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A B S T R A C T

The search for energy efficiency is an increasingly important requirement in the construction or renovation of residential, tertiary and commercial buildings. This requirement imposes the implementation of effective strategies for evaluating energetic performances. However, most of the literature works focused on the use of analytical approaches which sometimes proves insufficient, in the absence of taking into account the practical realities. This paper presents a methodology of risk analysis and assessment for efficient performance of buildings using the knowledge capitalization and exploitation from experience feedback processes.The target buildings (residential, tertiary and commercial) are chosen in the airport area of aeronautic context in which the lessons learnt are generated from the environmental assessment with the assistance of the main domain actors (experts, technicians and users). The effort is focused on identification of non-qualities and discomforts whose resolution could contribute to improving the energy and environmental performance of buildings. This approach integrates the collection of experienced knowledge from passive design strategies of sustainable buildings with innovative practices. Capitalization of knowledge from experience feedback processes will foster the development of proposais for preventive and corrective solutions and dissemination of good practices for solving problems regarding pathologies, damage, and other dysfunctions observed in the building field.

Keywords:
Experience feedback
Performance evaluation
Buildings
Risk
Assessment
Aeronautics

1. Introduction

It is estimated that the global economic activity will be quintupled by 2056, the world population will increase by 50% and global energy consumption will nearly triple (Ilha et al., 2009). Today, the building sector is responsible for many significant influences on our society with some environmental and economic impacts.

Most of the environmental impact is the consequence of the high energy consumption in buildings (polluting energy source, energy intensive equipment, construction methods not adapted to the local climates, etc.). So, there is a need to develop more sustainable strategies in building projects. For instance, there are many options to exploit solar energy in the Sahel areas where a sunny area with nearly 300 days of sunshine a year with temperatures of-30-45 °C in the shade. Meanwhile, the global warming contributes to rising temperatures aggravating the Jack of comfort and the growing need for electricity for air conditioning and ventilation of urban buildings for those who have the financial means. The notion of performance building in many regions of the world is not so new because for a long time our ancestors had some typical houses which were built using local materials (straw and wood houses) and nowadays other typical buildings are established: for example, the use of clay brick constructions in temperate or tropical climates provides good insolation and prevents thermal bridges.

In addition, the consequences of rapid urbanization in many cities in different continents cause two main problematic situations:

(i) On the one hand, there is a strong pressure on infrastructure and community facilities (increasing demand of social services including housing);
(ii) On the second hand, there is the approximation of dwellings in very sensitive areas (e.g.airport zone) causing degradation of the environment with some dangers for the quality of the vital space.

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Given these facts, a renovation in our construction techniques for energy and environmental performance of buildings in the developing and developed countries is increasingly required and economically viable.

Nowadays, many standards prescribe the eco-friendly construction, and therefore energy-efficient, design of buildings by using some sustainable and economic design principles called "passive buildings" that are applied in many countries.

The construction techniques of such passive buildings are focused on the architectural aspects (form, layout, choice of materials, and the building envelope) for better reducing energy consumption in buildings. To further consolidate these building techniques, assessment tools or methods of existing buildings are needed. This includes the Green Building Rating Tools (GBRTs), a set of assessment tools for sustainable buildings:

- BREEAM (BRE EnvironmentaJ Assessment Method),
- LEED (Leadership in Energy and Environmental Design),
- CASBEE(Comprehensive Assessment System for BuiJt Environment Efficiency),
- BEAM (Building Environmental Assessment Method) Plus,
- GBL-ASGB (Green Building Labeling-Assessment Standard for Green Building),

In different continents, BREEAM, LEED, CASBEE, BEAM plus and GBL-ASGB are adopted by architects, engineers and Researchers from more than 20 years to heJp promote more sustainable constructions. Each of these assessment tools (GBRTs) highlighted the energy usage as an important part of the evaluation of buildings and provided advices on the most effective strategies of energy consumption (Chen et al, 2015).

