

Tailored IoT & BigData Sandboxes and Testbeds for Smart,
Autonomous and Personalized Services in the European
Finance and Insurance Services Ecosystem

Infinitech

D2.12 – Data Models Specification - II

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² Can be left void

Executive Summary

The goal of task T2.6 “Specification and Design of Integrated Data Models” is the definition of the data models that will be exploited by each pilot deployed in the INFINITECH platform. In particular, the task has the objective of highlighting the specific characteristics of the logical schema of the provided datasets, which will be consumed by the business analytical tools via the data management components of the platform (mainly the central data repository that stores the data and enables HTAP processing). Towards this direction, the definition of the technical details of the datasets, as collected in the scope of task T2.5 “Open Banking APIs, Testbeds and Data Assets Specifications”, has been reported in the second version of the corresponding deliverable D2.10, in order to further describe the logical schema that defines the data model of each pilot.

Furthermore, one of the purposes of this task is to support the technical development of task T4.1 “Shared Semantics for BigData and IoT Streams” and, more precisely, gather all the requirements from the pilots regarding the needs for ontologies that will define the data semantic interoperability for the datasets. To this end, an initial survey was conducted, featuring state-of-the-art analysis on current prominent domain models which are widely used nowadays in the finance and insurance sectors. This process was vital in order to identify best practices and scenarios regarding domain models on these sectors, and then further validate which of the pilots will rely on semantic interoperability and will make use of integrated and harmonised datasets and how their own logical schemas can fit into an integrated domain model that will be defined in the technical tasks of WP4. After the initial INFINITECH Core Ontology definition, we enriched this document with an additional analysis on how the logical schemas can fit into our provision and which terms are still not covered. This will provide valuable input to the activities of T4.1 during the second phase of the project, extending the proposed ontology to include possible further extensions.

The output of task T2.6 “Specification and Design of Integrated Data Models” illustrates the requirements of the integrated data model of INFINITECH, whose purpose is to allow seamless access to data sources, thus enabling business analytics over the integrated data. This common data model is now part of the INFINITECH-RA, with the outcome of this task providing valuable input also to task T2.7 “Reference Architecture for BigData, AI and IoT in Financial Services Industry”.

It is important to highlight the fact that this is the second version of the deliverable, extending the work that has been already carried out at the previous phase of the project and reported in the first version of this document. It was primarily shaped by the maturity of the pilot descriptions and their scenarios, and hence apart from the initial analysis of their logical view of the existing schemas already presented, along with the state-of-the-art analysis of existing ontologies and vocabularies in the domains of insurance and finance sectors. This second version of the deliverable introduces an additional chapter, featuring

an analysis that compares the definition of the INFINITECH Core Ontology, its classes and properties with the already identified terms. Additionally, at this phase of the project, the use case scenarios of each pilot have been furtherly documented in the scope of task T7.1 "Detailed Pilot Specifications and Pilot Sites Preparation", while the technical work of the aforementioned T4.1 has already r advanced with the delivery of the first prototype of the core ontology.

This document is structured as follows: Section 1 provides an introductory text describing the objectives of this deliverable, while giving at the same time insights from other tasks and deliverables. Section 2 provides the general methodology that was implemented and presented to the various pilot in order to obtain the required information at this phase of the project, while section 3 provides a state-of-the-art analysis on prevalent data domain models and ontology's used in the finance and insurance sectors. Section 4 provides a general description of the existing data models that each pilot uses. Due to the different levels of maturity of each pilot and the fact that some of the pilots joined the consortium at a later phase, significant difference on the level of detail for each corresponding subsection is noted. Section 5 reports the outcomes of the analysis that took place during the second phase of T2.6, validating the proposed INFINITECH Core Ontology with the specific needs of the pilots and highlighting the required extensions and additions that need to be taken into account in its second version. Finally, section 6 concludes by providing the document's key findings..

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Abbreviations

WP	Work Package
IRA	INFINITECH Reference Architecture
DoA	Description of Action
MS	Microsoft
KYB	Know Your Business
KYC	Know Your Customer
ML	Machine Learning
DL	Deep Learning

1. Introduction

Task T2.6 "Specification and Design of Integrated Data Models" aims to describe the logical view of the pilot datasets and to define an integrated data model that can be used by the INFINITECH platform in order to provide access to harmonised datasets, which can be consumed in a seamless manner by the various business analytical tools (i.e. risk assessment, fraud detection, recommendation engines, etc.) of the platform. This will enable the reuse of such tools that will be available by the project's toolkit via the library of ML/DL algorithms, by different stakeholders and pilots, and will enable them to bring their own datasets, harmonize it and make it available in that integrated model. In order for this to happen, the initial definition of the logical view of the datasets of each pilot was necessary, along with an initial survey of existing domain models that are dominant and used by the enterprises in the finance and insurance sectors. In this second version, we extended the document with an additional analysis of how the most common terms and properties already identified in the previous version of this document can be covered by the INFINITECH Core Ontology. This analysis identifies potential gaps which have not yet been taken into account by the common ontology, driving its further development and indicating possible extensions in the second phase of the project.

1.1. Objective of the Deliverable

. The objective of this deliverable is to provide guidelines on the definition of the common ontology, which is now part of the integrated INFINITECH-RA and provides a harmonised logical view of the heterogeneous datasets coming from the diverse pilots the project accommodates, by using semantic annotations and semantic interoperability mechanisms of the reference architecture. By doing this, it provides a seamless access to the integrated data model for the business analytical tools of the project.

As this document is the second version of the deliverable, its initial text and outcomes has been extended by reporting the additional work that was planned to be carried out during the second phase of the activities of WP2. Therefore, apart from the description of the logical view of the pilot datasets, namely the domain model of each of the individual scenarios, the survey of the state-of-the-art analysis of the existing domain models and ontologies used in major organizations in the sectors that this project is focusing on, this document introduces further requirements to be covered by the INFINITECH Core Ontology.

1.2. Insights from other Tasks and Deliverables

This task is part of WP2, whose main goal is to collect the user and technical requirements of the different pilot applications and baseline technology components of the INFINITECH architecture, in order to drive both the technical development of the overall platform, along with its runtime environments for deployment and execution, and the validation of the project against all pilots that will be accommodated. Therefore, it illustrates strong dependencies with various tasks of the project.

First of all, all interactions regarding the internal tasks have been and can be depicted in Figure 1. It should be noted that all pilots are providing valuable input regarding the definition of their scenario and applications via the WP7 under which all use cases are defined. This input aims at defining to T2.1 the user stories of the pilots and the relevant requirements from the user/application perspective.

T2.1 is the fundamental task of WP2, which provides feedback to all others. In this sense, it drives the definition of the specific requirements of T2.5, which focuses on the definition of the datasets that each pilot is planning to make use of. However, as reported in the corresponding deliverable of T2.5, it mainly focuses on the technical aspects of the datasets, like volume and velocity of the data, type of datastore that it is currently stored, format (i.e. structural, un-structural data, etc.), APIs to connect and so on.

On the contrary, the scope of T2.6 is to rather focus on the logical view of the schemas of these datasets in order to identify common terminologies that could lead to the definition of the integrated data model that can be used by the business analytical tools. As the integrated data model using semantic annotations will be part of the INFINITECH-RA, the outcomes of T2.6 provides input to T2.7 that is associated with the reference architecture.

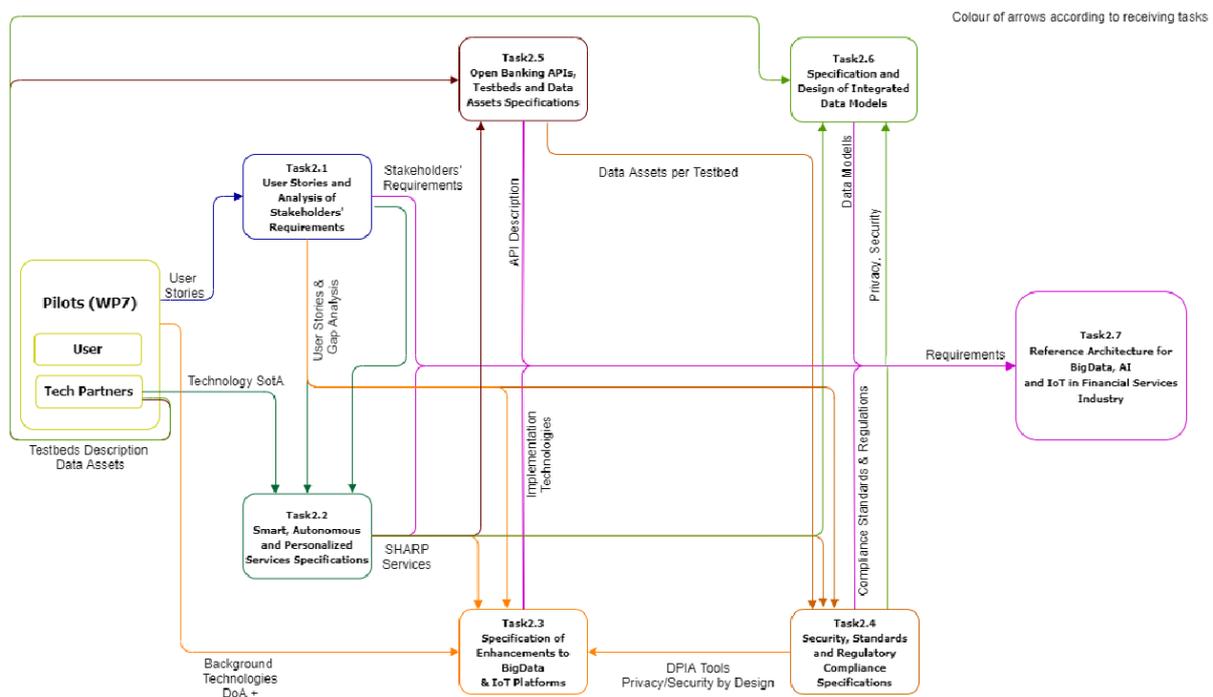


Figure 1: WP2 internal dependencies per task level

Apart from the internal WP2 dependencies, T2.6 is tightly related with tasks residing in other work packages. Firstly, as it has already been noted, it gets input from T7.1. Moreover, the output has been valuable for all main technical work packages (WP3-WP4-WP5) as i) WP3 benefits from the definition of the data schemas that need to be imported to the central data repository, ii) WP4 incorporates the common data model into its ontology for

the semantic interoperability and iii) the analytical tools of WP5 can consume data in the harmonised integrated data model. As a result, T2.6 is very centric to the whole project and has many interactions with tasks that drive the core development of the platform itself.

1.3 Summary of Changes

This document is an extension of the first version of this deliverable. Pilot 5A has been removed as the pilot has been withdrawn from the project. Section 5 has been added, which reports the analysis performed during the second phase of T2.6 in order to validate the first version of the INFINITECH Core Ontology with the needs of the pilots and proposes extensions and additions. The outcome of this analysis are further reflected in the document's conclusions.

2. Methodology

In order to obtain all the necessary information needed to accomplish the objectives of the task T2.6, different approaches have been followed. As i already mentioned, this deliverable includes a description of the logical views of the data assets that will be brought by the pilot applications in order to define the data models that they currently rely on. Additionally, it provides a state-of-the-art analysis of existing domain models that have been proposed in the literature and are widely used in the insurance and finance sectors. Finally, an analysis has been taken place in order to identify which of the already identified terms and relations are currently being covered by the first version of the INFINITECH Core Ontology, and which still remain uncovered. However, their importance is crucial and they should be included in the second version of the common ontology.

Regarding the collection of the data models that the pilot applications are currently using, this was part of a common methodology proposed by the project management board regarding how to address the pilot cases and the responsible partners in order to gather all required information. The INFINITECH project has the peculiarity of having 15 different pilot cases and almost 50 overall partners, so different methodologies have been established in order to establish the communication channels and ways of setting and monitoring all requests. Additionally, in order to obtain all the different aspects of the user and the technical requirements, there are several complementary tasks in the scope of WP2 that focus on specific parts of the whole requirements, like user requirements, regulatory constraints, restrictions by technological components, etc.

This imposes various challenges for their collection, as each pilot case would have been requested various and overlapping inputs for all activities of WP2 and of the technical tasks. Thus, the project management board established a common way of communication in order to ease this process. Each pilot case consists of the pilot leader, which is usually the domain expert of the use case: the finance or insurance organization itself, accompanied by numerous technical partners that provide their expertise in order to develop the solution. As in many cases, the business domain experts do not have the technical background to reply to the requests; one of the technical partners involved in a pilot was assigned as the *technical facilitator* and will have the role of the proxy between the domain expert and the overall consortium. This means that all requests are being forwarded to him/her, who is now responsible to communicate and gather the required inputs.

On another level, each pilot participates in one of the identified categories that have been defined in the DoA. It has been decided that all pilots that belong to the same category will be further coordinated by the responsible task leader of WP7, with the overall coordination at WP level being done by the Pilot leader. In that sense, all communications towards the pilots are being forwarded at WP7 level, then are being pushed down to the level of the technical facilitator that is responsible to execute the request and reply on behalf of the domain expert, in close collaboration with the latter however.

Apart from the definition of the communication channels that have been established between the technical partners and the pilot cases, it was identified that there are similar requests by the different tasks of WP2 that are overlapping, creating misunderstandings

regarding what it is needed to be reported in each task. To make matters worse, additional tasks in the technical work packages (WP3-WP4-WP5) contain tasks that require a preliminary interaction with the pilot cases in order to collect initial technical information so that they can be in a position to kick off their technical activities. In order to avoid members of the consortium asking for information all the time, the project management board decided to move all those requests coming from the technical work packages in the WP2 level, which is now the entry point that provides input to all others. To be more concrete, the requirements that were needed to be collected in the scope of the task T4.1 "Shared Semantics for BigData and IoT Streams", have been now moved into T2.6, that carries out a similar work regarding the definition of the integrated data model. Moreover, the technical coordinator along with the leaders of the tasks of WP2 worked together in order to define common questionnaires that are targeting wider types of requirements (i.e. dataset definition, testbed requirements, data regulatory constraints, etc).

Regarding the needs of task T2.6, an extended questionnaire was circulated to all technical facilitators of the pilots in order to retrieve information regarding the specification of the involved datasets, with additional details about the documentation of the logical schema that defines the data model of the pilot applications. This questionnaire has been uploaded in the private document repository of the project³. Each of the pilots has provided information about all datasets that are planning to exploit during the project, with the information being requested per dataset presented below:

- **Dataset name:** The name of the dataset
- **Dataset description:** A brief description of the dataset
- **Owner:** Which stakeholder is the owner of the dataset
- **License:** Whether or not the dataset is under a specific license or it is open
- **Anonymized:** Whether or not the dataset will be anonymized
- **Data Type:** The type of the data (tabular, text, image, etc)
- **Data format:** The format of the data: csv, json, txt, MS Excel file, etc
- **Size:** The estimated size of the provided data
- **Version:** Whether the data will be static, or periodically updated on the fly
- **Coverage:** Time that the data is covering
- **Data Store:** The type of the datastore where the data are currently stored (i.e. Apache Hadoop, MySQL, etc)
- **Data Volume:** The volume of the data
- **Data Velocity:** How often the data is updated

³ <https://drive.google.com/drive/u/1/folders/1s6LJ9P5M6b1uhfdMc7ggcg5DCHg42Ogk>

- **Availability:** Whether the data will be later on available to the INFINITECH project, or are confident to the pilot
- **Meta data:** If the dataset describes the metadata of the dataset
- **Link to dataset:** If the dataset is already available
- **Link to sample:** If a sample of the dataset is already available
- **Dataset:** Whether the dataset will be migrated to the central repository or will be available only on-premise
- **Read:** Whether that will be read-only or not

Furthermore, task T2.6 has also required an initial analysis of the state-of-the-art domain models on the insurance and finance sectors. This analysis was assigned to the domain experts that are involved in this task in order to be taken into account at a later phase, when the definition of the common data model of the INFINITECH-RA was developed. Having the first version of the INFINITECH Core Ontology defined and delivered, the aforementioned domain experts, with the assistance of the technical partners involved in this task, did an extensive analysis in order to drive further development and additions of the common ontology of the project.

3. State-of-the-Art analysis on existing domain models

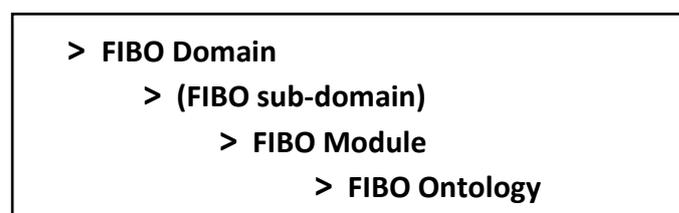
One of the main objectives of task T2.6 is to provide an analysis of the state-of-the-art domain models used by organizations of the insurance and finance sectors that has been performed in the first phase of the project. The following subsections provide details regarding information related to the three reference data models identified in the financial sector, i.e. the Financial Industry Business Ontology (FIBO), the Financial Instrument Global Identifier (FIGI) and the Legal Knowledge Interchange Format (LKIF). These three are considered as a starting point for building a semantic model in the context of the INFINITECH project.

3.1 Financial Industry Business Ontology (FIBO)

The Financial Industry Business Ontology (FIBO) defines the sets of things that are of interest in financial business applications and the ways that those things can relate to one another. In this way, FIBO can give meaning to any data (e.g., spreadsheets, relational databases, XML documents). FIBO is developed as an ontology in the Web Ontology Language (OWL). FIBO is a trademark of EDM Council, Inc. It is also standardized by the Object Management Group (OMG).

