



INFORMATION SOCIETY TECHNOLOGIES
(IST)
PROGRAMME



InTraServ

Intelligent Training Service for Management Training in SMEs

Deliverable DL 2

Learning Material Creation Report

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1. Introduction

The present document is the deliverable DL 2 of InTraServ resulting from the work performed by participants during the WP2 (Learning Material Preparation). The specifications are explained in the chapter 11 of DL 1. As better specified in the following chapters, this deliverable regards the creation of the learning material.

Given that one of the main purposes of the InTraServ project is to improve the managerial training system, especially in the Small and Medium Enterprise, we have individuated several courses, useful for SME managers: *Business decision*, *Marketing management*, *Marketing research*, *Management control*. As specified in the Annex I, only the *Business decision* course will be implemented during this trial (in particular WP2). Other titles are examples of courses that we might implement in the future, during the exploitation of the product, anyway after the end of the trial phase.

Instead, the purposes of this deliverable of InTraServ project, as described in the 11th chapter of the DL 1, is the creation of the course of Business Decision in three different languages, italian, english and spanish, and in a web deliverable format. This work requires the creation of the ontology of the domain, the creation of learning object and the indexing of all the material (metadata), as we'll see in the following paragraphs.

To be more detailed, the work consisted of several phases. The first one was the creation of the course, in a traditional expositive support: texts, images, graphs, and so on. The course (originally built in Italian), with all its components, has been translated in other two languages, English and Spanish.

Once we've had the course, we have proceeded to the conceptualisation of the domain, wich consists of the individuation of all the nuclear concepts explained, of their graphic rapresentation in a Ontology form. The Ontology represents all the domain concepts with all the relations between themselves.

The third part has consisted of the Learning Objects Arrangement. The work foresaw the resolution of the entire course in several parts, in order to let them became the contents of the Learning Objects (LO).

The fourth part of our work was the Learning Object Metadata Creation. A LO is, in fact, composed by a Metadata and a content. So, we've indexed all the learning material (test included), in order to link them with the ontology.

At the end of this document there are the following annexes:

1. the ontology we used to describe the Business Decision Domain;
2. example of English Learning Objects with the annexed Metatada;
3. example of Tests with the annexed Metadata.

2. Business decision course

The course “Business decision” introduces the learner to principal problems of enterprise management in order to create a reference framework synthesising principal issues concerning strategic and operative management, with particular attention to the methodology.

After that, the theme of the Information System is explained and a methodology based on it consenting to pass from planning to operating is introduced. The goal of this module is to define an analytic methodology and different techniques for business able to be applied to different enterprises.

Finally, the course presents fundamental topics about the business decisional process starting from a traditional analytic approach and then suggesting a systemic approach based on an holistic and an ecologic business vision. In addition, strategic business issues are considered and distinguished in different typologies basing on the decisional contents and on the business organisation.

2.1 Course description

The course has been developed by CRMPA in collaboration with the Department of Enterprise Studies and Research of the University of Salerno. They gave us the entire course in MS Word format, divided in three modules. The first module is about the decision problems and problem solving in a enterprise. The second module regards the Enterprise Information System. The third one concerns the decision making and the enterprise strategic decision.

The **first module** introduces the user to the main problems of the enterprise management. Its main purpose is to create a tool able to synthesize the main problems of strategic and operative management, mainly by a methodological point of view. Its logic process can be synthesized in:

- individuation of enterprise management problems;
- strategy in enterprise organisation;
- approach to the enterprise problem solving.

The **second module** is about the information system theme. It suggests a study and analysis methodology to pass from the project phase to the functional one. Purpose of the module is to define a analytic methodology and operative application technics extensible to the different situation of the enterprise or market. Its logic process can be synthesized in:

- practical and theoretical appearances common to all economic system and enterprise;
- study of the typical features of a sector “X”;
- projecting and realizing an Information System for the “X” Enterprise.

The **third module** concerns the main themes about the enterprise decision process. It starts from a traditional analytic approach to come to a systemic approach, based on an holistic and ecological vision of the enterprise. Then, the module explains the themes concerning the enterprise strategy, distinguishing the different types of strategy related with the decisional content.

Main purpose of the module is to give to the enterprise managers a conceptual and practical landscape of analysis of the enterprise decision process. Its logic process can be synthesized in:

- methodology of decision process approach;
- models and technics for the decision making.

2.2 Business decision course index

Here is the index of the entire course.

2.2.1 MODULE I – The decision making issues and the business problem solving

1. The business management as a decision making activity

1.1 The Business Management

1.1.1. Strategic Management and Operational Management

1.2. The Business decision-making activity

1.2.1. Formalised and non formalised decisions

- 1.3. The basic principles of the decision-making activity
 - 1.3.1. The principle of efficiency
 - 1.3.2. The principle of effectiveness
 - 1.3.3. The principle of profitability
 - 2. The definition of strategy
 - 2.1. The strategy for the organisation's success
 - 2.2. The role and function of strategy
 - 2.2.1. Strategy and planning
 - 2.2.2. Strategy and objectives
 - 2.2.3. Strategy and control
 - 2.3. Strategy as a support and effect of decisions
 - 2.4. Strategy and enterprise
 - 2.4.1. Strategy at a corporate level
 - 2.4.2. The business strategy
 - 2.4.3. The functional strategy
 - 3. The business problem solving
 - 3.1. The cognitive process and its factors
 - 3.2. The problem solving methodology
 - 3.2.1. Techniques and tools of the problem solving
- 2.2.2 MODULE II - The Business Information System (B.I.S.)**
- 1. From data to information
 - 1.1. Nature and typology of data
 - 1.1.1. The information construction process and the strategic relevance
 - 1.1.2. The non formalised decisions
 - 2. The information system (I.S.): an evolution of approaches
 - 2.1. The data treatment in the business information system
 - 2.2. An analytic approach to the information system
 - 2.3. The information system requirements
 - 3. The business information system (B.I.S.)
 - 3.1. The information system support to business management
 - 3.1.1. The decision support
 - 3.1.2. The activity support
 - 3.2. The formal and informal B.I.S.
 - 4. The B.I.S. planning
 - 4.1. Logical steps for the B.I.S. definition
 - 4.1.1. From idea to project
 - 4.2. Operational steps for the B.I.S. creation
 - 4.2.1. From project to its realisation
- 2.2.3 MODULE III - The formation of decisions and the business strategic decisions**
- 1. Approaches to the decision making activity
 - 1.1. From the analytic to systemic approach
 - 1.2. The Models
 - 1.2.1. The technology support
 - 2. The formation of decisions and the decision making activity
 - 2.1. The phases in the decision making process
 - 2.1.1. The business decision making problems identification
 - 2.1.2. The decision making issues definition

- 2.1.3 The research for alternative solutions
- 2.1.4 The analysis of choice alternatives
- 2.1.5 The comparative evaluation of alternatives
- 2.1.6 The decisions formation process
- 2.2 The business deliberative bodies
 - 2.2.1 The business administration bodies
 - 2.2.2. The business management bodies
 - 2.2.3 The managing committees
 - 2.2.4 The staff bodies
- 2.3 The decision making activity organisation
- 2.4 The decisions coordination
- 3. The decision making process and the business planning
 - 3.1 The business planning system
 - 3.2 Planning as a decision making methodology
 - 3.3 The decision making process implementation
 - 3.4 The flexibility of plans
 - 3.5 The business control
 - 3.5.1. Control of effectiveness and control of efficiency
 - 3.5.2. Techniques of business efficiency evaluation
- 4. Models and techniques for the business decisions
 - 4.1. From the environment analysis to sector analysis
 - 4.2. The sector and competitors analysis
 - 4.3. The strategic groups
 - 4.4. A new approach to the sector: the chain (filière)
 - 4.5. The value chain
 - 4.6. Techniques of sales forecasting
 - 4.7. Techniques of stocks management
 - 4.8. Techniques of operations research
 - 4.9. Techniques of planning and financial control
 - 4.10. Techniques of evaluation of investment plans

3. About content creation methodology

As well explained in the DL 1, inside the InTraServ training platform all didactic material concerning the knowledge domain must be organised in several web-deliverable *Learning Objects* (LO). A *Learning Object* is a logical container that represents an atomic resource such as a Lesson (an HTML page), a Simulation (a Java applet), a Virtual World (a VRML file), a Test (an HTML page with an evaluating Forms) and each kind of Web-deliverable document.

Learning Objects must be indexed in order to let both tutors and InTraServ intelligent components know what each LO is about and how it can be used during the learning process. Some kind of information about Learning Objects is so required. We call this kind of information *Metadata*.

We can say that a LO is the set of a Learning content ad its Metadata.

An important feature allowed through metadata is the so-called *Domain Conceptualisation*. For each LO there is a Metadata field called *Idea*, or *Taxon ID*, that contains the list of *Concept* explained in that specific LO. As already introduced, with the term *Concept* we intend an abstract notion that refers to a particular *Ontology*. Concepts, in facts, are organised separately from Metadata in one or more *Ontologies* that are graph-like structures where each node is a Concept and each link is a relation between Concepts (IsRequiredBy, Requires, IsPartOf, HasPart, IsRelatedTo).

In order to create InTraServ usable Learning Objects, three steps are needed:

1. *Domain Conceptualisation*;
2. *Learning Objects Arrangement*;
3. *Learning Objects Metadata Creation*.

In the following chapters we will explain our work through each one of these steps.

3.1 Contents translation

Before going to work on domain conceptualisation and materials indexing, we've had to thik about the translation of the contents.

In fact, the project foresee the creation of three courses of Business decision, in Italian, English and Spanish languages.

The work has been organised in the following way: CRMPA dealt with the revision of the material, in order to transfer form MS Word format into HTML format (Web deliverable), and with the translation in English. Then, sent all the material, both in Italian and in English to ASIMAG for the translation in Spanish. We chose to send both version because of the same philological type between italia and Spanish could help to understand and translate the main concepts in a better way. In fact, the main concepts have been originally written in Italian by Italians, and the translation in English, too, have been written by Italians.

CRMPA has coordinated all the works, with a pedagogical resource in staff with a technical one.

4. Domain conceptualisation

At this point of the work, we have all the material ready in html format. We're ready to start its analysis, to individuate all concepts and all relations.

The domain conceptualisation is the first step to walk to create Learning Object. As said before, the three steps are:

- Domain conceptualisation;
- Learning object arrangement ;
- Metadata creation.