The present article contributes to these tools through a methodology of risk assessment of energy performance in buildings studied. The methodology is based on the approach of experience feedback (Retour d'Expérience, abbreviated REX) (Kamsu-Foguem et al., 2015; Kamsu-Foguem and Abanda, 2015; Kamsu-Foguem and Mathieu, 2014; Kamsu-Foguem and Noyes, 2013; Jabrouni et al., 2013; Potes Ruiz et al., 2013; Kamsu-Foguem et al., 2013; Potes Ruiz et al., 2014; jabrouni et al., 2011; Kamsu-Foguem et al., 2008).

An approach whose relevance analysis and evaluation is recognized by the work done in the framework of the "RuJes of the Grenelle Environment Art 2012" in France.

This study is conducted to enhance performance of energy and environmentaJ quality of buildings.

For this, an evaluation and anaJysis of risks related to study factors influencing this performance is critical, it affords us to indicate:

- works that could lead to performance probJems (disorders, none qualities) by warning dangers of some implementations;
- works and good practices that promote energy savings, white ensuring users' comfort, environmental preservation and the building sustainability.

These evaluation and analysis are based on field surveys for feedback from specialists. During the meeting with the players involved in the design, the construction and the use of buildings visited, data collection and information is done in situ. The collected data are related to the information on the materials and techniques used, the buildings requirements of energy (why these needs), behaviour and comfort need of the inhabitants, etc.

The collection of such data and information allows us to:

- identify ait components that contribute to thermal behaviour of the building;
- analyze the various links between them;
- make thermal simulation with software to identify overall thermal operations;
- have a passive or bioclimatic building approach to interpret consumption observed to consider the most efficient energy provisions;
- jointly study its thermal behaviour of winter and its summer thermal comfort;
- recommend that improvements don't risk causing disorders.

From these analyzes, the achieved results allow us to estimate the weaknesses (risk factors) but also the qualities that influence the performances (energy and environmentaJ) of the building. This risk assessment study allows prioritising the most appropriate improvements to offset its weaknesses but also to preserve its thermal qualities. The good practices implemented in these target buildings are capitalized to provide quality improvement levers.

2. State of the art review

Risk assessments in buildings are related to aspects that determine their level of energy and environmental performance i.e. the thermo-physical envelope, geometry (shape and orientation), windows, sealing air and infiltration.

Studies have shown that two-thirds of discomforts can be eliminated by judicious use of simple passive designs taking account of the thermo-physical properties of the envelope and the configuration of the envelope (Ralegaonkar and Gupta, 2010). The schematic configuration of constructions allows the management of peripheral obstructions and any other relevant externat circumstances to determine the shape and orientation of the building that influence the availability of daylight and solar gain. Thermo-physical envelope consists of the application of thermal insulation materials and storage to reduce the transfer of heat by conduction through the walls, roof, windows and subsequently the conditioning Joad of air. Parameters such as ratio window surface/floor surface of the room, the location of the window and the sun breaks are classified as factors influencing the geometry of natural lighting, ventilation and solar gain. The airtightness and infiltration are important factors influencing the unfavourabJe heat gain or Joss of contrai through the cracks in the building envelope.

2.1. The thermo-physics envelope

The building envelope consists of walls, roof and fenestrations whose thermal properties greatly affect the cooling load/heating air-conditioned interiors. The thickness of externat wall insulation is one of the most important parameters that help save 70% of the annual heat load (Gong et al., 2012). The reduced thermal load can be managed with renewable energy sources to minimize energy consumption of a passive house (Badescu et al., 2011).

Hollow lightweight bricks with complex internai cavities of construction system compounds can be used to replace ordinary bricks only having large cavities (KoCi et al., 2014). The wall thickness at the use of such bricks may be reduced considerably, even those of wood-based houses. These bricks are overwhelmingly superior to the common brick as regards the vapour transmission rate of the thermal storage properties, tire resistance and biological stability, based on computer analysis. The bricks of low-cost fly ash were also used to build effective passive houses in Africa. The addition of fly ash with clay bricks improves properties by reducing the thermal conductivity and the water absorption. This type of South African houses meets the thermal comfort standards in 66%