3.1.1 FIBO Structure

FIBO is not a single ontology but rather a set of ontology's. It is organized in a hierarchical directory structure to organize the ontology's. Top-level directories are called *domains*; beneath that may be one or two levels of *sub-domains* and then *modules* and dozens of *ontology's* at the bottom level.



Website:	http://www.fibo.org/
FIBO Ontology Viewer:	https://spec.edmouncil.org/fibo/ontology
FIBO Viewer Github:	https://github.com/edmouncil/fibo-viewer
FIBO OWL:	https://spec.edmouncil.org/fibo

Figure 2 represents the structure of FIBO in terms of domains, modules and ontology's. At the top level are FIBO Domains, e.g. Business Entities, Business Process Domain, Financial Business and Commerce, Loans, Securities etc. In the next level, there are modules within each domain or sub-domain. For example, Corporations and Functional Entities are modules within the Business Entities domain. Then at the next level, there are ontology's within each

module, e.g. Loans Core Ontology and Loans HMDS Ontology are ontology's within the Loans Contracts Module under the Loans domain.



Figure 2: FIBO Structure

3.1.2 Financial Business and Commerce Domain (FBC)

The Financial Business and Commerce Domain covers business concepts that are common to a number of financial areas, such as loans, securities, and corporate actions, including products and services, financial intermediaries, registrars and regulators, and financial instruments and products.

3.1.2.1 FIBO FBC Products and Services Module

The products and services module extends the FND Products and Services module via ontology's defining financial products, financial services, financial service providers, and product catalogues, as well as customer/client accounts.

3.1.2.2 Clients and Accounts Ontology

This ontology provides basic concepts such as account, account holder, account provider, relationship manager that are commonly used by financial services providers to describe customers and to determine counterparty identities. Figure 3 shows the internal classes of Clients and Accounts Ontology.

account
account holder
account identifier
account provider
account-specific service agreement
accounting transaction
balance
bank account
bank account identifier
bank identifier
basic bank account identifier
brokerage account
certificate of deposit
demand deposit account
deposit account
fee
financial service account
general ledger
international bank account identifier
investment account
investment or deposit account
ledger account
loan or credit account
non-transaction deposit account
relationship manager
time certificate of deposit account
time deposit account
time deposit open account
transaction deposit account

Figure 3: Internal classes of Clients and Accounts Ontology

3.1.2.3 Bank Account

It is defined as “Account held or provided by, as a service, a bank” and depicted in Figure 4.

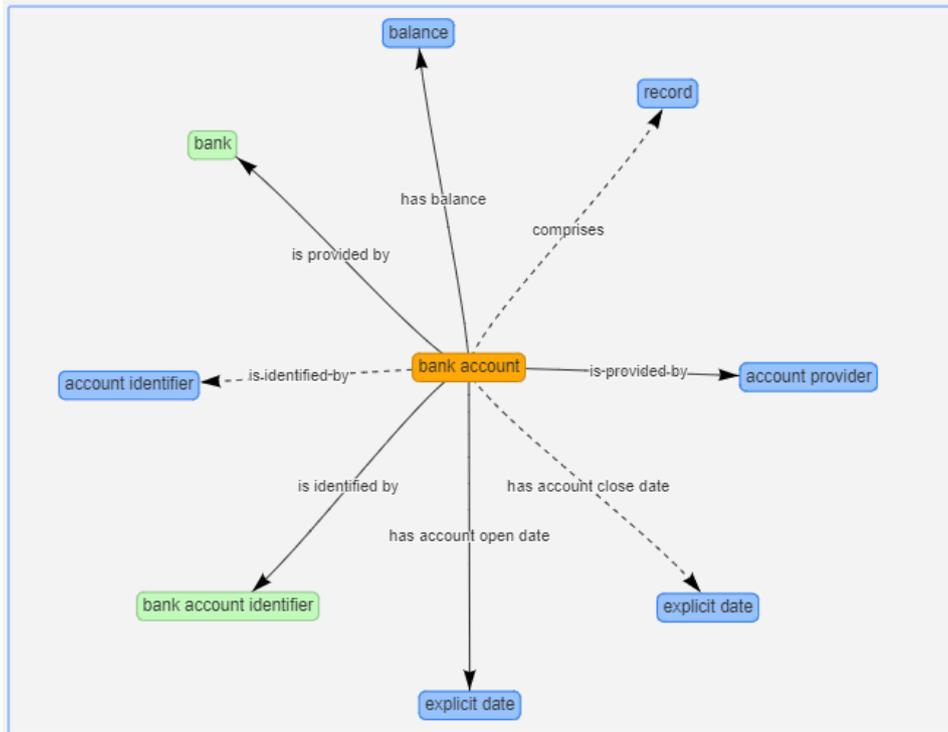


Figure 4: Bank Account Model

3.1.2.4 Account Holder

It is defined as “party holding an account” and is illustrated in Figure 5.

3.1.3.2 Agreements Ontology

This ontology defines concepts for agreements, for use in other ontology elements. Agreements as defined here are the actual agreements between parties, and this ontology is intended to be referred to in conjunction with the contracts ontology which defines the actual contracts which formalize such agreements. Figure 6 shows the concepts of agreement and contract are intended to be kept distinct in the FIBO ontology’s, that is neither intended to be regarded as a subtype of the other.

agreement
 beneficiary
 commitment
 commitment at large
 individual unilateral commitment
 mutual agreement
 mutual commitment
 obligee
 obligor
 unilateral commitment

Figure 6: Internal Classes of Agreement Ontology

3.1.3.3 Agreement

It is defined as “a negotiated understanding between two or more parties, reflecting the offer and acceptance of commitments on the part of either party” and presented in Figure 8 below.

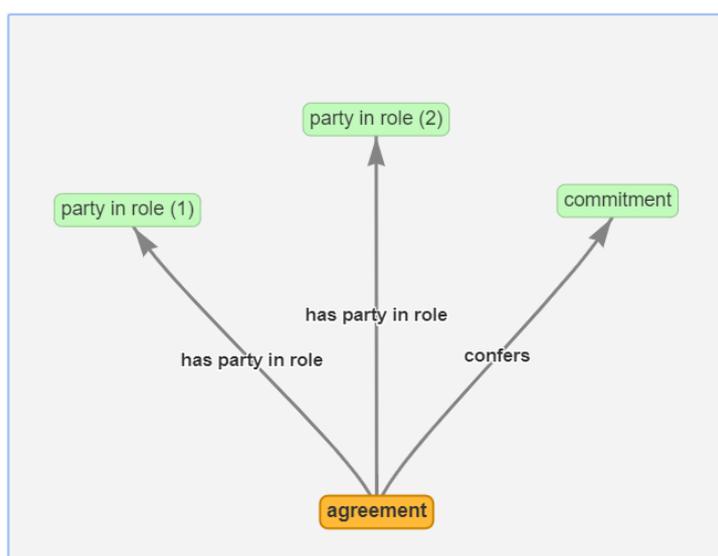


Figure 7: Agreement Model

3.1.3.4 Contracts Ontology

This ontology defines concepts relating to contracts for use in other FIBO ontology elements. These include written contracts which are the concrete evidence of agreements between parties, along with verbal contracts. Contracts are further broken down into bilateral and transferable contracts, with the latter being the basis for most financial instruments. Properties of contracts are also defined, in particular contractual terms and contract parties. Figure 8 shows these concepts which alltogether form the basis of contracts in the financial services industry. For example, interest payment terms are a kind of contract terms set and security holders are a kind of contract counterparty.

condition precedent
contract
contract document
contract originator
contract party
contract principal
contract third party
contractual commitment
contractual definition
contractual element
counterparty
mutual contractual agreement
non-binding terms
promissory note
term sheet
transferable contract
transferable contract holder
unilateral contract
verbal contract
written contract

Figure 8: Internal Classes of Contracts Ontology

3.1.3.5 Contract

It is defined as “a voluntary, deliberate agreement between two or more competent parties to which those parties agree to be legally bound, and to which the parties must have provided valuable consideration” and is shown in Figure 9.



Figure 9: Contract Model

3.2 Financial Instrument Global identifier (FIGI)

The Financial Instrument Global Identifier (FIGI)^{4 5} is an open standard, unique identifier of financial instruments that can be assigned to instruments including common stocks, options, derivatives, futures, corporate and government bonds, municipals, currencies, and mortgage products. The FIGI structure is represented in Figure 10, it is defined and copyrighted by the Object Management Group. Bloomberg L.P. is the Registration Authority and Certified Provider of the standard. FIGI have been created for more than 300 million unique securities, representing most asset classes of the financial markets.

The FIGI is a 12-character alpha-numerical code that does not contain information characterizing financial instruments, but serves for uniform unique global identification. Once issued, a FIGI is never reused and represents the same instrument in perpetuity. Unique FIGIs identify securities as well as individual exchanges on which they trade. Composite FIGIs are also issued to represent unique securities across related exchanges. There exists a unique FIGI to identify the common stock on each individual exchange, but also a composite FIGI to represent the company's common stock traded on United States exchanges.

⁴ <https://www.openfigi.com/>

⁵ <https://www.omg.org/spec/FIGI>

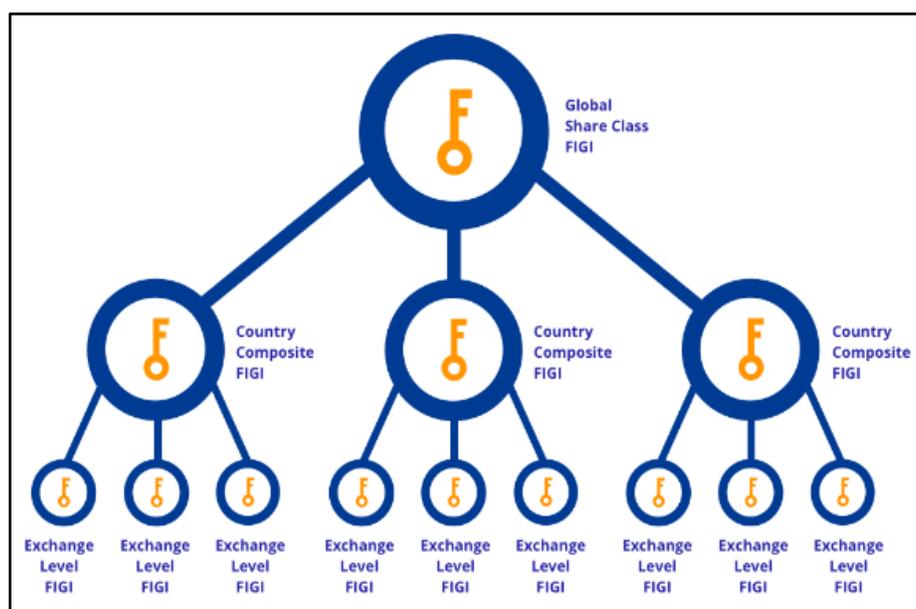


Figure 10: FIGI Identifier Structure

3.3 Legal Knowledge Interchange Format (LKIF)

The Legal Knowledge Interchange Format (LKIF) is an OWL ontology of legal concepts, allowing legal knowledge bases to be represented in OWL. LKIF defines epistemological concepts for legal reasoning and argumentation, such as legal rules, meta-level rules for reasoning about rule priorities and exceptions, legal arguments, legal procedures, cases and case factors, values and principles. In addition, LKIF defines an ontology of generally useful substantive legal concepts, such as obligations, permissions, rights and powers, which can be reused when modelling specific legal domains, such as tax law. LKIF provides direct support for representing three types of knowledge, which have been identified as critical to the law and the ability to reason about it: (i) terminological knowledge, (ii) legal rules, and (iii) normative statements.

LKIF Website: <http://www.estrellaproject.org/lkif-core/>
 LKIF Github: <https://github.com/RinkeHoekstra/lkif-core>
 LKIF Ontology: http://www.estrellaproject.org/?page_id=3

3.3.1 Terminological Knowledge

The layer of terminological knowledge is supported in LKIF through the Web Ontology Language (OWL). The terminological support provided by LKIF is extended with the LKIF-Core ontology of basic legal concepts.

3.3.2 Legal Rules

LKIF rules extend SWRL (Semantic Web rules-language) with support for negation and defeasible reasoning. The rule layer provides a language expressive enough to model legal rules in a way which comes much closer to the ideal of isomorphic modeling, i.e. in a way

which reflects the structure of the rules in a legislation. The rules layer supports rules with exceptions, assumptions, and exclusionary conditions, enabling meta-level information about rules to be represented, such as date of enactment, which is used in other rules such as *lex posterior* to reason about rule priorities.

3.3.3 Normative Statements

Normative statements are given a direct support via the “norm” module included in LKIF-Core ontology. The module contains minimally restricted definitions of major concepts and properties, based on the notion of subjunctive betterness, which are intended as basic constructs for modelling various deontic settings. Nevertheless, there exists a preferable mapping of normative statements into OWL representation, which preserves some essential properties of the modal frames semantics, associated with deontic logics.

3.3.4 LKIF Core

The LKIF core legal ontology is a library of ontology’s relevant for the legal domain. It consists of 15 modules, each of which describes a set of closely related concepts from both legal and commonsense domains.

3.3.4.1 Abstract Concepts

The most abstract concepts are defined in five closely related modules: (i) top, (ii) place, (iii) mereology, (iv) time, and (v) spacetime.

Top: The LKIF top ontology is largely based on the top-level of LRI-Core but has less ontological commitment in the sense that it imposes less restrictions on subclasses of the top categories.

Place: The place module partially implements the theory of relative places (Donnelly, 2005) in OWL DL.

Mereology: The mereology module defines mereological concepts such as parts and whole, and typical mereological relations such as part of, component of, containment, membership etc.

Time: The time module provides an OWL DL implementation of the theory of time by Allen (1984).

3.3.4.2 Basic Concepts

Basic-level concepts are distributed across four modules: (i) process, (ii) role, (iii) action, and (iv) expression.

Process: The process module extends the LKIF top ontology module with a definition of changes, processes (being causal changes) and physical objects. It introduces a limited set of properties for describing participant roles of processes.

Role: The role module defines a typology of roles (epistemic roles, functions, person roles, organisation roles) and the plays-property for relating a role filler to a role.

Action: The action module describes the vocabulary for representing actions in general. Actions are processes which are performed by some agent (the actor of the action). This module does not commit itself to a particular theory on thematic roles.

Expression: The expression module describes a vocabulary for describing propositions and propositional attitudes (belief, intention), qualifications, statements and media. It furthermore extends the role module with a number of epistemic roles, and it is the basis for the definition of norms.

3.3.4.3 Legal Concepts

These basic clusters are extended by three modules that form the legal ontology: (i) legal action, (ii) legal role, and (iii) norm.

Legal-action: The legal action module extends the action module with a number of legal concepts related to action and agent, such as public acts, public bodies, legal person, natural person, etc.

Legal-role: The legal role module extends the role module with a small number of legal concepts related to roles, legal professions, etc.

Norm: The norm module is an extension of the expression module where norms are defined as qualifications. It furthermore defines a number of legal sources, e.g. legal documents, customary law, etc., and a typology of rights and powers.

3.3.4.4 Framework Modules

In addition to these legal clusters, two modules are provided that cover the basic vocabulary of two frameworks: (i) modification, and (ii) rules.

Modification: The modification module is both an extension of the time module and the legal action module. The time module is extended with numerous intervals and moments describing the efficacy and being in force of legal documents. The action module is extended with a typology of modifications.

Rules: The rules & argumentation module defines roles central to argumentation, and describes the vocabulary for LKIF rules.

3.3.4.5 Core and Extended Ontology

Finally, the twelve modules of the abstract, basic and legal level are integrated in the LKIF Core ontology module. This module does not provide any additional definitions, but functions as an entry-point for users of the ontology library. The two framework modules

are accessible through the LKIF Extended ontology module. This module imports the LKIF Core module.

4. Terminology Analysis of Pilot Datasets

After conducting the survey with the pilot leaders' participation at the first phase of WP2 activities regarding the definition of the data sets that has been planned to be exploited during the progress of the project, the description of their logical representation has followed, in order for the technical partners to better understand the schemas that they rely on. In parallel, an analysis of their main entities, properties and attributes took place, as an attempt to collect information about the terminology that each pilot is using. The scope of this process was to identify common terminologies that are frequently shared among pilots, so that this can be a valuable input for the definition of a common data model that will be used inside the project, namely the **Infinitech Core Ontology**.

The results of this analysis are presented in the following subsections. We identify the common terminologies in each pilot and we cite all terms used by the pilots. We note the name of the term, a synonym that can be found and a short description of the term. Furthermore, we categorize each term according to each kind: Actor, Object, Process or Property. It has been highlighted that all pilots share some commonly used terms like *Score*, *Risk Assessment Score*, *Risk Assessment*, *Risk*, *Product*, *Processing System*, *Process*, *Financial Product* and *Client*.

4.1 Pilot #1: Invoices Processing Platform for a more Sustainable Banking Industry

Pilot 1 belongs to the category of *Smart, Reliable and Accurate Risk and Scoring Assessment*, so it is expected that terms like *Score*, *Risk*, *Assessment*, *Product* will be mainly used, along with the other terms expected to be commonly used like *Customer* or *Client*, *Bank* and *Service*. This pilot is related to the extraction of information from notary invoices in order to create a sustainability index of each notary that the bank is working with based on the number of physical copies that the notary is issuing. Then promote those with the highest index by promoting them to their customers. As a result, this pilot uses some very specific terms such as *notary*, *invoices*, and *sustainability index* that are not expected to be found in other pilots. In fact, the terms *Score*, *Risk Assessment Score*, *Risk Assessment*, *Risk*, *Product*, *Processing System*, *Process*, *Financial Product*, *Client*, *Service* are found in all pilots, followed by the terms *Bank*, *Assessment*, *Report*, *Financial Service* which are found mostly in the pilots of the finance sector. On the contrary, terms like *Index*, *Credit Risk Score*, *Credit Risk*, *Credit*, *Business*, *Sustainable Business*, *Sustainability Score*, *Sustainability Index*, *Sustainability*, *Notary Rate*, *Notary*, *Notarial Service*, *Invoice*, *Document*, *Credit Reporting Service*, *Credit Report* and *Accuracy* are pilot specific and can only be found in this case.