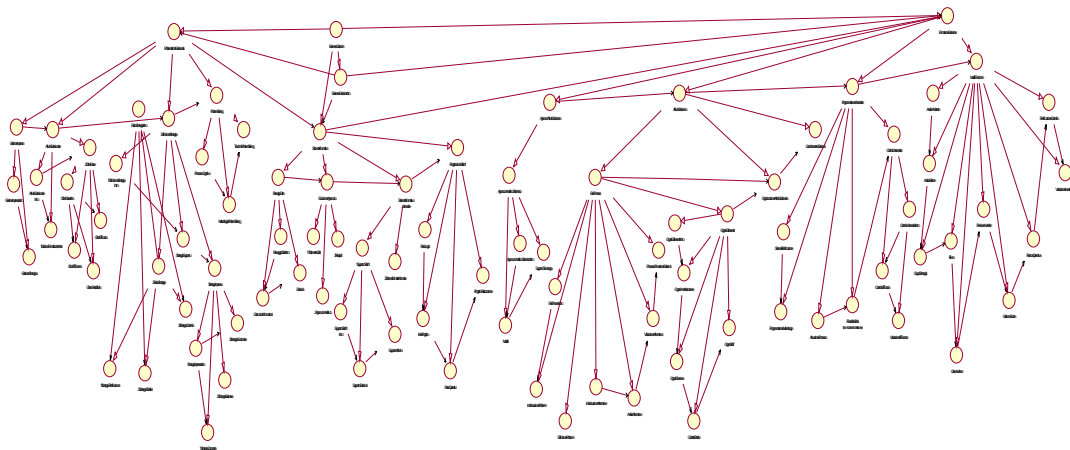
In this chapter we're going to describe the first of these steps.

4.1 The Ontology

A conceptualisation is an abstract, a simplified view of the world that we want to represent for our purpose. It consists of a group of concepts that belong to the domain. The domain is identified by a domain concept. So, the following our work was the individuation of all the nuclear concepts of the domain, taken as good the macro concept "Business decision" as domain concept. That's to say, we have divided the concept "Business decision" in several smaller concepts. Then, each concept has been divided in smaller concept, until we arrived to the smallest concepts explained by one piece of course. The graph we drew, the Ontology, is the representation of all the concepts, and of all the relations between themselves. So, to describe one ontology we have had to individuate all the relation between the concepts.

After having individuated all the concepts, we looked for all the possible relations between all the concepts. So, the conceptualisation is complete. In fact, now we know all we need about the domain.

It rests to translate the ontology in format readable by the system.



Here is a sample of the ontology created (a readable version is attached as annex). As we can see, each single knot is a concept. The position of one knot, in the conceptual graph, must be read looking at the arrows, that represents the relations between the concepts. So, we have all the concepts and all the relation between themselves.

4.2 The Relations

Within the InTraServ context, Ontologies are used to link concepts underlying the knowledge domain with several kind of relations. The main are:

- **Prerequisite:** the prerequisite relations are the requirement relations. That is, one concepts requires, or is required by one other. To explain a certain concepts, A that requires another one, B, we must explain first concept B, then A. This relation can be drawn, in the graph with an arrow identified with R (requires) or IRB (is required by).
- **Sub-concept:** these are relation of part. That to say that one concept is composed by some other. The concept A, e.g., is composed by A1, A2 and A3. They are parts of A, and they all explain A. So, to explain one concept, we must explains all its parts. We can indicate this relation with IPO (is part of) or HP (has part).
- **General relation:** general relation show us, in a graph, that there is a relation between two concepts. We can indicate it with IRT (is related to). It's better, anyway, to indicate exact (non-general) relation in order to create a good learning path.
- **Suggested relation:** There also is the relation Suggested order (SO). This relation indicates a suggested order between concepts of the same generation, the same importance. If we find some of those concepts in our learning path (in our particular course), this relation show which concept is better that is explained before. Is better, not is obligatory, in fact it isn't a prerequisite or sub-concept relation. We often use this relation between concepts that are parts of another one, without any requirement.

5. Learning Object Arrangement

At this point of the work, we have the following situation:

- all learning material, in three languages;
- the knowledge domain conceptualisation (ontology).

Ontology give information about how concepts explained are related between themselves. Concepts are explained by the Learning Objects (LO). A Learning object, as just said, is a content (web deliverable) and a metadata. Metadata links the object to ontology. That because in the metadata there is the concepts coverage, the explanation of which concepts is explained by the LO.

So, once produced the graph we can going on with the metadata creation. First, however, we have to individuate the single LO by the analysis of the material.

As rule, a single LO must be as atomic and as self-consistent as possible. It means that a LO must concern the smaller number of concepts, and must explain the entire concepts. The best scenario is to have n concepts to be explained and n Learning Objects explaining them, one for each concept.

Self-Consistent, on the contrary, means that a Learning Object explaining concepts A must contains all information about concepts A. It must entirely explain its concept.

A possible problem can arise with the self-consistence constrain: if we have a Learning Object *LO1* that introduces concept [*a*] and a Learning Object *LO2* that fully explains the same concept [*a*] what we can do? The best solution is to merge the two Learning Objects in order to create a new self-consistent Learning Object fully explaining [*a*].

An other point to explode is the *link* problem. Each Learning Object is an HTML page (or a PDF page or each kind of Web-deliverable object) so it can contains links to other HTML pages. In order to facilitate the task for InTraServ intelligent components, it is important to follow a simple policy for links.

1. There is no restriction for internal links (links referring to different positions in the same page).
2. Deepening links to internal pages are allowed but new pages must be opened in new browser windows leaving the old page in the main InTraServ page. In this case, deepening pages are considered part of the calling LO and haven't to be indexed through separate Metadata structures.
3. Links to external pages in the Web are allowed but must be placed, preferentially, at the end of the page and must be opened in the same frame used by internal pages.

A separate discourse is required for Testing Activities. Test pages are generated automatically by InTraServ exploiting a question/answer database. This means that no page are necessary for tests. They are defined only through Metadata so we will discuss about them in the subsequent paragraph.

Analysing the material (just analysed to individuate the concepts) we have divided the entire course in 70 learning object. Reading the index (paragraph 2.2 *Business decision course index*) we have individuated one LO for each subparagraph.

Here is a table of matching between paragraphs of the course and LOs individuated.

Index of Business decision course	Learning Object files
Introduction to the corse	001_business_decision_intro.htm
MODULE I – The decision making issues and the business problem solving	
1. The business management as a decision making activity	
1.1 The Business Management	002_gestione_impresa_intro.htm
1.1.1. Strategic Management and Operational Management	003_gestione_strategica.htm
1.2. The Business decision-making activity	004_attivita_decisionale_intro.htm
1.2.1. Formalised and non formalised decisions	005_decisioni_formalizzate_non.htm

Index of Business decision course	Learning Object files
1.3. The basic principles of the decision-making activity	006_criteri_base_intro.htm
1.3.1. The principle of efficiency	007_criteri_efficienza.htm
1.3.2. The principle of effectiveness	008_criteri_efficacia.htm
1.3.3. The principle of profitability	009_criterio_redditivita.htm
2. The definition of strategy	
2.1. The strategy for the organisation's success	010_definizione_strategia_intro.htm
2.2. The role and function of strategy	011_ruolo_strategia_intro.htm
2.2.1. Strategy and planning	012_strategia_pianificazione.htm
2.2.2. Strategy and objectives	013_strategia_obiettivi.htm
2.2.3. Strategy and control	014_strategia_controllo.htm
2.3. Strategy as a support and effect of decisions	015_strategia_supporto.htm
2.4. Strategy and enterprise	016_strategia_impresa_intro.htm
2.4.1. Strategy at a corporate level	017_strategia_corporate.htm
2.4.2. The business strategy	018_strategia_business.htm
2.4.3. The functional strategy	019_strategia_funzionale.htm
3. The business problem solving	
3.1. The cognitive process and its factors	020_processo_cognitivo.htm
3.2. The problem solving methodology	021_metodologia_problem_solving.htm
3.2.1. Techniques and tools of the problem solving	022_tecniche_problem_solving.htm
MODULE II - The Business Information System (B.I.S.)	
1. From data to information	
1.1. Nature and typology of data	023_passaggio_dato_intro.htm
1.1.1. The information construction process and the strategic relevance	024_costruzioni_informazioni.htm
1.1.2. The non formalised decisions	025_decisioni.htm
2. The information system (I.S.): an evolution of approaches	
2.1. The data treatment in the business information system	026_trattamento_dati.htm
2.2. An analytic approach to the information system	027_approccio_analitico.htm
2.3. The information system requirements	028_requisiti.htm
3. The business information system (B.I.S.)	
3.1. The information system support to business management	029_supporto_sisinf_intro.htm
3.1.1. The decision support	030_supporto_decisioni.htm
3.1.2. The activity support	031_supporto_attivita.htm
3.2. The formal and informal B.I.S.	032_sistema_formale_informale.htm
4. The B.I.S. planning	
4.1. Logical steps for the B.I.S. definition	033_passi_logici.htm
4.1.1. From idea to project	034_idea_proggetto.htm
4.2. Operational steps for the B.I.S. creation	035_passi_operativi.htm
4.2.1. From project to its realisation	036_rogetto_realizzazione.htm
MODULE III - The formation of decisions and the business strategic decisions	
1. Approaches to the decision making activity	
1.1. From the analytic to systemic approach	037_approccio_analitico_sistemico_intro.htm

Index of Business decision course	Learning Object files
1.2. The Models	038_modelli.htm
1.2.1. The technology support	039_supporto_tecnologia.htm
2. The formation of decisions and the decision making activity	
2.1 The phases in the decision making process	040_fasi_processi_intro.htm
2.1.1 The business decision making problems identification	041_individuazione_problemi.htm
2.1.2 The decision making issues definition	042_definizione_problemi.htm
2.1.3 The research for alternative solutions	043_individuazione_alternative.htm
2.1.4 The analysis of choice alternatives	044_analisi_alternative.htm
2.1.5 The comparative evaluation of alternatives	045_valutazione_alternativa.htm
2.1.6 The decisions formation process	046_processo_formazione_decisioni.htm
2.2 The business deliberative bodies	047_organismi_deliberanti_intro.htm
2.2.1 The business administration bodies	048_organismi_amministrazione.htm
2.2.2. The business management bodies	049_organismi_direzione.htm
2.2.3 The managing committees	050_comitati_direttivi.htm
2.2.4 The staff bodies	051_organismi_staff.htm
2.3 The decision making activity organisation	052_organizzazione_attivita_decisoria.htm
2.4 The decisions coordination	053_coordinamento_decisioni.htm
3. The decision making process and the business planning	
3.1 The business planning system	054_sistema_pianificazione.htm
3.2 Planning as a decision making methodology	055_programmazione_metodologia.htm
3.3 The decision making process implementation	056_attuazione_processo.htm
3.4 The flexibility of plans	057_flessibilita_piani_bd.htm
3.5 The business control	058_controllo_aziendale_intro.htm
3.5.1. Control of effectiveness and control of efficiency	059_controllo_efficacia.htm
3.5.2. Techniques of business efficiency evaluation	060_valutazione_efficienza.htm
4. Models and techniques for the business decisions	
4.1. From the environment analysis to sector analysis	061_analisi_ambiente.htm
4.2. The sector and competitors analysis	062_analisi_settore.htm
4.3. The strategic groups	063_gruppi_strategici.htm
4.4. A new approach to the sector: the chain (filiera)	064_filiera.htm
4.5. The value chain	065_catena_valore.htm
4.6. Techniques of sales forecasting	066_previsione_vendite.htm
4.7. Techniques of stocks management	067_gestione_scorte.htm
4.8. Techniques of operations research	068_ricerca_operativa.htm
4.9. Techniques of planning and financial control	069_pianificazione_controllo.htm
4.10. Techniques of evaluation of investment plans	070_valutazione_investimento.htm

The name of the reported LO are in Italian, and they concern the Italian version course. We decided, according with the translators to keep the Italian filenames, putting the letter “E_“ (English) before the English version, and “Es_” before the Spanish version. So, the same file name:

067_ricerca_operativa.htm belonging to the italian version is

E_067_ricerca_operativa.htm in the english one, and

Es_067_ricerca_operativa.htm in the spanish one.

