Appendix 3.3

Information needs about construction insurance

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1.1 Information needs about construction insurance

This third study will present the construction insurance underwriting process in general, highlighting its specific information needs. Notably, it will try to clarify the main risk assessment principles and the role of the Technical Inspection Service in this process.

1.1.1 Construction Insurance Underwriting Process

The following description will present the general construction insurance underwriting process. As already mentioned, considering an innovative technology framework, the insurer cannot use his standard risk underwriting procedure which is based on statistical data on claims records and therefore profitability. The process is here based on a case by case approach, leading to specific insurance terms and conditions.
For instance, the presented different phases could take place following a request made by an owner who builds a work which includes an innovative technology, such as geothermal piles, and wants an Inherent Defect Insurance for his building.

The underwriting process usually includes the following phases:

1 - Insurance Application
The client, in our case the owner, may directly contact an insurer or ask for the help of a broker, in order to obtain the best insurance conditions from the market. If it's the case, it will then be the broker's mandate to adapt the insurance request to his client needs, collect and present the technical information to the insurers and in the end to compare the insurance offers. The broker will usually make a request to various insurers in order to obtain better conditions.
In all cases, it remains the policyholder's entire responsibility to provide to the insurer the proper and complete declarative information about his risk. In case of a claim, a misrepresentative risk statement could lead the insurer to deny (partially or totally) the cover.

2 - Global Check
From here on the underwriting process takes place inside the insurers walls
First of all, the insurer will verify that the request complies with his general guidelines, which define the general scope of insurer's operation. Construction insurance being very particular, requiring very specific underwriting competences and possibly including a long tail financial exposure (e.g. IDI), the insurer will first verify if the type of cover fits into his portfolio (e.g. no IDI without recourse on TPL insurance). He will then often check for the type of construction (e.g. no offshore windmill). He also verifies that the amounts to be covered fit with its financial capacity. Consequently, the request may be rejected or could also be forwarded to a more competent department (e.g. Corporate Solutions). Therefore, depending on their market position, some insurers may only cover small, typical construction works (e.g. dwellings), that do not use innovative construction techniques or technologies.
In order to do this global check, insurance companies usually use a standard checklist.

3 - Level of Interest
Based on the economic context and its internal policy, the insurer will then appraise its level of interest to provide such cover.

For example, if the project or contract is very small, the insurance company might not be interested to provide insurance, in order to prevent relatively high administrative costs. The selection criteria are logically closely linked to the insurers risk portfolio structure, such as:

- Administrative costs, including the expertise needed to study and cover a particularly market or risk;
- Risk appetite, depending on the type of cover and type of construction work (specific profitability criteria notably based on loss experience)
- Risk appetite, depending on the market conjecture and the insurer's financial conditions (e.g. necessity to develop or reduce the turnover of a class of risk / insurance line);
- Solvency requirements designed to ensure an insurer's financial capacity (subject to Solvency II EU directive requirements);

If the client also passes this acceptance stage, the insurer will do a specific risk assessment

4 - Detailed risk assessment

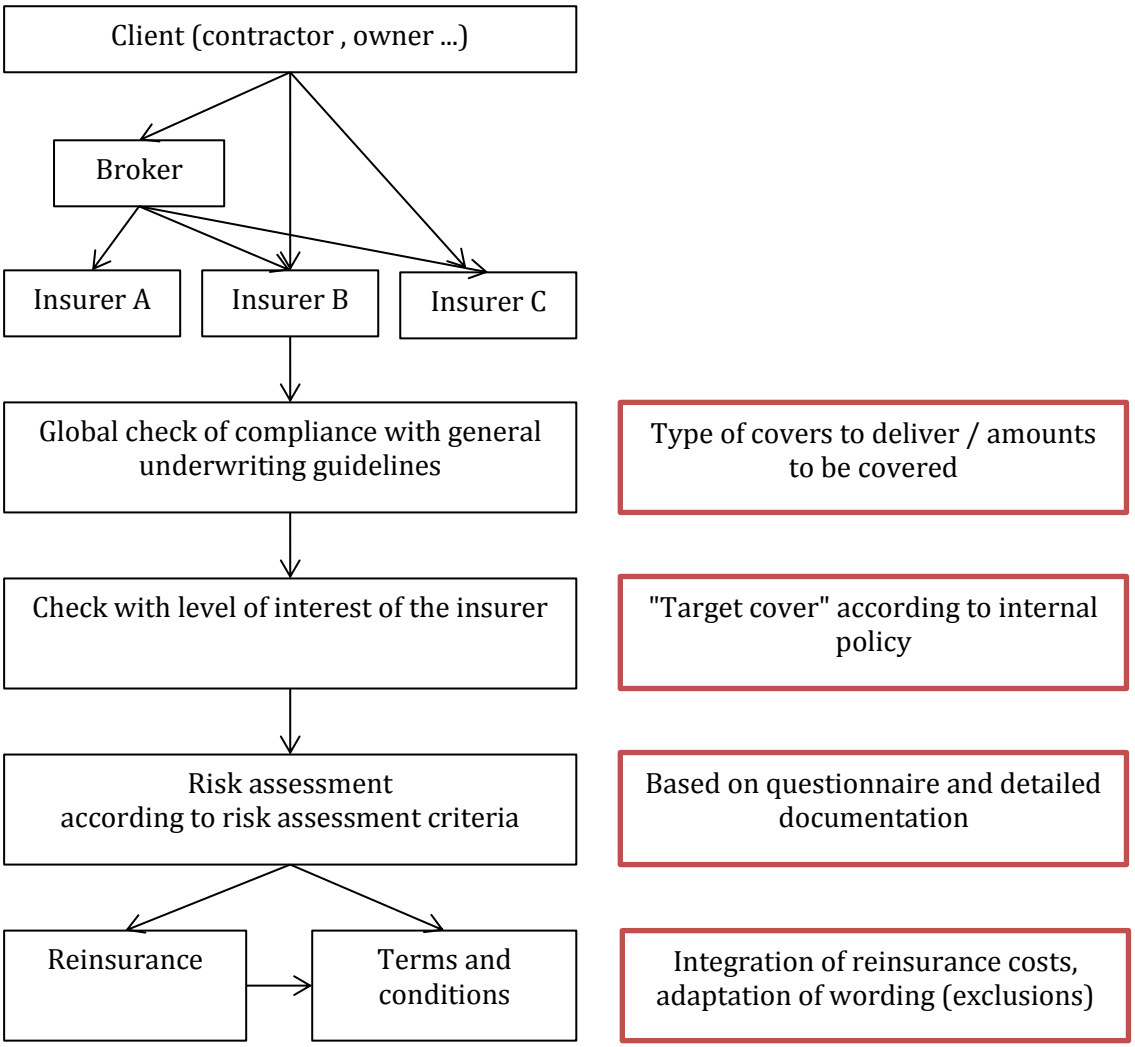
As presented more thoroughly in the corresponding section, based on his technical knowledge, the insurer will appraise qualitatively his technical risks for this specific project. He will also determine a level of exposure.