Table 1 shows the list of all terminologies that have been identified for Pilot 1.

Table 1: Identified terms for Pilot 1

Term	Synonym	Kind	Description
Accuracy	Risk of failure, risk of non-repayment, risk of insolvency	Property	The possibility of a loss resulting from a borrower's failure to repay a loan or meet contractual obligations

Assessment	Credit Risk rating, credit worthiness	Property	The number used by lenders that provides a snapshot of your credit risk picture at a particular point in time
Bank	Certificate, record, form, report	Object	Paper or a set of papers with written or printed information, especially of an official type
Business	Financial instruments, financial tools	Object	A financial product is a product (typically in the form of a contract) provided to consumers and businesses or other organizations (municipalities or sovereigns) by financial institutions such as banks, insurance companies, brokerage firms, consumer finance companies, and investment companies all of which comprise the financial services industry
Client	Banking, business services, financial affairs	Process	Service provided by the finance industry involving the investment, lending, and management of money and assets
Cost	Indicator, indication	Property	System of numbers used for comparing values of things that change according to each other or a fixed standard
Credit	Bill	Object	Itemized list of goods shipped, usually specifying the price and terms of sale
Credit Report	Notarize, notarizations	Process	Notary Services are services rendered by a state commissioned notary public
Credit Reporting Service	Notary public, public official, certifier	Actor	A person who has been licensed/authorized by a state to perform certain legal functions, especially to draw up or certify contracts, deeds, and other documents
Credit Risk	Notary fees	Property	The fee that a notary charges for their notary services
Credit Risk Score	Procedure, transaction	Process	A series of actions or steps taken in order to achieve a particular end
Document	Information processing, data processing	Process	The combination of machines, people, and processes that for a set of inputs produces a defined set of outputs
Financial Product	Commodity, output, solution	Object	It is an object or system made available for consumer use; it is anything that can be offered to a market to satisfy the desire or need of a customer
Financial Service	Account, story, chronicle, record	Object	An account, statement or document describing in detail an event, situation, or the like, usually as the result of observation, inquiry, etc.
Index	Hazzard, pitfall, threat, trouble	Property	Risk is defined in financial terms as the chance that an outcome or investment's actual gains will differ from an expected outcome or return. Risk includes the possibility of losing some or all of an original investment.
Invoice	Risk evaluation, risk analysis	Process	The systematic process of evaluating the potential risks and/or to determine the likelihood of loss on an asset, loan, or investment
Notarial Service	Risk rating score, risk scoring	Property	It is a calculated number (score) that reflects the severity of a risk due to some factors
Notary	Amount, number, amount, final count	Property	It is a number that expresses facts about an actual situation

Notary Rate	Assistance, support, utility	Object	The organized system of apparatus, appliances, employees, etc. for supplying some accommodation required by the public
Process	Service charge, additional charge	Property	The expense associated with having another person performs a valuable task for which specialized expertise may be required
Processing System	Maintainable, supportable	Property	The ability to be maintained at a certain rate or level
Product	Performance indicator	Property	Instrument to measure the responsibility of a certain company in social, environmental and economic development. It can be used to predict a debtor's financial performance and improve the predictive validity of the credit rating process
Report	Sustainability rating	Property	It allows for a quick assessment of how well a company is run
Risk	Green business	Object	Enterprise that has minimal negative impact on the global or local environment, community, society, or economy
Document	Risk of failure, risk of non-repayment, risk of insolvency	Property	The possibility of a loss resulting from a borrower's failure to repay a loan or meet contractual obligations
Risk Assessment Score	Credit Risk rating, credit worthiness	Property	The number used by lenders that provides a snapshot of your credit risk picture at a particular point in time
Score	Certificate, record, form, report	Object	Paper or a set of papers with written or printed information, especially of an official type
Service	Financial instruments, financial tools	Object	A financial product is a product (typically in the form of a contract) provided to consumers and businesses or other organizations (municipalities or sovereigns) by financial institutions such as banks, insurance companies, brokerage firms, consumer finance companies, and investment companies all of which comprise the financial services industry
Service Cost	Banking, business services, financial affairs	Process	Service provided by the finance industry involving the investment, lending, and management of money and assets
Sustainability	Indicator, indication	Property	System of numbers used for comparing values of things that change according to each other or a fixed standard
Sustainability Index	Bill	Object	Itemized list of goods shipped, usually specifying the price and terms of sale
Sustainability Score	Sustainability rating	Property	It allows for a quick assessment of how well a company is run
Sustainable Business	Green business	Object	Is an enterprise to be that has minimal negative impact on the global or local environment, community, society, or economy

This pilot is not currently relying on a specific ontology to build its overall solution.

4.2 Pilot #2: Real-time risk assessment in Investment Banking, Partners

Pilot 2 belongs to the category of *Smart, Reliable and Accurate Risk and Scoring Assessment*, so it is expected to use the commonly shared terms that were identified before, along with pilot specific ones for this scenario. This pilot plans to implement a procedure for real-time risk assessment and to monitor the risk for standard metrics that are being used in the sector. Its objective is to estimate the market risk and continuously re-evaluate it upon the change of market prices. As a result, it is expected the presence of pilot specific terms such as the names of the metrics, trades, assets, etc. In fact, the terms *Score, Risk Assessment Score, Risk Assessment, Risk, Product, Processing System, Process, Financial Product, Client, Service* are found in all pilots, followed by the terms *Bank, Assessment, Financial Regulator, Portfolio* which are found mostly in the pilots of the finance sector. On the contrary, terms like *Trade, Trade Analysis, Market, Asset Management, Asset, Value-at-Risk, Trader, Supervisory Authority, Sales Manager, Rules, Risk Metrics, Risk Manager, Policy, Market Risk, Manager, Lead, Expected Shortfall* and *Asset Manager* are unique and specific to this pilot.

Table 2 shows the list of all terminologies that have been identified for Pilot 2.

Table 2: Identified terms for Pilot 2

Term	Synonym	Kind	Description
Assessment	Determination, rating, estimation, valuation	Process	The process of judging or deciding the amount, value, quality, or importance of something, or the judgment or decision that is made
Asset	Resource, property	Object	An asset is a resource with economic value that an individual, corporation, or country owns or controls with the expectation that it will provide a future benefit.
Asset Management	Investment management, portfolio management, wealth management	Process	Refers to the active management of an investor's portfolio by a financial services company (usually an investment bank)
Asset Manager	Investment manager, portfolio manager, wealth manager	Actor	A person that determines what investments to make, or avoid, that will grow a client's portfolio
Bank	Investment Firm, Trust Company	Actor	It is a type of financial institution that accepts deposits, offers checking account services, purchases various loans, and offers basic financial products like certificates of deposit (CDs) and savings accounts to individuals and small businesses. A commercial bank is where most

			people do their banking, as opposed to an investment bank
Client	Customer	Actor	A person or organization who engages or use the services of a lawyer or of another professional person or company
Expected Shortfall	ES, CVaR, Expected Tail loss	Property	It is a risk assessment measure used in the field of financial risk measurement to evaluate the market risk or credit risk of a portfolio. It is the expected return on the portfolio if the worst-case threshold is ever crossed
Financial Organization	Financial Institution, Trust Company, Bank	Actor	It is an institution (public or private) that collects funds (from the public or other institutions) and invests them in financial assets
Financial Product	Financial instruments, financial tools	Object	A financial product is a product (typically in the form of a contract) provided to consumers and businesses or other organizations (municipalities or sovereigns) by financial institutions such as banks, insurance companies, brokerage firms, consumer finance companies, and investment companies all of which comprise the financial services industry
Financial Regulator	Financial supervisor, financial authority	Actor	A financial regulator is an institution that supervises and controls a financial system and related financial services. Their objective is to guarantee fair and efficient markets and financial stability
Lead	Potential customer, potential client, interested customer, interested client	Actor	It is an individual or organization with an interest in what you are selling
Manager	Administrator, director	Actor	It is a person who manages or is in charge of something
Market	Retail, exchange, marketplace	Object	It is a place where two parties can gather to facilitate the exchange of goods and services. The parties involved are usually buyers and sellers
Market Risk	Systematic risk	Property	It is the possibility of an investor experiencing losses due to factors that affect the overall performance of the financial markets in which he or she is involved
Policy	Plan, strategy	Object	A course or principle of action adopted or proposed by an organization or individual
Portfolio	Collection of investments	Object	It is a grouping of financial assets such as stocks, bonds, commodities, currencies and cash equivalents, as well as their fund counterparts, including mutual, exchange-traded and closed funds
Process	Procedure, transaction	Process	A series of actions or steps taken in order to achieve a particular end
Processing System	Information processing, data processing, DP	Process	The combination of machines, people, and processes that for a set of inputs that produces a defined set of outputs

Product	Commodity, output, solution	Object	It is an object or system made available for consumer use; it is anything that can be offered to a market to satisfy the desire or need of a customer
Regulatory Authority	Regulatory agency, regulatory institution	Actor	A regulatory authority is an autonomous authority or agency established by a federal, state or provincial government
Risk	Hazard, pitfall, threat, trouble	Property	Risk is defined in financial terms as the chance that an outcome or investment's actual gains will differ from an expected outcome or return. Risk includes the possibility of losing some or all of an original investment.
Risk Assessment	Risk evaluation, risk analysis	Process	The systematic process of evaluating the potential risks and/or to determine the likelihood of loss on an asset, loan, or investment
Risk Assessment Score	Risk rating score, risk scoring	Property	It is a calculated number (score) that reflects the severity of a risk due to some factors
Risk Manager	Risk supervisor, director risk	Actor	An individual responsible for managing an organization's risks and minimizing the adverse impact of losses on the achievement of the organization's objectives
Risk Metrics	Risk measures	Property	The attribute of a risk that is being measured. Risk metrics are the statistical features used in risk measure calculations
Rules	Law, regulation	Complex Property	An accepted principle or instruction that states the way things are or should be done, and tells you what you are allowed or are not allowed to do
Sales Manager	Sales supervisor, sales leader	Actor	A manager in charge of the sales department and responsible for its performance, organization and planning
Score	Amount, number, amount, final count	Property	It is a number that expresses facts about an actual situation
Supervisory Authority	SA, DPA	Actor	It is an independent public authority that supervises, through investigative and corrective powers, the application of European data protection law
Trade	Exchange, transaction	Process	The action of buying and selling goods and services with compensation paid by a buyer to a seller, or the exchange of goods or services between parties
Trade Analysis	Technical analysis	Process	A trading discipline employed to evaluate investments and identify trading opportunities by analyzing statistical trends gathered from trading activity, such as price movement and volume
Trader	dealer, buyer, seller	Actor	An individual who engages in the buying and selling of financial assets in any financial market, either for himself or on behalf of another person or institution
Value-at-Risk	VaR	Property	It is a statistic that measures and quantifies the level of financial risk within a firm, portfolio or position over a specific time frame

This pilot is not currently relying on a specific ontology to build its overall solution.

4.3 Pilot #3: Collaborative Customer-centric Data Analytics for Financial Services

Pilot 3 belongs to the category of *Personalized Retail and Investment Banking Services*. Apart from the commonly used terms, we expect to find terminologies related with the KYC and KYB aspects. Its scope is to use intelligent support tools for new customer services using permission-based mechanisms for data sharing with associated analytics capability and improve the KYC by sharing data from external sources related to the customer. This activity will improve credit scoring; while at the same time will detect possible transactions related with money laundering. This pilot shares terms with many pilots of the same category such as *Financial Organization, Digital Service, Data, Customer Service, Customer Data, Bank, Assessment, Financial Service, Financial Data*. Terms that are specific to this pilot are hardly found in others and are the following ones: *Loyalty, Anti-Money Laundering, Data Anonymization, Business and Data Custodian Service*.

Table 3 shows the list of all terminologies that have been identified for Pilot 3.

Table 3: Identified terms for Pilot 3

Term	Synonym	Kind	Description
Anti-Money Laundering	AML	Process	Anti-money laundering refers to a set of laws, regulations, and procedures intended to prevent criminals from disguising illegally obtained funds as legitimate income.
Assessment	Determination, rating, estimation, valuation	Process	The process of judging or deciding the amount, value, quality, or importance of something, or the judgment or decision that is made
Bank	Investment Firm, Trust Company	Actor	It is a type of financial institution that accepts deposits, offers checking account services, makes various loans, and offers basic financial products like certificates of deposit (CDs) and savings accounts to individuals and small businesses. A commercial bank is where most people do their banking, as opposed to an investment bank
Business	Affair, trade, transaction, contract	Process	The activity/process of buying and selling goods and services
Client	Customer	Actor	A person or organization who engages or use the services of a lawyer or other professional person or company
Cost	Expense, expenditure, score	Property	An outlay or expenditure of money, time, effort, labour, trouble to acquire, produce, accomplish or maintain anything

Credit	Loan	Object	The ability and/or contractual agreement in which a customer obtains goods or services before payment, based on the trust that payment will be made in the future
Credit Risk	Risk of failure, risk of non-repayment, risk of insolvency	Property	The possibility of a loss resulting from a borrower's failure to repay a loan or meet contractual obligations
Credit Risk Score	Credit Risk rating, credit worthiness	Property	The number used by lenders that provides a snapshot of your credit risk picture at a particular point in time
Customer Data	Consumer Data	Object	Refers to all personal, behavioural, and demographic data that is collected by marketing companies and departments from their customer base.
Customer Service	Client service	Process	It is the direct one-on-one interaction between a consumer making a purchase and a representative of the company that is selling it
Data	Info, facts	Object	The facts and statistics collected together for reference or analysis
Data Anonymization	Data de-identification, data privacy, data obfuscation, data masking	Process	It is the process of removing sensitive information from a document or other message whose intent is privacy protection
Data Custodian Service	Data custody service	Process	It is responsible for the safe custody, transport, storage of the data and implementation of business rules
Digital Service	Electronic service, computer service	Process	Refers to the electronic delivery of information including data and content across multiple platforms and devices like web or mobile
Financial Data	Financial statements	Object	Financial data consists of pieces or sets of information related to the financial health of a business
Financial Organization	Financial Institution, Trust Company, Bank	Actor	It is an institution (public or private) that collects funds (from the public or other institutions) and invests them in financial assets
Financial Product	Financial instruments, financial tools	Object	A financial product is a product (typically in the form of a contract) provided to consumers and businesses or other organizations (municipalities or sovereigns) by financial institutions such as banks, insurance companies, brokerage firms, consumer finance companies, and investment companies all of which comprise the financial services industry
Financial Service	Banking, business services, financial affairs	Process	Service provided by the finance industry involving the investment, lending, and management of money and assets
Loyalty	Allegiance, devotion	Property	In general, loyalty is a devotion and faithfulness to a nation, cause, philosophy, country, group, or person
Process	Procedure, transaction, faithfulness	Process	A series of actions or steps taken in order to achieve a particular end

Processing System	Information processing, data processing, DP	Process	The combination of machines, people, and processes that for a set of inputs produces a defined set of outputs
Product	Commodity, output, solution	Object	It is an object or system made available for consumer use; it is anything that can be offered to a market to satisfy the desire or need of a customer
Risk	Hazard, pitfall, threat, trouble	Property	Risk is defined in financial terms as the chance that an outcome or investment's actual gains will differ from an expected outcome or return. Risk includes the possibility of losing some or all of an original investment.
Risk Assessment	Risk evaluation, risk analysis	Process	The systematic process of evaluating the potential risks and/or to determine the likelihood of loss on an asset, loan, or investment
Risk Assessment Score	Risk rating score, risk scoring	Property	It is a calculated number (score) that reflects the severity of a risk due to some factors
Score	Amount, number, amount, final count	Property	It is a number that expresses facts about an actual situation
Service	Assistance, support, utility	Object	The organized system of apparatus, appliances, employees, etc., for supplying some accommodation required by the public
Service Cost	Service charge, additional charge	Property	The expense associated with having another person perform a valuable task for which specialized expertise may be required

Table 3: Identified terms for Pilot 3

This pilot already uses an internal model for data representation and currently a study is being carried out to identify if this model is compliant with FIBO, FIGI or even LKIF, by looking at the legal framework terms. The general idea is to be able to have a way to semantically describe the format of this pilot in order to make it compatible with one of the three ontology's, or generate or create extensions of them that can be proposed to be adapted in the INFINITECH Data Model as semantic annotations to datasets.

4.4 Pilot #4: Personalized Portfolio Management (“Why Private Banking cannot be for everyone?”)

Pilot 4 belongs to the category of *Personalized Retail and Investment Banking Services*. Apart from the commonly used terms, we expect to find terminologies related with the KYC (“Know-Your-Customer”) and KYB (“Know-Your-Business”) aspects. Its scope is to explore the possibilities of AI Based Portfolio construction for Wealth Management in general, regardless which amount has to be invested, thus enabling interested advisors and customers to use the existing platform of this bank in order to make a risk-profiling, calculate their portfolio and identify and suggest different ways to invest or to “fit” the portfolio. Terms that are widely found among other pilots and especially to those of this category are the following: *Digital Service, Data, Customer Service, Customer Data,*

Regulatory Authority, Artificial Intelligence, Big Data, Bank, Risk profiling, Financial Service, Financial Regulator, Financial Data, Portfolio, Fund. However, the terminologies that are pilot specific and are hardly found on others include terms such as *Service Cost, Loyalty, Wealth-Management, Relationship Manager, Open Data, Advisor and Optimization.*

Table 4 shows the list of all terminologies that have been identified for Pilot 4.