We also decided to put a number “00n_” before the name to have all the LO files ordered like in the index, and to recall the association with the .xml file created by the metadata generator, that could begin with the same ID number (e.g. 67_business_decision.xml is the metadata of the LO 067_ricerca_operativa.htm).

The folders containing the LO also contain the image file (.gif) of the LO’s picture and about 43 html page linked to several LO as glossary of some terms used in the course.

6. Metadata creation

Once we have all the material, we can proceed with the indexing of the LO, that consists in the creation of the metadata.

What we've just created is a list, a collection of atomic and self-consistent web deliverable objects (HTML pages). Now, metadata associate LO to the concept and to ontology. So, from a Learning path of explainable concepts the system can create a course, calling all the LO that explain all those concepts.

In order to create Metadata we used the InTraServ built-in Metadata Authoring Tool. These is a list of the most significant Metadata fields valid for the IMS standard:

general

identifier (ID)

title

language

description

keyword

coverage

technical

format

size

educational

interactivitytype

learningresourceetype

interactivitylevel

semantic density

context

typicalagerange

difficulty

typicallearningtime

description

rights

cost

copyrightandotherrestrictions

description

classification

taxonpath

id (taxon ID)

taxon

Here is the specification of the IMS standard committee for the Learning Resource Metadata Information Model explaining the meaning of each field.

Name	Explanation	Multiplicity	Vocabulary	Type	Example
general	Groups information describing learning object as a whole	Single instance			
identifier	Globally unique label for LO	Single value		String	
title	LO's name	Single value		LangStringType 1000 char	business
language	LO's language	Unordered list, max 10 items		String 100 char	en, it, es
description	Content description	Unordered list, max 10 items		LangStringType 1000 char	...principle of business...
keyword	Keyword description of the resource	Unordered list, max 10 items		LangStringType 1000 char	Business, market, enterprise
coverage	Temporal spatial characteristics of context	Unordered list, max 10 items		LangStringType 1000 char	Economic context
technical	Technical feature of the learning object	Single instance			
format	Technical data of the resource	Unordered list, max 40 items		String 500 char	mpeg, htm,
size	Size of the digital resource	Single value	In bytes	String 30 char	1024
educational	Educational or pedagogic features of the learning object	Single instance			
interactivitytype	The type of interactivity supported by the learning object	Single value	active, expositive, mixed, undefined	Vocabulary	
learningresourcetype	Specific kind of resource, most dominant first	Ordered list, max 10 items	exercise, simulation, questionnaire, diagram, figure, graph, index, slide, table, narrative text, exam, experiment, problemstatement, selfassessment	Vocabulary	
interactivitylevel	Level of interactivity between an end user and the LO	Single value	very low, low, medium, high, very high	Vocabulary	
semanticdensity	Subjective measure of the learning object's usefulness as compared to its size or duration	Single value	very low, low, medium, high, very high	Vocabulary	

Name	Explanation	Multiplicity	Vocabulary	Type	Example
context	Typical learning environment where use of LO is intended to palce	Unordered list, max 4 items	Primary education, secondary education, higher education, university first cycle, university second cycle, university postgrade, technical school first cycle, technical school second cycle, professional formation, continuous formation, vocational training	Vocabulary	
typicalagerange	Age of the typical user	Unordered list, max 5 items		LangStrinTrype 1000 char	Adults, children
difficulty	How hard is to work through the LO for the typical target audience	Single value	Very easy, easy, medium, difficult, very difficult	Vocabulary	
typicallearningtime	Approximate or typical time it takes to work with the resource	Sinlge value	ISO 6801	DateType	00:01:00 (one minute)
description	Comments on haw the LO is to be used	Sinlge value		LangStrinTrype 1000 char	Teacher's guidelines
rights	Conditions of use of the resource	Single instance			
cost	Whether use of the resource requires payment	Single value	Si, no	Vocabulary	
copyrightandotherres trictions	Whether copyright or other restrictions apply	Single instance	Si, no	Vocabulary	
description	Comment on the conditions of use of the resource	Single value		LangStringType 1000 char	
classification	Description of a charateristic of the resource by entries in calssifications	Unordered list, max 40 items			
taxonpath	A taxonomic path in a specific classification	Unordered instance, max 15 items			
id	Taxon identifier in taxonomic system	Single value		String 100 char	
taxon	An entry ina a classification	Ordered list, max 15 items			Physics, Medecine

Some example of metadata is included in annex B. Moreover, some examples of tests metadata are in the annex C.

7. Annexes

At the end of this document there are the following annexes:

Annex A: the ontology we used to describe the Business Decision Domain;

Annex B: example of English Learning Objects with the annexed Metatada;

Annex C: example of Tests with the annexed Metadata.

8. Annex A: Ontology of Business Decision

To create the Ontology we need some informations about the domain, the possible relation, and about all the concepts.

The following table, taken from the Ontology Creator, indicates the domain, that is Business Decision.

ID	Domain
01	BusinessDecision

The following table shows the three possible kind of relation of our Ontology

ID	Relation	C.N.
1	IsRequiredBy	2
2	hasPart	2
3	suggestedOrder	2

We chose those three relation, with the number of involved concepts set as "2". That's to say that we describe one relation at time, with the two concept involved.

The following table describes all the concepts.

ID	Concept
73	BusinessDecisionIntro
74	GestionelmpresalIntro
75	Gestionestrategica
76	AttivitaDecisionaleIntro
77	DecisioniFormalizzateNon
78	CriteriBaseIntro
79	CriteriEfficienza
80	CriteriEfficacia
81	RuoloStrategialIntro
82	StrategiaPianificazione
83	StrategiaObiettivi
84	StrategiaControllo
85	StrategiaSupporto
86	StrategialmpresalIntro
87	StrategiaCorporate
88	StrategiaBusiness
89	StrategiaFunzionale
90	ProcessoCognitivo
91	MetodologiaProblemSolving

ID	Concept
121	ComitatiDirettivi
122	OrganiStaff
123	OrganizzazioneAttivitaDecisoria
124	CoordinamentoDecisioni
125	SistemaPianificazione
126	ProgrammazioneMetodologia
127	AttuazioneProcesso
128	FlessibilitaPiani
129	ControlloAziendaleIntro
130	ControlloEfficacia
131	ValutazioneEfficienza
132	AnalisiAmbiente
133	AnalisiSettore
134	GruppiStrategici
135	Filiera
136	CatenaValore
137	PrevisioneVendite
138	GestioneScorte
139	RicercaOperativa

ID	Concept
92	TecnicheProblemSolving
93	PassaggioDatoIntro
94	CostruzioniInformazioni
95	Decisioni
96	TrattamentoDati
97	ApproccioAnalitico
98	Requisiti
100	SupportoSistInfIntro
101	SupportoDecisioni
102	SupportoAttivita
103	SistemaFormaleInformale
104	PassiLogici
105	IdeaProgetto
106	PassiOperativi
107	ProgettoRealizzazione
108	ApproccioAnaliticoSistemicIntro
109	Modelli
110	SupportoTecnologia
111	FasiProcessiIntro
112	IndividuazioneProblemi
113	DefinizioneProblemi
114	IndividuazioneAlternative
115	AnalisiAlternative
116	ValutazioneAlternativa
117	ProcessoFormazioneDecisioni
118	OrganiDeliberantiIntro
119	OrganiAmministrazione
120	OrganiDirezionale

ID	Concept
140	PianificazioneControllo
141	ValutazioneInvestimento
142	CriterioRedditivita
143	DefinizioneStrategiaIntro
144	BusinessDecision
145	ProblematicheDecisionali
146	SistemaInformativo
147	FormazioneDecisione
148	GestioneImpresa
149	AttivitaDecisionale
150	DefinizioneStrategia
151	ProblemSolving
152	CriteriBase
153	RuoloStrategia
155	StrategiaImpresa
156	PassaggioDato
157	EvoluzioneApproccio
158	SistemaInformativoAziendale
159	ProgettazioneSistInf
160	SupportoSistInf
161	ApprocciAttivitaDecisionale
162	AttivitaDecisionale
163	ProgrammazioneAziendale
164	ModelliTecniche
165	ApproccioAnaliticoSistemic
166	FasiProcessi
167	OrganiDeliberanti
168	ControlloAziendale

In the following table, on the contrary, we have all the relation between the concepts of the domain.

Relationship	ID 1	Concept 1	ID 2	Concept 2
hasPart	144	BusinessDecision	73	BusinessDecisionIntro
hasPart	144	BusinessDecision	145	ProblematicheDecisionali
hasPart	144	BusinessDecision	146	SistemaInformativo
hasPart	73	BusinessDecisionIntro	147	FormazioneDecisione

Relationship	ID 1	Concept 1	ID 2	Concept 2
IsRequiredBy	73	BusinessDecisionIntro	145	ProblematicheDecisionali
IsRequiredBy	73	BusinessDecisionIntro	146	SistemaInformativo
IsRequiredBy	73	BusinessDecisionIntro	147	FormazioneDecisione
hasPart	145	ProblematicheDecisionali	148	GestioneImpresa
hasPart	145	ProblematicheDecisionali	149	AttivitaDecisionale
hasPart	145	ProblematicheDecisionali	150	DefinizioneStrategia
hasPart	148	GestioneImpresa	151	ProblemSolving
hasPart	148	GestioneImpresa	74	GestioneImpresaIntro
hasPart	148	GestioneImpresa	75	GestioneStrategica
IsRequiredBy	74	GestioneImpresaIntro	75	GestioneStrategica
hasPart	149	AttivitaDecisionale	76	AttivitaDecisionaleIntro
hasPart	149	AttivitaDecisionale	77	DecisioniFormalizzateNon
hasPart	149	AttivitaDecisionale	152	CriteriBase
IsRequiredBy	76	AttivitaDecisionaleIntro	77	DecisioniFormalizzateNon
IsRequiredBy	76	AttivitaDecisionaleIntro	152	CriteriBase
hasPart	152	CriteriBase	78	CriteriBaseIntro
hasPart	152	CriteriBase	79	CriteriEfficienza
hasPart	152	CriteriBase	142	CriterioRedditivita
hasPart	152	CriteriBase	80	CriteriEfficacia
IsRequiredBy	78	CriteriBaseIntro	79	CriteriEfficienza
IsRequiredBy	78	CriteriBaseIntro	142	CriterioRedditivita
IsRequiredBy	78	CriteriBaseIntro	80	CriteriEfficacia
IsRequiredBy	148	GestioneImpresa	149	AttivitaDecisionale
IsRequiredBy	149	AttivitaDecisionale	150	DefinizioneStrategia
IsRequiredBy	150	DefinizioneStrategia	151	ProblemSolving
hasPart	150	DefinizioneStrategia	143	DefinizioneStrategiaIntro
hasPart	150	DefinizioneStrategia	153	RuoloStrategia
hasPart	150	DefinizioneStrategia	85	StrategiaSupporto
hasPart	150	DefinizioneStrategia	155	StrategiaImpresa
IsRequiredBy	85	StrategiaSupporto	155	StrategiaImpresa
hasPart	153	RuoloStrategia	81	RuoloStrategiaIntro
hasPart	153	RuoloStrategia	82	StrategiaPianificazione
hasPart	153	RuoloStrategia	83	StrategiaObiettivi
hasPart	153	RuoloStrategia	84	StrategiaControllo
IsRequiredBy	143	DefinizioneStrategiaIntro	82	StrategiaPianificazione
IsRequiredBy	81	RuoloStrategiaIntro	83	StrategiaObiettivi
IsRequiredBy	81	RuoloStrategiaIntro	84	StrategiaControllo
IsRequiredBy	81	RuoloStrategiaIntro	85	StrategiaSupporto
hasPart	155	StrategiaImpresa	86	StrategiaImpresaIntro
hasPart	155	StrategiaImpresa	87	StrategiaCorporate
hasPart	155	StrategiaImpresa	88	StrategiaBusiness