of the time in summer and 79% in winter on a year of data monitoring (Makaka et al., 2008). Dynamic insulation reduces heat Joss by recycling the heat conducted through the building envelope to minimize the cross-sectional temperature gradient, which is normally realized by an air stream through a porous and permeable medium in the opposite direction of the heat conduction. ln a tropical house, the roof can contribute up to 70% to the total heat gain (Al-Obaidi et al., 2014) so that the use of reflections, radiators and insulating materials are considered to be effective in terms of contributing to reduce heat gain and create a comfortable indoor environment. The adoption of green roof vegetation or other insulation materials can significantly reduce the external gain through the roofs of buildings. The light colours of roofs and facades that absorb Jess heat can reduce building energy consumption and this colour choice is generally adopted for buildings located in the areas with warmer climates (e.g. the Southwest region of United States of America) as suggested by the statistical survey on the prevalence of passive strategies (Kruzner et al., 2013). The insulation of the roof in a house with passive design features has been shown to reduce bath cooling and heating Joads by slightly increasing the average air temperature in winter and decreasing in summer soil temperatures (Benhamou and Bennouna, 2013). The insulated sandwich panel roofs and integrated with phase change materials (PCM) have proven to be effective strategies for reducing the energy Joad for houses designed with passive principles (Kong et al., 2014).

2.2. *The geometry and orientation of the building*

Aspects such as cooling, heating and lighting are the characteristics of the passive design of buildings. However, obstacles near the site can severely affect access to daylight, because natural ventilation and dissipation of pollutants could be blocked. Obstructions, uneven obstacles forms of construction, the effects of the non-optimal orientation of the glazing and self-shadowing are identified as possible constrictions affecting the implementation of solar access techniques (Littlefair, 1998). The sunshine criteria given in other GBRTs also require consideration of the impact of neighbouring buildings during orientation and simulation calculations. Many analytical methods, including simple criteria (e.g. angular measurements) provided by computer programs/software such as TOWNSCOPE and SOMBRERO are already used to estimate the access of sunlight (Chen et al., 2015). In addition, the coefficient of buildings and ground reflection surfaces can also have an impact on the particularly high energy performance. IES-VE (synthetic building simulation software) is able to associate the light of day and the dynamic thermal analysis to perform calculations with self-adjusting lamps (Chen et al., 2015). A survey of 60 residential buildings was conducted to explore the concept of trends and patterns related to high-rise buildings in Hong Kong. Three configuration patterns have been chosen for the study done in (Chan, 2012). Interactive Shading between adjacent apartments can generate more air conditioning and energy saving charge of additional lightings consumed during the day based on the type of lighting schedule in Hong Kong's subtropical climate. Five key design parameters, namely the orientation of the building, the fiat surface, the area of the window, the type of glazing, shading and colour of the outer surface finish were studied by a simulation study (Li et al., 2006). lt was recommended that the angle of obstruction for a kitchen should not be less than 10° and is within the range from 25° to 45° to the bedroom in order to achieve a light factor of the average day (DF) of 1%, 1.5% and 2% for the bedroom, living room and kitchen respectively.

The orientation and shape determine the level of solar radiation incident on a building facade. The azimuth of the wall and building orientation is in favour of the design by Jowering the cost of the initial design, increasing the amount of daylight and reduce energy demand (Pacheco et al., 2012). ln a cold region of Turkey, the orientation of angles between 0° and 90° and form factors (the ratio of the Jongest and smallest dimension of the building, e.g. 2/1, 1/1 and 1/2) were investigated by a parametric study (Aksoy and lnalli, 2006). The buildings with different combinations of orientations and form factors can contribute to energy performance with energy saving rates between 1% and 5%. The sustainable construction practices also derive the optimal form factors and building positions based on parametric analysis. The calculation of solar radiation on the facades of buildings, a south facing wall showed that the optimal high heat gain in winter and cooling Joad in summer is limited, so the biggest walls in the considered construction region should be directed towards the South (Mingfang, 2002).