5 - Terms and conditions

Depending on his reinsurance treaty conditions, the insurer may need to take into account specific reinsurance terms and conditions in order to make its own offer. The reinsurers underwriting process follows the same stages as those of the insurer.

Based on his risk analysis, the insurer will adapt his offer's terms (e.g. by excluding some risks), and conditions (e.g. by limiting some cover extensions), taking into account his reinsurance cost. In accordance with the risk assessment, the insurance premium will of course also take into account aggravating factors coming from technical conditions.

Figure 1: ***The underwriting process***



Therefore the insurance companies define their insurance guidelines and interest in regard of their global strategies and experience of the field. As free players in the market, the insurance companies are in their own right to use any non-discriminatory technical criteria, in accordance with regulation, notably the Services Directive.

1.1.2 Risk assessment principles

Considering innovative technologies, the risk assessment cannot rely on historical statistical data about claims and must rely on a qualitative prospective approach. Therefore, based on their knowledge in construction risk assessment and their experience, the technical inspector, the insurer and the reinsurer analyst have to qualify the risk according to various criteria, focusing on known pathology, and on failure cost and probability of occurrence.
The usual information provided by the client usually specific needed information is often provided in addition

1.1.2.1 Risk assessment criteria

Regarding single covers (specifically linked to a construction work), the risk assessment made by the (re)insurer will globally deal with the different topics described hereafter:

a) Construction scheme
- Type of construction. Some risks are specific to technologies used in certain type of constructions. For example HVAC systems are critical for hospitals, where nosocomial disease is a risk.
- Nature of the work (new works / rehabilitation / turnkey project). The adaptation to an existing context is a source of interface risks.
- Intended use of the construction (to be sold / operated by the developer). The implication of the owner as a great impact on the care taken on the design phase, thus on the operating risks.
- Adequacy of planned maintenance
- Owner / developer experience and know how on this type of project
- Expected use of the construction by the owner (quality level requirements / opportunity of claiming the guarantees)
- Level of complexity / innovation. By definition the insurer hates prototypes, for which he lacks vision
- Surroundings (level of exposure) for the Third Party Liability assessment (damage to third parties).
- Cost of construction. Cost breakdown is an important tool to appraise the level of standard / quality expected.
- Involvement of a Technical Inspection Service

b) Natural event context (to be analysed even if not covered)
- External loads taken into account:
  - Weather exposure (wind / snow / rain);
  - Water intake (groundwater uprising / flood);
  - Earthquake loads.
- Design in regard of natural events :
  - Level of design loads in regard of specific national standards (national annex to Eurocode);
  - Necessity of further studies (ex: modelling) made by external engineering firm (cross check);
  - Type of stress assessed in the design in the light of the risks to cover (thermal gradient, fatigue).

c) Materials
- Conformity of materials/products with standards for critical elements (to be checked by TIS during construction);
- Quality of elements assembled in different countries and with different material origins (problems of consistency, tolerance, compatibility, common and shared regulations, to be checked by TIS during construction);
- Welding control (on-site vs. workshop welding / control of welding by trusted institute).

d) Systems
- Specific analysis of systems such as photovoltaic panels or heat pumps that require a set of specific criteria notably linked to their integration and interactions with the rest of the structure, including the envelope (see example of criteria for photovoltaic panels hereafter)

e) Design
- Intrinsic risks associated with the type of work (structural complexity, choice of technology / materials);
- Known pathology for this type of work, based on insurer's experience or expertise of the technology;
- Level of loads in regard of national standards;
- Adaptation to the context;
- Interaction with other construction elements (ex: effect of humidity on wood framework caused by high level of airtightness imposed in new constructions);
- Scale of design studies;
- Use of non-traditional techniques;
- Qualification / specialization of designers;
- Quality of the reports.

f) Technical Inspection Service (TIS)
For the insurer, the TIS role is of utmost importance. Being in direct contact with the construction actors and reviewing all designer's document, the TIS is considered as the eyes of the insurer. A great part of the identification of the risks comes from the TIS reports. As explained more extensively later, within the different possible assessments made by the TIS, only "risk assessment" reports will be useful in the underwriting process (as opposed to conformity assessment). Therefore, the insurer will assess the TIS work through:
- Qualification / trust in the TIS;
- Quality / specific knowledge of the person in charge of the control with this specific type of work;
- Type of reports and extent of the mission (mission / number of visits / nature of the reports);
- Adequacy of fees (evaluation of time allocated to the project).

g) Execution / methodology
- Type of contract. Structure of contractual relations between contractors has an impact on recourses possibilities hence extent of the cover;
- Qualifications / experience of contractors on this specific type of work;
- Construction / installation methods;
- Quality plan / self-check.

h) Surroundings / neighbouring
- Risks of impact of a defect on construction works with different owner (general liability risk); Ex: distance of neighbours (risk of fire spread);
- Exposure / amounts at stakes.

i) Existing works
- Standards to be applied;

- Level of connection with existing parts / compatibility risk;
- Adequacy of new work in regard of the existing one / analysis from a global point of view;
- Importance of the modifications on existing bearing structure;
- Specific risks of covered existing parts.

j) Construction work inherent risk
- Geometry:
  - Geometry of work (height, asymmetric geometry, non-alignment of bearing elements, "transparency" in lower levels);
  - Geometry of bearing parts (spans of simple or cantilever beams and floors, slenderness of columns / walls);
  - Depth of excavations;
- Structure: Innovative materials / Bearing elements / Bracing;
- Roof / Façade: Glass roof / Point fixed structural glazing.

k) Known pathology / claims on comparable work

As seen risk assessment is mainly dependant on the person making the analysis, his knowledge and experience on the type of construction, without any very specific and objective predominant criteria. However regarding inherent risks, based on their knowledge, insurers developed some specific internal confidential technical risk criteria for some now widespread eco-technologies such as Photovoltaic panels or Heating pumps.

For example in the case of photovoltaic panels, following criteria could be added:
- Surface of the installation (linked to the level of exposure but also to the seriousness and the effort put into the installation job)
- Type of building receiving the panels (e.g. farm building, houses or shopping mall)
- Presence of a diagnostic of existing parts
- Type of support (e.g. glass, tiles or membranes)
- Integrated panels or not (linked to an exposure to waterproofing risk)
- Qualification / expertise of installer regarding both electricity and waterproofing competences
- Type of panels and electrical components (linked to their sensitivity toward risks such as fire or corrosion)
- PV systems specific QS (e.g. MCS, RAL, QualiPV, TÜV long term sequential test)
- Type of maintenance contract

1.1.2.2 Definition of relevant technical criteria

In relation to WP1, this section examines how signs are used to assess "eco technologies'" risks in construction insurance, and more specifically what constitutes a relevant technical criterion for the insurer.

