Traceability in scientific research
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project

- **origin** / organizational transparency
  - *identification of the framework for the actions carried out (administrative framework itself, but also financial supports, institutions involved)*
    project [title, registration number, dates, organisations, individuals (affiliation), description, external links]
  - *planned operational players, team and role of each*
    project [individuals (affiliation), organisations involved, description]
  - *mention of expertise and training required*
    project (external links)
  - *temporality: timestamps, scheduling, ...*
    project (dates, description, external links)

- **origin** / transparency of scientific objectives transparency
  - *general goals - general statements about the scientific issues that will be addressed, high-level objectives suggested through roadmaps*
    project (description, external links)
  - *research objectives - motivations, hypotheses, specific questions that can be addressed or answered completely*
    project (description, external links)
    project > process (description)
  - *general goals - general statements about the scientific issues that will be addressed, high-level objectives suggested through roadmaps*
    project (description, external links)
  - *research design and planning - step-by-step goals, description of stages and expected outcomes, durations needed to carry out each action properly, provisional schedule, methods and resources to be deployed*
    project > prototype process* [activities (descriptors, dates, durations), process structure (activity infrastructure chain), expected output*]
    project > process [(research design activity (descriptors, remarks, external links*) description)]
  - *research instrumentation - measurement requirements, instrument requirements and instrument performance, system requirements*
    project > prototype process* [activities (instruments, software, remarks, infrastructure)]
    project > process [research design activity (descriptors, remarks, external links*) description]
  - *research reporting strategy*
    project (description, external links)
    project > prototype process* (description)
    project > process (description)

- **decision transparency** / traceability of the research roadmap's evolution
  - *persons responsible for decisions (clarification of responsibility)*
    project > process [activities (individuals (affiliation), organisation, remarks]
    project [individuals (affiliation), organisations involved, description, link]
  - *the reasons that led to changes in the roadmap*
    project > process (description)
    project (description, link)
  - *any changes in needs and objectives resulting from constraints or limitations experienced, considerations and decisions taken at each point in the research process*

project > process [(activities (expertise (description, link)), remarks, activity doc.*) description, milestone notes]

- *temporality (rescheduling)*
  project (dates, description, links)

- **results** / conditions of use
  - *research funding, confidentiality agreements (protection of information exchanges), material transfer agreements (protection of material transfers), copyright (protection of creative works), access and use rights*
    project (description, links)
    (output, composition, publication, infrastructure) **process > project (funding organisations, description, links)**

infrastructure

A set of computer-based solutions used to generate, manage, structure and manipulate a collection of data (e.g., information systems), assure short-term or long-term file storage (e.g., backup servers, archiving servers), provide distribution/accessibility of web pages (web servers), grant data exchange (e.g., mail servers, VPN) or distant computing (e.g., third-party or local licence server).
An infrastructure is described through general metadata (e.g. name, date, creators, thematic areas, description, links) as well as through metadata focusing on technical aspects (e.g. data storage, access type, output formats, programming languages, interoperability).

- **origin** /foundations

  Licencing and conditions of use of the infrastructure can be described either as a part of the infrastructure's description, or identified as a remote autonomous document (copyright link).

  Upgrading of the infrastructure metadata may include enriching 'link' component by a specific copyright input inside the form (link identified as a copyright information).

  - *research instrumentation - measurement requirements, instrument requirements and instrument performance, system requirements*
    project > prototype process* (infrastructure)
  - *tools techniques and systems at play*
    infrastructure

- **protocol transparency** /procedural and technical aspects
  - *all the data, materials used, acquired or produced (list of samples/materials used in the experiments, request numbers, raw data used, conditions under which it is obtained)*
    process (infrastructure)
  - *pre-processing, transformation or filtering of data and information (e.g., translation, interpretations) - algorithms, computations and data processing methods*
    process (infrastructure)
  - *instruments, devices or applications used (technical conjecture), possible parameterisation or calibration, performance assessment, readiness, maintenance and checks*
    process (infrastructure)