2.3. *Infiltration and airtightness*

Infiltration refers to uncontrolled movement and unfavourable of air through the building envelope due to leakage. The air conditioning Joad can be greatly affected by the infiltration of unconditional air brings, by the warmth, moisture and outdoor pollutants. The inner surface of the outer walls can still encounter problems of condensation caused by temperature differences. The condensation on the wall surfaces causes biological contamination and compromises the quality of the inside air. An effective way to alleviate uncontrolled seepage is to improve the building seal. The airtightness is measured by pressurizing the building under pressure of 50 Pa and recording its air exchange rate per hour (ACH), through a blower door tests (Blower Door Test) (Badescu and Sicre, 2003). For a building based on the passive house concept, the CHA should normally be less than 0.6 (Mahdavi, 2010; Allard et al., 2013). In a passive house in Germany, the air change rate per hour under a pressure of 50 Pa was measured at 0.27 Pa of the interior volume in order to test the appropriate airtightness of the house. However, such a tightness test may not be applicable to large buildings in the target area; in this case a domain mode! or a thermal imaging is feasible for indoor surveillance. The calculation of the infiltration load was divided into sensible and latent loads using a linear function connecting the loads to the outside temperature (Wang et al., 2014). Tian et al. (Tian et al., 2014). have checked in their study of the sensitivity analysis that infiltration is the third highest contributor to the heating Joad after the U-value window and the heating set point.

3. Methodology and approaches adopted

The methodology of this research study is structured in six well-defined andsequential steps: (1) selection of the buildings, (2) selection of actors and site visits, (3) capitalization of information, (4) the extraction of information, (5) data analysis and risk assessment and (6) restitution of the results.

The graphie illustration and details of these six steps are given below (Fig. 1):

3.1. *Stage 1: selection of the buildings*

The constructions having the High Environmental Quality certification and buildings relying on innovative products or processes are favored during the selection stage. The selection criteria are focused on energy and environmental performance of target buildings. These performance criteria solicit buildings with Jow energy consumption in which solar lighting and natural ventilation are encouraged and airport buildings in which the waste disposai and discharge are mastered concerning the use and recycling of

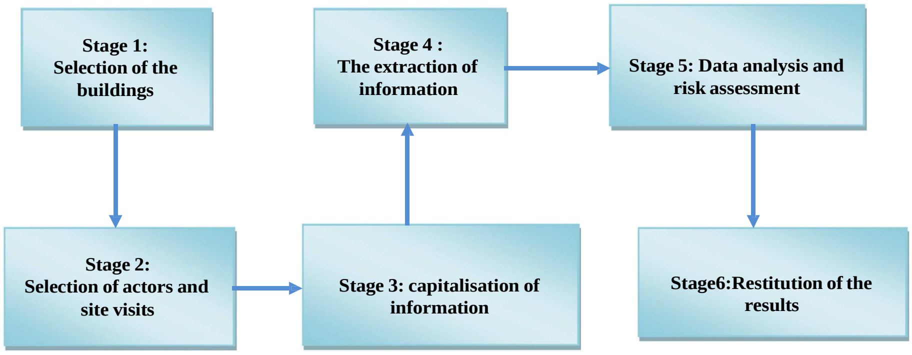

Fig. 1. Graphic illustration of the steps included in the proposed methodology.

polluting products (e.g. carbon dust, lubricants with metal-carbon etc.) and other buildings requiring extensive renovation and refurbishing works.

3.2. *Stage 2: selection of actors and site visits*

The selection of actors and site visits are two important parts of this stage. It involves identifying different actors in the construction sector who are willing to share their knowledge. Their experiences and motivations are crucial to support the collection of qualitative and quantitative information. The actors consulted belong to the three categories of stakeholders involved in the construction or use of buildings: designers (architects), manufacturers (engineers, masons, carpenters …) and operators (users). A field survey is conducted to collect in situ observations and interview of actors (from the design phase, to construction and usage phases). The visits of buildings are essential in order to anticipate further interviews and take photos for illustration and consolidation of information concerning the quality of execution of construction projects. For each construction project visited at least two different actors are interviewed to cross their opinions and to have a comprehensive and objective views of relevant information from experience feedback processes. Some buildings can be visited during the construction phase to see the difficulties faced by constructers. Depending on the nature of stakeholders, the survey may be in face-to-face interviews or in questionnaire (form to be completed); it allows us to derive the maximum of information relating to non-qualities. After this step, it is possible to organize the selected data into a database configured to structure the collection of disorders and possible solutions.

