TO NPL ONBOARDING PHASE: REPLY’S SMART DATA ROOM SOLUTION

Reply has developed a “Smart Data Room” solution designed to be deployed to support the onboarding process. Currently, the onboarding phase is mainly a manual process that requires the NPL office operator or the third party supplier to open each document contained in the NPL portfolio to assess relevance and classify significant information. In case of large portfolios, the process can take many months to complete.

The solution transforms the manual process by automatizing the activities performed by the operator, leveraging ML and AI technologies.

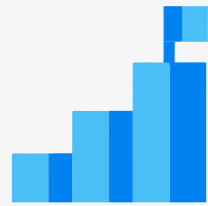
The current potential of automation is at a mature level that can transform processes such as the NPL onboarding phase.

Artificial Intelligence is transforming the way organizations work, moving from the application of deterministic rules, to a data

driven reality where decisions are made based on the analysis of input data. The paradigm shift revolves around the application of new and diverse **Machine Learning techniques**.

Artificial Intelligence solutions are implemented on the basis of specific use cases with the aim of reducing costs, maximizing productivity gains and enhancing accuracy and speed. When organizations introduce a new technology in their existing processes, they can apply two different approaches, depending on the extent of the change they wish to apply.

If they wish to change the existing process gradually, they will apply a “step-by-step approach”, while, if they wish to transform more radically, they will apply a “re-design approach”.



STEP-BY-STEP APPROACH

It will assess individual process steps characterized by manual tasks and apply the technology to process them automatically. The overall process and flow of activities remains the same, but tasks are automated, bringing velocity and accuracy.

RE-DESIGN APPROACH

Based on the availability of the new technology, the flow and nature of activities are changed for overall optimization. Tasks sequencing and execution are transformed leveraging the new ML and AI application.



In first approach, the first activity to do is to analyze the as-is process to identify the activities that can be automated, and the different types of documents, categories, most relevant words or items of information: this input is crucial for the semantic analysis. Within the transformation, the overall process flow doesn't change, but single process steps can be switched from manual to automated through the ML engine processing: the

switch from manual to automatic reduces dramatically processing time. This approach has the advantage of a limited operational impact on the users/operators of the process, and the time saving induced by the reduction of manual activities. Conveniently, it is possible to shift to the re-design approach at a later stage of the transformation. This approach seeks to optimize the

overall process with automation. The overall process is redefined to allow the optimal allocation of the ML engine. Processing time and manual activity reduction are pushed to the optimal level, while activities can be performed in parallel. This approach requires a new roll-out process, and, in this case, the ML engine is used to the full potential redesigning the overall process.

Here below, we'll go over a specific use case, and the application that supports the automated process.

The first step consists in analyzing the as-is activities. The onboarding phase has the objective of retrieving the information set and classifying the documents according to relevant categories.

The main characteristics of the as-is process are:

- **Documents are manually opened and read by operators** in order to classify them in specific categories: relevant documents (contracts, etc.) and generic documents (eg: emails);
- **Processing time is defined by the number of people assigned to the process of reading the documents** and by the size of the portfolio, without the possibility to apply scaling and with costs based on operator costs;
- The **activity** performed by the operator

is organized in single steps: costs are applied based on the steps and repeating the steps will determine a higher price;

- The **performance** of the classification activity is linked to the operator's skills.

The opportunities of applying ML technologies are:

- **Documents are automatically opened**, and the determination of the document's class is assigned based on information previously fed to the system (training set); alternatively, if the categories are unknown, the system will proceed to cluster the documents accordingly to similar patterns that it determines by processing the files;
- **Processing time is based on infrastructure** and on portfolio size; there is a better margin for scalability as the only dependency is technological (hardware);
- **Identification of the single steps that can be automated**: higher flexibility in prioritizing processes without impact on costs and possibility of opening only the relevant documentation;
- **Performances are enhanced**: the more documentation is processed, the better the algorithm performs.