As previously stated, regarding eco-technologies, the insurer's risk assessment is essentially qualitative, based on the underwriter's own experience, whether the risk is a stand-alone project or the activity of a company (manufacturer, installer …). It appraises the adaptation of the eco-technology to the construction work and its environment in general on a technical basis, to be translated into insurance terms and conditions.

In case of innovative construction systems, the insurer does not have the technical means to assess directly the associated risks. Therefore he also has to rely on information provided by experts and potentially carried by QS.

As a reminder, QS aim to bring information to construction actors in order to design, build and maintain building works that meet basic requirements (see WP1 1.2.2). QS do not aim as such to bring information to insurers in order to assess their risks. Nevertheless QS may contain useful information in the insurer's risk assessment procedure.

Insurers will for instance be interested in information concerning specific aspects of construction systems, e.g. their field of use (compatibility issue) or the required installation competences.

This information draws the attention of the insurer on aspects that may be a source of risks. For instance, if a QS on a given construction system highlights the use of a specific competence; this requirement will be taken into account by the insurer to assess its risks.

Table 1 : Examples of national QS used by insurers in their risk assessment of eco-technologies

Country	Name of the sign	QS delivered by
France	Avis Technique (ATEC)	CSTB
Germany	TUVdotCOM	TÜV Rheinland
Italy	Certificato di conformità (of TIS)	ACCREDIA (ex SINCERT)
Spain	Documentos de Idoneidad Técnica (DIT)	Instituto Eduardo Torroja
United Kingdom	MCS Certificate	Microgeneration Certification Scheme

Nonetheless, few QS can be considered as discriminating and give some information on the risk level. As a consequence, findings show that QS directly used by insurers for their risk assessment are very scarce, and essentially concerns competences or systems.

More specifically, construction products QS are not taken into consideration since they only reflect the compliance with standards, norms or requirements in general. As for other standards, on design for example, absence of compliance would be symptomatic of a possible failure or defect, but the presence of a QS, stating the compliance with the standard does not give any information in regard of the risk, or more precisely of any specific information about the risk.

Even though QS, in general, are rarely **directly** used by insurer in his underwriting process, it is not the case for the TIS, through his conformity assessment, at it is described in next section on the TIS role. Therefore, the TIS being somewhat an extension of the insurer regarding risk management, we can consider that QS are **indirectly** helping the insurers, by improving the construction quality.

1.1.2.3 Technical Inspection Service role

Alongside insurances, technical inspection services, which will be defined precisely in this part, become essential actors in the construction process. They participate in the protection of construction quality as well as the protection of the consumer, whether he is the person who builds, or the person who uses the construction. In order to understand how their intervention could help eventually stimulate innovation or promote new technologies, their role and framework of intervention in each country have to be analysed precisely. Their means have to be identified as well in order to help involving them in the process, mostly with insurances, in countries where their

participation could help better risk analysis. General references (CEBC 2006 ; Joao Branco Pedro 2010)

Technical Inspection Services as partners of construction quality

In the construction process, technical inspection services might play, depending on the country, a major role in evaluating risks or conformity. They often bring guarantees concerning the construction. This first part focuses on the definition of TIS and of their intervention. Differences between countries are stressed out, resulting of researches and surveys conducted during ELIOS 2. A recap table summarises at the end the examples that are given in this part.

Technical Inspection Services as Insurance partners

As it is described hereafter, generally TISs don't work for the insurers (with important exceptions). In fact, even though they were initially created to meet an insurance need, they are now more commonly appointed by another entity. Consequently, TIS missions are not intended for the insurer. Nonetheless, for the insurer, TISs remain the main risk information providers through their risk assessment missions.

Therefore, it is important to outline that the following description encompasses different TIS roles, including conformity check and risk assessment. Of these activities, insurers only directly take advantage of the risk assessment, during their underwriting process.

Nonetheless, more globally, TISs are participating in the improvement of the construction quality and are therefore also indirectly improving insurers' results.

1 Definition of Technical Inspection Services (TIS)

1.a Are TIS private or public bodies?

TIS might be private, public or both in some countries. When they are public, they are mostly represented by local authorities. In these cases, administration carries out the checking of the construction but their intervention is mostly at the conception stage or at the completion stage. This is the case for Cyprus, Czech Republic, and Ireland for example. However, when projects become too technically complex, some local authorities transfer the responsibility of the technical inspection to private bodies, for example in Germany or in Sweden, where the technical aspect is exclusively undertaken by private bodies (Deman Jonas 2013 ; De Decker Thomas 2013).

Other countries such as Italy, Belgium or France have a private-control-based system of technical inspection. However, even in these countries, there might be a complementary public inspection for some specific stages of the construction (e.g. conception or completion, with certificates provided by local authorities) (Deman Jonas 2013 ; De Decker Thomas 2013 ; PCR 2011).

A third type of countries has both public TIS and private organisations. United Kingdom for example has building control bodies (BCB) of two types: Local Authority Building Control (LABC) or private sector Approved Inspector Building Control (AIBC) (Royal Institution of Chartered Surveyors 2015 ; Johnson Hugh 2015 ; Planning Portal 2015). Denmark and Spain also have public and private TIS. For Spain (Instituto de Ciencias de Construcción Eduardo Torroja 2015 ; Javier Lopez y Garcia de la Serrana), the city council on one hand and OCT (Organismo de Control Tecnico) on the other hand might intervene in the inspection process but they do not interfere. Their intervention however might differ, as it will be seen further on in paragraph A-3. In the Netherlands, where the system is

currently changing (Visscher Henk and Meijer Frits), at the moment, both municipal building authority and private approved inspectors can act in the inspection process, but the role of public administration is actually handed over progressively to private inspectors. The case of the Netherlands reflects the tendency of privatisation of technical inspection services, partly due to the lack of financial means and technical skills for public administrations (PCR 2011 ; Deman Jonas 2013).

1.b Control of products and/or construction

During the evaluation of the construction quality process, two aspects can be distinguished, one focusing on the products themselves, the second one being the use of this product within a precise context, and given some specifications relative to its implementation. The first aspect is discussed in this report, in the chapter on quality signs. The second one might be addressed by TIS specifically. Therefore, it is important to stress out the difference between these two approaches: they might be complementary in the process but, in order to explain the role of TIS, the relevant one is about control of the construction. However, in some countries, such as Germany for example, some organisms do both certification of products and control of construction.

1.c Accreditation

Whether TIS are accredited or not depends on the country. It seems that, a priori, local authorities do not need any accreditation, except for some specific cases, such as in the Netherlands, where local authorities are supervised by a national building inspectorate. For private bodies, most countries require at least an authorisation. Indeed, in Belgium, the BELAC gives accreditation to TIS, this responsibility is based on the COFRAC (COmité FRançais d'ACcréditation) in France or the SWEDAC (Swedish Board for Accreditation and Conformity Assessment) in Sweden. In Germany, The Netherland or Denmark, private controllers and engineers need to be accredited as well. In United Kingdom, UKAS inspection approves AIBCs. In Italy, the obligation of accreditation applies only for construction works of more than 20 Million Euros. This formal accreditation is covered at a European level by the E.A., European Accreditation (European co-operation for Accreditation 2015). This aspect is developed more precisely in part B of the corresponding deliverable.