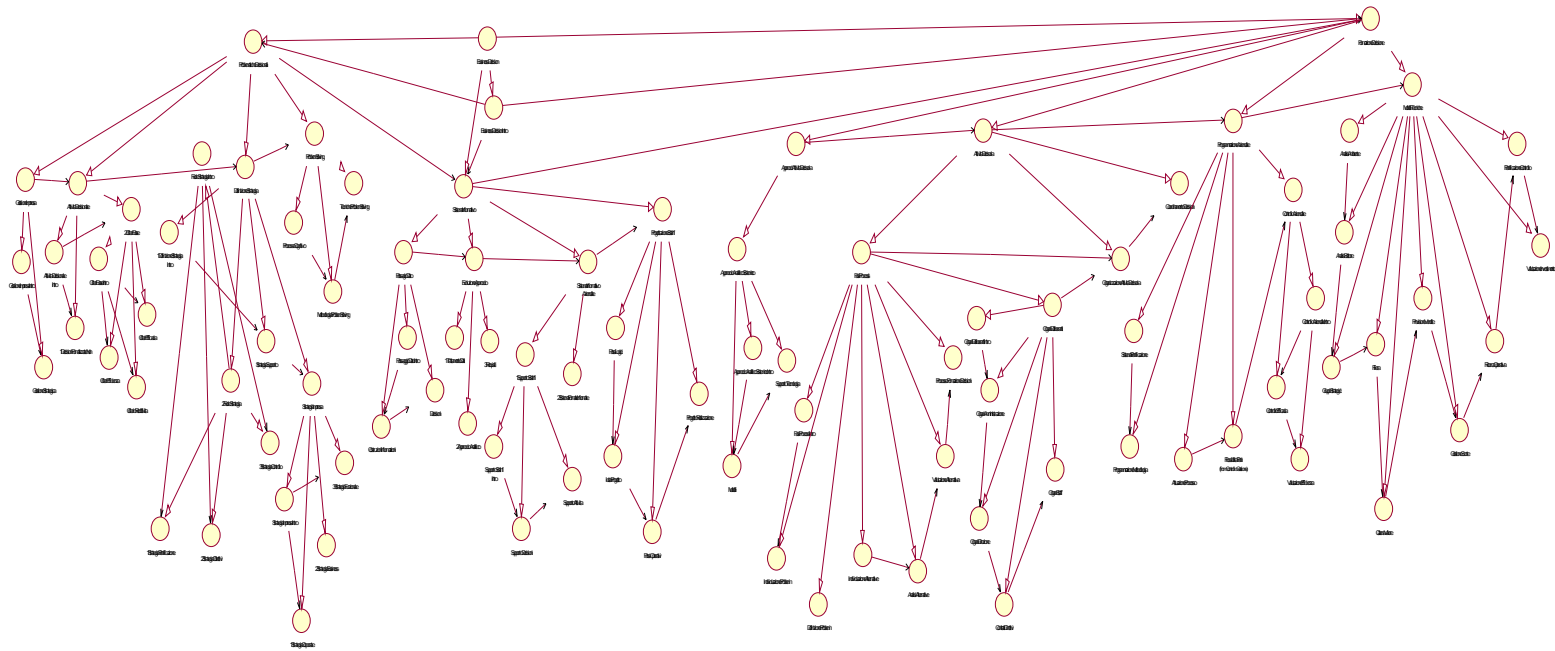
Relationship	ID 1	Concept 1	ID 2	Concept 2
hasPart	155	StrategiaImpresa	89	StrategiaFunzionale
IsRequiredBy	86	StrategiaImpresaIntro	87	StrategiaCorporate
IsRequiredBy	86	StrategiaImpresaIntro	89	StrategiaFunzionale
hasPart	151	ProblemSolving	90	ProcessoCognitivo
hasPart	151	ProblemSolving	91	MetodologiaProblemSolving
hasPart	151	ProblemSolving	92	TecnicheProblemSolving
IsRequiredBy	90	ProcessoCognitivo	91	MetodologiaProblemSolving
IsRequiredBy	91	MetodologiaProblemSolving	92	TecnicheProblemSolving
IsRequiredBy	145	ProblematicheDecisionali	146	SistemaInformativo
hasPart	146	SistemaInformativo	156	PassaggioDato
hasPart	146	SistemaInformativo	157	EvoluzioneApproccio
hasPart	146	SistemaInformativo	158	SistemaInformativoAziendale
hasPart	146	SistemaInformativo	159	ProgettazioneSistInf
IsRequiredBy	156	PassaggioDato	157	EvoluzioneApproccio
IsRequiredBy	157	EvoluzioneApproccio	158	SistemaInformativoAziendale
IsRequiredBy	158	SistemaInformativoAziendale	159	ProgettazioneSistInf
hasPart	156	PassaggioDato	93	PassaggioDatoIntro
hasPart	156	PassaggioDato	94	CostruzioniInformazioni
hasPart	156	PassaggioDato	95	Decisioni
IsRequiredBy	93	PassaggioDatoIntro	94	CostruzioniInformazioni
IsRequiredBy	94	CostruzioniInformazioni	95	Decisioni
hasPart	157	EvoluzioneApproccio	96	TrattamentoDati
hasPart	157	EvoluzioneApproccio	97	ApproccioAnalitico
hasPart	157	EvoluzioneApproccio	98	Requisiti
hasPart	158	SistemaInformativoAziendale	160	SupportoSistInf
hasPart	158	SistemaInformativoAziendale	103	SistemaFormaleInformale
hasPart	160	SupportoSistInf	100	SupportoSistInfIntro
hasPart	160	SupportoSistInf	101	SupportoDecisioni
hasPart	160	SupportoSistInf	102	SupportoAttivita
IsRequiredBy	100	SupportoSistInfIntro	101	SupportoDecisioni
IsRequiredBy	101	SupportoDecisioni	102	SupportoAttivita
hasPart	159	ProgettazioneSistInf	104	PassiLogici
hasPart	159	ProgettazioneSistInf	105	IdeaProgetto
hasPart	159	ProgettazioneSistInf	106	PassiOperativi
hasPart	159	ProgettazioneSistInf	107	ProgettoRealizzazione
IsRequiredBy	104	PassiLogici	105	IdeaProgetto
IsRequiredBy	105	IdeaProgetto	106	PassiOperativi
IsRequiredBy	106	PassiOperativi	107	ProgettoRealizzazione
IsRequiredBy	146	SistemaInformativo	147	FormazioneDecisione
hasPart	147	FormazioneDecisione	161	ApprocciAttivitaDecisione
hasPart	147	FormazioneDecisione	162	AttivitaDecisione

Relationship	ID 1	Concept 1	ID 2	Concept 2
hasPart	147	FormazioneDecisione	163	ProgrammazioneAziendale
hasPart	147	FormazioneDecisione	164	ModelliTecniche
hasPart	161	ApprocciAttivitaDecisoria	165	ApproccioAnaliticoSistemico
hasPart	165	ApproccioAnaliticoSistemico	108	ApproccioAnaliticoSistemicoIntro
hasPart	165	ApproccioAnaliticoSistemico	109	Modelli
hasPart	165	ApproccioAnaliticoSistemico	110	SupportoTecnologia
IsRequiredBy	108	ApproccioAnaliticoSistemicoIntro	109	Modelli
IsRequiredBy	109	Modelli	110	SupportoTecnologia
hasPart	162	AttivitaDecisoria	166	FasiProcessi
hasPart	162	AttivitaDecisoria	123	OrganizzazioneAttivitaDecisoria
hasPart	162	AttivitaDecisoria	124	CoordinamentoDecisioni
IsRequiredBy	166	FasiProcessi	123	OrganizzazioneAttivitaDecisoria
IsRequiredBy	123	OrganizzazioneAttivitaDecisoria	124	CoordinamentoDecisioni
hasPart	166	FasiProcessi	111	FasiProcessiIntro
hasPart	166	FasiProcessi	112	IndividuazioneProblemi
hasPart	166	FasiProcessi	113	DefinizioneProblemi
hasPart	166	FasiProcessi	114	IndividuazioneAlternative
hasPart	166	FasiProcessi	115	AnalisiAlternative
hasPart	166	FasiProcessi	116	ValutazioneAlternativa
hasPart	166	FasiProcessi	117	ProcessoFormazioneDecisioni
hasPart	166	FasiProcessi	167	OrganiDeliberanti
IsRequiredBy	111	FasiProcessiIntro	112	IndividuazioneProblemi
IsRequiredBy	114	IndividuazioneAlternative	115	AnalisiAlternative
IsRequiredBy	115	AnalisiAlternative	116	ValutazioneAlternativa
IsRequiredBy	116	ValutazioneAlternativa	117	ProcessoFormazioneDecisioni
hasPart	167	OrganiDeliberanti	118	OrganiDeliberantiIntro
hasPart	167	OrganiDeliberanti	119	OrganiAmministrazione
hasPart	167	OrganiDeliberanti	120	OrganiDirezioni
hasPart	167	OrganiDeliberanti	121	ComitatiDirettivi
hasPart	167	OrganiDeliberanti	122	OrganiStaff
IsRequiredBy	167	OrganiDeliberanti	123	OrganizzazioneAttivitaDecisoria
hasPart	163	ProgrammazioneAziendale	125	SistemaPianificazione
hasPart	163	ProgrammazioneAziendale	126	ProgrammazioneMetodologia
hasPart	163	ProgrammazioneAziendale	127	AttuazioneProcesso
hasPart	163	ProgrammazioneAziendale	128	FlessibilitaPiani
hasPart	163	ProgrammazioneAziendale	168	ControlloAziendale
IsRequiredBy	125	SistemaPianificazione	126	ProgrammazioneMetodologia
IsRequiredBy	127	AttuazioneProcesso	128	FlessibilitaPiani
IsRequiredBy	128	FlessibilitaPiani	168	ControlloAziendale
hasPart	168	ControlloAziendale	129	ControlloAziendaleIntro
hasPart	168	ControlloAziendale	130	ControlloEfficacia