- **protocol transparency** /AI specific issues
  - *any modification to a referenced method or of techniques and procedures employed*
    process (infrastructure)

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- **protocol transparency** /AI specific issues
  - *information about the operation of the AI model - training procedure, training data (what data was used in the decision and how, whether the data is reliable), machine learning algorithms, methods of testing and validating the AI system*
    infrastructure (programing languages)
  - *people involved, origin of the system (clarification of responsibility)*
    infrastructure [name, individuals (affiliation), organisation, description, localisation, links}

- **results** / identification
  - *authors and contributors*
    infrastructure [individuals (affiliation), organisation, infrastructure provider]
  - *formal and distinctive designation of the result*
    infrastructure (UID, title)
  - *typology, quantities and form*
    infrastructure (infrastructure type, data storage model, accessibility)

- **results** / conditions of use
  - *research funding, confidentiality agreements (protection of information exchanges), material transfer agreements (protection of material transfers), copyright (protection of creative works), access and use rights*
    infrastructure (description, copyright*)

- **results** / descriptive elements
  - *result's description*
    infrastructure (project, description)
  - *information useful for understanding the result's scope, limitations, characteristics*
    infrastructure (interface design, infrastructure data gateway, thematic scope, assistance and maintenance, description, modification of structure, content update)
  - *temporality: date/period of creation/publication*
    infrastructure (period of creation)
    infrastructure > process [activity (dates, duration), process structure]
  - *location of result*
    infrastructure (localisation, link)
  - *technical information useful for enabling the result's re-use*
    infrastructure (programming languages, operating systems, infrastructure data gateway, description, documentation)

- **results** / contextual elements
  - *retention strategy - deadlines and when the result is to be destroyed or displaced - date, reason and method*
    infrastructure [localisation (retention deadline*)]
    presentation of infrastructure *(comments, feedbacks*, link to feedback*)

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output

- **origin** /foundations

  Internal pieces of knowledge, information and data acting as inputs to activities, along with related metadata (e.g. title, date, creators, links) and qualitative free text like quality assessment (description).*

  ** More detailed quality assessment is to be found inside the activities that led to the production of the output.*

  When documenting an output in MEMORIA, tools, techniques and systems at play can be described through specific pieces of metadata (e.g. instruments, operating system, software, file format). We are talking here about the technical components specific to the final result and its exploitation and not about all the technical components used in the creation of this final result.

  Licencing and conditions of use of the output can be described either as a part of the output's description, or identified as a remote autonomous document (copyright link).

  Upgrading of the output metadata may include enriching 'link' component by a specific copyright input inside the form (link identified as a copyright information).

  - *internal or external pieces of knowledge, methodological approaches, methods and skills (authors ...)*
    output [title, date, individuals (affiliation), organisation, links]

  - *tools techniques and systems at play*
    output - as a tool or system

  - *pre-existing materials and data sets along with tangible evidence of their origin - authors, dates of creation/modification, suppliers (individuals, groups, or organisations)*
    output [title, date, temporal coverage, individuals (affiliation), organisation, links]

  - *quality or relevance assessment for pre-existing materials and data sets*
    output (description)

  - *licencing and conditions of use of the pre-existing materials and data sets*
    output (description, copyright links*)

- **protocol transparency** /intermediary results
  - *keep track of raw or intermediate results (e.g. when their variation affects the final result)*
    output
    process (output)

- **results** / identification
  - *formal and distinctive designation of the result*
    output (UID, title)

  - *typology, quantities and form*
    output (sizing, type, subtype, file format)

  - *authors and contributors*
    output [individuals (affiliation), organisation]

- **results** / conditions of use
  - *research funding, confidentiality agreements (protection of information exchanges), material transfer agreements (protection of material transfers), copyright (protection of creative works), access and use rights*
    output (description, copyright*)

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- **results** / descriptive elements
  - *result's description*
    output (description)
    process > project

  - *information useful for understanding the result's scope, limitations, characteristics*
    output [object of study (granularity ...), language, temporal coverage, description]