The approach oriented towards the introduction of Machine Learning techniques enables the optimization of static and deterministic rules that are

currently used in processes.

The main ML technologies that we apply to semantic document analysis are: OCR (Optical Character Recognition), that enables the semantic recognition, CV (Computer Vision), that enables object detection (search of a signature in the document), Supervised approach (classification) and Non supervised approach (clustering).

Focusing on the supervised and non supervised approaches, the key factors are.

Supervised approach - Classification:

- Efficient on categories with finite information characteristics **previously known**;
- Requires a **training set** to train and assess results;
- **Does not require** technical resources

and high computational capacity in the inference phase;

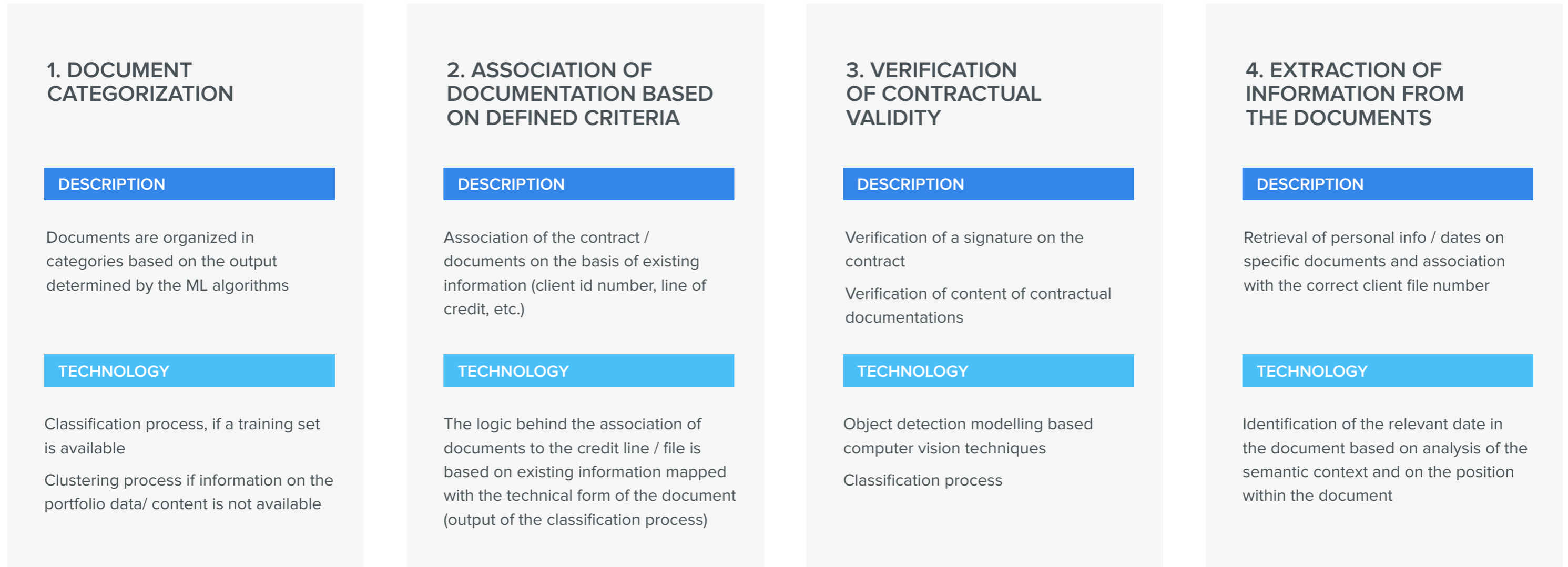
- **Results improve** as the training set grows;
- Specific classification of **output categories**.

Non supervised approach – Clustering:

- Does not require known categories up front;
- Is useful in exploring semantic text details;
- Requires high computation capacity;

- **The output** of previous executions cannot be used to train and enhance performance;
- **Requires categorization** labels to be assigned manually.