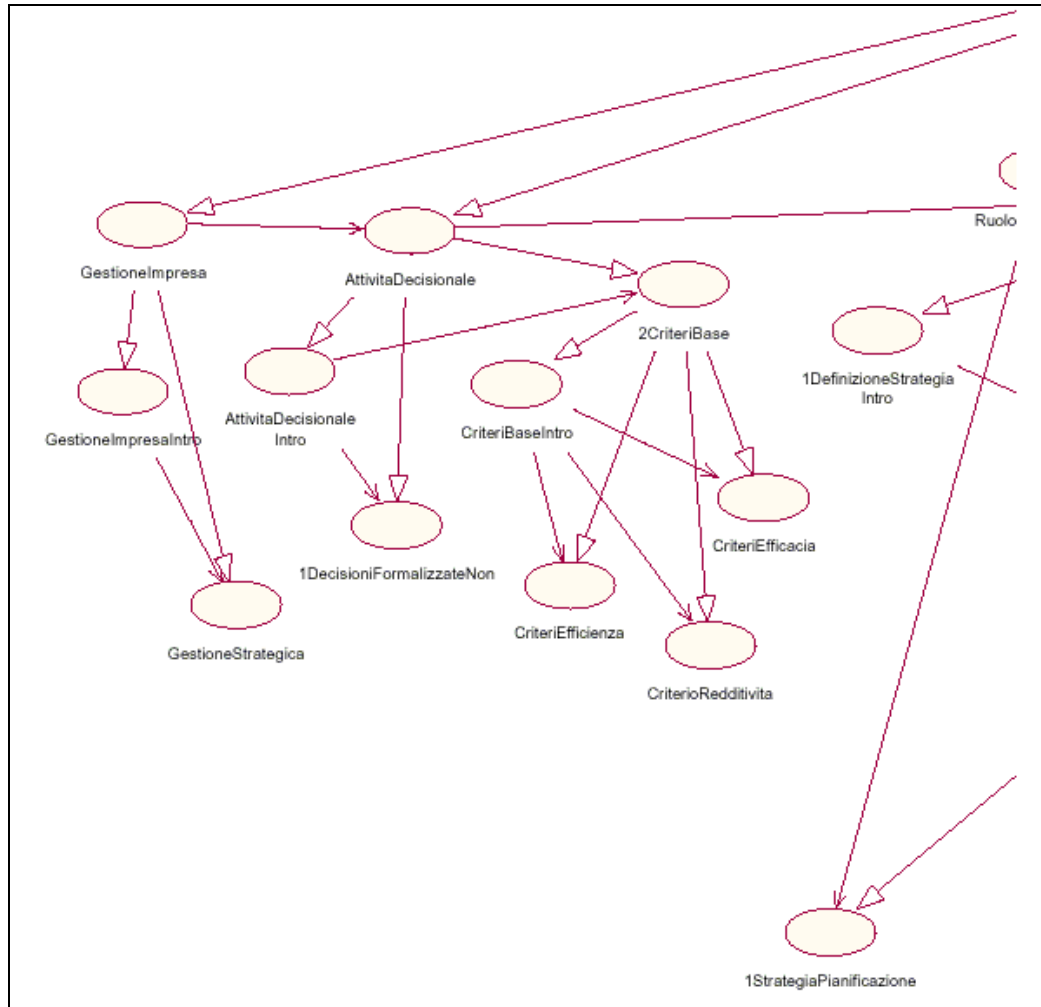
Relationship	ID 1	Concept 1	ID 2	Concept 2
hasPart	168	ControlloAziendale	131	ValutazioneEfficienza
IsRequiredBy	129	ControlloAziendaleIntro	130	ControlloEfficacia
IsRequiredBy	130	ControlloEfficacia	131	ValutazioneEfficienza
hasPart	164	ModelliTecniche	132	AnalisiAmbiente
hasPart	164	ModelliTecniche	133	AnalisiSettore
hasPart	164	ModelliTecniche	134	GruppiStrategici
hasPart	164	ModelliTecniche	135	Filiera
hasPart	164	ModelliTecniche	136	CatenaValore
hasPart	164	ModelliTecniche	137	PrevisioneVendite
hasPart	164	ModelliTecniche	138	GestioneScorte
hasPart	164	ModelliTecniche	139	RicercaOperativa
hasPart	164	ModelliTecniche	140	PianificazioneControllo
hasPart	164	ModelliTecniche	141	ValutazioneInvestimento
IsRequiredBy	132	AnalisiAmbiente	133	AnalisiSettore
IsRequiredBy	133	AnalisiSettore	134	GruppiStrategici
IsRequiredBy	134	GruppiStrategici	135	Filiera
IsRequiredBy	135	Filiera	136	CatenaValore
IsRequiredBy	136	CatenaValore	137	PrevisioneVendite
IsRequiredBy	137	PrevisioneVendite	138	GestioneScorte
IsRequiredBy	138	GestioneScorte	139	RicercaOperativa
IsRequiredBy	139	RicercaOperativa	140	PianificazioneControllo
IsRequiredBy	140	PianificazioneControllo	141	ValutazioneInvestimento
suggestedOrder	96	TrattamentoDati	97	ApproccioAnalitico
suggestedOrder	97	ApproccioAnalitico	98	Requisiti
suggestedOrder	82	StrategiaPianificazione	83	StrategiaObiettivi
suggestedOrder	83	StrategiaObiettivi	84	StrategiaControllo
suggestedOrder	77	DecisioniFormalizzateNon	152	CriteriBase
suggestedOrder	143	DefinizioneStrategiaIntro	153	RuoloStrategia
suggestedOrder	87	StrategiaCorporate	88	StrategiaBusiness
suggestedOrder	88	StrategiaBusiness	89	StrategiaFunzionale
suggestedOrder	160	SupportoSistInf	103	SistemaFormaleInformale
IsRequiredBy	161	ApprocciAttivitaDecisoria	162	AttivitaDecisoria
IsRequiredBy	162	AttivitaDecisoria	163	ProgrammazioneAziendale
IsRequiredBy	163	ProgrammazioneAziendale	164	ModelliTecniche
IsRequiredBy	118	OrganiDeliberantIntro	119	OrganiAmministrazione
IsRequiredBy	119	OrganiAmministrazione	120	OrganiDirezione
IsRequiredBy	120	OrganiDirezione	121	ComitatiDirettivi
IsRequiredBy	121	ComitatiDirettivi	122	OrganiStaff

In this chart, the kind of relation is indicated in the first column. In the third and fifth columns there are the two related concepts.

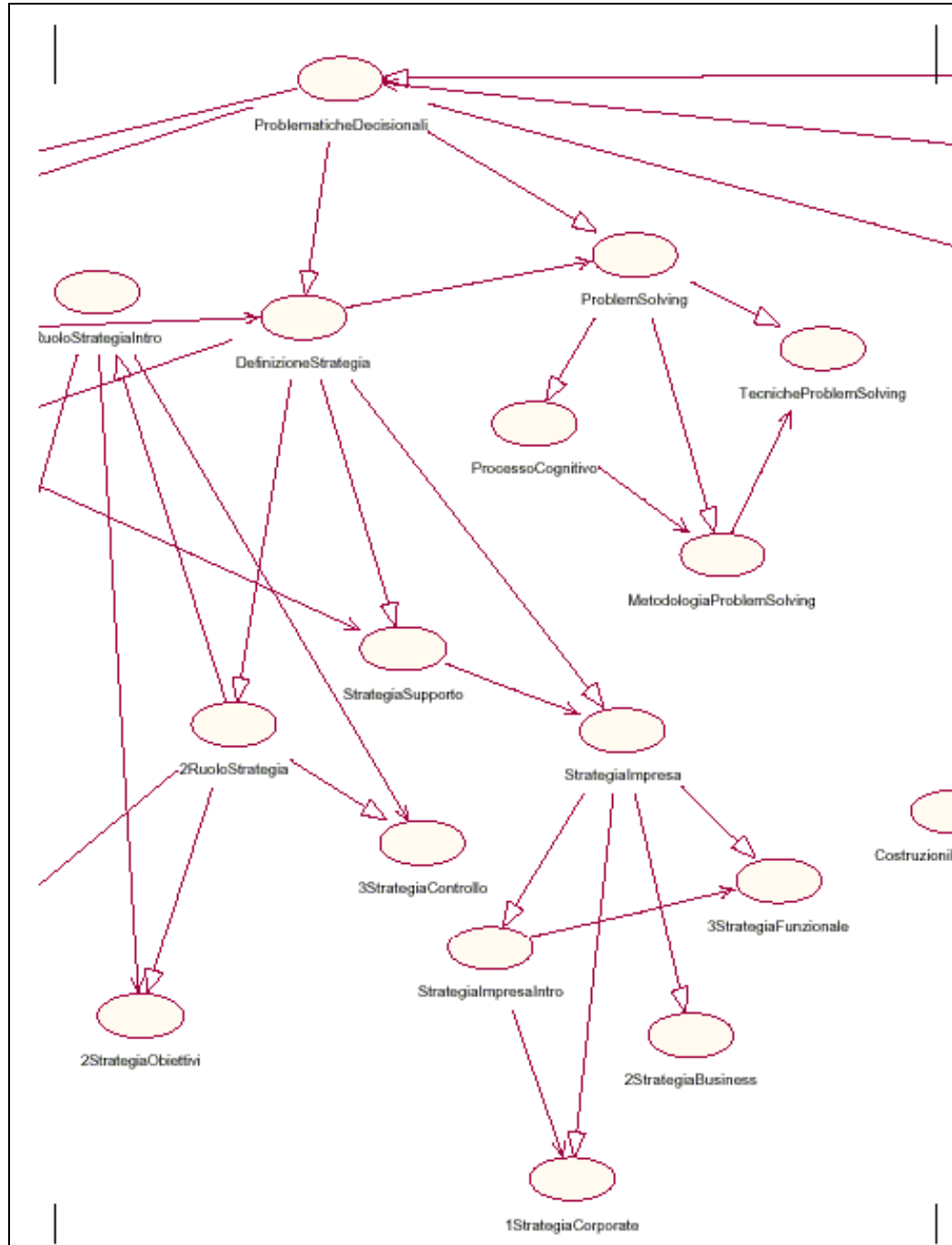
As shown in the 4.1 paragraph of this document, the Ontology can also be represented as a graph, a concepts map, like the following:



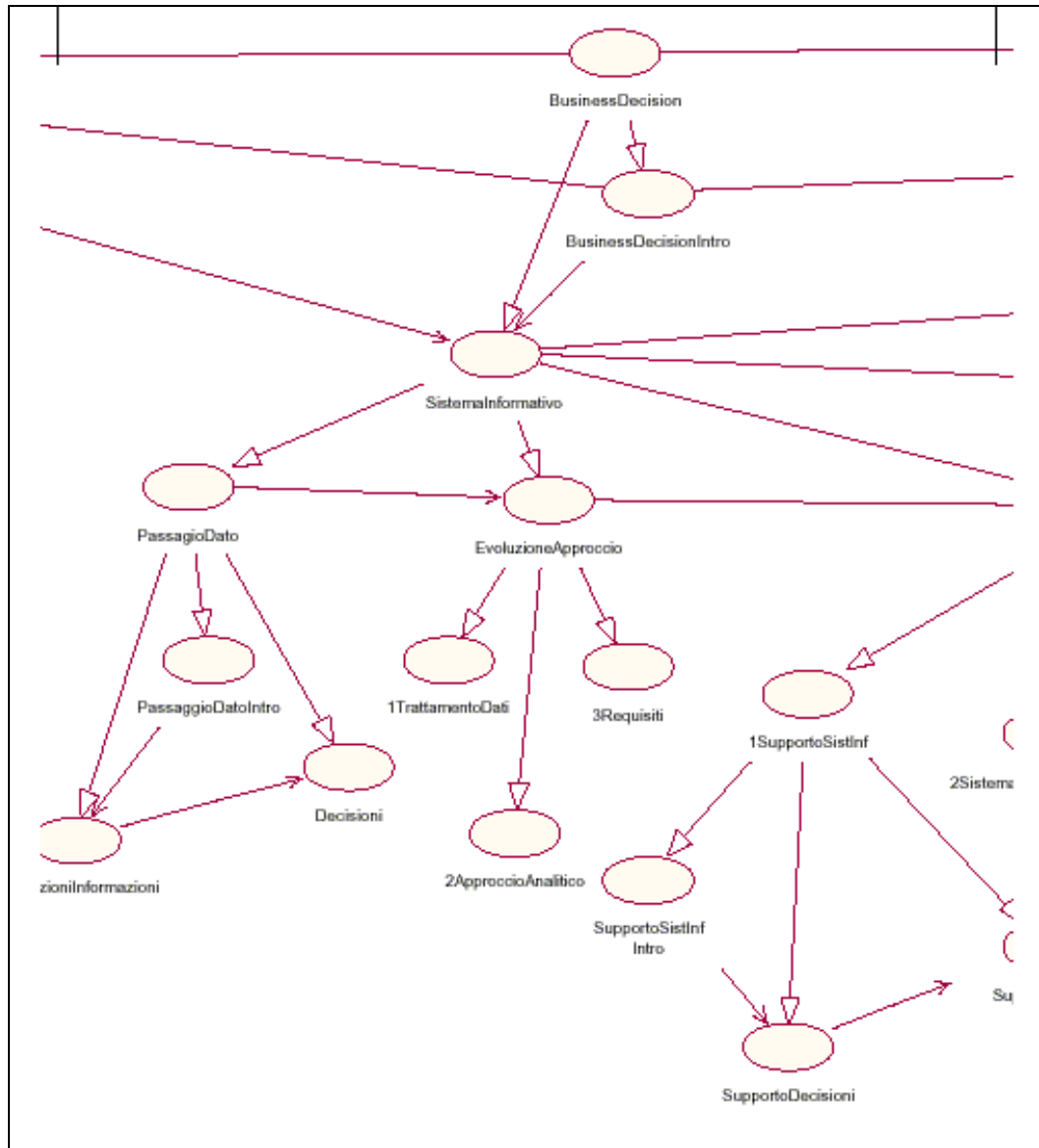
Here is a more readable version of the ontology, divided in 9 images.