When we talk about authorisations more than accreditations, some may correspond more to an obligation of insurance than a proof of competence. For example in Slovakia, TIS must have the authorisation of the chamber of construction engineers, in order to guarantee in some way there liability.

2 Framework of the intervention of TIS

2.a Is their intervention voluntary or compulsory?

Clear conclusions and answers to this question are difficult to sum up as in each country; the organisation depends on a lot of different factors that make it difficult to strictly classify the intervention of TIS. However some major frames of intervention have been drawn out.

During our researches, it has appeared that technical inspection services were required only rarely on a voluntary basis. An example of this exception could be Malta but there seems to be no real technical inspection included in the construction process.

However, a major difference appeared between legal obligation (mandatory by law) and obligation for insurance purposes (required by insurances). Examples to illustrate the first case are: Germany, where the intervention of TIS is required in the frame of the building permit, Sweden, where assessment by a private organisation is mandatory (Visscher Henk and Meijer Frits), UK, where building regulation approval is needed as well (Royal Institution of Chartered Surveyors 2015 ; Johnson Hugh 2015 ; Planning Portal 2015 ; De Decker Thomas 2013). In Ireland, this obligation is

more complicated: it is mandatory to refer to the building control authority but inspection is not systematic (Heritage and Local government of Ireland).

On the other hand, the intervention of TIS is almost exclusively required by insurances: in Belgium for example, depending on the value of the building (Deman Jonas 2013 ; De Decker Thomas 2013). It is however important to note that in this country, insurance is voluntary (but widely used).

Between these two cases (legally mandatory or required by insurances), a lot of countries have a mandatory-based system of technical inspection, whether it is required by insurances or by the government: Italy, France and Spain (Instituto de Ciencias de Construcción Eduardo Torroja 2015 ; Javier Lopez y Garcia de la Serrana ; Gobierno de Espana - Ministerio de Fomento 1999) illustrate this case. In each of these countries, the frame of obligation depends on the type (housing, public buildings, etc..) or the complexity (size, cost, etc...) of construction.

2.b Who do TIS work for?

Generally speaking, it can be conclude that when TIS are embodied by local authorities they work for the administration itself (Cyprus, Czech Republic, etc...) and when TIS are private bodies, they mostly work for the constructor or the owner of the project (Belgium, France, Sweden, UK, etc...). Exceptions are when local authorities delegate to private controller as we have seen it might happen. In Germany, in the most important construction works, an independent body may intervene in addition to local building control, for the owner (De Decker Thomas 2013).

Therefore, TIS may act as a delegation of powers granted by the government, on technical aspects or for a client, whether it is mandatory or a specific technical assistance is wanted.

Moreover, a third case exists, with TIS working directly for insurers. This happens in United Kingdom for example, in the frame of the Home Warranty: indeed, NHBC produces its own norms and has a control service inspecting constructions.

3 Conformity assessment and risk analysis approaches

Depending most of the time on whether TIS are local authorities or private bodies, or indeed, whether they work for administration or owner of project, their role is different. We have distinguished two different fields of action: conformity assessment or risk analysis. The third part of this chapter defines more precisely the role of TIS, linked to insurances and liabilities. It will sum up the frame of intervention of technical inspection giving what interests us for ELIOS.

3.a Conformity assessment

Conformity assessment is based on regulatory requirements. It results most of the time in the production of certificates and attestations. Cyprus, Denmark, Ireland and Czech Republic are example of countries where TIS do essentially conformity assessment (Heritage and Local government of Ireland). In Slovakia, the mission of TIS is checking the process and the products of construction according to the building permit. In France, conformity checking is also part of the mission of the technical controller but remains not the main objective. In Spain, OCT's are not in charge of the control of conformity but the city council is. Similar case happens in Belgium where TIS are not involved in the completion certificate (that is produced by the architect or engineer). The Netherlands are specific as the system is changing (Visscher Henk and Meijer Frits ; Deman Jonas 2013) but inspection is carried out by municipalities on a base a precise protocol with checkpoints. This approach is typical of conformity assessment; however the establishment of such matrices had been based on a risk analysis approach in the first place (PCR 2011).

3.b Risks analysis

In countries where risks analysis is the primary aspect of the mission of TIS, standardisation of risk is the main objective. This is the case in Belgium (Deman Jonas 2013 ; De Decker Thomas 2013). In Spain (Instituto de Ciencias de Construcción Eduardo Torroja 2015) or in France, the intervention of TIS consists mainly on evaluating construction risks. In Sweden, technical controllers have a sort of risk analysis approach: a quality control plan is defined by a quality site manager for the construction. Similarly, in UK, the approach is more of a risk analysis as decisions of TIS must be reasonable and they would be relieved of their liability (Johnson Hugh 2015).

This notion of liability and link to insurances is crucial as it will be seen in next paragraph. In order to carry out their analysis, TIS have different tools, such as quality signs that are described later.

3.c Conformity assessment or risk analysis in relation with insurance regimes

The research and investigations, mainly based on questionnaires and interviews, have resulted in a more precise definition of the role of the private technical inspector in the construction process. Several factors are involved:

- The construction defect protection model
- The liability regime (legislative, contractual, etc.)
- Liability coverage (insurance, bank guarantee, etc.)

Even though no official classification of liability regimes exists, four types can be distinguished at present whose characteristics can be used to define the technical inspector's role. In this part the corresponding operating modes are identified and one or two examples are given to illustrate each particular case.

Type 1: Countries in which TIS role is essentially legislative-based and contractors are required by law to take out insurance to cover their liability

- The technical inspector assesses the construction risks. This helps to determine the construction insurance coverage required and prevent any further defects.
- The technical inspector is also delegated by the administrative authorities to inspect drawings and technical details and conduct on-site inspections in order to ensure that the project meets the regulations.
- Building contractors are required to provide ten-year and two-year warranties.

Case of France:

The technical inspection of constructions can be compulsory by law or optional but when it is not compulsory, it is often required to the owner by the insurance company. It is compulsory when stipulated by the legislation, particularly in the case of certain public assembly buildings, very high buildings and exceptional structures (span, depth, cantilever). Solidity, safety of persons, respect of earthquake construction regulations and regulations pertaining to accessibility for the disabled are the main concerns.

The technical inspector must take out ten-year warranty insurance. Like the contractor, the inspector has a public liability insurance obligation for 10 years after acceptance of the construction. General references (Deman Jonas 2013 ; De Decker Thomas 2013).

Type 2: Countries in which TIS role is essentially legislative-based but in which there is no legal insurance obligation for construction defects even though such insurance is widely practised

- Technical inspectors are delegated by the administrative authorities to inspect drawings and technical details and conduct on-site inspections in order to ensure that the project meets the regulations.
- When an owner chooses to take out ten-year inherent defect and two-year equipment cover, the technical inspector is called upon by the insurers but contracts with the owner in order to assess the construction risks.
- The technical inspector's role is therefore very similar to that of type 1 described above.