Table 4: Identified terms for Pilot 4

Term	Synonym	Kind	Description
Advisor	Consultant	Actor	A person who gives advice in a particular field
Artificial Intelligence	AI, machine intelligence	Process	It refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions
Bank	Investment Firm, Trust Company	Actor	It is a type of financial institution that accepts deposits, offers checking account services, makes various loans, and offers basic financial products like certificates of deposit (CDs) and savings accounts to individuals and small businesses. A commercial bank is where most people do their banking, as opposed to an investment bank
Big Data	Massive data, BDA	Process	It is a field that treats ways to analyze, systematically extract information from, or otherwise deal with data sets that are too large or complex to be dealt with by traditional data-processing application software
Client	Costumer	Actor	A person or organization who engages or use the services of a lawyer or other professional person or company
Customer Data	Consumer Data	Object	Refers to all personal, behavioural, and demographic data that is collected by marketing companies and departments from their customer base.
Customer Service	Client service	Process	It is the direct one-on-one interaction between a consumer making a purchase and a representative of the company that is selling it
Data	Info, facts	Object	The facts and statistics collected together for reference or analysis
Digital Service	Electronic service, computer service	Process	Refers to the electronic delivery of information including data and content across multiple platforms and devices like web or mobile
Financial Data	Financial statements	Object	Financial data consists of pieces or sets of information related to the financial health of a business
Financial Organization	Financial Institution, Trust Company, Bank	Actor	It is an institution (public or private) that collects funds (from the public or other institutions) and invests them in financial assets
Financial Product	Financial instruments, financial tools	Object	A financial product is a product (typically in the form of a contract) provided to consumers and businesses or other organizations (municipalities or sovereigns) by financial institutions such as banks, insurance

			companies, brokerage firms, consumer finance companies, and investment companies all of which comprise the financial services industry
Financial Regulator	Financial supervisor, financial authority	Actor	A financial regulator is an institution that supervises and controls a financial system and related financial services. Their objective is to guarantee fair and efficient markets and financial stability
Financial Service	Banking, business services, financial affairs	Process	Service provided by the finance industry involving the investment, lending, and management of money and assets
Fund	Capital, endowment, foundation	Object	It is a pool of money that is allocated for a specific purpose
Loyalty	Allegiance, devotion	Property	In general use, loyalty, is a devotion and faithfulness to a nation, cause, philosophy, country, group, or person
Open Data	Free data, free accessible data	Object	Open data is the idea that some data should be freely available to everyone to use and republish as they wish, without restrictions from copyright, patents or other mechanisms of control
Optimization	Enhancement, improvement	Process	The action of making the best or most effective use of a situation or resource
Portfolio	Collection of investments	Object	It is a grouping of financial assets such as stocks, bonds, commodities, currencies and cash equivalents, as well as their fund counterparts, including mutual, exchange-traded and closed funds
Process	Procedure, transaction, faithfulness	Process	A series of actions or steps taken in order to achieve a particular end
Processing System	Information processing, data processing, DP	Process	The combination of machines, people, and processes that for a set of inputs produces a defined set of outputs
Product	Commodity, output, solution	Object	It is an object or system made available for consumer use; it is anything that can be offered to a market to satisfy the desire or need of a customer
Regulatory Authority	Regulatory agency, regulatory institution	Actor	A regulatory authority is an autonomous authority or agency established by a federal, state or provincial government
Relationship Manager	Account manager, account executive	Actor	Relationship managers work to improve business relationships with partner firms and clients. Relationship management is generally divided into two fields: client relationship management and business relationship management
Risk	Hazard, pitfall, threat, trouble	Property	Risk is defined in financial terms as the chance that an outcome or investment's actual gains will differ from an expected outcome or return. Risk includes the possibility of losing some or all of an original investment.

Risk Assessment	Risk evaluation, risk analysis	Process	The systematic process of evaluating the potential risks and/or to determine the likelihood of loss on an asset, loan, or investment
Risk Assessment Score	Risk rating score, risk scoring	Property	It is a calculated number (score) that reflects the severity of a risk due to some factors
Risk profiling	Risk-profile	Process	Evaluation of an individual's willingness and ability to take risks
Score	Amount, number, amount, final count	Property	It is a number that expresses facts about an actual situation
Service	Assistance, support, utility	Object	The organized system of apparatus, appliances, employees, etc., for supplying some accommodation required by the public
Service Cost	Service charge, additional charge	Property	The expense associated with having another person perform a valuable task for which specialized expertise may be required
Wealth-Management	Customer relationship management, CRM	Process	It is an investment advisory service that combines other financial services to address the needs of affluent clients. It is a consultative process whereby the advisor gleans information about the client's wants and tailors a bespoke strategy utilizing appropriate financial products and services

Table 4: Identified terms for Pilot 4

This pilot is not currently relying on a specific ontology to build its overall solution.

4.5b Pilot #5b: Business Financial Management (BFM) tools delivering a Smart Business Advice

Pilot 5b also belongs to the category of *Personalized Retail and Investment Banking Services*. As a result, it uses the same terms with the other pilots of this group. Its scope is also to explore the possibilities of AI Based Portfolio construction for Wealth Management in general in order to make a risk-profiling and suggest different ways to. Terms that are widely found among other pilots and especially to those of this category are the following: *Digital Service, Data, Customer Service, Customer Data, Regulatory Authority, Artificial Intelligence, Big Data, Bank, Risk profiling, Financial Service, Financial Regulator, Financial Data, Portfolio, Fund*.

Table 5: Identified terms for Pilot 5b

Term	Synonym	Kind	Description
Advisor	Consultant	Actor	A person who gives advice in a particular field
Client	Costumer	Actor	A person or organization who engages or use the services of a lawyer or other professional person or

			company
Customer Data	Consumer Data	Object	Refers to all personal, behavioural, and demographic data that is collected by marketing companies and departments from their customer base.
Customer Service	Client service	Process	It is the direct one-on-one interaction between a consumer making a purchase and a representative of the company that is selling it
Financial Data	Financial statements	Object	Financial data consists of pieces or sets of information related to the financial health of a business
Financial Organization	Financial Institution, Trust Company, Bank	Actor	It is an institution (public or private) that collects funds (from the public or other institutions) and invests them in financial assets
Financial Product	Financial instruments, financial tools	Object	A financial product is a product (typically in the form of a contract) provided to consumers and businesses or other organizations (municipalities or sovereigns) by financial institutions such as banks, insurance companies, brokerage firms, consumer finance companies, and investment companies all of which comprise the financial services industry
Portfolio	Collection of investments	Object	It is a grouping of financial assets such as stocks, bonds, commodities, currencies and cash equivalents, as well as their fund counterparts, including mutual, exchange-traded and closed funds
Product	Commodity, output, solution	Object	It is an object or system made available for consumer use; it is anything that can be offered to a market to satisfy the desire or need of a customer
Risk	Hazard, pitfall, threat, trouble	Property	Risk is defined in financial terms as the chance that an outcome or investment's actual gains will differ from an expected outcome or return. Risk includes the possibility of losing some or all of an original investment.
Risk Assessment	Risk evaluation, risk analysis	Process	The systematic process of evaluating the potential risks and/or to determine the likelihood of loss on an asset, loan, or investment
Risk Assessment Score	Risk rating score, risk scoring	Property	It is a calculated number (score) that reflects the severity of a risk due to some factors

This pilot is not currently relying on a specific ontology to build its overall solution.

4.6 Pilot #6: Personalized Closed-Loop Investment Portfolio Management for Retail Customers

Pilot 6 belongs to the category of *Personalized Retail and Investment Banking Services*. Apart from the commonly used terms, we expect to find terminologies related with the KYC and KYB aspects. Its objective is implement an integrated BigData/AI workflow for the automation in order to automate and personalize investment recommendations, including

client research and profiling, prospects identification, portfolio construction and monitoring. It uses terminologies that are usually found in pilots of the insurance sector, especially the ones of the personalized retail and investment banking category, such as *Customer Service, Customer Data, Regulatory Authority, Artificial Intelligence, Customer Profile, Big Data, Bank, Risk profiling, Financial Service, Financial Regulator, Financial Data, Retail Customer, Portfolio, Investment*. However, there can be found additional terms that are pilot specific, such as *Trade, Loyalty, Wealth-Management, Trade Analysis, Relationship Manager, Open Data, Market, Know Your Client, Advisor, Service Provider, Investor profile, Investor, Investment profile, Investment Advice*.

Table 5 shows the list of all terminologies that have been identified for pilot 6.

Table 6: Identified terms for Pilot 6

Term	Synonym	Kind	Description
Advisor	Consultant	Actor	A person who gives advice in a particular field
Artificial Intelligence	AI, machine intelligence, machine learning, ML	Process	It refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions
Bank	Investment Firm, Trust Company	Actor	It is a type of financial institution that accepts deposits, offers checking account services, makes various loans, and offers basic financial products like certificates of deposit (CDs) and savings accounts to individuals and small businesses. A commercial bank is where most people do their banking, as opposed to an investment bank
Big Data	Massive data, BDA	Process	It is a field that treats ways to analyze, systematically extract information from, or otherwise deal with data sets that are too large or complex to be dealt with by traditional data-processing application software
Client	Costumer	Actor	A person or organization who engages or use the services of a lawyer or other professional person or company
Customer Data	Consumer Data, customer dataset	Object	Refers to all personal, behavioural, and demographic data that is collected by marketing companies and departments from their customer base.
Customer Profile	Client Profile, client profiling	Process	It is a summary of a specific customer type that is based primarily on available statistical information, such as demographics, income (or company revenue if B2B), gender, age, location, etc.
Customer Service	Client service	Process	It is the direct one-on-one interaction between a consumer making a purchase and a representative of the company that is selling it
Data	Info, facts	Object	The facts and statistics collected together for reference or analysis
Digital Service	Electronic service, computer service	Process	Refers to the electronic delivery of information including data and content across multiple platforms

			and devices like web or mobile
Financial Data	Financial statements	Object	Financial data consists of pieces or sets of information related to the financial health of a business
Financial Organization	Financial Institution, Trust Company, Bank	Actor	It is an institution (public or private) that collects funds (from the public or other institutions) and invests them in financial assets
Financial Product	Financial instruments, financial tools	Object	A financial product is a product (typically in the form of a contract) provided to consumers and businesses or other organizations (municipalities or sovereigns) by financial institutions such as banks, insurance companies, brokerage firms, consumer finance companies, and investment companies all of which comprise the financial services industry
Financial Regulator	Financial supervisor, financial authority	Actor	A financial regulator is an institution that supervises and controls a financial system and related financial services. Their objective is to guarantee fair and efficient markets and financial stability
Financial Service	Banking, business services, financial affairs	Process	Service provided by the finance industry involving the investment, lending, and management of money and assets
Investment	Transaction, expenditure, funding	Process	It is the purchase of goods that are not consumed today but are used in the future to create wealth
Investment Advice	Investment recommendation	Process	It is any recommendation or guidance that attempts to educate, inform, or guide an investor regarding a particular investment product or series of products.
Investment profile	investment profiling	Process	It brings together a group of investments with a similar level of risk. It is made up of key data relating to investments or financial assets
Investor	shareholder, stockholder	Actor	It is any person or other entity (such as a firm or mutual fund) who commits capital with the expectation of receiving financial returns
Investor profile	Investment style	Process	It defines an individual's preferences in investment decisions
Know Your Client	KYC	Process	It is a standard in the investment industry that ensures investment advisors know detailed information about their clients' risk tolerance, investment knowledge, and financial position
Loyalty	Allegiance, devotion	Property	In general use, loyalty, is a devotion and faithfulness to a nation, cause, philosophy, country, group, or person
Market	Retail, exchange, marketplace	Object	It is a place where two parties can gather to facilitate the exchange of goods and services. The parties involved are usually buyers and sellers
Open Data	Free data, free accessible data	Object	Open data is the idea that some data should be freely available to everyone to use and republish as they wish, without restrictions from copyright, patents or other mechanisms of control
Portfolio	Collection of	Object	It is a grouping of financial assets such as stocks, bonds,

	investments		commodities, currencies and cash equivalents, as well as their fund counterparts, including mutual, exchange-traded and closed funds
Process	Procedure, transaction, faithfulness	Process	A series of actions or steps taken in order to achieve a particular end
Processing System	Information processing, data processing, DP	Process	The combination of machines, people, and processes that for a set of inputs produces a defined set of outputs
Product	Commodity, output, solution	Object	It is an object or system made available for consumer use; it is anything that can be offered to a market to satisfy the desire or need of a customer
Regulatory Authority	Regulatory agency, regulatory institution	Actor	A regulatory authority is an autonomous authority or agency established by a federal, state or provincial government
Relationship Manager	Account manager, account executive	Actor	Relationship managers work to improve business relationships with partner firms and clients. Relationship management is generally divided into two fields: client relationship management and business relationship management
Retail Customer	Retail client	Actor	It is customer who is going to buy in small quantity and the product usage would be by him or by his family or friends
Risk	Hazard, pitfall, threat, trouble	Property	Risk is defined in financial terms as the chance that an outcome or investment's actual gains will differ from an expected outcome or return. Risk includes the possibility of losing some or all of an original investment.
Risk Assessment	Risk evaluation, risk analysis	Process	The systematic process of evaluating the potential risks and/or to determine the likelihood of loss on an asset, loan, or investment
Risk Assessment Score	Risk rating score, risk scoring	Property	It is a calculated number (score) that reflects the severity of a risk due to some factors
Risk profiling	Risk-profile	Process	The evaluation of an individual's willingness and ability to take risks
Score	Amount, number, amount, final count	Property	It is a number that expresses facts about an actual situation
Service	Assistance, support, utility	Object	The organized system of apparatus, appliances, employees, etc., for supplying some accommodation required by the public
Service Provider	SP, service bureau	Actor	Organization, business or individual which offers service to others in exchange for payment
Trade	Exchange, transaction, financial transaction	Process	The action of buying and selling goods and services with compensation paid by a buyer to a seller, or the exchange of goods or services between parties

Trade Analysis	Technical analysis	Process	A trading discipline employed to evaluate investments and identify trading opportunities by analyzing statistical trends gathered from trading activity, such as price movement and volume
Wealth-Management	Customer relationship management, CRM	Process	It is an investment advisory service that combines other financial services to address the needs of affluent clients. It is a consultative process whereby the advisor gleans information about the client's wants and tailors a bespoke strategy utilizing appropriate financial products and services

Table 5: Identified terms for Pilot 6

This pilot is not currently relying on a specific ontology to build its overall solution.

4.7 Pilot #7: Avoiding Financial Crime

Pilot 7 belongs to the category *Financial Crime and Fraud Detection*, where we expect the usage of more specific terms related with topics above. Its scope is to create a more accurate, comprehensive and near real-time picture of suspicious behaviour in the Financial Crime remit, using high performance computing and machine learning in order to allow the detection algorithms to respond the moment such a transaction takes place. It shares terms that are commonly found in other pilots of the insurance sector, like *Customer Service, Customer Data, Regulatory Authority, Artificial Intelligence, Customer Profile, Bank, Risk profiling, Financial Service, Financial Regulator, Financial Data, Alert, Retail Customer, Investment, Fund*. As all pilots, it also contains terms that are specific to this scenario such as *Financial Crime Risk, Financial Crime, Anti-Money Laundering, Terrorist Financing*.

Table 6 shows the list of all terminologies that have been identified for pilot 7.