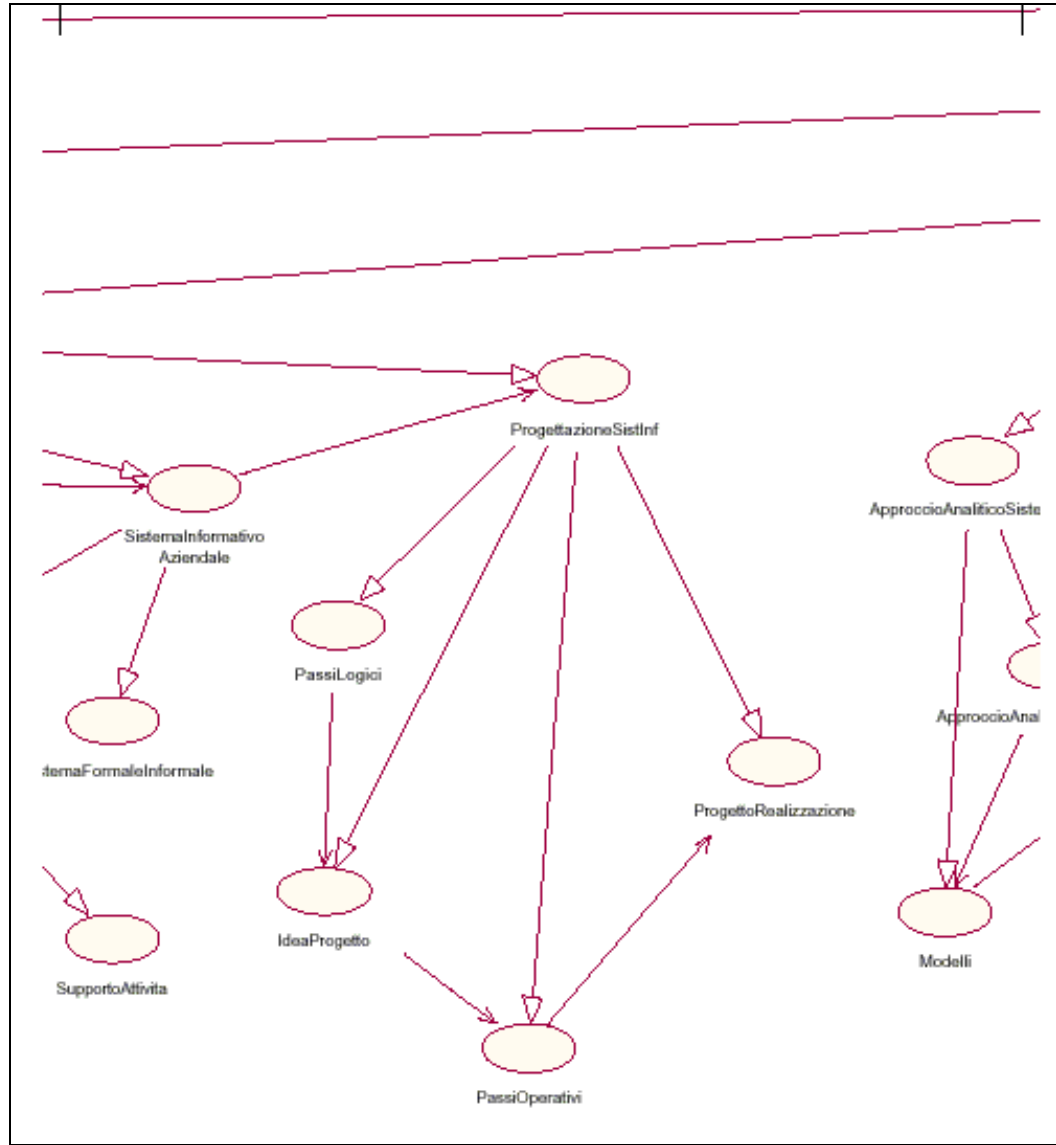
Picture n. 1



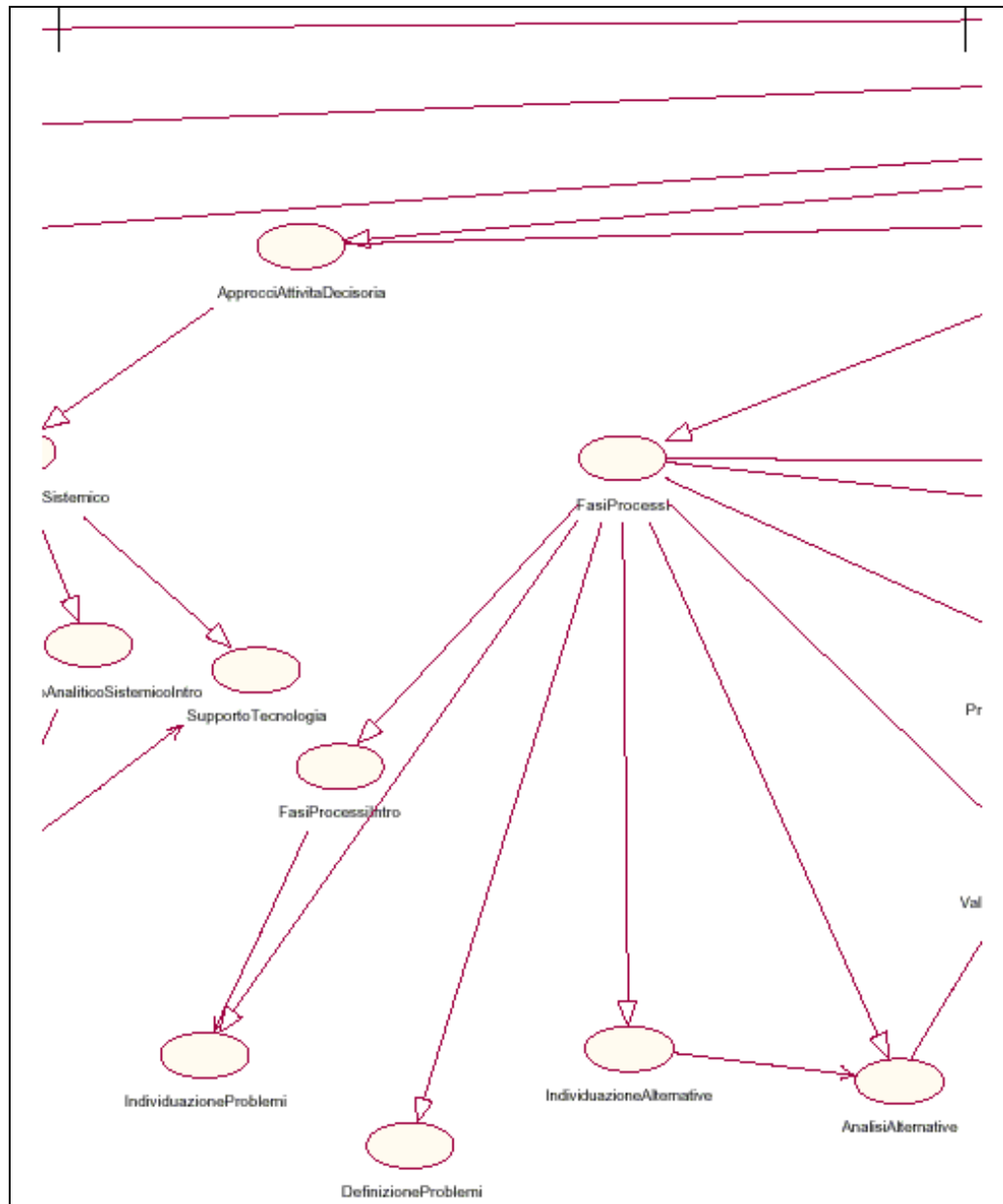
Picture n. 2



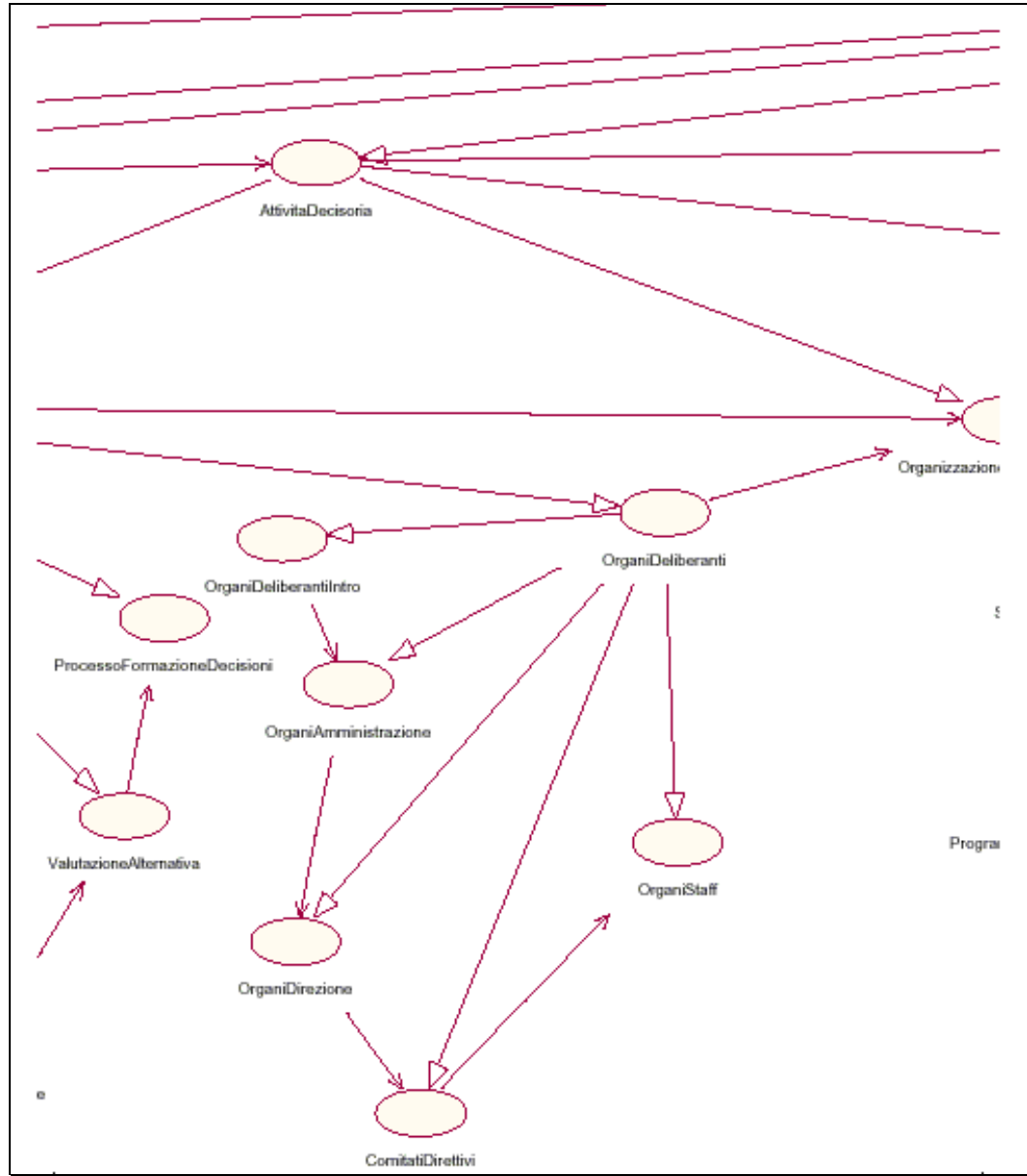
Picture n. 3



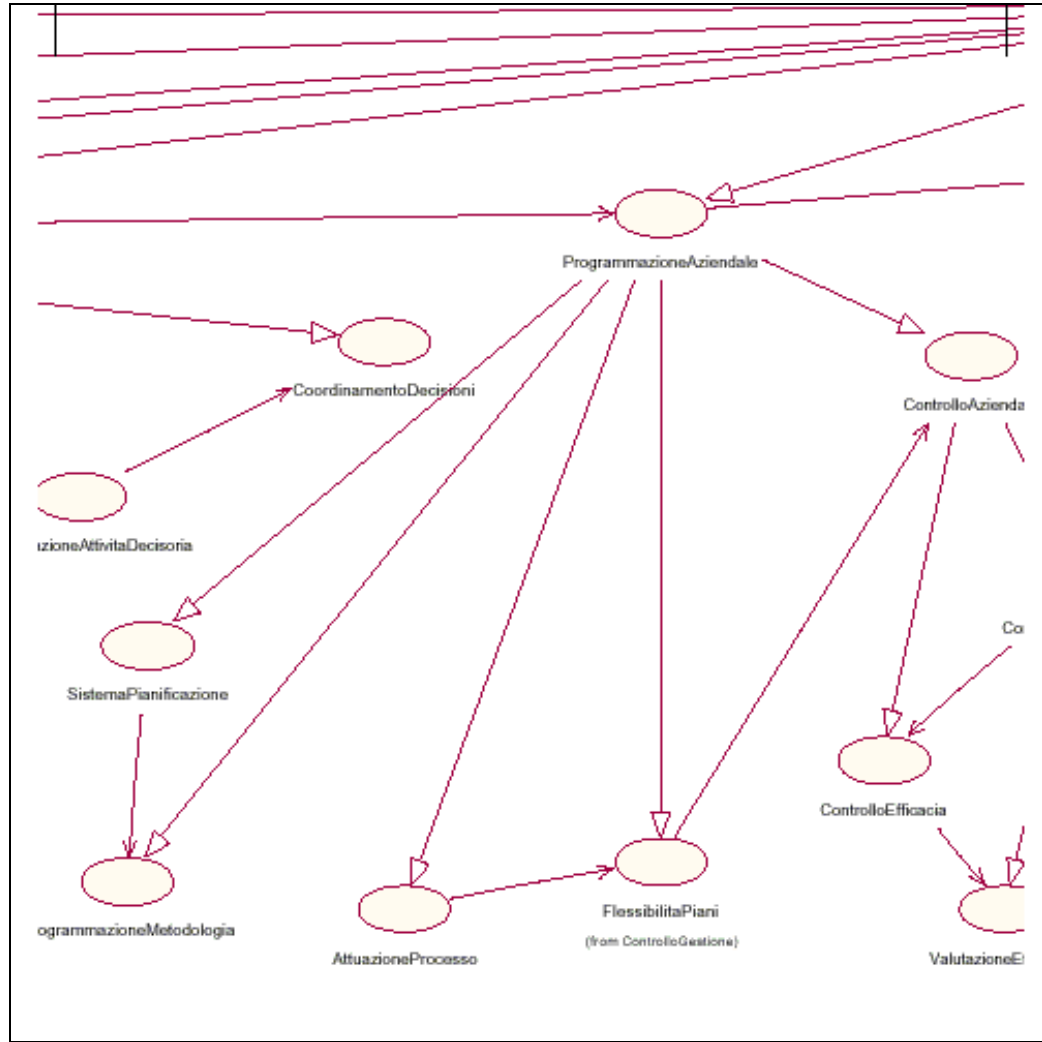
Picture n. 4



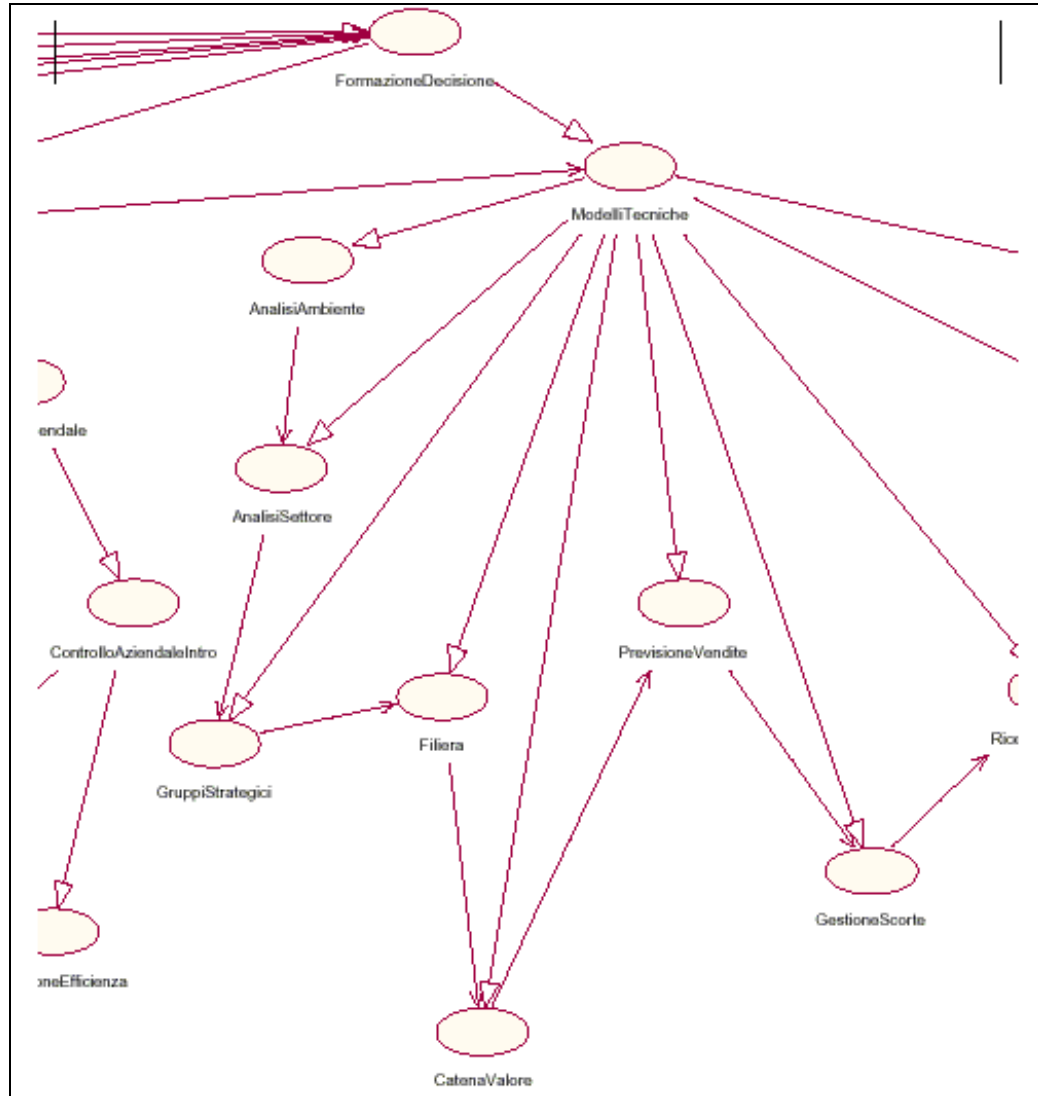
Picture n. 5



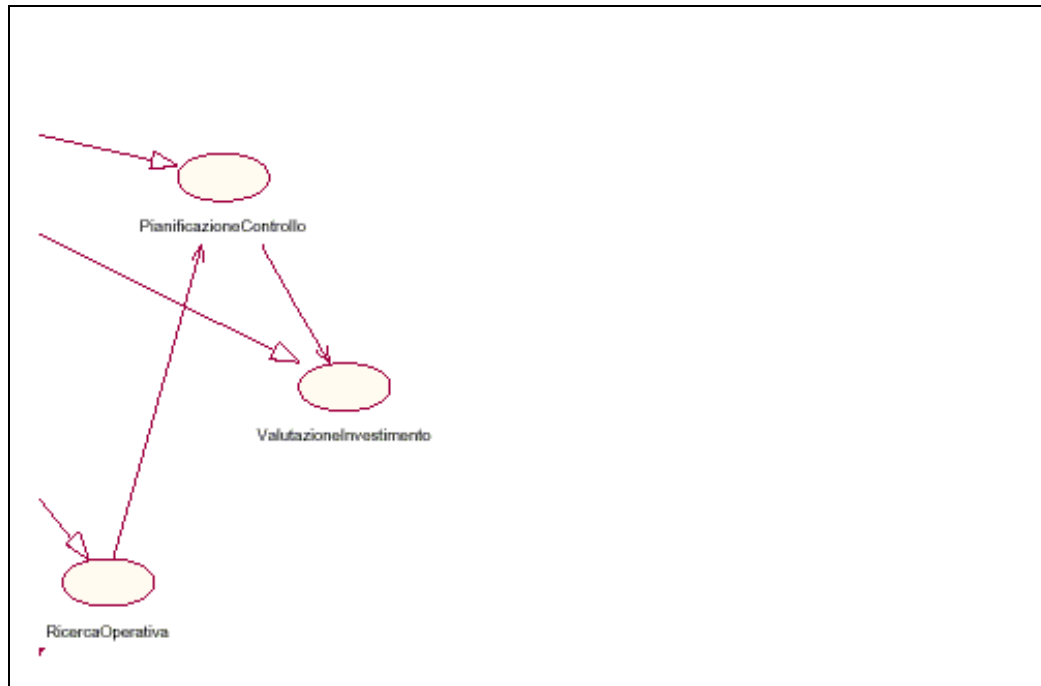
Picture n. 6



Picture n. 7



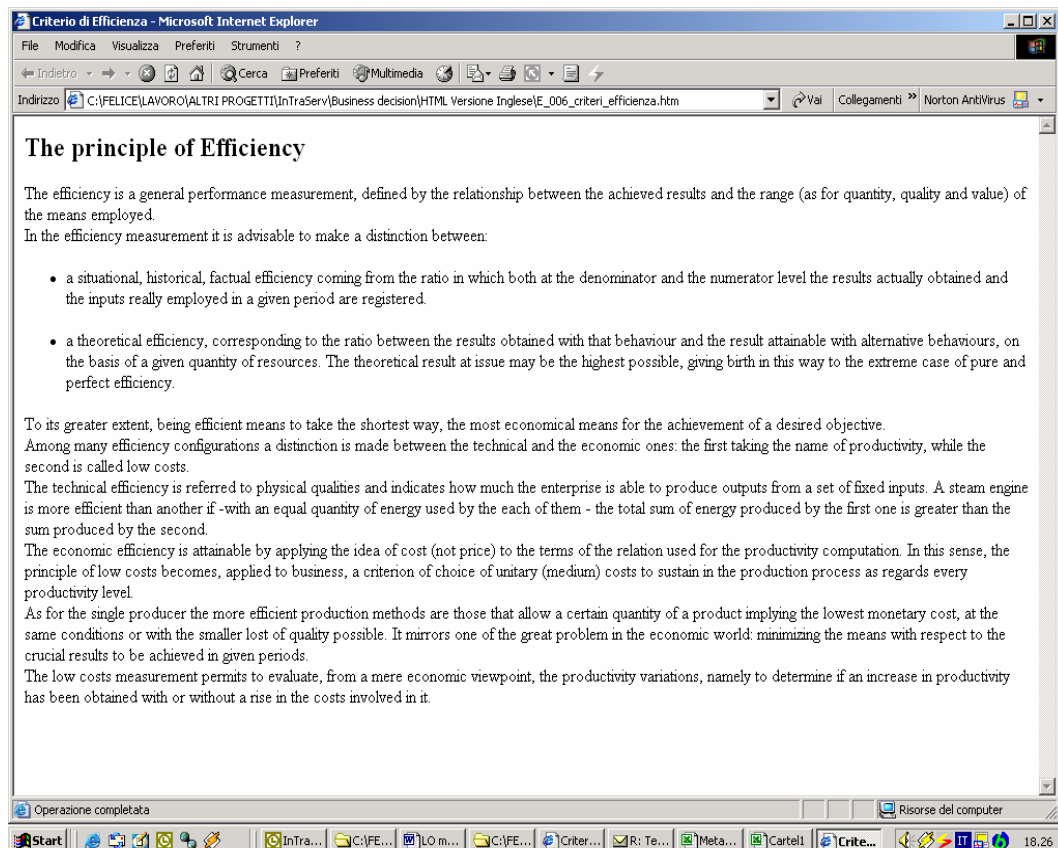
Picture n. 8



Picture n. 9

9. Annex B: LO and metadata (example)

Here is an example of LO (HTML file)



After having analyzed this learning content, we have indexed it in the following metadata:

ID	7
Title	The principle of Efficiency
Description	The principle of Efficiency
Language	en
Keyword	Efficiency
Format	text/html
Size	3.743
Interactivity Type	EXPOSITIVE
Interactivity Level	VERY LOW
Learning Resource Type	TEXT
Semantic Density	VERY LOW
Context	PROFESSIONAL FORMATION
Typical Age Range	young adults
Difficulty	VERY EASY
Typical Learning Time	00:01:40
Taxon ID	79
Taxon Description	CriteriEfficienza
Learning Object Name	En_007_criteri_efficienza

From this metadata we have generated the following IMS file (xml format):

```

<?xml version="1.0"?>
<lom xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://www.imsglobal.org/xsd/imsmd_v1p2">
<general>
<identifier>The principle of Efficiency</identifier>
<title>
<langstring xml:lang="en">The principle of Efficiency</langstring>
</title>
<language>en</language>
<description>
<langstring xml:lang="en">The principle of Efficiency</langstring>
</description>
<keyword>
<langstring xml:lang="en">Efficiency</langstring>
</keyword>
</general>
<technical>
<format>text/html</format>
<size>3743</size>
</technical>
<educational>
<interactivitytype>
<source>
<langstring xml:lang="x-none">LOMv1.0</langstring>
</source>
<value>
<langstring xml:lang="EN">EXPOSITIVE</langstring>
</value>
</interactivitytype>
<learningresourcetype>
<source>
<langstring xml:lang="x-none">LOMv1.0</langstring>
</source>
<value>
<langstring xml:lang="EN">TEXT</langstring>
</value>
</learningresourcetype>
<interactivitylevel>
<source>
<langstring xml:lang="x-none">LOMv1.0</langstring>
</source>
<value>
<langstring xml:lang="EN">VERY LOW</langstring>
</value>
</interactivitylevel>
<semanticdensity>
<source>
<langstring xml:lang="x-none">LOMv1.0</langstring>
</source>
<value>
<langstring xml:lang="EN">VERY LOW</langstring>
</value>
</semanticdensity>
<context>
<source>
<langstring xml:lang="x-none">LOMv1.0</langstring>
</source>
<value>
<langstring xml:lang="EN">PROFESSIONAL FORMATION</langstring>
</value>
</context>

```

```
<typicalagerange>
  <langstring xml:lang="EN">young adults</langstring>
</typicalagerange>
<difficulty>
  <source>
    <langstring xml:lang="x-none">LOMv1.0</langstring>
  </source>
  <value>
    <langstring xml:lang="EN">VERY EASY</langstring>
  </value>