Case of Luxembourg:
The owner takes out optional ten-year and two-year liability insurance for the project concerned. All defects are covered without having to determine liability.
The technical inspector contracts with the owner or sometimes with the building contractors at the owner's request. The inspector's risk assessment is mainly based on the solidity of the main structures (frame/roof) but sometimes includes smaller structures defined under the terms and conditions of the agreement. The guidelines used to carry out the assessment are mainly German and Belgian standards.
Compliance with the regulations is determined by an approved organisation which performs acceptance of the completed work required by the operating authorisation. Technical inspectors are also approved organisations.

Type 3: Countries in which TIS role is essentially legislative-based but where contractor's insurance is neither compulsory nor frequently used
Case of Czech Republic:
- Technical inspectors are very rarely called upon. Construction projects are inspected at the beginning and end of the project by the Building Inspection Department, which is a local authority, in order to grant planning permission and operating authorisation and during construction by government officials and approved engineering consultancies.

Type 4: Countries in which TIS role and insurance covers are completely or mainly contractual
- The role of independent technical inspectors varies considerably according to the country. When called upon, the inspector may contract with the Owner, the architect or the building contractor.
- The technical inspector is more concerned with verifying conformity than with analysing risks.

Case of Great Britain:
Technical inspection is very common due to both legal obligations and insurance practices. The law stipulates that all constructions must be inspected to ensure compliance with building regulations, starting with the planning permission phase. On-site inspections are then carried out during construction and a completion certificate is issued at the end of construction. The certificate guarantees that the building is fit for use. The owner decides whether inspection will be carried out by the local authorities or by an approved inspector such as the NHBC Building Control Service, a subsidiary of the NHBC insurance company. Inspections are often outsourced to avoid complaints in the case of defects.

In particular, insurers are often involved in the technical monitoring of housing construction. An insurer such as the NHBC thus has the necessary skills and human resources to carry out technical appraisal of construction projects (even before construction begins) and to inspect the work site even having remedial work carried out when necessary at the expense of the building contractor who has taken out the insurance. The specific role of the Building Control Service is therefore to

check compliance with rules established by the insurers (conformity) but it also means that construction risks are addressed.
General References (Royal Institution of Chartered Surveyors 2015 ; Johnson Hugh 2015 ; Planning Portal 2015 ; De Decker Thomas 2013).

Case of the Netherlands:
The local building authority is responsible, both operationally and legally, for technical inspection which is carried out during both the design and construction phases (verification of compliance with building regulations).

Technical inspection is based on detailed design documents supplied by the owner to the service in charge of inspection of construction and housing.

Inspection concerns not only compliance with town planning regulations but also with the rules, technical standards and instructions in force including insulation, respect of environmental regulations, fire protection, etc. The documents required now systematically include the design of the building foundations and a ground survey whose validity is checked by the service concerned. Inspection of the stability and solidity of the structures is usually outsourced to certified engineering consultancies. General references (PCR 2011 ; Visscher Henk and Meijer Frits ; Deman Jonas 2013).

The present approach helps us to understand the responsibility of technical inspection services in the field of construction and to determine their role in risk assessment. The party responsible for the risk and how it is insured must first be identified in each country. We could then study the tools and guidelines used by technical inspection services to analyse risks and identify the quality markers which enable them to insure a construction product or method.

Main classifications and conclusions of this research can be found in following table.

The following table sums up the different classifications and conclusions we have drawn after our researches. It focuses only on some countries.

	TIS is							
Countries	**Voluntary***	**Mandatory***	**required by insurance***	**TIS work for…**	**TIS is…**	**Conformity assessment**	**Risk analysis**	**Is TIS accredited?**
Belgium	The owner might seek TIS intervention		Depending on the value of the building TIS may be required by insurance. Insurance is voluntary but widely used.	The owner	Private bodies. In some particular cases public authorities intervene at the completion stage (hospitals,hotels,etc..)	TIS are not involved in the completion certificate (that is produced by the architect or engineer)	standardisation of risks remains the main objective	Accredited by the BELAC
Cyprus				*A priori*, the local authority	Building Control Authorities (public)	conformity ckecking	no risk assesment	*A priori* local authorities do not need accreditation…
Czech republic		Intervention of TIS is mandatory		*A priori*, the local authority	Building control department (public, i.e. local authority)	conformity checking	no risk assesment	*A priori* local authorities do not need accreditation…
Denmark	TIS intervention is optionnal				Both local authorities and approved independent controller	mostly conformity checking		private controller are accredited
France		Intervention of TIS is most of the time mandatory	May be required by insurance for housing	The owner	Private bodies.	Conformity ckecking is part of the mission but not the main objective.	Mostly risk analysis	Accredited by COFRAC

Germany		Mandatory, in the frame of the building permit		Local authorities, when they are themselves not qualified enough to carry out technical site inspections. In the most important construction works, an independent body may intervene in addition to local building control, for the owner.	Local authorities (lawyers and engineers) or private checking engineer if the project is complex			private checking engineer needs to be accredited
Ireland		It is mandatory to refer to the building control authority but inspection is not systematic		*A priori*, the local authority	Building control system (local authorities) . There exist complementary private building control bodies (no information on their role)	Mostly certificates of conformity.		
Italy		Mandatory intervention	May be required by insurance for housing	Administration	Private bodies or administration for the smallest projects			Technical control bodies must be accredited for construction work of more than 20Millions euros
Malta	There seems to be no real technical control, except for the MEPA			Government	MEPA: Malta Environment and Planning Authority	Conformity on substainability		

Portugal						There is no technical referential therefore no possibility of establishing conformity.		
Slovakia				The constructor	Private bodies	Checking of the process and the products of construction according to the building permit.	No risk analysis	TIS must have the authorisation of the chamber of construction engineers.
Spain		May be mandatory in some particular cases (mostly about safety)	Mostly required by insurers	The owner	The city council on one hand, OCT (Organismo de Control Tecnico) on the other hand. They do not interfere.	The city council is in charge of the control of conformity	OCTs evaluate construction risks	
Sweden		Assessment by a private sector orgnisation is compulsory.		The owner	Local authority (Committee) for building plans, some supervisions and completion certificate but not on a technical approach. Private control bodies for technical requirements.	The committe is in charge of the conformity part.	Technical controllers have a sort of risk analysis approach. A quality control plan is defined by the quality site manager.	Accredited by Swedac (Swedish board of Accreditation and Conformity Assessment)
The Netherlands	It is optional to have private TIS intervening. This possibility is recent enough not to		Nota: there is no compulsory insurance.		Municipal building authority on one hand and private approved inspectors on the other hand.	Municipalities use precise protocol with checkpoints to control construction.		Local authority are overseen by a national building inspectorate. Private controllers are approved.

	be widely used yet.							
United Kingdom		Building regulations approval is needed.		The owner	Building Control Bodies (BCB) of 2 types: Local Authority Building Control (LABC) or private sector Approved Inspector Building Control (AIBC). These approved inspectors may be corporate bodies or individual approved inspectors		The approach is more of a risk analysis. Decisions of TIS must be reasonable and they would be relieved of their liability.	UKAS inspection approves AIBCs

: no information

*: This may depend on the inspected domain; therefore it seems that discussing in general terms could be the most representative.