Table 7: Identified terms for Pilot 7

Term	Synonym	Kind	Description
Alert	Warning, notice, notification	Property	An announcement, notice, or signal warning of potential dangerous situations and/or circumstances
Artificial Intelligence	AI, machine intelligence, machine learning, ML	Process	It refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions
Anti-Money Laundering	AML	Process	Anti-money laundering refers to a set of laws, regulations, and procedures intended to prevent criminals from disguising illegally obtained funds as legitimate income.
Bank	Investment Firm, Trust Company	Actor	It is a type of financial institution that accepts deposits, offers checking account services, makes various loans, and offers basic financial products like certificates of deposit (CDs) and savings accounts to individuals and

			small businesses. A commercial bank is where most people do their banking, as opposed to an investment bank
Client	Costumer	Actor	A person or organization who engages or use the services of a lawyer or other professional person or company
Customer Data	Consumer Data, customer dataset	Object	Refers to all personal, behavioural, and demographic data that is collected by marketing companies and departments from their customer base.
Customer Profile	Client Profile, client profiling	Process	It is a summary of a specific customer type that is based primarily on available statistical information, such as demographics, income (or company revenue if B2B), gender, age, location, etc.
Customer Service	Client service	Process	It is the direct one-on-one interaction between a consumer making a purchase and a representative of the company that is selling it
Data	Info, facts	Object	The facts and statistics collected together for reference or analysis
Digital Service	Electronic service, computer service	Process	Refers to the electronic delivery of information including data and content across multiple platforms and devices like web or mobile
Financial Crime	Financial infraction, financial misconduct, financial transgression	Process	It is crime committed against property, involving the unlawful conversion of the ownership of property (belonging to one person) to one's own personal use and benefit
Financial Crime Risk	Financial infringement risk, financial misconduct risk, financial transgression risk	Property	It is the risk of an organization to become victim of a financial crime
Financial Data	Financial statements	Object	Financial data consists of pieces or sets of information related to the financial health of a business
Financial Organization	Financial Institution, Trust Company, Bank	Actor	It is an institution (public or private) that collects funds (from the public or other institutions) and invests them in financial assets
Financial Product	Financial instruments, financial tools	Object	A financial product is a product (typically in the form of a contract) provided to consumers and businesses or other organizations (municipalities or sovereigns) by financial institutions such as banks, insurance companies, brokerage firms, consumer finance companies, and investment companies all of which comprise the financial services industry
Financial Regulator	Financial supervisor, financial	Actor	A financial regulator is an institution that supervises and controls a financial system and related financial services. Their objective is to guarantee fair and

	authority		efficient markets and financial stability
Financial Service	Banking, business services, financial affairs	Process	Service provided by the finance industry involving the investment, lending, and management of money and assets
Fund	Capital, endowment, foundation	Object	It is a pool of money that is allocated for a specific purpose
Investment	Transaction, expenditure, funding	Process	It is the purchase of goods that are not consumed today but are used in the future to create wealth
Know Your Client	KYC	Process	It is a standard in the investment industry that ensures investment advisors know detailed information about their clients' risk tolerance, investment knowledge, and financial position
Process	Procedure, transaction, faithfulness	Process	A series of actions or steps taken in order to achieve a particular end
Processing System	Information processing, data processing, DP	Process	The combination of machines, people, and processes that for a set of inputs produces a defined set of outputs
Product	Commodity, output, solution	Object	It is an object or system made available for consumer use; it is anything that can be offered to a market to satisfy the desire or need of a customer
Regulatory Authority	Regulatory agency, regulatory institution	Actor	A regulatory authority is an autonomous authority or agency established by a federal, state or provincial government
Retail Customer	Retail client	Actor	It is customer who is going to buy in small quantity and the product usage would be by him or by his family or friends
Risk	Hazard, pitfall, threat, trouble	Property	Risk is defined in financial terms as the chance that an outcome or investment's actual gains will differ from an expected outcome or return. Risk includes the possibility of losing some or all of an original investment.
Risk Assessment	Risk evaluation, risk analysis	Process	The systematic process of evaluating the potential risks and/or to determine the likelihood of loss on an asset, loan, or investment
Risk Assessment Score	Risk rating score, risk scoring	Property	It is a calculated number (score) that reflects the severity of a risk due to some factors
Risk profiling	Risk-profile	Process	Evaluation of an individual's willingness and ability to take risks
Score	Amount, number, amount, final count	Property	It is a number that expresses facts about an actual situation
Service	Assistance, support, utility	Object	The organized system of apparatus, appliances, employees, etc., for supplying some accommodation required by the public

Terrorist Financing	TF	Process	is the provision of funds or providing financial support to individual terrorists or non-state actors
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Table 6: Identified terms for Pilot 7

This pilot is not currently relying on a specific ontology to build its overall solution.

4.8 Pilot #8: Platform for Anti Money Laundering Supervision (PAMLS)

Pilot 8 belongs to the category called *Financial Crime and Fraud Detection*, where we expect to use more specific terms related with these topics. Its scope is to improve the effectiveness of the existing supervisory activities in the area of anti-money laundering and combating terrorist financing. It shares terms with a wide list of pilots such as *Financial Organization, Digital Service, Data, Customer Service, Customer Data, Regulatory Authority, Artificial Intelligence, Customer Profile, Big Data, Bank, Risk profiling, Report, Financial Service, Financial Regulator, Financial Data, Alert, Retail Customer, Investment, Fund*, while it also contains terms that are specific to the pilots of this category: *Financial Crime Risk, Financial Crime, Risk-based Supervision, Forensics Analyst, Anti-Money Laundering, Terrorist Financing*.

Table 7 shows the list of all terminologies that have been identified for pilot 8.

Table 8: Identified terms for Pilot 8

Term	Synonym	Kind	Description
Alert	Warning, notice, notification	Property	An announcement, notice, or signal warning of potentially dangerous situations and/or circumstances
Artificial Intelligence	AI, machine intelligence, machine learning, ML	Process	It refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions
Anti-Money Laundering	AML	Process	Anti-money laundering refers to a set of laws, regulations, and procedures intended to prevent criminals from disguising illegally obtained funds as legitimate income.
Bank	Investment Firm, Trust Company	Actor	It is a type of financial institution that accepts deposits, offers checking account services, makes various loans, and offers basic financial products like certificates of deposit (CDs) and savings accounts to individuals and small businesses. A commercial bank is where most people do their banking, as opposed to an investment bank
Big Data	Massive data, BDA	Process	It is a field that treats ways to analyze, systematically extract information from, or otherwise deal with data sets that are too large or complex to be dealt with by traditional data-processing application software
Client	Costumer	Actor	A person or organization who engages or use the

			services of a lawyer or other professional person or company
Customer Data	Consumer Data, customer dataset	Object	Refers to all personal, behavioural, and demographic data that is collected by marketing companies and departments from their customer base.
Customer Profile	Client Profile, client profiling	Process	It is a summary of a specific customer type that is based primarily on available statistical information, such as demographics, income (or company revenue if B2B), gender, age, location, etc.
Customer Service	Client service	Process	It is the direct one-on-one interaction between a consumer making a purchase and a representative of the company that is selling it
Data	Info, facts	Object	The facts and statistics collected together for reference or analysis
Digital Service	Electronic service, computer service	Process	Refers to the electronic delivery of information including data and content across multiple platforms and devices like web or mobile
Financial Crime	Financial infraction, financial misconduct, financial transgression	Process	It is crime committed against property, involving the unlawful conversion of the ownership of property (belonging to one person) to one's own personal use and benefit
Financial Crime Risk	Financial infringement risk, financial misconduct risk, financial transgression risk	Property	It is the risk of an organization to become victim of a financial crime
Financial Data	Financial statements	Object	Financial data consists of pieces or sets of information related to the financial health of a business
Financial Organization	Financial Institution, Trust Company, Bank	Actor	It is an institution (public or private) that collects funds (from the public or other institutions) and invests them in financial assets
Financial Product	Financial instruments, financial tools	Object	A financial product is a product (typically in the form of a contract) provided to consumers and businesses or other organizations (municipalities or sovereigns) by financial institutions such as banks, insurance companies, brokerage firms, consumer finance companies, and investment companies all of which comprise the financial services industry
Financial Regulator	Financial supervisor, financial authority	Actor	A financial regulator is an institution that supervises and controls a financial system and related financial services. Their objective is to guarantee fair and efficient markets and financial stability
Financial Service	Banking, business services, financial affairs	Process	Service provided by the finance industry involving the investment, lending, and management of money and assets

Forensics Analyst	Financial Forensics	Actor	It may help with risk management and risk reduction through customized design of accounting and auditing systems and procedures. As a function of due diligence and investment analysis, they will advise on a wide variety of financial transactions
Fund	Capital, endowment, foundation	Object	It is a pool of money that is allocated for a specific purpose
Investment	Transaction, expenditure, funding	Process	It is the purchase of goods that are not consumed today but are used in the future to create wealth
Process	Procedure, transaction, faithfulness	Process	A series of actions or steps taken in order to achieve a particular end
Processing System	Information processing, data processing, DP	Process	The combination of machines, people, and processes that for a set of inputs produces a defined set of outputs
Product	Commodity, output, solution	Object	It is an object or system made available for consumer use; it is anything that can be offered to a market to satisfy the desire or need of a customer
Regulatory Authority	Regulatory agency, regulatory institution	Actor	A regulatory authority is an autonomous authority or agency established by a federal, state or provincial government
Report	Account, story, chronicle, record	Object	An account, statement or document describing in detail an event, situation, or the like, usually as the result of observation, inquiry, etc.
Retail Customer	Retail client	Actor	It is customer who is going to buy in small quantity and the product usage would be by him or by his family or friends
Risk	Hazard, pitfall, threat, trouble	Property	Risk is defined in financial terms as the chance that an outcome or investment's actual gains will differ from an expected outcome or return. Risk includes the possibility of losing some or all of an original investment.
Risk Assessment	Risk evaluation, risk analysis	Process	The systematic process of evaluating the potential risks and/or to determine the likelihood of loss on an asset, loan, or investment
Risk Assessment Score	Risk rating score, risk scoring	Property	It is a calculated number (score) that reflects the severity of a risk due to some factors
Risk-based Supervision	RBS	Process	It is a comprehensive, formally structured system that assesses risks within the financial system, giving priority to the resolution of those risks
Risk profiling	Risk-profile	Process	Evaluation of an individual's willingness and ability to take risks
Score	Amount, number, amount, final count	Property	It is a number that expresses facts about an actual situation

Service	Assistance, support, utility	Object	The organized system of apparatus, appliances, employees, etc., for supplying some accommodation required by the public
Terrorist Financing	TF	Process	It is the provision of funds or providing financial support to individual terrorists or non-state actors

This pilot is not currently relying on a specific ontology to build its overall solution.

4.9 Pilot #9: Analyzing Blockchain Transaction Graphs for Fraudulent Activities

Pilot 9 belongs to the *Financial Crime and Fraud Detection* category, where we expect to use more specific terms related with these topics. Its scope is to develop and deploy a scalable and high performance blockchain transaction graph analysis system for investigating whether customer blockchain account transactions can be traced to fraudulent activities or accounts. It shares terms with a variety of other pilots of the finance sector such as *Financial Organization, Digital Service, Data, Customer Service, Customer Data, Regulatory Authority, Artificial Intelligence, Customer Profile, Big Data, Bank, Assessment, Risk profiling, Report, Financial Service, Financial Regulator, Financial Data, Alert, Retail Customer, Investment, Fund*. It additionally shares some terms with pilots of the same category, such as *Financial Crime Risk, Financial Crime, Risk-based Supervision, Fraud, Forensics Analyst, Asset Management, Asset, Exchange Company*.

Table 8 shows the list of all terminologies that have been identified for pilot 9.

Table 9: Identified terms for Pilot 9

Term	Synonym	Kind	Description
Alert	Warning, notice, notification	Property	An announcement, notice, or signal warning of potentially dangerous situations and/or circumstances
Artificial Intelligence	AI, machine intelligence, machine learning, ML	Process	It refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions
Assessment	Determination, Rating, Estimation, Valuation	Process	The process of judging or deciding the amount, value, quality, or importance of something, or the judgment or decision that is made
Asset	Resource, property	Object	An asset is a resource with economic value that an individual, corporation, or country owns or controls with the expectation that it will provide a future benefit.
Asset Management	Investment management, portfolio management, wealth management	Process	It refers to the active management of an investor's portfolio by a financial services company (usually an investment bank)

Bank	Investment Firm, Trust Company	Actor	It is a type of financial institution that accepts deposits, offers checking account services, makes various loans, and offers basic financial products like certificates of deposit (CDs) and savings accounts to individuals and small businesses. A commercial bank is where most people do their banking, as opposed to an investment bank
Big Data	Massive data, BDA	Process	It is a field that treats ways to analyze, systematically extract information from, or otherwise deal with data sets that are too large or complex to be dealt with by traditional data-processing application software
Client	Costumer	Actor	A person or organization who engages or use the services of a lawyer or other professional person or company
Customer Data	Consumer Data, customer dataset	Object	It refers to all personal, behavioural, and demographic data that is collected by marketing companies and departments from their customer base.
Customer Profile	Client Profile, client profiling	Process	It is a summary of a specific customer type that is based primarily on available statistical information, such as demographics, income (or company revenue if B2B), gender, age, location, etc.
Customer Service	Client service	Process	It is the direct one-on-one interaction between a consumer making a purchase and a representative of the company that is selling it
Data	Info, facts	Object	The facts and statistics collected together for reference or analysis
Digital Service	Electronic service, computer service	Process	It refers to the electronic delivery of information including data and content across multiple platforms and devices like web or mobile
Exchange Company	Exchange broker	Actor	It is a company that offers currency exchange and international payments to private individuals and companies
Financial Crime	Financial infraction, financial misconduct, financial transgression	Process	It is crime committed against property, involving the unlawful conversion of the ownership of property (belonging to one person) to one's own personal use and benefit
Financial Crime Risk	Financial infringement risk, financial misconduct risk, financial transgression risk	Property	It is the risk of an organization to become victim of a financial crime
Financial Data	Financial statements	Object	Financial data consists of pieces or sets of information related to the financial health of a business
Financial Organization	Financial Institution, FI,	Actor	It is an institution (public or private) that collects funds (from the public or other institutions) and invests them

	Trust Company, Bank		in financial assets
Financial Product	Financial instruments, financial tools	Object	A financial product is a product (typically in the form of a contract) provided to consumers and businesses or other organizations (municipalities or sovereigns) by financial institutions such as banks, insurance companies, brokerage firms, consumer finance companies, and investment companies all of which comprise the financial services industry
Financial Regulator	Financial supervisor, financial authority	Actor	A financial regulator is an institution that supervises and controls a financial system and related financial services. Their objective is to guarantee fair and efficient markets and financial stability
Financial Service	Banking, business services, financial affairs	Process	Service provided by the finance industry involving the investment, lending, and management of money and assets
Forensics Analyst	Financial Forensics	Actor	It may help with risk management and risk reduction through customized design of accounting and auditing systems and procedures. As a function of due diligence and investment analysis, they will advise on a wide variety of financial transactions
Fraud	Fraudulence, criminal deception	Process	It is an intentionally deceptive action designed to provide the perpetrator with an unlawful gain or to deny a right to a victim. Fraud can occur in finance, real estate, investment, and insurance
Fund	Capital, endowment, foundation	Object	It is a pool of money that is allocated for a specific purpose
Investment	Transaction, expenditure, funding	Process	It is the purchase of goods that are not consumed today but are used in the future to create wealth
Process	Procedure, transaction, faithfulness	Process	A series of actions or steps taken in order to achieve a particular end
Processing System	Information processing, data processing, DP	Process	The combination of machines, people, and processes that for a set of inputs produces a defined set of outputs
Product	Commodity, output, solution	Object	It is an object or system made available for consumer use; it is anything that can be offered to a market to satisfy the desire or need of a customer
Regulatory Authority	Regulatory agency, regulatory institution	Actor	A regulatory authority is an autonomous authority or agency established by a federal, state or provincial government
Report	Account, story, chronicle, record	Object	An account, statement or document describing in detail an event, situation, or the like, usually as the result of observation, inquiry, etc.
Retail Customer	Retail client	Actor	It is customer who is going to buy in small quantity and

			the product usage would be by him or by his family or friends
Risk	Hazard, pitfall, threat, trouble	Property	Risk is defined in financial terms as the chance that an outcome or investment's actual gains will differ from an expected outcome or return. Risk includes the possibility of losing some or all of an original investment.
Risk Assessment	Risk evaluation, risk analysis	Process	The systematic process of evaluating the potential risks and/or to determine the likelihood of loss on an asset, loan, or investment
Risk Assessment Score	Risk rating score, risk scoring	Property	It is a calculated number (score) that reflects the severity of a risk due to some factors
Risk-based Supervision	RBS	Process	It is a comprehensive, formally structured system that assesses risks within the financial system, giving priority to the resolution of those risks
Risk profiling	Risk-profile	Process	evaluation of an individual's willingness and ability to take risks
Score	Amount, number, amount, final count	Property	It is a number that expresses facts about an actual situation
Service	Assistance, support, utility	Object	the organized system of apparatus, appliances, employees, etc., for supplying some accommodation required by the public

This pilot is not currently relying on a specific ontology to build its overall solution.

4.10 Pilot #10: Real-time cyber security analytics on Financial Transactions' BigData

Pilot 10 also belongs to the category *Financial Crime and Fraud Detection* and as expected with the rest of the pilots of the category specific relevant terminology will be used. Its scope is to enable the identification of security-related anomalies while they are occurring, allowing, proactive and prompt interventions on such potential security threats by building a sophisticated tool that will analyse in real-time the financial transactions of a home and mobile banking system, thus improving significantly the detection rate of malicious events in the very same moment in which they are happening. It shares terminologies with other pilots such as *Financial Organization, Digital Service, Data, Customer Service, Customer Data, Regulatory Authority, Artificial Intelligence, Customer Profile, Big Data, Bank, Assessment, Risk profiling, Report, Financial Service, Financial Regulator, Financial Data, Alert, Retail Customer, Investment, Fund*, while it additionally uses some terms specific to this category of use cases such as *Financial Crime Risk, Financial Crime, Trade, Risk-based Supervision, Fraud, Forensics Analyst, Open-banking, Cyber-security, Cyber-attack, Ancillary service*.

Table 9 shows the list of all terminologies that have been identified for pilot 10.