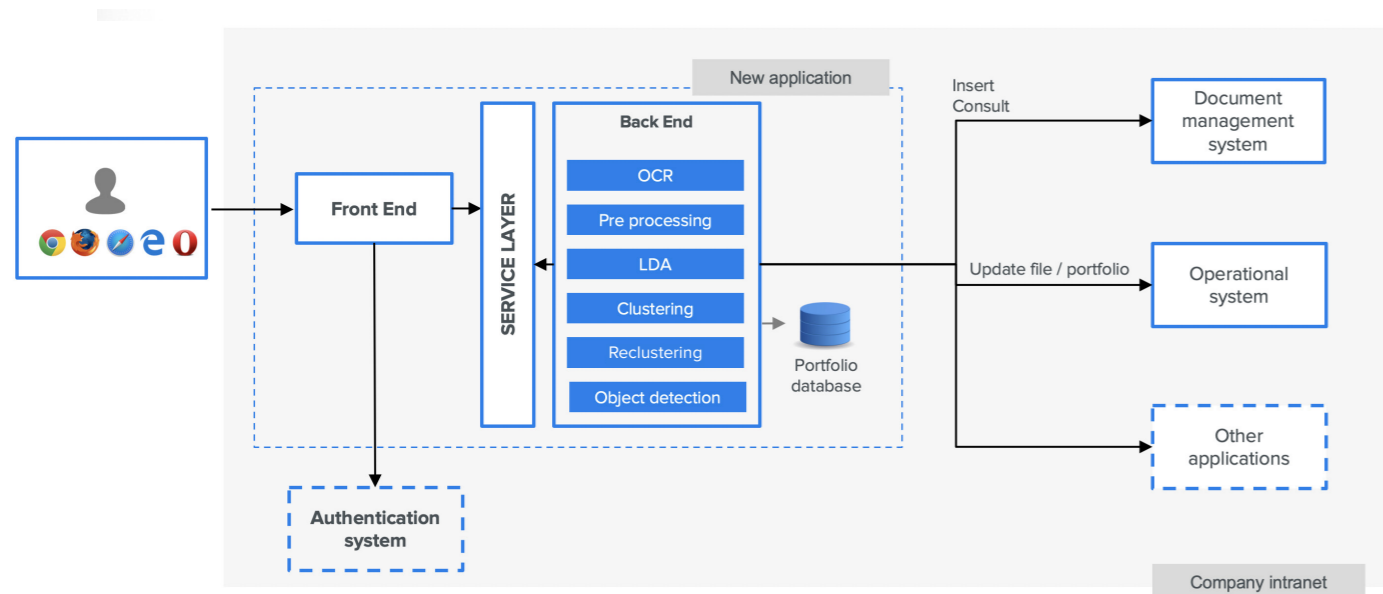
The diagram below illustrates the process steps and describes the different logic and technology that drives the automatization of the process through Machine Learning and Artificial Intelligence.



To enable the deployment of the new solution, Reply has created an asset that frames the ML and AI algorithms within a versatile architectural framework. The framework can be accessed also by APIs, therefore potentially used by third party

applications.

The application landscape illustrates the relations between the different components and how they interact within the new application and with the external systems.



The components of the new application are:

- **Back End/ML Engine:** configuration of the components dedicated to the algorithms, inclusive of OCR step and pre-processing steps necessary to deploy ML.
- **Portfolio Database:** DB at the basis of the application, with a data model and relation model between data to allow data analytics.
- **Service layer:** the services and API allow the execution of the ML algorithms and the reading of the output. This can be done with the specific Front End built for the

application or accessed by third party applications/FE.

- **Front End:** views and pages to navigate the application, in order to review the results of the algorithms, drill down on specific information, enable consultation and review.