3.3. *Stage 3: capitalization of information*

After investigation, the database is completed with a criticality matrix that is built in the working group (including actors from the construction sector and actors from computer science). This working group aims at elaborating an effective means for processing information in order to characterise the different disorders observed in each phase of construction projects and also to capitalize the best practices.

For instance, the information can be processed using data mining tools whose the general principle of analysis is consistent with the knowledge discovery in databases process. The risk matrix supports the evaluation and classification risks according to their criticality by means of a risk rating that includes the following elements:

- Three severity levels: minor, moderate, major
- Three occurrence levels: minor (1 or 2 repetitions), medium (2 or 3 repetitions), and major (more than 3 repetitions)
- Three risk levels (obtained by crossing severity and occurrence): Low/Medium/Strong associated with a color code (green, orange, and red respectively).

The color code allows:

✓ To carry out a comparative ranking of risks;
✓ To prioritize improvement actions.

The severity categories are determined in collaboration with the technicians of buildings, and, energy companies. The results of the risks assessment can be formalized in a summary table having a structured format and a specific notation. The characteristics of the buildings, as well as information collected on the disorders are described in this table.

3.4. *Stage 4: the extraction of information*

The extraction of information allows us to classify the various categories of disorders: difficulties, malfunctions, damage. These categories of observed disorders are described by an explanatory text and indexed according to the technical element concerned, the origin of the disorder and its impact. The corrective solutions and good practices associated with these disorders are also described. They provides ome elements of continuous improvement for all actors involved in the target construction project.

3.5. *Stage 5: data analysis and risk assessment*

Risk analysis and data evaluation are carried out in several stages. In order to analysis the raw information from experience feedback and help determining the technical causes of the disorders, the task force can include the following actors:

- Representatives of businesses and artisans;
- Representatives of project management (design office and architects);
- Technical controllers;
- Expert;
- Insurers

The risk assessment is based on the occurrence of observations in the obtained samples and severity of the disorders. The criteria chosen for the study of occurrence are related to the probability of occurrence of the risk factor and therefore exposure to the hazard. The crossing of the occurrence and severity of observations within

Table 1
Criticality matrix.

Description of the observation is established, its main origin and its impacts		Degree of improvement or deterioration in the energy and environmental performance		
	Levels of occurrence	Minor	Medium	Major
	Major	M	fu	fu
	Medium	Fa	M	Fo
	Minor	Fa	Fa	M

the matrix defines the level ofrisk in constructions studied with the classical formula:

(Occurrence of the observation) X (Severity of the observation).

The definition of risk status is not based on an accurate risk-scoring but on a subjective assessment of risk. The criteria chosen for the study of occurrence are related to the repetition of the risk factor and therefore exposure to the hazard. However, occurrence was sometimes modulated by the background knowledge (e.g. assumptions estimating the potential development of the disorder or the estimate of the development of the market shares of the affected system).

The exercise is to fill the database of criticality matrix for processing and interpretation of information related to risk estimation with deterioration characterization or identification of opportunities for improvement (Table 1).

The risks of pathologies are assessed and fall into various categories: the risks of discomfort, health risks, safety or security risk, risks to health, tire risk, legal risk, etc. The severity level (low, medium or major) is given by the cost of maintenance and the complexity of the recovery solution development.

For each of the findings, the risk assessment conclusions are shown in the columns of energy performance and Pathology. The criteria taken into account for the evaluations are shown in these columns. Risk levels and building types are listed in the tables below (Tables 2 and 3):

3.6. Stage 6: restitution of the results

The expected results capitalize the relevant elements of experience feedback processes achieved by actors acting for sustainable buildings with high environmental quality.The main non-qualities observed in the field are presented with corrective solutions and associated good practices. Sharing these information and knowledge from experience feedback processes can contribute to raise awareness of ail stakeholders. It is part of a continuous improvement approach, allowing avoiding the repetition of the identified or similar mistakes. It also aims to serve as a pedagogic resource to continuous training based on learning by errors (RAGE, 2014).

Table 2
Risk levels.

Fo	Serious risk
M	Medium risk
Fa	Slight risk
V	Weak risk
So	Without abject

Table 3
Building types.