Table 10: Identified terms for Pilot 10

Term	Synonym	Kind	Description
Alert	Warning, notice, notification	Property	An announcement, notice, or signal warning of potentially dangerous situations and/or circumstances
Ancillary service	Secondary services, supporting services	Process	A variety of other services or products a bank provides along with the necessary banking services
Artificial Intelligence	AI, machine intelligence, machine learning, ML	Process	It refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions
Assessment	Determination, Rating, Estimation, Valuation	Process	The process of judging or deciding the amount, value, quality, or importance of something, or the judgment or decision that is made
Bank	Investment Firm, Trust Company	Actor	It is a type of financial institution that accepts deposits, offers checking account services, makes various loans, and offers basic financial products like certificates of deposit (CDs) and savings accounts to individuals and small businesses. A commercial bank is where most people do their banking, as opposed to an investment bank
Big Data	Massive data, BDA	Process	It is a field that treats ways to analyze, systematically extract information from, or otherwise deal with data sets that are too large or complex to be dealt with by traditional data-processing application software
Client	Customer	Actor	A person or organization who engages or use the services of a lawyer or other professional person or company
Cyber-attack	Attack, threat action, cyber-threat	Process	A cyberattack is any type of offensive maneuver that targets computer information systems, infrastructures, computer networks, or personal computer device
Cyber-security	IT security, network security, or computer security	Process	It refers to the practice of securing electronic devices from unauthorized access or attack or the measures taken in pursuit of this practice
Customer Data	Consumer Data, customer dataset	Object	It refers to all personal, behavioural, and demographic data that is collected by marketing companies and departments from their customer base.
Customer Profile	Client Profile, client profiling	Process	It is a summary of a specific customer type that is based primarily on available statistical information, such as demographics, income (or company revenue if B2B), gender, age, location, etc.
Customer Service	Client service	Process	It is the direct one-on-one interaction between a consumer making a purchase and a representative of the company that is selling it
Data	Info, facts	Object	The facts and statistics collected together for reference

			or analysis
Data stream	data transmission, data flow	Process	A set of digital signals used for different kinds of content transmission
Digital Service	Electronic service, computer service	Process	It refers to the electronic delivery of information including data and content across multiple platforms and devices like web or mobile
Financial Crime	Financial infraction, financial misconduct, financial transgression	Process	It is crime committed against property, involving the unlawful conversion of the ownership of property (belonging to one person) to one's own personal use and benefit
Financial Crime Risk	Financial infringement risk, financial misconduct risk, financial transgression risk	Property	It is the risk of an organization to become victim of a financial crime
Financial Data	Financial statements	Object	Financial data consists of pieces or sets of information related to the financial health of a business
Financial Organization	Financial Institution, Trust Company, Bank	Actor	It is an institution (public or private) that collects funds (from the public or other institutions) and invests them in financial assets
Financial Product	Financial instruments, financial tools	Object	A financial product is a product (typically in the form of a contract) provided to consumers and businesses or other organizations (municipalities or sovereigns) by financial institutions such as banks, insurance companies, brokerage firms, consumer finance companies, and investment companies all of which comprise the financial services industry
Financial Regulator	Financial supervisor, financial authority	Actor	A financial regulator is an institution that supervises and controls a financial system and related financial services. Their objective is to guarantee fair and efficient markets and financial stability
Financial Service	Banking, business services, financial affairs	Process	Service provided by the finance industry involving the investment, lending, and management of money and assets
Forensics Analyst	Financial Forensics	Actor	It may help with risk management and risk reduction through customized design of accounting and auditing systems and procedures. As a function of due diligence and investment analysis, they will advise on a wide variety of financial transactions
Fraud	Fraudulence, criminal deception	Process	It is an intentionally deceptive action designed to provide the perpetrator with an unlawful gain or to deny a right to a victim. Fraud can occur in finance, real estate, investment, and insurance
Fund	Capital,	Object	It is a pool of money that is allocated for a specific

	endowment, foundation		purpose
Investment	Transaction, expenditure, funding	Process	It is the purchase of goods that are not consumed today but are used in the future to create wealth
Open-banking	Open data bank	Process	It is a banking practice that provides third-party financial service providers open access to consumer banking, transaction, and other financial data from banks and non-bank financial institutions through the use of application programming interfaces (APIs).
Process	Procedure, transaction, faithfulness	Process	A series of actions or steps taken in order to achieve a particular end
Processing System	Information processing, data processing, DP	Process	The combination of machines, people, and processes that for a set of inputs produces a defined set of outputs
Product	Commodity, output, solution	Object	It is an object or system made available for consumer use; it is anything that can be offered to a market to satisfy the desire or need of a customer
Regulatory Authority	Regulatory agency, regulatory institution	Actor	A regulatory authority is an autonomous authority or agency established by a federal, state or provincial government
Report	Account, story, chronicle, record	Object	An account, statement or document describing in detail an event, situation, or the like, usually as the result of observation, inquiry, etc.
Retail Customer	Retail client	Actor	It is customer who is going to buy in small quantity and the product usage would be by him or by his family or friends
Risk	Hazzard, pitfall, threat, trouble	Property	The risk is defined in financial terms as the chance that an outcome or investment's actual gains will differ from an expected outcome or return. Risk includes the possibility of losing some or all of an original investment.
Risk Assessment	Risk evaluation, risk analysis	Process	The systematic process of evaluating the potential risks and/or to determine the likelihood of loss on an asset, loan, or investment
Risk Assessment Score	Risk rating score, risk scoring	Property	It is a calculated number (score) that reflects the severity of a risk due to some factors
Risk-based Supervision	RBS	Process	It is a comprehensive, formally structured system that assesses risks within the financial system, giving priority to the resolution of those risks
Risk profiling	Risk-profile	Process	Evaluation of an individual's willingness and ability to take risks
Score	Amount, number, amount, final count	Property	It is a number that expresses facts about an actual situation
Service	Assistance,	Object	The organized system of apparatus, appliances,

	support, utility		employees, etc., for supplying some accommodation required by the public
Trade	Exchange, transaction, financial transaction	Process	The action of buying and selling goods and services with compensation paid by a buyer to a seller, or the exchange of goods or services between parties

This pilot is not currently relying on a specific ontology to build its overall solution.

4.11 Pilot #11: Personalized insurance products based on IoT connected vehicles

Pilot 11 belongs to the insurance sector and has been assigned to the *Personalized Usage Based Insurance Products* category. Its scope is to improve risk insurance profiles for vehicle insurance using the vast amount of information collected by connected vehicle, in order to provide personalized insurance plans, to collect additional data about the status of the vehicle and the reaction of the drive in case of an accident in order to inform him/her properly when there is damages in it over a specific threshold and to provide a dynamic billing system. It mostly shares terms that are commonly found in the majority of all pilots such as *Digital Service, Data, Customer Service, Customer Data, Regulatory Authority, Artificial Intelligence, Customer Profile, Big Data, Assessment, Report, Alert, Data stream, Insured, Insurance premium, Insurance Product, Insurance Company, Insurance*. Other terms, more specific to this pilot are *Sensor, Internet of Things, Device, Vehicle insurance, Vehicle identification number, Vehicle Inspection, Vehicle, Usage-based Insurance, Ministry of Transport, Ministry database, Manufacturer Maintenance Program, Location Data, License, Fraud detection, Driver's behaviour Monitoring, Data vehicle, Car owner, Bill, Accident*. It can be noted that pilots of the insurance sector tend to make use of terminologies that are of a narrow scope and more related with the specific type of insurances.

Table 10 shows the list of all terminologies that have been identified for pilot 11.

Table 11: Identified terms for Pilot 11

Term	Synonym	Kind	Description
Accident	Collision, crush	Process	An unfortunate incident that happens unexpectedly and unintentionally, typically resulting in damage or injury
Alert	Warning, notice, notification	Property	An announcement, notice, or signal warning of potential dangerous situations and/or circumstances
Artificial Intelligence	AI, machine intelligence, machine learning, ML	Process	It refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions
Assessment	Determination, Rating, Estimation,	Process	The process of judging or deciding the amount, value, quality, or importance of something, or the judgment or decision that is made

	Valuation		
Big Data	Massive data, BDA	Process	It is a field that treats ways to analyze, systematically extract information from, or otherwise deal with data sets that are too large or complex to be dealt with by traditional data-processing application software
Bill	Invoice	Object	A statement of money owed for goods or services supplied
Car owner	Registered owner	Actor	It is usually used in instances of title of a vehicle (such as an automobile) to refer to the person who has right of possession of the vehicle
Client	Costumer	Actor	A person or organization who engages or use the services of a lawyer or other professional person or company
Customer Data	Consumer Data, customer dataset	Object	Refers to all personal, behavioural, and demographic data that is collected by marketing companies and departments from their customer base.
Customer Profile	Client Profile, client profiling	Process	It is a summary of a specific customer type that is based primarily on available statistical information, such as demographics, income (or company revenue if B2B), gender, age, location, etc.
Customer Service	Client service	Process	It is the direct one-on-one interaction between a consumer making a purchase and a representative of the company that is selling it
Data	Info, facts	Object	The facts and statistics collected together for reference or analysis
Data stream	data transmission, data flow	Process	A set of digital signals used for different kinds of content transmission
Data vehicle	Vehicle telemetry, car data, car telemetry	Object	Live data collected from the vehicle
Device	Appliance, instrument	Object	A thing made or adapted for a particular purpose, especially a piece of mechanical or electronic equipment
Digital Service	Electronic service, computer service	Process	It refers to the electronic delivery of information including data and content across multiple platforms and devices like web or mobile
Driver's behaviour Monitoring	Driver behaviour estimation, driver behaviour service	Process	It is the process that allows to gain valuable insights into driving behavior and vehicle usage patterns from collected vehicle data
Financial Organization	Financial Institution, Trust Company, Bank	Actor	It is an institution (public or private) that collects funds (from the public or other institutions) and invests them in financial assets
Financial Product	Financial instruments, financial tools, insurance	Object	A financial product is a product (typically in the form of a contract) provided to consumers and businesses or other organizations (municipalities or sovereigns) by financial institutions such as banks, insurance

			companies, brokerage firms, consumer finance companies, and investment companies all of which comprise the financial services industry
Fraud	Fraudulence, criminal deception, theft	Process	It is an intentionally deceptive action designed to provide the perpetrator with an unlawful gain or to deny a right to a victim. Fraud can occur in finance, real estate, investment, and insurance
Fraud detection	Fraud prevention, fraudulent activities detection	Process	It is a set of activities undertaken to prevent money or property from being obtained through false pretenses
Insurance	Assurance, protection	Object	Insurance is a contract, represented by a policy, in which an individual or entity receives financial protection or reimbursement against losses from an insurance company
Insurance Company	Insurance firm, insurer	Actor	A business that provides coverage, in the form of compensation resulting from loss, damages, injury, treatment or hardship in exchange for premium payments
Insurance premium	Insurance price, tariffs	Property	It is the amount of money an individual or business pays for an insurance policy. Insurance premiums are paid for policies that cover healthcare, auto, home, life, and others
Insurance Product	Insurance contract, insurance service	Object	Insurance products are common financial arrangements in which an insurance provider states its guarantee to pay on covered claims. In return, the buyer agrees to pay a monthly premium cost.
Insured	Protected, covered, assured	Actor	Person covered by insurance
Internet of Things	IoT	Object	It is a system of interrelated computing devices, mechanical and digital machines provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction
License	Drive license	Object	It is an official document, permitting a specific individual to operate one or more types of motorized vehicles, such as a motorcycle, car, truck, or bus on a public road
Location Data	Vehicle Location Data	Object	It is the big data collection of vehicle locations, including automatic vehicle location data
Manufacturer Maintenance Program	Servicing program, car care program, car care service	Object	It is a document containing the maintenance scheduled servicing, inspections, and vehicle repairs that needs to be carried out to prevent potential problems and maximize vehicle availability
Ministry database	Ministry db	Object	A set of structured data about driver and vehicle information that is available to the public
Ministry of Transport	Ministry of Transportation	Actor	Ministry responsible for transportation within a country

Process	Procedure, transaction, faithfulness	Process	A series of actions or steps taken in order to achieve a particular end
Processing System	Information processing, data processing, DP	Process	The combination of machines, people, and processes that for a set of inputs produces a defined set of outputs
Product	Commodity, output, solution	Object	It is an object or system made available for consumer use; it is anything that can be offered to a market to satisfy the desire or need of a customer
Regulatory Authority	Regulatory agency, regulatory institution	Actor	A regulatory authority is an autonomous authority or agency established by a federal, state or provincial government
Report	Account, story, chronicle, record	Object	An account, statement or document describing in detail an event, situation, or the like, usually as the result of observation, inquiry, etc.
Risk	Hazard, pitfall, threat, trouble	Property	Risk is defined in financial terms as the chance that an outcome or investment's actual gains will differ from an expected outcome or return. Risk includes the possibility of losing some or all of an original investment.
Risk Assessment	Risk evaluation, risk analysis	Process	The systematic process of evaluating the potential risks and/or to determine the likelihood of loss on an asset, loan, or investment
Risk Assessment Score	Risk rating score, risk scoring	Property	It is a calculated number (score) that reflects the severity of a risk due to some factors
Score	Amount, number, amount, final count	Property	It is a number that expresses facts about an actual situation
Sensor	Detector, sensing device, transducer	Object	A device which detects or measures a physical property and records, indicates, or otherwise responds to it
Service	Assistance, support, utility	Object	The organized system of apparatus, appliances, employees, etc., for supplying some accommodation required by the public
Usage-based Insurance	UBI, PAYD, PHYD, mile-based auto insurance	Object	It is a type of vehicle insurance whereby the costs are dependent upon type of vehicle used, measured against time, distance, behavior and place
Vehicle	Car, automobile	Object	A road vehicle, typically with four wheels, powered by an internal combustion engine and able to carry a small number of people
Vehicle identification number	VIN, car identification number	Property	It is the identifying code for a specific automobile
Vehicle Inspection	Technical Inspection	Object	Vehicle inspection is a procedure mandated by national or subnational governments in many countries, in which a vehicle is inspected to ensure that it conforms to regulations governing safety, emissions, or both

Vehicle insurance	Auto insurance, car insurance, motor insurance	Object	It is insurance for cars, trucks, motorcycles, and other road vehicles
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This pilot makes use of the FIWARE approach and the data models described within the FIWARE Foundation⁶ in order to define ontologies. Therefore, it makes use of the FIWARE Vehicle Data Model⁷ to represent the data linked to vehicle related entities. Accordingly, the corresponding data models are being used in order to describe data related to *Roads* and *RoadSegments*.

4.12 Pilot #12: Real World Data for Novel Health-Insurance products

Pilot 12 belongs to the insurance sector and has been put under the umbrella of the *Personalized Usage Based Insurance Products* category. Its scope is to demonstrate how Real World Data can be utilized from insurance companies to result in novel insurance products for the benefit of the insurer and the customers. Common terminologies that are usually found in other pilots are *Digital Service, Data, Customer Service, Customer Data, Regulatory Authority, Artificial Intelligence, Customer Profile, Big Data, Assessment, Report, Alert, Data stream*. It also contains terms that are commonly on pilots of the insurance sector like *Insured, Insurance premium, Insurance Product, Insurance Company, Insurance*, while it also uses terms that are specific to the pilots of this category like *Sensor, Internet of Things, Device, Medical device, Health Risk Assessment, Health Insurance*.

Table 11 presents all terminologies identified for pilot 12.

Table 12: Identified terms for Pilot 12

Term	Synonym	Kind	Description
Alert	Warning, notice, notification	Property	An announcement, notice, or signal warning of potentially dangerous situations and/or circumstances
Artificial Intelligence	AI, machine intelligence, machine learning, ML	Process	It refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions
Assessment	Determination, Rating, Estimation, Valuation	Process	The process of judging or deciding the amount, value, quality, or importance of something, or the judgment or decision that is made
Big Data	Massive data, BDA	Process	It is a field that treats ways to analyze, systematically extract information from, or otherwise deal with data sets that are too large or complex to be dealt with by traditional data-processing application software
Client	Costumer	Actor	A person or organization who engages or use the services of a lawyer or other professional person or

⁶ <https://www.fiware.org/>

⁷ <https://fiware-datamodels.readthedocs.io/en/latest/Transportation/Vehicle/VehicleModel/doc/spec/index.html>

			company
Customer Data	Consumer Data, customer dataset	Object	It refers to all personal, behavioural, and demographic data that is collected by marketing companies and departments from their customer base.
Customer Profile	Client Profile, client profiling	Process	It is a summary of a specific customer type that is based primarily on available statistical information, such as demographics, income (or company revenue if B2B), gender, age, location, etc.
Customer Service	Client service	Process	It is the direct one-on-one interaction between a consumer making a purchase and a representative of the company that is selling it
Data	Info, facts	Object	The facts and statistics collected together for reference or analysis
Data stream	Data transmission, data flow	Process	A set of digital signals used for different kinds of content transmission
Device	Appliance, instrument	Object	A thing made or adapted for a particular purpose, especially a piece of mechanical or electronic equipment
Digital Service	Electronic service, computer service	Process	It refers to the electronic delivery of information including data and content across multiple platforms and devices like web or mobile
Financial Organization	Financial Institution, Trust Company, Bank	Actor	It is an institution (public or private) that collects funds (from the public or other institutions) and invests them in financial assets
Financial Product	Financial instruments, financial tools, insurance	Object	A financial product is a product (typically in the form of a contract) provided to consumers and businesses or other organizations (municipalities or sovereigns) by financial institutions such as banks, insurance companies, brokerage firms, consumer finance companies, and investment companies all of which comprise the financial services industry
Health Insurance	Medicare, medical insurance, health plan	Object	It is a type of insurance coverage that pays for medical, surgical, and sometimes dental expenses incurred by the insured
Health Risk Assessment	HRA, health risk appraisal, health & well-being assessment	Process	It is a health questionnaire, used to provide individuals with an evaluation of their health risks and quality of life
Insurance	Assurance, protection	Object	Insurance is a contract, represented by a policy, in which an individual or entity receives financial protection or reimbursement against losses from an insurance company
Insurance Company	Insurance firm, insurer	Actor	A business that provides coverage, in the form of compensation resulting from loss, damages, injury, treatment or hardship in exchange for premium payments

Insurance premium	Insurance price, tariffs	Property	It is the amount of money an individual or business pays for an insurance policy. Insurance premiums are paid for policies that cover healthcare, auto, home, life, and others
Insurance Product	Insurance contract, insurance service	Object	Insurance products are common financial arrangements in which an insurance provider states its guarantee to pay on covered claims. In return, the buyer agrees to pay a monthly premium cost.
Insured	Protected, covered, assured	Actor	Person covered by insurance
Internet of Things	IoT	Object	It is a system of interrelated computing devices, mechanical and digital machines provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction
Medical device	Medical appliance, medical instrument	Object	Any instrument, apparatus, implement, machine, appliance, implant, reagent for in vitro use, software, material or other similar or related article, intended by the manufacturer to be used, alone or in combination, for human beings, for one or more of the specific medical purpose(s)
Process	Procedure, transaction, faithfulness	Process	A series of actions or steps taken in order to achieve a particular end
Processing System	Information processing, data processing, DP	Process	The combination of machines, people, and processes that for a set of inputs produces a defined set of outputs
Product	Commodity, output, solution	Object	It is an object or system made available for consumer use; it is anything that can be offered to a market to satisfy the desire or need of a customer
Regulatory Authority	Regulatory agency, regulatory institution	Actor	A regulatory authority is an autonomous authority or agency established by a federal, state or provincial government
Report	Account, story, chronicle, record	Object	An account, statement or document describing in detail an event, situation, or the like, usually as the result of observation, inquiry, etc.
Risk	Hazard, pitfall, threat, trouble	Property	The risk is defined in financial terms as the chance that an outcome or investment's actual gains will differ from an expected outcome or return. Risk includes the possibility of losing some or all of an original investment.
Risk Assessment	Risk evaluation, risk analysis	Process	The systematic process of evaluating the potential risks and/or to determine the likelihood of loss on an asset, loan, or investment
Risk Assessment Score	Risk rating score, risk scoring	Property	It is a calculated number (score) that reflects the severity of a risk due to some factors
Score	Amount, number,	Property	It is a number that expresses facts about an actual

	amount, final count		situation
Sensor	Detector, sensing device, transducer, measuring device	Object	A device which detects or measures a physical property and records, indicates, or otherwise responds to it
Service	Assistance, support, utility	Object	The organized system of apparatus, appliances, employees, etc., for supplying some accommodation required by the public

This pilot is not currently relying on a specific ontology to build its overall solution.