  - *temporality: date/period of creation/publication*
    output (date/period of creation)
    output > process [activity (dates, duration), process structure]

  - *location of result*
    output (localisation, link)

  - *technical information useful for enabling the result's re-use*
    output (format, software, operating system, instruments, description)

  - *information specific to cases where results are verified, repeated or replicated*
    output (description)
    repetition/replication **process [research design activity (inputs, remarks), process structure, preceding process, description]**
    verification/evaluation **process [validity assessment activity/verification (descriptors, remarks),** process structure, **milestone notes**, **description]**

- **results** / contextual elements
  - *retention strategy - deadlines and when the result is to be destroyed or displaced - date, reason and method*
    output [localisation (retention deadline*)]

  - *possible integration of feedback from the communication of results (following their production)*
    presentation of output (comments, feedbacks*, link to feedback*)

*expected output**

- **origin** / organizational transparency
  - *research design and planning - step-by-step goals, description of stages and expected outcomes, durations needed to carry out each action properly, provisional schedule, methods and resources to be deployed*
    project > prototype process* (expected output*)

composition

- **origin** /foundations

  - *internal or external pieces of knowledge, methodological approaches, methods and skills (authors ...)*
    composition [title, individuals (affiliation), organisation, linkage to outputs, links]

  - *licencing and conditions of use of the pre-existing materials and data sets*
    composition (description, copyright links*)

Internal result that combines and reorganises outputs and may act as inputs to activities, along with related metadata (e.g. title, date, creators, linkage to outputs, support, description, links).

Licencing and conditions of use of the composition can be described either as a part of the it's description, or identified as a remote autonomous document (copyright link).

Upgrading of the composition metadata may include:
- adding a date/period of production
- enriching 'link' component by a specific copyright input inside the form (link identified as a copyright information *i.e. copyright link*).

- **protocol transparency** /intermediary results
  - *keep track of raw or intermediate results (e.g. when their variation affects the final result)*
    composition
    process (composition)

- **results** / identification
  - *formal and distinctive designation of the result*
    composition (UID, title)

  - *typology, quantities and form*
    composition (support*)
    (digital (media employed, comments), paper (final format, media employed, paper size, customised, ~~software, instruments~~, comments), 3D printing (scale, instruments, printer type/model, post treatments, material type (main component, additional component, material name)), remarks]

  - *authors and contributors*
    composition [individuals (affiliation), organisation]

- **results** / conditions of use
  - *research funding, confidentiality agreements (protection of information exchanges), material transfer agreements (protection of material transfers), copyright (protection of creative works), access and use rights*
    composition (description, copyright*)

- **results** / descriptive elements
  - *result's description*
    composition (description)
    composition process > project

  - *information useful for understanding the result's scope, limitations, characteristics*
    composition (output(s), description)

  - *temporality: date/period of creation/publication*
    composition (date/period of creation*)
    composition > process [activity (dates, duration), process structure]

  - *location of result*
    composition (localisation, link)

  - *technical information useful for enabling the result's re-use*
    composition (support*, description)

- **results** / contextual elements
  - *retention strategy - deadlines and when the result is to be destroyed or displaced - date, reason and method*
    composition [localisation (retention deadline*)]

  - *possible integration of feedback from the communication of results (following their production)*

presentation of composition (comments, feedbacks*, link to feedback*)

publication

- **origin** /foundations

  A document presenting internal findings in a systematic and organised way that may be used as a basis for activities, along with related metadata (e.g. title, date, creators, linkage to outputs and compositions, links) and an assessment of the publication's background and relevance (context, audience, description).

  Licencing and conditions of use of the publication are described by ownership rules (operators) and the publication's description. It can also be identified as a remote autonomous document (copyright link).

  Upgrading of the publication metadata may include enriching 'link' component by a specific copyright input inside the form (link identified as a copyright information).