</difficulty>
<typicallearningtime>
  <datetime>00:01:40</datetime>
  <description>
    <langstring xml:lang="EN">00:01:40</langstring>
  </description>
</typicallearningtime>
</educational>
<classification>
  <taxonpath>
    <source>
      <langstring xml:lang="EN">1</langstring>
    </source>
    <taxon>
      <id>79</id>
      <entry>
        <langstring xml:lang="EN">CriteriEfficienza</langstring>
      </entry>
    </taxon>
  </taxonpath>
</classification>
</lom>
```

10. Annex C: test and metadata (example)

As we seen, an expositive LO is composed by a content file and a metadata. The content is a Web-deliverable object. Also tests are composed by a content file and a metadata: the difference is that the content, also, is represented by an XML file exploiting the QTI format.

As an example, starting from the following test:

002_gestione_impresa_intro.htm

1. Why the managerial decision requires theory:

- A. The theory represents a source of knowledge on matters and behaviours of which one has not direct experience; **(correct)**
- B. the theory allows the firm to describe itself apart from the surrounding environment;
- C. the theory is the conceptualisation of what has happened in the near past.

We have, charged on the platform, the following window:

Testo della domanda

Why the managerial decision requires theory. ?

Risposte

The theory represents a source of knowledge on matters and behaviours of which one has not direct experience

the theory allows the firm to describe itself apart from the surrounding environment

the theory is the conceptualisation of what has happened in the near past

Charging the test consist in writing the question and all the possible answers, the kind of test (e.g. multiple choice), the indication of the correct answer with the own concept coverage.

Then, it's possible to write the metadata. Here is the .xml file created.

```

</technical>
- <educational>
- <context>
- <source>
  <langstring xml:lang="x-none">LOMv1.0</langstring>
</source>
- <value>
  <langstring xml:lang="default">PROFESSIONAL FORMATION</langstring>
</value>
</context>
- <typicalagerange>
  <langstring xml:lang="default">18-30</langstring>
</typicalagerange>
- <typicallearningtime>
  <datetime>00:01:00</datetime>
- <description>
  <langstring xml:lang="en">en</langstring>
</description>
</typicallearningtime>
</educational>

```

```

- <classification>
- <taxonpath>
- <source>
  <langstring xml:lang="default">4</langstring>
</source>
- <taxon>
  <id>74</id>
- <entry>
  <langstring xml:lang="default">GestioneImpresaIntro</langstring>
</entry>
</taxon>
</taxonpath>
</classification>
</lom>

```

So, looking at the choosen fields of metadata, we have:

context	PROFESSIONAL FORMATION
typicalagerange	18-30
typicallearningtime	0.01.00
language	en
id	74
taxon	GestioneImpresaIntro