The “core” of the Smart Data Room solution is the ML Engine that stores the ML and AI algorithms. The image above contains the main steps required for the Clustering - non supervised approach, but

many other are stored and accessible.

The clustering activity is a sequence of algorithms and of activities performed by the engineers.

To extract the output, the engine performs a series of complex algorithms that are constantly fine-tuned by engineers and data scientists:

- 1. OCR:** documents reading in the various formats, and production of txt files with the original semantic content – document digitalization;
- 2. Pre-processing:** text cleaning of what has been read in step 1;
- 3. Feature extraction:** topic identification, that represent pieces of documents with similar semantic content;
- 4. Clustering:** grouping of documents based on similar semantic content. The output produced by the clustering process contains also the silhouette, needed to evaluate the data produced by the algorithm. The silhouette is a statistical graph that represents the similarity of the different documents within a certain cluster;
- 5. Cluster recycling:** after evaluating the silhouette results and other parameters (eg. mean distribution of a cluster, % of non-representative documents), the system automatically determines if another clustering cycle should be performed, for the partitions that have not reached the minimum requirements;
- 6. Results:** displaying results output in different formats.

In order to deploy the algorithms and the application, the following infrastructures and resources were needed.

- O.C.R., data processing and Machine Learning components have been developed with **Python** scripts (version 3.6.9);
- Script invocation is managed by a set of microservices, which are developed in **Spring Boot** framework (version 2.3.8) and coded in Java 8;
- Support database is needed: in our test case we developed it with **MySQL** (version 14.14);
- A list of API is exposed to a single page application that provides the user interface which is developed in **Angular** (version 8).

As a general rule, a 100 GB sized Portfolio (200.000 documents) requires the following standards, to be automatically processed in 2 weeks (24/7):

- RAM: 250 GB
- Cores: 16 (32 threads)
- Disk space: 250 GB (130 for temporary results)

THE POTENTIAL VALUE OF THE SOLUTION IN SEMANTIC ANALYSIS

The value of the solution, in semantic analysis, is related to four main items.

REDUCED PROCESSING TIME

The processing time of hundreds of thousands of documents is compressed by the engine (if an outsourcer processes between 1000 and 2000 documents per day, an ML engine can process thousands of documents each hour, 24 hours a day²).

AUTOMATION OF STANDARD ACTIVITIES

- Activities that can be standardized are performed by the engine that, as volume grows, becomes more efficient and precise due to the «machine learning» process;
- Controls and checks are performed by the engine; the operator performs controls only in cases where the output is uncertain.

LOWER THIRD PARTY PROVIDER (TPP) COSTS

The activities performed by the TPPs are reviewed and they are handed out lower volumes, as the documents that are non-relevant are singled out by the engine. This allows to lower processing volumes and costs for the TTP, that focuses on activities that cannot be performed by the machine.

REDUCED TTM FOR DUE DILIGENCE, VALIDATION & WORKOUT

- Reduced due diligence timing: the engine can perform automatic clustering on the portfolio documentation³;
- Reduced timing to assign the portfolio value: accounting value of the portfolio available sooner;
- Workout process can be started earlier.

CONCLUSIONS

We strongly believe that **ML and AI technology are prime** to support labor-intensive processes that require analysis of documentation and extraction of significant information. Surely, the technology will further evolve, and therefore deliver increased benefits: that is the reason why embracing a programme of adopting these methodologies requires a mind-shift.

First, the **projects must be seen as “rolling”** and not static: Machine Learning and Artificial Intelligence require constant optimization rework and upgrade.

Excellent engineering skills need to be deployed to be able to select, try and optimize the new technologies.

The two elements above are already capable of delivering incredible results in terms of benefits.

Reply has the experience, the skills, know-how, expertise – and a powerful asset – to support your organization in the journey towards AI and ML in semantic analysis.

² Reply benchmark; the data depends on the technological infrastructure available

³ Under the assumption of availability of due diligence data room for processing