  - *internal or external pieces of knowledge, methodological approaches, methods and skills (authors ...)*
    publication [title, date, individuals (affiliation), organisation, links]

  - *quality or relevance assessment for pre-existing materials and data sets*
    publication (context, audience, description)

  - *licencing and conditions of use of the pre-existing materials and data sets*
    publication (description, operators, copyright links*)

- **protocol transparency** /intermediary results
  - *keep track of raw or intermediate results (e.g. when their variation affects the final result)*
    publication
    process (publication)

- **results** / identification

  - *formal and distinctive designation of the result*
    publication (UID, title)

  - *typology, quantities and form*
    publication (support*)
    (digital (media employed, comments), paper (final format, media employed, paper size, customised, ~~software, instruments~~, comments), 3D printing (scale, instruments, printer type/model, post treatments, material type (main component, additional component, material name)), remarks]

  - *authors and contributors*
    publication [individuals (affiliation), organisation]

- **results** / conditions of use
  - *research funding, confidentiality agreements (protection of information exchanges), material transfer agreements (protection of material transfers), copyright (protection of creative works), access and use rights*
    publication [operators, description, copyright*, project (funding organisations, description, links)]

- **results** / descriptive elements
  - *result's description*
    publication (place of publication, project, description)

  - *information useful for understanding the result's scope, limitations, characteristics*
    publication (output(s), composition(s), description, publication context, audience)
  - *temporality: date/period of creation/publication*

publication (date of publication)
publication > process [activity (dates, duration), process structure]

- *location of result*
  publication (localisation, link)

- *technical information useful for enabling the result's re-use*
  publication (support*, description)

- **results** / contextual elements
  - *retention strategy - deadlines and when the result is to be destroyed or displaced - date, reason and method*
    publication [localisation (retention deadline*)]

  - *possible integration of feedback from the communication of results (following their production)*
    presentation of publication (comments, feedbacks*, link to feedback*)

source

- **origin** /foundations

  external piece of information and knowledge (explicit/declarative - that has been articulated and is transmissible), external pre-existing materials and data sets along with tangible evidence of their origin (authors, dates of creation), quality assessment as well as licencing and conditions of use*

  source (title, authors, dates, link)
  source (nature, description, links)
  source (copyrights)

  materials in the sense of experimental sciences not supported at present due to our filed of concern – could be structured like instruments by categories and types (controlled vocabulary) and accessible inside activities descriptions (sources and materials seen like inputs in an activity)

  **quality assessment sources> qualitative free text like description (limits, particularities). More detailed quality assessment is to be found inside of activities exploiting the source (e.g. data analysis > data evaluation activities > descriptors and remarks)*

process

- **origin** / transparency of scientific objectives
  - *research objectives - motivations, hypotheses, specific questions that can be addressed or answered completely*
    project > process (description)

  - *research design and planning - step-by-step goals, description of stages and expected outcomes, durations needed to carry out each action properly, provisional schedule, methods and resources to be deployed*
    project > process [research design activity (descriptors, remarks, external links*), description]

  - *research instrumentation - measurement requirements, instrument requirements and instrument performance, system requirements*
    project > process [research design activity (descriptors, remarks, external links*), description]

  - *research reporting strategy*
    project > process (description)

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- *research instrumentation - measurement requirements, instrument requirements and instrument performance, system requirements*
  project > process [research design activity (descriptors, remarks, external links*), description]

- **origin** /foundations
  - *internal or external pieces of knowledge, methodological approaches, methods and skills (authors ...)*
    preceding process [activities (descriptors, individuals (affiliation), organisation, expertise)]
    output/publication (title, date, individuals (affiliation), organisation, links)
    composition (title, individuals (affiliation), organisation, *linkage to outputs,* links)
    source (title, authors, dates, link)
  - *quality assessment for pre-existing materials and data sets*
    preceding process [activities (descriptors, remarks), description]
    source (nature, description, links)
    output (description), publication (context, audience, description)
  - *pre-existing materials and data sets along with tangible proof of their origin - authors, dates of creation/modification, suppliers (individuals, groups, or organisations)*
    preceding process [activities (descriptors, individuals (affiliation), organisation)]
    output (title, date, individuals (affiliation), organisation, link)
    source (title, authors, dates, link)