1.1.2.4 QS used by the TIS

As mentioned previously, technical building inspection involves both risk assessment and inspection using specific practices and methods based on technical guidelines that are specific to the country concerned (existence of building regulations, technical rules, etc.) which generally address one or more of the following actions:

- Assessment of compliance with regulations according to the use of the building as defined in the building permit
- Assessment of technical risks during design
- Supervision of construction and inspection carried out by contractors during construction,
- Assessment of compliance in view of building acceptance or operating authorisation.

Based on the above, insurers identify the structures/building parts at risk in order to determine the coverage to be applied. Some QS are also taken into account in risk assessment. These are mostly signs on construction systems and competences of designers/contractors.

Product performances, systems fitness
CE marking based on the declaration of performance of products provides information on essential characteristics of construction products related to basic requirements for construction work. This information is mainly based on existing harmonised standards. They can be used in conjunction with harmonised design rules (e.g. Eurocodes).
Such harmonized standards and rules are not available for innovative construction products. In this case, construction actors need information addressing the whole construction system (as defined in 1.2.1), i.e. relevant products characteristics, design, implementation and maintenance rules. Some specific QS (e.g. TA, see 1.2.4.2) carry such information. Trust in any of the above mentioned QS varies according to the subject and the origin of the QS.

Competence of building contractors
Recognition of the competence and professionalism of building contractors is also used during risk assessment. It is based on non-harmonised systems aimed at:

- Qualification of contractors by an accredited body – QUALIBAT in France,
- Pre-qualification of contractors in Germany and Great Britain,
- Certification of the construction process – KOMO in the Netherlands

Performances of building works
Labels and certifications which concern the building work as a whole are not used by the TIS for the purposes of technical assessment. Examples are EFFINERGIE, PASSIV HAUS, MINERGIE, QUALITEL, BREEAM and LEED. These signs concern the performance of building works after completion or during construction. They are not required by the regulations and are used for commercial promotion purposes.

1.1.2.5 Recognition of the profession of Technical Building Inspector

There are two possible ways of recognising the competence of technical building inspectors:

- The certification of services provided by the profession based on specific standard drawn up in conjunction with the insurers on the one hand,

- Accreditation of conformity assessment bodies (CAB) according to standard ISO 17020 to determine the conformity of construction projects to regulatory requirements on the other hand.

Accreditation of inspection activities in view of conformity assessment (CAB)
The State delegates validation of the competence and quality of the reports of Conformity Assessment Bodies (CABs) to the national accreditation body which regularly monitors the way in which they operate.
This system is already operating in several countries. Inspection bodies are accredited according to ISO 17020 as type A inspection bodies, that is, bodies that are independent of the parties involved, impartial and unbiased:

- The accreditation system maintained by the State guarantees the competence of all assessment bodies to inspect the regulatory requirements.
- This accreditation system is an international support system that provides formal recognition of the competence of a network of technical inspection services.
- The accreditation system exists in all the European countries (attached to the EA) and across the globe (attached to ILAC and IAF).
- An accreditation certificate issued for a given perimeter in a European country has the same value as an accreditation issued in another European country; it is also valid in countries having signed ILAC and IAF recognition agreements outside the European Union.
- Each European country has only one accreditation body: UKAS in the United Kingdom, DAkkS in Germany, COFRAC in France (complete list available on the EA website, on the "members" page.
- They are all members of a European organisation - EA (European co-operation for Accreditation) which harmonises the practices of national accreditation bodies. http://www.european-accreditation.org/ea-members. EA monitoring guarantees the equivalence of accreditation certificates issued in the different European countries by providing a solid foundation for mutual recognition.

Nonetheless, it seems unlikely that accreditation, i.e. the inspection of regulatory requirements by an independent third party (CAB), inspire confidence to those who, like insurers, depend on these bodies to assess construction risks. Consequently, another path could be the certification of the services provided by a TIS.

Certification of technical construction inspection process
Certification of technical construction inspection process would be governed by the network of professionals and issued by an independent certification body which recognises that the provision of services is in conformity with the commitments defined in standard specific to the profession.

The service certification standard would be defined collectively by the service providers (network of professionals such as Consortium of European Building Control) and the insurers on a European level, and incorporate performance requirements for risk assessment and technical competence of inspectors.

This service certification approach is complementary to the ISO 9001 certification approach:

- It would be recognised by insurers.
- The professional competence guidelines would be carried by European professional organizations.

- The professional competence standard on a European level would be common to all the certification bodies.
- The service certification attributed to a body in a European country would have the same value as the certification attributed in another European country provided that the standard are defined on a European level.
- The certification process would be recognized by an accreditation body that is a member of the EA (European co-operation for Accreditation) which ensures harmonisation of the practices of national accreditation bodies (European Accreditation 2015).

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Appendix A: TIS Survey Questionnaire

TIS SURVEY QUESTIONNAIRE

A- Framework

ELIOS 2 PROJECT

Elios 2 is a study initiated by the European Commission .It aims to "*Facilitate access to insurance by self-employed builders and small building firms so as to stimulate innovation and the promotion of eco-technologies in the European Union*"[1].
In order to do so, the Elios team notably seeks to set up a website to inform companies about the construction insurance requirements across the 28 constituent members of the EC.

Within the Elios 2 team, APAVE contributes to the Work-Package 3 which deals with "insurance".
For further details on Elios, its goals and organization, please visit: www.elios-ec.eu/

By completing this survey, you will help the industry to understand insurance information needs and procedures to obtain coverage in each EC country.

SUBJECT OF THE QUESTIONNAIRE

Therefore, on behalf of the European Commission, we would appreciate you completing this survey in order to provide information on the involvement of Technical Inspection Services (TIS) in the technical risk assessment for construction works.

You will help us to answer the following items:

- The countries where risk assessment by a technical inspection service is mandatory or voluntary and is linked to the insurance schemes,
- The prime requirements of the construction work which come within the technical Inspection scope and are guaranteed by the insurer,
- The types of concerned construction works,
- The mission of the technical controller,
- Which quality signs are used by technical Inspection service?

Feel free to add comments, or give a more detailed description of your conformity or risk assessment for construction work.

Filling in the questionnaire should take about 30 minutes.
The information collected through this survey will not be made available to any third parties except in anonymous summary report.

Many thanks for your contribution

B- Identification

Country
Name of your Company
Activity
Your Name
Address
Phone
E-mail

[1] Final report to be published by the European Commission by the beginning of 2015

Part A: Intervention of Technical Inspection Services (TIS)

Cases where Technical Inspection Services are involved in the technical risk assessment regarding construction works:

According to building main requirements, are technical Inspection Services carried out?