MI	Individual house
C	Collective building
T	Commercial building
A	Airport building

4. case study: Final Assembly line (FAL) of the new airbus A350

4.1. Presentation of the case study

The construction project of a new logistics building called Final Assembly Line (FAL) completed for the final assembly of the new Airbus A350 was chosen for the case study of efficient and airport buildings. FALs are designed by stations, with each accomplishing an explicit task in the aircraft's production and logistics. The use of the building began in the early 2010s on the outskirts of Toulouse airport (South west region of France). With 300 m long, the L-shaped building rises to about 35 m to the highest architectural element. In 2006, the Architecture agency Cardete-Huet won the competition to design the work in association with the Setec and jaillet-Rouby engineering offices. Studies have actually started in early 2008 and lasted two years. In parallel, the construction started in early 2009 by foundations and the technical gallery. According to the designers, the project was a real challenge, due to a particularly tight budget, as financial means to manage organizational changes with technical constraints and a complex industrial environment. The other project challenges included tire protection, specific loads such as tooling and networking.The different approval procedures for the receptions of the construction site took place over 2011 and commissioning of a FAL with the tirst aircraft sections to assemble arrived in early 2012 (Fig. 2).

4.2. Analysis and ris/< assessment

In this case study, we use the practical knowledge from the experience feedback process as the basisfor providing the required information for the analysis. More specifica lly, the risk assessment methodology employed is consistent with the demands of energy and environmental performance.The final assembly of the new FAL Project A350 is designed to estimate the level of risk on the quality or non-quality and comfort or discomfort according to the building use and the architectural layout of the site. The analysis and risk assessment are intended to provide a ranking of the disorders to identify the findings of non-quality of most concerns. The crossing of the occurrence and severity of observation within the matrix results in the following formula is the basis for risk analysis regarding environmental performance assessment of buildings. The values of the risk matrix are determined by the following equation:

$R = Re \cdot G$.

Where, R, Re and G mean respectively: risk-control levels, occurrence levels, the severity levels of the finding. The principle of risk assessment is to assess the improvement or degradation of performance options. In the case of degradation, the risk of the identified pathology is evaluated. The collective problem-solving and consensus-building exercises between members of the working group are of paramount importance for the risk assessment of non-energy performance. Three levels of damage and occurrence are predefined (Minor, Medium, and Major).

Example: risk assessment in the case offinal assembly line (FAL) of the new Airbus A350.

Fig. 2. Aerial view of Final Assembly Line (FAL) of the new Airbus A350.

1. REX with positive event (case of risks related to the insu/ation, sealing and production system building energy) (Tables 4 and 5).

ln this matrix, the findings crossing level (horizontal) and the probability occurrence level (vertical) determines the risk level.

Risk assessment related to the aspects of sealing and roof insulation is energy and environmental.

The roof is the part of the building envelope which receives most of the solar radiation that contributes largely to heat gains.

The heat gains and losses, respectively in winter and summer, can cause thermal discomfort inside and respectively require in these periods enormous heating and cooling energy needs.

The thermal properties of roof envelope considerably affect the cooling load/indoor heating.

On the one hand, a better roof sealing effectively attenuates infiltration into the building and on the other hand, its insulation helps to reduce thermal loads. The thermal Joad and the building energy needs may be insured by renewable energy sources.

So, the use of solar panels and PVC plastic membrane on the roof can be an effective method to reduce heat gain and create an comfortable interior environment.

The above description allows us to consider that risk factors have an average level of occurrence and a major improvement observation level. ln the criticality matrix, the crossing of these two levels leads to a strong risk level noted Fo.

Table 4
Criticality matrix on the first risk factor studied.

A	B	C			
Observation	Type of use		Performance improvement level		
The roof of the buildings is almost fiat for a seal with a plastic membrane in Polyvinyl Chloride (PVC) and covered with photovoltaic panels.		levels of occurrence	*Minor*	*Medium*	*Major*
Origin: better implementation of the design.	C, A	*Major*			
Impacts: good Joss or gain on thermal heat management, enhancing of the envelope performance, energy self-sufficiency.		*Medium*			Fo
		Minor			

At column A, the description of the risk factor observation is given.
A description based on sealing a plastic membrane in PVC then the insulation with photovoltaic panels.
Column B specifies the type of studied building namely collective building and airport noted respectively C and A
Column C shows the estimated risk level in the criticality matrix.