- **protocol transparency** /identification
  - *actors involved*
    process [activities (individuals (affiliation), organisation, expertise (individuals (affiliation), organisation)]
  - *formal and distinctive designation of protocol*
    process (UID, name)
  - *operational data (temporality, location, ...)*
    process [activities (dates, duration, location*)]

- **protocol transparency** /cognitive aspects
  - *methodological approaches, concepts, pieces of knowledge, methods and skills, experiences one draws on*
    process [activities (descriptors, sources, input, expertise, remarks, activity doc.*)]
  - *logic transparency (explicitness of reasoning and chaining of activities)*
    process [activities (descriptors, remarks, activity doc.*), milestone notes)]
  - *principles and methods of testing and validation*
    process [activities (descriptors, remarks, activity doc.*), milestone notes) description]

activity documentation (links, other) – may contain links and a description of localisation of additional activity documentation (e.g. photos, sound recording, video, ...)

protocol transparency / procedural and technical aspects
- *all the data, materials used, acquired or produced (list of samples/materials used in the experiments, request numbers, raw data used, conditions under which it is obtained)*
  process [activities (descriptors, sources, input, remarks, activity doc.*), infrastructure, description]
- *all pre-processing, transformation or filtering of data and information (e.g., translation, interpretations), algorithms, computations and data processing methods*
  process [activities (descriptors, instruments, software (parametrisation*), operating system, remarks, activity doc.*), infrastructure]
- *chain of activities (nature of the actions, protocols and operations)*

process [activities (descriptors), process structure (activity infrastructure chain), preceding process, milestone notes]

- *operational agents (persons or teams responsible for the activities, and role of each of them)*
  process [activities (individuals (affiliation), organisation, remarks)]
- *trainings followed by agents bearing responsibility for the actions*
  process [skills/knowledge acquisition activities (descriptors, individuals (affiliation), organisation), remarks]
- *temporality: dates (complete) of creation/modification, durations, lapses of time when no actions are undertaken*
  process [activities (date, duration), process structure (activity infrastructure chain), milestone notes]
- *instruments, devices or applications used (technical conjecture), possible parameterisation or calibration, performance assessment, readiness, maintenance and checks*
  process [activities (descriptors, instruments, software (parametrisation*), operating system, remarks, activity doc.*), infrastructure]

- **protocol transparency** /AI specific issues
  - *people involved, origin of the system (clarification of responsibility)*
    process [activities (individuals (affiliation), organisation]
  - *information about the operation of the AI model - training procedure, training data (what data was used in the decision and how, whether the data is reliable), machine learning algorithms, methods of testing and validating the AI system*
    process [activities (descriptors, sources, inputs, instruments, software (parametrisation*), operating system, remarks, activity doc.*), process structure (activity infrastructure chain), preceding process, milestone notes]
  - *experiment documentation (human machine interactions), decisions of the AI system (reasons that led to the decision in a specific manner - explainability component, backward looking)*
    process [activities (descriptors, remarks, activity doc.*), process structure (activity infrastructure chain)]
  - *justification of the objectivity and fairness of the result of the AI operation*
    process [activities (descriptors, remarks), description, milestone notes]

- **protocol transparency** /contextual aspects
  - *observations made or key facts occurring in the flow of action which are likely to have impacted the protocol or which expose an unexpected behaviour or event*
    process [activities (remarks, activity doc.*) milestone notes]
  - *references made to any document guiding or in relation with the action (laboratory notebook, project notes, reports, ...)*
    process [activities (remarks, activity doc.*) description]
  - *any other relevant information deemed useful for understanding and reproducing experimental protocols*
    process [activities (descriptors, remarks) milestone notes, description]

- **protocol transparency** /intermediary results
  - *keep track of raw or intermediate results (e.g. when their variation affects the final result)*
    output, composition, publication
    process [activities (descriptors, individuals (affiliation), organisation, remarks, activity doc.*) output, composition, publication]