INDIVIDUAL HOUSING *Houses build for personal use*

Main requirements	On a mandatory basis	On a voluntary basis	Required by (re)insurance company	Never required
0-Being in accordance with the planned use	☐	☐	☐	☐
1-Mechanical resistance and stability	☐	☐	☐	☐
2-Safety in case of fire	☐	☐	☐	☐
3-Hygiene, health and the environment	☐	☐	☐	☐
4-Safety and accessibility in use	☐	☐	☐	☐
5-Protection against noise	☐	☐	☐	☐
6-Energy economy and heat retention	☐	☐	☐	☐
7-Sustainable use of natural resources	☐	☐	☐	☐

Comments

COLLECTIVE HOUSING *Dwelling buildings built to be sold*

Main requirements	On a mandatory basis	On a voluntary basis	Required by (re)insurance company	Never required
0-Being in accordance with the planned use	☒	☐	☐	☐
1-Mechanical resistance and stability	☐	☐	☐	☐
2-Safety in case of fire	☐	☐	☐	☐
3-Hygiene, health and the environment	☐	☐	☐	☐
4-Safety and accessibility in use	☐	☐	☐	☐
5-Protection against noise	☐	☐	☐	☐
6-Energy economy and heat retention	☐	☐	☐	☐
7-Sustainable use of natural resources	☐	☐	☐	☐

Comments

BUILDING WITH PUBLIC ACCESS

Main requirements	On a mandatory basis	On a voluntary basis	Required by (re)insurance company	Never required
0-Being in accordance with the planned use	☐	☐	☐	☐
1-Mechanical resistance and stability	☐	☐	☐	☐
2-Safety in case of fire	☐	☐	☐	☐
3-Hygiene, health and the environment	☐	☐	☐	☐
4-Safety and accessibilty in use	☐	☐	☐	☐
5-Protection against noise	☐	☐	☐	☐
6-Energy economy and heat retention	☐	☐	☐	☐
7-Sustainable use of natural resources	☐	☐	☐	☐

Comments

OFFICE BUILDING

Main requirements	On a mandatory basis	On a voluntary basis	Required by (re)insurance company	Never required
0-Being in accordance with the planned use	☐	☐	☐	☐
1-Mechanical resistance and stability	☐	☐	☐	☐
2-Safety in case of fire	☐	☐	☐	☐
3-Hygiene, health and the environment	☐	☐	☐	☐
4-Safety and accessibility in use	☐	☐	☐	☐
5-Protection against noise	☐	☐	☐	☐
6-Energy economy and heat retention	☐	☐	☐	☐
7-Sustainable use of natural resources	☐	☐	☐	☐

Comments

INDUSTRIAL BUILDING

Main requirements	On a mandatory basis	On a voluntary basis	Required by (re)insurance company	Never required
0-Being in accordance with the planned use	☐	☐	☐	☐
1-Mechanical resistance and stability	☐	☐	☐	☐
2-Safety in case of fire	☐	☐	☐	☐
3-Hygiene, health and the environment	☐	☐	☐	☐
4-Safety and accessibility in use	☐	☐	☐	☐
5-Protection against noise	☐	☐	☐	☐
6-Energy economy and heat retention	☐	☐	☐	☐
7-Sustainable use of natural resources	☐	☐	☐	☐

Comments

Part B: Process of conformity and risk assessments of construction works

The aim of this part is to answer the following questions:

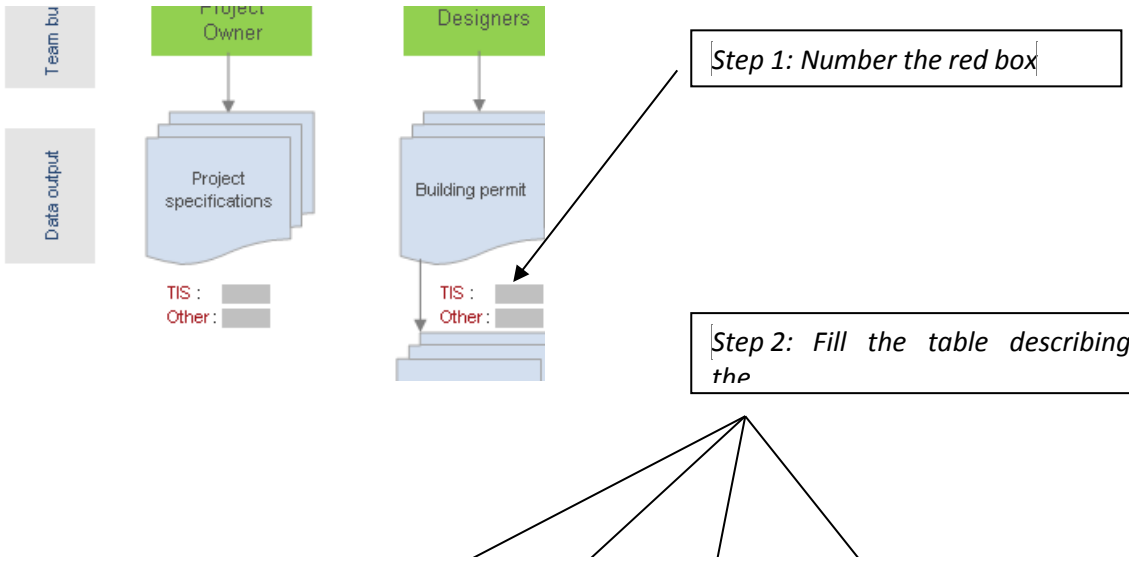
- During which phases of the construction and the exploitation of the building do assessment bodies (and more particularly the TIS) act?
- Who are the assessment bodies? (Authorities, private experts, TIS,TAB…)
- For whom do they work?
- What is the modus operandi of the assessment bodies?

In order to answer these questions, you will find next page a synthetic diagram representing:

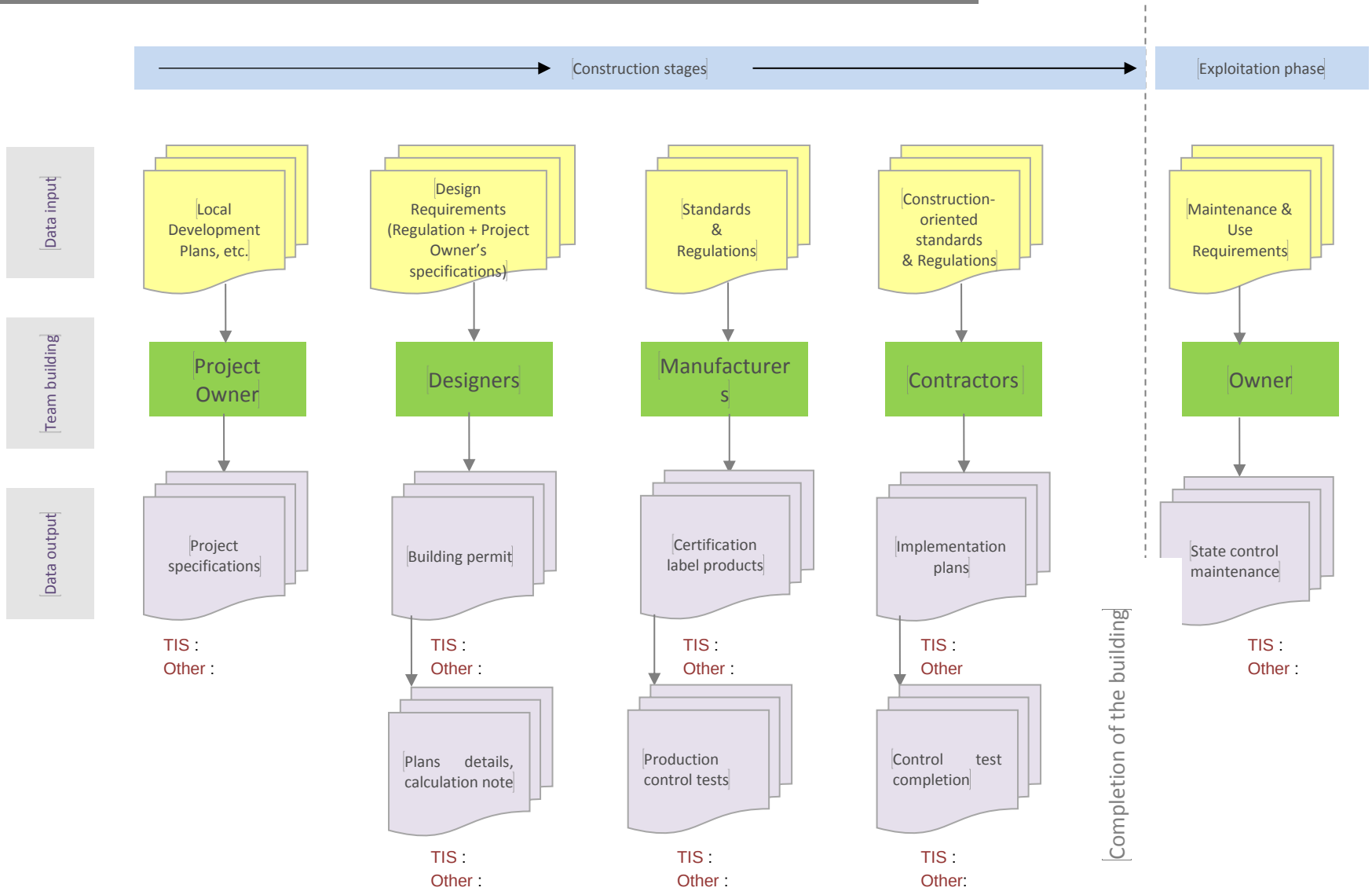
In green boxes: the stakeholders of a construction project
In yellow boxes: the type of regulation that may apply
In blue boxes: the data they exchange

You will find also a table to be filled along with the diagram: please number the grey boxes corresponding to a conformity or risk assessment and explain the process in the table.

Example:



¶ number¶ ¤	¶ Assessment·body¶ (eg.·authorities,·private·experts,·TIS,·TAB,·etc.)¶ ¤	Evaluation·report's·recipient¤	¶ Criteria·used·for·conformity·or·risk·assessment· (e.g.·product·certificate,·quality·management·system,·test·reports)¤	Comment·(e.g.·conformity·or·risk·assessment?)¤
¶ 1¶ ¤	*Who·carries·out·the·assessment¤*	*Whom·the·mission·is·contracted·with¤*	*The·regulation·that·is·applied·and·the·quality·signs·that·are·used¤*	*Add·any·comments¤*
¶ 2¶	¤	¤	¤	¤


Construction stages
Exploitation phase
Data input
Team building
Data output
Local Development Plans, etc.
Design Requirements (Regulation + Project Owner's specifications)
Standards & Regulations
Construction-oriented standards & Regulations
Maintenance & Use Requirements
Project Owner
Designers
Manufacturers
Contractors
Owner
Project specifications
Building permit
Certification label products
Implementation plans
State control maintenance
TIS :
Other :
TIS :
Other :
TIS :
Other :
TIS :
Other
TIS :
Other :
Plans details, calculation note
Production control tests
Control test completion
TIS :
Other :
TIS :
Other :
TIS :
Other:
Completion of the building

number	Assessment body (eg. authorities, private experts, TIS, TAB, etc.)	Evaluation report's recipient	Criteria used for conformity or risk assessment (e.g. product certificate, quality management system, test reports)	Comment (e.g. conformity or risk assessment?)
1	[ ]	[ ]	[ ]	[ ]
2	[ ]	[ ]	[ ]	[ ]
3	[ ]	[ ]	[ ]	[ ]
4	[ ]	[ ]	[ ]	[ ]
5	[ ]	[ ]	[ ]	[ ]
6	[ ]	[ ]	[ ]	[ ]
7	[ ]	[ ]	[ ]	[ ]
8	[ ]	[ ]	[ ]	[ ]
9	[ ]	[ ]	[ ]	[ ]
10	[ ]	[ ]	[ ]	[ ]
11	[ ]	[ ]	[ ]	[ ]
12	[ ]	[ ]	[ ]	[ ]
13	[ ]	[ ]	[ ]	[ ]

Part C: Quality signs regarding technical risks assessment

Please tick the quality signs that Technical Inspection Services consider when assessing technical risks related to a construction work as a whole or in its separate parts.

Regarding the product or the system	☐ CE marking ☐ Product certificate / quality signs *Please, give some examples*: ☐ Test reports ☐ Pathology ☐ Other:
Regarding professional skills / quality management	☐ Management system's certification ☐ Quality plans ☐ Quality signs (qualifications, authorisations, accreditation…) *Please, name the principal one* ☐ Others :
Regarding suitability for intended use	☐ Specific studies ☐ Contractor's verification procedures ☐ Others

Please describe shortly your conformity and/or risk assessment procedure when in front of an innovative eco-technology that is to be implemented in a construction work, focusing on quality signs that you consider relevant

Part D: Liability of the TIS

Do Technical Inspection Services have a liability?

- ☐ Yes, legal liability
- ☐ Yes, penal liability
- ☐ Yes, other:
- ☐ No

If the TIS have a liability, is this liability insured?

- ☐ Yes, on a mandatory basis
- ☐ Yes, on a voluntary basis
- ☐ No

In the case of an insured legal liability of the TIS, is the amount of the guarantee limited?

- ☐ Yes
- ☐ No

If yes, what is this amount?

- ☐ Amount limited to:
- ☐ Unknown

Comment field :

Please send your questionnaire back by e-mail: **elios2@apave.com**

Or post to Claire DOUTRELUINGNE

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Phone number 0033 492 294 058 or mobile 0033 626 606 131