Table s
The assessment description and the recommended solution for the first observation.

Risk assessment		Recommended solution
Energy performance	Positive effects	
Opportunity: -insulation improvement (decrease of its thermal conductivity) -energy production (self-sufficient energy) -energy building need decrease.	-life quality improvement within the building (thermal comfort) - building environmental preservation.	Use of a storage system required for energy conservation during periods of snow and periods of little sunshine.

The consequences of the resulting events determined by risk assessment of these aspects are analysed with their positive effects.

The table below brings us to the consequences on the corresponding performances and recommended solutions.

2. *REX with negative event (case of* risks *related to the building structure)(Tables* 6 and 7).

Steel is a durable metal, but it risks losing its resistance in case of fire and the graduai degradation due to chemical actions (corrosion).

The roof height and the wind speed may affect the balance generating the structure deformation risk. The above description allows us to consider that the risk factors have an occurrence average level and an improvement observation minor level. This gives a low risk level noted **Fa** in criticality matrix.

The event consequences determined by risks assessment of these aspects are negative (pathology). The table below brings us to the consequences on the corresponding performances and recommended solutions.

3. REX with positive event (case of risks *related to the management and waste* recycling)(Tables 8 and 9).

Risk assessment to management related aspects and recycling waste is environmental in nature.

Table 6
Criticality Matrix on the second studied risk factor.

A	B	C	
Observation	Type of use		Performance degradation level
A cost-effective design for the structure with the steel frame beams bolted on site. The timber Crusses require a roof structure with more height and Jess metal.		levels of occurrence	*Minor Medium Major*
Origin: implementation, design	C, A	*Minor*	
Impacts: risk for the structure strength.		*Medium*	***Fa***
		Major	

Coiumn A contains the observation description on the factor based on the building structure stability.
The beams structure are **in** current steel and bolted on site. Roofing is higher and less metal.
Coiumn B specifies the type of studied building namely collective building and airport noted respectively C and A.
Column C describes the estimated risk level in the criticality matrix.Risk assessment related to the aspect of the structure economy is function of resistance and the building balance.

Table 7
The assessment description and the recommended solution for the second observation.

Risk assessment		Recommended solution
Performance of structure stability	Pathology (negative effects)	
- Risk of losing the structure resistance (beams) in case of lire or corrosion, -Risk of the structure deformation under the speed wind effect.	Lack of stability or risk imbalance of the building understructure.	the metal structure must be covered by layers of non-flammable materials

Thble 8
Criticality Matrix on the third studied risk factor.

A	B	C	
Observation	Type of use		The performance improvement level
The carbon dust from drilling operations of aeronautic parts (the fuselage and wings) made of composite materials is inhaled by two networks of aspirators.		Levels occurrence	*Minor Medium Major*
Origin: best design choice	C, A	*Major*	**Fo**
Impacts: environmental preservation (good waste management, risk of health, lire hazard)		*Medium*	
		Minor	

Column A contains the observation description on the factor relating to the management and the waste recycling.
Two networks of aspirators of carbon dust and waste (lubricant with metal-carbon) has been established, involving the stations to recycle carbon dust created by drilling parts of aircraft composite.
Column B specifies the type of studied building namely collective building and airport noted respectively C and A.
Column C shows the estimated risk level in the criticality matrix.

Table 9
The assessment description and the recommended solution for the third observation.

Risk assessment		Solution for maintaining comfort
Environmental performance	Positive effect	
Environmental protection through the carbon dust aspiration, waste and the air recycling.	Protect: -the building against lire (carbon dust and waste) -the users against respiratory disease due to aspiration of carbon dust and waste.	There is possibility of noise so the suction network circuit must be dressed body (such as polyurethane foams or melamine) that absorb sound energy. Given the complexity and the large size of aircraft construction workshops (assembly halls), one must optimizethe location of air outlets and air intakes so that contaminants are not sucked.

Aircraft construction workshops (assembly halls) are characterized by extremely complex chemical environments.