- **decision transparency** / traceability of the research roadmap's evolution

- *persons responsible for decisions (clarification of responsibility)*
  project > process [activities (individuals (affiliation) organisation, remarks]

- *any modification to a referenced method or of techniques and procedures employed*
  process [activities (descriptors, instruments, software, operating system, remarks, infrastructure) milestone notes]

- *any changes in needs and objectives resulting from constraints or limitations experienced, considerations and decisions taken at each point in the research process*
  project > process [(activities (expertise (description, link)), remarks, activity doc.*) description, milestone notes]

- *the reasons that led to changes in the roadmap*
  project > process (description)

- *new hypotheses, questions, interpretations, criticisms and comments*
  process [activities (descriptors, expertise, remarks, activity doc.*) description]

- **results** / identification
  - *authors and contributors*
    process [activities (individuals (affiliation), organisation)]

- **results** / descriptive elements
  - *result's description*
    output/composition/publication > process

  - *information specific to cases where results are verified, repeated or replicated*
    repetition/replication **process (title, research design activity, process structure (activity infrastructure chain), preceding process, description)**

instruments

instruments - *Supplies or tools needed to produce or display the output*
controlled vocabulary
category of the device, type of the device, name, remarks (specifications, ...), URL of specification, project: what funds were used to pay for the equipment, other funds used to pay for the equipment,

- **origin /** transparency of scientific objectives
  - *research instrumentation - measurement requirements, instrument requirements and instrument performance, system requirements*
    project > prototype process* (instruments)

- **origin /** foundations
  - *tools techniques and systems at play*
    instruments

- **protocol transparency /** procedural and technical aspects
  - *all pre-processing, transformation or filtering of data and information (e.g., translation, interpretations) - algorithms, computations and data processing methods*
    process (instruments)

  - *instruments, devices or applications used (technical conjecture), possible parameterisation or calibration, performance assessment, readiness, maintenance and checks*
    process (instruments)

- **protocol transparency /** AI specific issues
    - *information about the operation of the AI model - training procedure, training data (what data was used in the decision and how, whether the data is reliable), machine learning algorithms, methods of testing and validating the AI system*
      process (instruments)

decision transparency / traceability of the research roadmap's evolution

- *any modification to a referenced method or of techniques and procedures employed*
  process (instruments)

results/ descriptive elements

- *technical information useful for enabling the result's re-use*
  output (instruments)

software

software – controlled vocabulary computer programs, libraries and related non-executable data (such as online documentation or digital media).
category, name of software, (freeware, open source, web based only, internal application, remarks)

- **origin** / transparency of scientific objectives
    - *research instrumentation - measurement requirements, instrument requirements and instrument performance, system requirements*
      prototype process* **(software)**

- **origin** /foundations
    - *tools techniques and systems at play*
      software

- **protocol transparency** /procedural and technical aspects
    - *all pre-processing, transformation or filtering of data and information (e.g., translation, interpretations) - algorithms, computations and data processing methods*
      process [activities (software (parametrisation*)]

    - *instruments, devices or applications used (technical conjecture), possible parameterisation or calibration, performance assessment, readiness, maintenance and checks*
      process [activities (software (parametrisation*)]

- **protocol transparency** /AI specific issues
    - *information about the operation of the AI model - training procedure, training data (what data was used in the decision and how, whether the data is reliable), machine learning algorithms, methods of testing and validating the AI system*
      process [activities (software (parametrisation*)]

- **decision transparency** /traceability of the research roadmap's evolution
    - *any modification to a referenced method or of techniques and procedures employed*
      process [activities (software)]

- **result** / descriptive elements
    - *technical information useful for enabling the result's re-use*
      output (software)

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prototype process

- **origin** / organizational transparency
  - *mention of expertise and training required*
    prototype process* [activities (descriptors, organisations, individuals (affiliation), expertise (domain))]
  - *temporality: timestamps, scheduling, ...*
    prototype process* [activities (dates, duration)]