4.13 Pilot #13: Alternative/automated insurance risk selection - product recommendation for SME

Pilot 13 belongs to the insurance sector and is included in *Configurable and Personalized Insurance Products* category. Its goal is to develop an insurance product configuration platform for SMEs, which will leverage large amounts of digital data in order to compute the offering. It shares common terms with other pilots like *Data, Customer Service, Customer Data, Regulatory Authority, Artificial Intelligence, Customer Profile, Big Data, Assessment, Risk profiling, Report, Portfolio, Data stream, Insured, Insurance premium, Insurance Product, Insurance Company, Insurance, Cost*, while it also defines its own pilot specific such as *Unsupervised Learning, Underwriting, Supervised Learning, Insurer, Data Anonymization, Client Portfolio, Agent, Small and Medium Enterprise, Data protection*.

Table 12 shows the list of all terminologies that have been identified for pilot 13.

Table 13: Identified terms for Pilot 13

Term	Synonym	Kind	Description
Agent	Broker	Actor	He/She is a person who has been legally empowered to act on behalf of another person or an entity
Artificial Intelligence	AI, machine intelligence, machine learning, ML	Process	It refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions
Assessment	Determination, Rating, Estimation, Valuation	Process	The process of judging or deciding the amount, value, quality, or importance of something, or the judgment or decision that is made
Big Data	Massive data, BDA	Process	It is a field that treats ways to analyze, systematically extract information from, or otherwise deal with data sets that are too large or complex to be dealt with by traditional data-processing application software
Client	Customer	Actor	A person or organization who engages or use the services of a lawyer or other professional person or

			company
Cost	Expense, expenditure, score	Property	An outlay or expenditure of money, time, effort, labour, trouble to acquire, produce, accomplish or maintain anything
Client Portfolio	Customer base, customer wallet, client base	Object	It is a segmented list of the various groups that do business with you
Customer Data	Consumer Data, customer dataset	Object	It refers to all personal, behavioural, and demographic data that is collected by marketing companies and departments from their customer base.
Customer Profile	Client Profile, client profiling	Process	It is a summary of a specific customer type that is based primarily on available statistical information, such as demographics, income (or company revenue if B2B), gender, age, location, etc.
Customer Service	Client service	Process	It is the direct one-on-one interaction between a consumer making a purchase and a representative of the company that is selling it
Data	Info, facts	Object	The facts and statistics collected together for reference or analysis
Data Anonymization	Data de-identification, data privacy	Process	It is the process of removing sensitive information from a document or other message whose intent is privacy protection
Data protection	Data privacy	Process	It is the process of protecting data and involves the relationship between the collection and dissemination of data and technology, the public perception and expectation of privacy and the political and legal underpinnings surrounding that data
Data stream	data transmission, data flow	Process	A set of digital signals used for different kinds of content transmission
Digital Service	Electronic service, computer service	Process	It refers to the electronic delivery of information including data and content across multiple platforms and devices like web or mobile
Financial Organization	Financial Institution, Trust Company, Bank	Actor	It is an institution (public or private) that collects funds (from the public or other institutions) and invests them in financial assets
Financial Product	Financial instruments, financial tools, insurance	Object	A financial product is a product (typically in the form of a contract) provided to consumers and businesses or other organizations (municipalities or sovereigns) by financial institutions such as banks, insurance companies, brokerage firms, consumer finance companies, and investment companies all of which comprise the financial services industry
Insurance	Assurance, protection	Object	Insurance is a contract, represented by a policy, in which an individual or entity receives financial protection or reimbursement against losses from an insurance company
Insurance	Insurance firm,	Actor	A business that provides coverage, in the form of

Company	insurer		compensation resulting from loss, damages, injury, treatment or hardship in exchange for premium payments
Insurance premium	Insurance price, tariffs	Property	It is the amount of money an individual or business pays for an insurance policy. Insurance premiums are paid for policies that cover healthcare, auto, home, life, and others
Insurance Product	Insurance contract, insurance service	Object	Insurance products are common financial arrangements in which an insurance provider states its guarantee to pay on covered claims. In return, the buyer agrees to pay a monthly premium cost.
Insured	Protected, covered, assured	Actor	Person covered by insurance
Insurer	Underwriter, insurance underwriter	Actor	A person or company that underwrites an insurance risk; the party in an insurance contract undertaking to pay compensation
Portfolio	Collection of investments	Object	It is a grouping of financial assets such as stocks, bonds, commodities, currencies and cash equivalents, as well as their fund counterparts, including mutual, exchange-traded and closed funds
Process	Procedure, transaction, faithfulness	Process	A series of actions or steps taken in order to achieve a particular end
Processing System	Information processing, data processing, DP	Process	The combination of machines, people, and processes that for a set of inputs produces a defined set of outputs
Product	Commodity, output, solution	Object	It is an object or system made available for consumer use; it is anything that can be offered to a market to satisfy the desire or need of a customer
Regulatory Authority	Regulatory agency, regulatory institution	Actor	A regulatory authority is an autonomous authority or agency established by a federal, state or provincial government
Report	Account, story, chronicle, record	Object	An account, statement or document describing in detail an event, situation, or the like, usually as the result of observation, inquiry, etc.
Risk	Hazard, pitfall, threat, trouble	Property	The risk is defined in financial terms as the chance that an outcome or investment's actual gains will differ from an expected outcome or return. Risk includes the possibility of losing some or all of an original investment.
Risk Assessment	Risk evaluation, risk analysis	Process	The systematic process of evaluating the potential risks and/or to determine the likelihood of loss on an asset, loan, or investment
Risk Assessment Score	Risk rating score, risk scoring	Property	It is a calculated number (score) that reflects the severity of a risk due to some factors
Risk profiling	Risk-profile	Process	Evaluation of an individual's willingness and ability to take risks

Score	Amount, number, amount, final count	Property	It is a number that expresses facts about an actual situation
Service	Assistance, support, utility	Object	The organized system of apparatus, appliances, employees, etc., for supplying some accommodation required by the public
Small and Medium Enterprise	SME, SMB	Actor	They are businesses that maintain revenues, assets or a number of employees below a certain threshold
Supervised Learning	Classification	Process	It is the machine learning task of learning a function that maps an input to an output based on example input-output pairs
Underwriting	Insure, subscription	Process	Underwriting is the process through which an individual or institution takes on financial risk for a fee
Unsupervised Learning	Clustering	Process	It is a type of machine learning that looks for previously undetected patterns in a data set with no pre-existing labels and with a minimum of human supervision

This pilot is not currently relying on a specific ontology to build its overall solution.

4.14 Pilot #14: Big Data and IoT for the Agricultural Insurance Industry (

Pilot 14 belongs to the insurance sector and has been put under the umbrella of the *Configurable and Personalized Insurance Products* category. Its scope is to define, structure and pilot test a decision intelligence framework that will offer to the Agricultural Insurance sector a variety of innovative services. It uses terms that often found in the majority of the pilots of the project, such as *Data, Customer Service, Customer Data, Artificial Intelligence, Customer Profile, Big Data, Assessment, Risk profiling, Report, Portfolio, Data stream*, while it also shares terms that are most likely to be found in pilots of the insurance sector, such as *Insured, Insurance premium, Insurance Product, Insurance Company, Insurance, Cost*. Finally, it uses terms that are pilot specific and can be found only at this case: *climate risk management, Wind Storm indicator, Weather-index Insurance, Weather index, Weather data, Water stress, Warm Spell Duration Index, Underwriter, Topography, Temperature, Sowing date shifting Indicator, Soil Map, Sales Agent, Remote Sensing, Precipitation, Phenological Indicator, Pesticide, Pest Impact Indicator, Normalized Difference Vegetation Index, Loss adjuster, Late frost Indicator, Land Use, Insurance Broker, Heat stress, Hail Storm Indicator, Geographical Data, Evotranspiration, Disaster Risk Management, Damage Assessment, Crop, Cold Spell Indicator, Agroclimatic advisories, Agroclimatic Indicator, Agricultural Insurance and Actuary*.

The terminologies identified for pilot 14 are presented in Table 13.

Table 14: Identified terms for Pilot 14

Term	Synonym	Kind	Description
Actuary	Statistician	Actor	A person who compiles and analyses statistics and uses them to calculate insurance risks and premiums

Agent	Broker	Actor	He/She is a person who has been legally empowered to act on behalf of another person or an entity
Agricultural Insurance	Agl, Crops Insurance	Object	It is a valuable business risk management tool that provides farmers with financial protection against production losses (loss or damage to crops) caused by natural perils, such as drought, excessive moisture, hail, frost, wind and wildlife
Agroclimatic advisories	Agroclimatic advisory services	Object	Agrometeorological advisory involves research and applied work aimed at communicating weather information and agricultural advice to farmers, based on weather monitoring and forecasting
Agroclimatic Indicator	Agroclimatic index	Property	A measure or indicator of an aspect of the climate that has specific agricultural significance
Artificial Intelligence	AI, machine intelligence, machine learning, ML	Process	It refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions
Assessment	Determination, Rating, Estimation, Valuation	Process	The process of judging or deciding the amount, value, quality, or importance of something, or the judgment or decision that is made
Big Data	Massive data, BDA	Process	It is a field that treats ways to analyze, systematically extract information from, or otherwise deal with data sets that are too large or complex to be dealt with by traditional data-processing application software
Client	Costumer	Actor	A person or organization who engages or use the services of a lawyer or other professional person or company
climate risk management		Process	It is the systematic approach to and practice of considering climate-related trends and events in development decision-making to minimize potential harm (UNDP BCPR 2013)
Client Portfolio	Customer base, customer wallet, client base	Object	It is a segmented list of the various groups that do business with you
Cold Spell Indicator	Cold spell duration index, CSDI	Property	It measures the number of days with a minimum daily temperature below its climatological 10th percentile for at least 6 consecutive days
Cost	Expense, expenditure, score	Property	An outlay or expenditure of money, time, effort, labour, trouble to acquire, produce, accomplish or maintain anything

Crop	Selection, Batch, lot, collection	Object	It is a plant or animal product that can be grown and harvested extensively for profit or subsistence
Customer Data	Consumer Data, customer dataset	Object	It refers to all personal, behavioural, and demographic data that is collected by marketing companies and departments from their customer base.
Customer Profile	Client Profile, client profiling	Process	It is a summary of a specific customer type that is based primarily on available statistical information, such as demographics, income (or company revenue if B2B), gender, age, location, etc.
Customer Service	Client service	Process	It is the direct one-on-one interaction between a consumer making a purchase and a representative of the company that is selling it
Damage Assessment		Process	Preliminary but fairly accurate onsite evaluation of damage or loss caused by an accident or natural event before filing a formal claim or disaster declaration. Damage assessment records the extent of damage, what can be replaced, restored, or salvaged, and time required for their execution
Data	Info, facts	Object	The facts and statistics collected together for reference or analysis
Data stream	Data transmission, data flow	Process	A set of digital signals used for different kinds of content transmission
Digital Service	Electronic service, computer service	Process	It refers to the electronic delivery of information including data and content across multiple platforms and devices like web or mobile
Disaster Risk Management	DRM	Process	The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster
Evotranspiration	ET	Property	It is the sum of evaporation and plant transpiration. It is the water lost from an area through the combined effects of evaporation from the ground surface and transpiration from the vegetation
Financial Organization	Financial Institution, Trust Company, Bank	Actor	It is an institution (public or private) that collects funds (from the public or other institutions) and invests them in financial assets
Financial Product	Financial instruments,	Object	A financial product is a product (typically in the form of a contract) provided to consumers

	financial tools, insurance		and businesses or other organizations (municipalities or sovereigns) by financial institutions such as banks, insurance companies, brokerage firms, consumer finance companies, and investment companies all of which comprise the financial services industry
Geographical Data	Spatial data	Property	Data that contains information about the spatial location (position) and the attribute being monitored (yield, seed population, etc.)
Hail Storm Indicator	Potential Hail Indicator, Potential Hail Index, PHI	Property	It quantifies the atmospheric potential for hailstorms and can be derived from atmospheric numerical models
Heat stress		Property	Temperatures above the optimum for growth can be deleterious, causing injury or irreversible damage, which is generally called 'heat stress' (Wahid et al. 2007)
Index	indicator, indication, measure	Property	System of numbers used for comparing values of things that change according to each other or a fixed standard
Insurance	Assurance, protection	Object	Insurance is a contract, represented by a policy, in which an individual or entity receives financial protection or reimbursement against losses from an insurance company
Insurance Broker	Broker	Actor	An individual or firm who represents buyers of insurance and deals with insurance companies or their agents in arranging for insurance coverage for the buyer
Insurance Company	Insurance firm, insurer	Actor	A business that provides coverage, in the form of compensation resulting from loss, damages, injury, treatment or hardship in exchange for premium payments
Insurance premium	Insurance price, tariffs	Property	It is the amount of money an individual or business pays for an insurance policy. Insurance premiums are paid for policies that cover healthcare, auto, home, life, and others
Insurance Product	Insurance contract, insurance service	Object	Insurance products are common financial arrangements in which an insurance provider states its guarantee to pay on covered claims. In return, the buyer agrees to pay a monthly premium cost.
Insured	Protected, covered, assured	Actor	Person covered by insurance
Insurer	Underwriter, insurance underwriter	Actor	A person or company that underwrites an insurance risk; the party in an insurance contract undertaking to pay compensation
Land Use		Process	Human activities, which are directly related to

			the land, making use of its resources, or having an impact upon it. A given land use may take place on one or more than one piece of land, and several land uses may occur on the same piece of land
Late frost Indicator		Property	It provides a prediction of the last late frost of the season
Loss adjuster	Claims adjuster	Actor	An insurance agent who assesses the amount of compensation that should be paid after a person has claimed on their insurance policy
Normalized Difference Vegetation Index	NDVI	Property	It is a simple graphical indicator that can be used to analyze remote sensing measurements, often from a space platform, assessing whether or not the target being observed contains live green vegetation
Pest Impact Indicator	Assessment Indicator of Damage	Property	It measures the pest and/or disease damage
Pesticide	Insecticide, fungicide	Object	Substances intended to repel, mitigate, control or destroy diseases and pests in plants or animals and to prevent any harm to agricultural commodities during production, storage, transport, processing and marketing etc.
Phenological Indicator	Crop Phenology Indicator	Property	It is an indicator s associated to the periodic events in the life cycle of living species, used to manage crop activities
Portfolio	Collection of investments	Object	It is a grouping of financial assets such as stocks, bonds, commodities, currencies and cash equivalents, as well as their fund counterparts, including mutual, exchange-traded and closed funds
Precipitation	Rainfall, hail, hailstorm, snow	Property	The quantity of such water falling in a specific area within a specific period
Process	Procedure, transaction, faithfulness	Process	A series of actions or steps taken in order to achieve a particular end
Processing System	Information processing, data processing, DP	Process	The combination of machines, people, and processes that for a set of inputs produces a defined set of outputs
Product	Commodity, output, solution	Object	It is an object or system made available for consumer use; it is anything that can be offered to a market to satisfy the desire or need of a customer
Remote Sensing	Remote-sensing, remote monitoring	Process	The act of detection and/or identification of an object, series of objects, or landscape without having the sensor in direct contact with the object. The most common forms

			include color and color infrared aerial photography, satellite imaging and radar sensing
Report	Account, story, chronicle, record	Object	An account, statement or document describing in detail an event, situation, or the like, usually as the result of observation, inquiry, etc.
Risk	Hazard, pitfall, threat, trouble	Property	The risk is defined in financial terms as the chance that an outcome or investment's actual gains will differ from an expected outcome or return. Risk includes the possibility of losing some or all of an original investment.
Risk Assessment	Risk evaluation, risk analysis	Process	The systematic process of evaluating the potential risks and/or to determine the likelihood of loss on an asset, loan, or investment
Risk Assessment Score	Risk rating score, risk scoring	Property	It is a calculated number (score) that reflects the severity of a risk due to some factors
Risk profiling	Risk-profile	Process	Evaluation of an individual's willingness and ability to take risks
Sales Agent	Insurance agent	Actor	It helps insurance companies generate new business by contacting potential customers and selling one or more types of insurance. Insurance sales agents explain various insurance policies and help clients choose plans that suit them
Score	Amount, number, amount, final count	Property	It is a number that expresses facts about an actual situation
Service	Assistance, support, utility	Object	The organized system of apparatus, appliances, employees, etc., for supplying some accommodation required by the public
Soil Map	Soil features, earth features	Object	A map that indicates differences in soil properties (texture, fertility, organic matter, pH, etc.) within a field
Sowing date shifting Indicator	Planting date shifting indicator	Property	It measures the optimal planting time
Supervised Learning	Classification	Process	It is the machine learning task of learning a function that maps an input to an output based on example input-output pairs
Temperature	TI, Thermal reading	Property	The degree or intensity of heat present in a substance or object, especially as expressed according to a comparative scale and shown by a thermometer or perceived by touch
Topography	Chorography, geomorphology	Process	A detailed description or representation on a map of the physical features of an area

Underwriter	Guarantor, risk-taker, insurance underwriter	Actor	It is any party that evaluates and assumes another party's risk for a fee.
Underwriting	Insure, subscription	Process	Underwriting is the process through which an individual or institution takes on financial risk for a fee
Unsupervised Learning	Clustering	Process	It is a type of machine learning that looks for previously undetected patterns in a data set with no pre-existing labels and with a minimum of human supervision
Warm Spell Duration Index	WSDI	Property	It defines periods of excessive warmth, cold, wetness or dryness. WSDI is defined as the annual count of days with at least 6 consecutive days when the daily maximum temperature is exceeding the threshold T90
Water stress		Property	It occurs when water demand exceeds water supply. Increased drought occurrence will lead to increased crop water stress in areas where irrigation infrastructure is lacking, or plants are unable access groundwater (Lobell and Gourjji 2012)
Weather data	Weather indication, climatological data	Property	Information about precipitation, wind, temperature, and other climate conditions
Weather index		Property	It is based on specific weather parameters measured over a pre-specified period of time at a particular weather station (World Bank 2011)
Weather-index Insurance		Object	A class of insurance products that can allow weather-related risk to be insured in developing countries where traditional agricultural insurance may not always be feasible, thereby helping to increase farmers' ability (and willingness) to invest in measures that might increase their productivity
Wind Storm indicator	Wind Storm Index	Property	It measures the changes in wind speed

This pilot is not currently relying on a specific ontology to build its overall solution.