Drilling, repeated installation and removal of aircraft parts in composite materials can release carbon dust or solvent-resin mixtures in aerosols forrn.

To enhance comfort in working within these workshops, environmental quality and industrial hygiene, it is necessary to provide in these workshops of aircraft constructions some aspiration and ventilation systems for the air recycling and renewal.

The above description allows us to consider that risk factors which have a major occurrence level and a major improvement observation level. In the criticality matrix, this gives a strong risk level noted Fo.

The consequences of the resulting risk assessment events of these aspects are analysed with their positive effects.

The table below brings us the consequences on the corresponding performances and recommended solutions.

5. Discussions

Nowadays, there is an increasing interest for the improvement of energy and environmental performance, in the construction and renovation projects of buildings. Many methods or techniques of performance evaluations and risk assessment have been proposed, for instance the five evaluation techniques of passive design with GBRTs (BREEAM, LEED, CASBEE, BEAM plus and GBL-ASGB) (Chennet al, 2015). ln order to strengthen the previous methods, the adopted research approaches in line with the approach to development of adaptive risk management (Bjerga and Aven, 2014) which highlights the ongoing requirement to gain information and knowledge about a set of relevant alternatives. The analysis by the method of adaptive risk management (Aven and Renn, 2009) requires a detailed characterization of risks through deep uncertainties such as the couple (C, U) in which the risks (Aven and Renn, 2009, 2010) is considered as a generalization of the well-known basic probability of risk defined by Kaplan and Garrick (Kaplan and Garrick, 1981). ln view of the couple (C. U), the risk is defined as a combination of two dimensions (C, U) where C is the severity of the consequence of the activity in question and U represents associated uncertainties.According to this thinking, the risk is described by specifying the consequences (C ') and using a measure (Q) (interpreted in a broad sense) of uncertainty, leading to a newrisk characterisation with (C', Q, K) where K is background knowledge on which are based C 'and Q (Aven et al., 2014).

The approach of adaptive risk management is based on the concepts of uncertainty measurement (e.g. via probability theory) that is relevant, but in fact it is more effective to add practical knowledge (experience) in the risk assessment. This adaptive perspective is integrated in the methodology described in this present article. ln principle, it is necessary to combine theory and practice to better diagnose the risk of performance in buildings. Therefore the approach of risk management with experience feedback integrates field surveys (inte1views of actors working in the buildings sector, site visits, taking photos, etc.). During these field surveys, factors relating to the risk of performance (energy and environmental views) in buildings i.e. non-qualities, discomfort, discharge of wastes are recognized and identified. The data recorded during investigations are then filled in the data base designed and developed on the principle of extracting knowledge from data in order to assess the risks of Energy performance and possible underlying pathologies. Corrective or preventive solutions and best practices can be given according to each case investigated. The five GBRT tools and techniques (BREEAM. LEED.CASBEE, BEAM Plus and GBL-ASGB) for assessing the passive design (Kaplan and Garrick, 1981) have mainly proposed as assessment methods based on the principle of weights as building rating standards.The reductions of energy consumption and carbon emissions have been weighted more independently from the deep knowledge of the target application. A situation that perfectly reflects the major concem associated is the high ratio of energy consumption of buildings without efficient strategies in total energy consumption. The ratings of five methods of passive design did not provide corrective or preventive solutions in case of non-compliance with established standards. This important aspect is considered in this article as it suggests conceptual means to identify risks and pathologies with relevant options to diagnose problems and recommend appropriate solutions.

6. Conclusion

We conducted this study using a methodology based on the concept of Experience Feedback with a conceptual view of risk, focusing on the information and knowledge from the field of investigation for sustainable building research (interviews with key stakeholders, pictures and documents). Through the described case study, we are able to highlight illustrative information on the quality or non-quality and the challenges we need to meet in order to achieve more sustainable building projects. The links between challenges and possible responses can lead to the prioritization of ways for development of efficient actions and services for sustainable constructions. Finally, the combination of risk management with experience feedback processes provides an interesting framework to share knowledge and best practices, including socioeconomic, technological and energetic realities as well as building information modelling from industrial professionals that would echo innovative initiatives to achieve other outcomes supporting the sustainability for buildings.

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