- ***origin** / transparency of scientific objectives*
  - *research design and planning - step-by-step goals, description of stages and expected outcomes, durations needed to carry out each action properly, provisional schedule, methods and resources to be deployed*
    project > prototype process* [activities (descriptors, dates, durations), process structure (activity infrastructure chain), expected output*]
  - *research instrumentation - measurement requirements, instrument requirements and instrument performance, system requirements*
    project > prototype process* [activities (instruments, software, remarks, infrastructure)]
  - *research reporting strategy*
    project > prototype process* (description)

process structure

- **origin** / transparency of scientific objective
  - *research design and planning - step-by-step goals, description of stages and expected outcomes, durations needed to carry out each action properly, provisional schedule, methods and resources to be deployed*
    project > prototype process* (expected output*)

- **protocol transparency** / procedural and technical aspects
  - *chain of activities (nature of the actions, protocols and operations)*
    process (process structure (activity infrastructure chain))
  - *temporality: dates (complete) of activities, durations, lapses of time when no actions are undertaken*
    process (process structure (activity infrastructure chain))

- **protocol transparency** /AI specific issues
  - *information about the operation of the AI model - training procedure, training data (what data was used in the decision and how, whether the data is reliable), machine learning algorithms, methods of testing and validating the AI system*
    process (process structure (activity infrastructure chain))
  - *experiment documentation (human machine interactions), decisions of the AI system (reasons that led to the decision in a specific manner - explainability component, backward looking)*
    process (process structure (activity infrastructure chain))

- **results** / descriptive elements
  - *information specific to cases where results are verified, repeated or replicated*
    process (process structure (activity infrastructure chain))

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milestone notes

- **origin** /foundations
  - *quality assessment for pre-existing materials and data sets*
    preceding process (milestone notes)

- **protocol transparency** / cognitive aspects
  - *logic transparency (explicitness of reasoning and chaining of activities)*
    process (milestone notes)
  - *principles and methods of testing and validation*
    process (milestone notes)

- **protocol transparency** / procedural and technical aspects
  - *chain of activities (nature of the actions, protocols and operations)*
    process (milestone notes)
  - *temporality: dates (complete) of activities, durations, lapses of time when no actions are undertaken*
    process (milestone notes)

- **protocol transparency** /AI specific issues
  - *information about the operation of the AI model - training procedure, training data (what data was used in the decision and how, whether the data is reliable), machine learning algorithms, methods of testing and validating the AI system*
    process (milestone notes)
  - *justification of the objectivity and fairness of the result of the AI operation*
    process (milestone notes)

- **protocol transparency /** contextual aspects
  - *observations made in the flow of action which expose an unexpected behaviour or event*
    process (milestone notes)
  - *any other relevant information deemed useful for understanding and reproducing experimental protocols*
    process (milestone notes)

- **decision transparency** / traceability of the research roadmap's evolution
  - *any modification to a referenced method or of techniques and procedures employed*
    process (milestone notes)
  - *any changes in needs and objectives resulting from constraints or limitations experienced*
    process (milestone notes)

- **results** / descriptive elements
  - *information specific to cases where results are verified, repeated or replicated*
    verification/evaluation **process (milestone notes)**

Traceability in scientific research
solutions for assuring traceability in MEMORIA IS system

presentations

- **results** / contextual elements
  - *possible integration of feedback from the communication of results (following their production)*
    presentation of output/composition/publication/infrastructure* (comments, feedbacks*, link to feedback*)

*materials**

- **origin** /foundations
  - *pre-existing materials and data sets along with tangible evidence of their origin - authors, dates of creation/modification, suppliers (individuals, groups, or organisations)*
    materials* (categories, types, suppliers... controlled vocabulary)
  - *quality or relevance assessment for pre-existing materials and data sets*
    materials* (?? categories, types, suppliers... controlled vocabulary)
  - *licencing and conditions of use of the pre-existing materials and data sets*
    materials* (... conditions of use*)
- **protocol transparency** / procedural and technical aspects
  - *all the data, materials used, acquired or produced (list of samples/materials used in the experiments, request numbers, raw data used, conditions under which it is obtained)*
    materials*(..., request numbers)