5. INFINITECH Core Ontology mapping with pilot terminology descriptions

The focus of the first version of this document was to provide an initial analysis of the terminologies that are being used by each pilot. The outcome of this highlighted common terms and concepts shared among the majority of the pilots, while others are more relevant per specific pilot category. This gave input to the definition of the first version of the INFINITECH Core Ontology. This has been documented in D4.1 (“Semantic Models and Ontologies- I”) which provided input to our analysis presented hereafter. After its delivery, an additional review took place under the scope of T2.6 whose main focus is to map the pilot terms and concepts reported in the first version of this deliverable with the proposed common data model. The purpose of this review was to identify which entities and attributes have already been addressed by the common data model and which still need to be included in its second version. The results of the review showed that some, critical for the majority of the pilots, concepts are still missing, which makes requirements for D4.1 all the more critical. Other concepts on the other hand are pilot specific, or can be covered by extending the current version of the INFINITECH Core Ontology with the incorporation of already mature ontologies that cover those domains.

The results of this analysis are reported in the subsections below. We followed a per-pilot approach, but we also mention the similarities of each pilot with the others, in order to highlight the most important requirements that need to be addressed in the second version of the data model. In fact, the outcomes of this section will drive the definition of the second version of the common ontology of the project.

5.1 Pilot #1: Invoices Processing Platform for a more Sustainable Banking Industry

Pilot 1 belongs to the category “*Smart, Reliable and Accurate Risk and Scoring Assessment*” and is related to the extraction of information from notary invoices in order to create a sustainability index of each notary that the bank is working with based on the number of physical copies that the notary is issuing. From our initial analysis in 4.1, we identified that this pilot share some common entities with others, like *Bank, Client* that can be mapped to the INFINITECH Core Ontology exploiting its classes like *Person, Organisation*, while has the need for pilot specific terms like *Notary, Invoice, Document* etc. which are not found in other pilots. However, these terms can be mapped to the corresponding classes of the common ontology like *Legal Person, Legal Document* etc.

On the other hand, as this pilot needs to promote its customers notaries with the highest sustainability index, it makes use of terms that are also common in the majority of the pilots involved in INFINITECH and are the target audience of the project, which mainly are related with *Score, Risk Assessment Score, Risk Assessment, Risk*. These are not yet covered by the INFINITECH Core Ontology and must be included in the second version of its prototype. This will be very beneficial for other pilots, as the risk assessment algorithms are a common

trend in organizations in the finance sector. Many other AI solutions could get great benefit when consuming external datasets that can be interoperable with the ones provided by this pilot.

5.2 Pilot #2: Real-time risk assessment in Investment Banking, Partners

Pilot 2 belongs to the category “*Smart, Reliable and Accurate Risk and Scoring Assessment*” and implements a procedure for real-time risk assessment and to monitor the risk for standard metrics that are being used in the sector, trying to estimate the market risk and continuously re-evaluate it upon the change of market prices. As a result, apart from the common *terms* that are being shared among all pilots like *Product, Bank* and *Client*, which they are already mapped by the INFITECH Core Ontology, it also makes use of terms like *Score, Risk Assessment Score, Risk Assessment, Risk* that we mentioned that have not yet been incorporated into the common data model. The need for this second pilot for the definition of such entities makes this requirement more critical. Pilot specific terms are also *Product, Trades* and *Portfolio* that need to be treated carefully. Even if these terms can fit under a wider ontology for *Products*, they have a specific meaning in the context of this pilot and need to be included as separate classes.

5.3 Pilot #3: Collaborative Customer-centric Data Analytics for Financial Services

Pilot 3 belongs to the category “*Personalized Retail and Investment Banking Services*” which includes common terminologies used by all pilots, the risk assessment related ones that were common in the first category of pilots, and additional ones related with the KYC and KYB aspects. Its scope is to use intelligent support tools for new customer services using permission-based mechanisms for data sharing with associated analytics capability. Additionally to the first two pilots, it introduces terms like *Financial Organization, Digital Service, Data, Customer Service, Customer Data, Bank, Assessment, Financial Service, Financial Data*. These terms can be covered by the first version of the INFINITECH Core Ontology, as they are being described by the *Organization, Person, Corporation* related classes and their properties. There are also many terms related with its *Products*, as this pilot offers a variety of products to its clients (both for persons or organizations) which need to be covered carefully, as we highlighted in the previous pilot. However, there is the need to describe the *Risk* related aspects that have not yet being addressed by the common data model and must be included in its second version of this prototype.

5.4 Pilot #4: Personalized Portfolio Management (“Why Private Banking cannot be for everyone?”)

Pilot 4 also belongs to the category “*Personalized Retail and Investment Banking Services*” and uses common terminologies along with KYC and KYB related ones. Its scope is to explore the possibilities of AI Based Portfolio construction for Wealth Management in general, regardless which amount has to be invested in order to allow advisors to make customer risk-profiling to suggest different types of products that the customers should invest. This is very similar to pilot#3 where we have different types of products and there is the need for calculate the relevant risk. As a result, we are in the same situation, that most of the terms have been already addressed by the INFINITECH Core Ontology, but there is the need to model the risk assessment aspects in order to allow for data exchange of already calculated risk.

5.5 Pilot #5b: Business Financial Management (BFM) tools delivering a Smart Business Advice

Pilot 5b is also member of the category “*Personalized Retail and Investment Banking Services*” and uses common terminologies along with KYC and KYB related ones. Its scope is similar to pilot 6 which is mainly to make customer risk-profiling to suggest different types of products that the customers should invest on. As of all other pilots of the same category where we have different types of products, here we also have the need for calculate the relevant risk. Most of the terms have been already addressed by the INFINITECH Core Ontology, but there is also the need to model the risk assessment aspects in order to allow for data exchange of already calculated risk.

5.6 Pilot #6: Personalized Closed-Loop Investment Portfolio Management for Retail Customers

Pilot 6 is the last pilot belonging to the “*Personalized Retail and Investment Banking Services*” category, whose objective is to implement an integrated BigData/AI workflow in order to automate and personalize investment recommendations, including client research and profiling, prospects identification, portfolio construction and monitoring. It also shares common terminologies among other pilots that have been well described and incorporated into the current version of the INFINITECH Core Ontology and others that are specific to the pilots of this category and have been partially described in the common data model. The latter needs to be further validated during the integration of the semantic interoperability framework with the pilots of this category to see if they might need to be further extended. Finally, as all pilots of these two categories, there is the need to model the risk related terms, which is something that should be included in the second version of the core ontology of INFINITECH.

5.7 Pilot #7: Avoiding Financial Crime

Pilot 7 is the first of the pilots that belongs to the category called *Financial Crime and Fraud Detection*. Its objective is to create a more accurate, comprehensive and near real-time

indication of suspicious behaviour in the Financial Crime remit that will allow the detection algorithms to respond to transactions that trigger such suspicions. Towards this direction, an important role can be the interchange of data from other finance institutions, mainly describing entities like *Product, Organization, Person, Legal Authorities*. All those terms have been already described and incorporated in the INFINITECH Core Ontology delivered at the first phase of the project, and reported in D4.1. However, as with these types of pilots and pilot 7 in particular, there is the need to model the finance *transactions* that their customers are generating, in order to allow for sophisticated AI algorithms to exploit and compare the finance traffic that the clients are being involved. This is missing in the current version of the common data model and this is a strong requirement that needs to be addressed in the second version of the core ontology.

5.8 Pilot #8: Platform for Anti Money Laundering Supervision (PAMLS)

Pilot 8 is the second pilot that belongs to the category “*Financial Crime and Fraud Detection*” and its scope is to improve the effectiveness of the existing supervisory activities in the area of anti-money laundering and combating terrorists’ financing. Towards this goal, it shares common entities and attributes with pilot 7, with the additional need to describe the *Legal Authorities* and external *Agents*. These last two entities have been already incorporated into the common ontology of INFINITECH. However, there is the shared need among the pilots of this category for modelling financial *transactions* in order to allow advanced AI algorithms to make use of third-party relevant datasets to perform their analysis.

5.9 Pilot #9: Analyzing Blockchain Transaction Graphs for Fraudulent Activities

Pilot 9 also belongs to the category “*Financial Crime and Fraud Detection*”, where we expect to use more specific terms related with these topics. Its scope is to develop and deploy a scalable and high performance blockchain transaction graph analysis system for investigating whether customer blockchain account transactions can be traced to fraudulent activities or accounts. It is important to mention that this pilot relies on existing data stored using Blockchain technology and it does not impose a specific requirement for extending the common data model. However, if there is a need for such an integration, the incorporation of the *Transaction* into the model will become a necessity.

5.10 Pilot #10: Real-time cyber security analytics on Financial Transactions’ BigData

Pilot 10 is the last of the pilots that belong to the category called *Financial Crime and Fraud Detection*. Its scope is to enable the identification of security-related anomalies while they are occurring, allowing, proactive and prompt interventions on such potential security. It will benefit from extensions of the current INFINITECH Core Ontology to define classes that define the *Financial Crime* and *Risk*. Other attributes related to the *Persons, Organizations, Products* have been already defined or planned to be included in the next version of the

common data model. The latter needs to solve similar requirements added by the previous pilots.

5.11 Pilot #11: Personalized insurance products based on IoT connected vehicles

Pilot 11 introduces use cases and scenarios relevant to the insurance sector. It is part of “*Personalized, Usage-Based, Insurance Products*” category and its scope is to improve risk insurance profiles for vehicle insurance using data collected by connected vehicle, in order to provide personalized insurance plans. A common pattern that has been identified in all pilots related with the insurance sector is that they share common terms and attributes with the ones coming from the finance sector, but additionally, they also use domain specific ones that are only relevant to the specific insurance domain that the pilot is related. As a result, pilot 11 needs entities like *Product*, *Persons*, and *Organizations* which are well defined in the current version of the INFINITECH Core Ontology, with the additional common requirement of all pilots to extend the latter with aspects related with the risk assessment. However, in this case the calculated risk is not related with the product, nor with the transactions, but with the client itself, according to his/her behaviour. Apart from the aforementioned requirements for extensions of the common data model, already noticed in other pilots, additionally there is the need to include pilot specific terms for vehicles, traffic information etc in order for the AI algorithms developed under the scope of this task to benefit from the usage of external and publically available datasets. The particularity of this domain compared to the finance sector is that there is a vast amount of publically available datasets for these scenarios that are easily accessible (i.e. open data for traffic lights, traffic in streets, social demographics of the people living in different areas etc.) and can be used by more sophisticated AI algorithms. These datasets have been already incorporated by the FIWARE Vehicle Data Model that is being currently used by pilot 11 and a strong recommendation would be the extension of the INFINITECH Core Ontology to additionally include classes of this model.

5.12 Pilot #12: Real World Data for Novel Health-Insurance products

Pilot 12 also belongs to the insurance sector and has been put under the umbrella of the *Personalized Usage Based Insurance Products* category. Its scope is to demonstrate how Real-World Data can be utilized from insurance companies to result in novel insurance products for both the benefit of the insurer and the customers. As in the case of the Pilot #11, Pilot #12 also requires common classes that have already been included in the INFINITECH Core Ontology or are planned to be included in its second version, along with pilot specific ones related with the healthcare domain. However, as the latter is pilot specific, this is not a strong requirement for the common data model.

5.13 Pilot #13: Alternative/automated insurance risk selection - product recommendation for SME

Pilot 13 belongs to the insurance sector and has been put under the umbrella of the *Configurable and Personalized Insurance Products* category and aims to develop an insurance product configuration platform for SMEs. Following the same pattern as all insurance pilots of the project, it requires common classes that have been already included in the INFINITECH Core Ontology or are planned to be included in its second version. The main difference among others of this category type is that the target group is other organizations that sell *Products*, whose value is being changed and have other *Persons* as customers. Therefore, the pilot specific terms and attributes related with these scenarios have been already covered by the current version of the common model.

5.14 Pilot #14: Big Data and IoT for the Agricultural Insurance Industry

Pilot 14 is the last pilot belonging to the insurance sector and more specifically to the *Configurable and Personalized Insurance Products* category. Its goal is to provide a decision-making AI framework that will offer a variety of innovative services to the Agricultural Insurance sector. As a result, it makes use of domain specific terminologies related to weather conditions and soil related information. It follows a similar pattern with pilot 11 in the sense that the required additions for these scenarios are relevant with publically available open data. Towards this direction, it would be an important requirement for the activities of T4.1 which defines the INFINITECH Core Ontology, towards the investigation of other proposed ontologies for this domain that could be possibly included in the definition of the common data model of the project.

6. Conclusions

This document reports the work that has been carried out in the scope of task T2.6 “Specification and Design of Integrated Data Models”. The aim of this task was to provide the requirement for the definition of the common data model that will be referenced as the **INFINITECH Core Ontology** and whose purpose is to harmonize the way that pilots from the insurance and finance sector describe their datasets. This will allow the re-usability of datasets (either real or synthetic) that are made available by the platform and utilised by business intelligence and analytical tools of other pilots. For instance, the objective is for a pilot to be able to use an already available dataset for fraud detection in order to train their own model, and then, to use their trained tools in order to provide real-time fraud detection of their customers’ transactions. In order to achieve this, data needs to be harmonized and mapped on a common logical data model.

Towards this direction, an initial analysis of the existing data models and logical schemas of all pilots was required, in order to identify common or widely used *entities* and *attributes*, along with their relationships. To this end, during the first phase of the activities carried out under T2.6, there has been initial surveys and interviews with the majority of the pilots. The results of this process have been reported in section 4. The results of this analysis is that most pilots use common terms, however, pilots that belong to the same category tend to share a lot more common *entities*. Another outcome was that pilots that belong to the insurance sector have a lot of diversities as they tend to specialize in the specific sector they are involved: car insurance make use of terms related with *vehicles, roads etc*, health insurances make us of terms related to the quality of life, while insurance companies that are involved with agricultural products focus more on terms related with weather conditions. However, even if they specialize in their sector, they all use common terms as *clients, products* and *risk*.

Apart from the survey of the existing data models, an effort had been spent on the analysis of existing domain specific ontologies that are widely used in the insurance and finance sectors. We identified that the most commonly used ones are the FIBO that is related with the financial business, the FiGi that is used to model identifiers and the LKIF that is used for interchanges. An analytical presentation of those ontologies has been reported in section 3. Our goal is to rely on those and try to extend them in order to support additional terms that the pilots are using in their solutions.

During the second phase of the activities being carried out under T2.6, the first version of the INFINITECH Core Ontology had been delivered and documented, trying to address the common terms that are used by all pilots. Having this definition already delivered, a second analysis took place whose goal was to identify which are the terms and attributes that are still missing and need to be included in the second version of the common data model. The results of this analysis were included in section 5. The main outcomes are that there are terms related with the risk aspects that are being used by all pilots and are missing. Moreover, even if Products are already included, there might be the need to further go down into more detail and create additional subclasses, as this need became significant. Transactions also need to modelled, as there is the need for all pilots belonging to the category of *Financial Crime and Fraud Detection*. Finally, we identified that pilots belonging

to the insurance section need to inter-exchange datasets with other use cases that belong to the same domain. Therefore, it goes beyond the scope of this project to have a common ontology to describe all domain specific. However, many pilots make use of publically available and open datasets, where there are existing ontologies and initiatives that describe these terminologies. A strong suggestion from the T2.6 level is to make use these existing ontologies and extend the INFINITECH Core Ontology to include.