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A rating system for integrating building performance tools in developing countries

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Abstract

The increasing attention on the environment impacts of the activities of the companies is a phenomena that arise from many industrial sectors. Regarding the construction and property industries, in last decades the acknowledgement of their responsibilities for the environment caused a shift in how buildings are designed, built and operated.

The requirement of always more innovative and sustainable technologies and materials for buildings takes shape from two different point of view of the global construction industry. The basis of these two different orientations of the world construction sector would be found in the divergent demand of the developed and developing Countries.

The measurement of the environmental performance of new and existing buildings is fundamental to weigh up the effects and the potential improvements of the building energy regulations. In last decades many building performance assessment tools were developed in order to sustain the "Green Building philosophy". The Leadership in Energy and Environmental Design (LEED) system is considered one of the most popular green building certification program used in worldwide. In the developing countries scenario many tools rose from the LEED system, that is one of a reference framework for researches. In this paper we purpose a short review on the researches of the role of the buildings energy regulations in developing countries and the development of building performance assessment tools in Colombia, Qatar and Jordan. The aim of this analysis is to purpose the integration of Building Rating Value (BRaVe) system to the existing tools developed in the developing countries. The BRaVe system would contribute to upgrade the variables used for a comprehensive evaluation of a building thank you to the application of a "cross-disciplinary" criteria that embrace different thematic or scientific areas.

Peer-review under responsibility of the organizing committee of the SBE16 Tallinn and Helsinki Conference.

Keywords: Building performance evaluation; Developing Countries; Rating systems; Environment impacts; Innovative and sustainable technologies; Green Building.

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1. Introduction

In last decades, the acknowledgement of the responsibilities of the construction and property industries for the environment, caused a shift in how buildings are designed, built and managed. In according with [1] this new attitude comes from the conscious public policy decisions imposing requirements on industrial and economic activities and, also, from a growing market demand for environmentally sound products and services.

The requirement of always more innovative and sustainable technologies and materials for buildings takes shape from two different point of view of the global construction industry. Therefore, the building energy regulations and polices are raising in two different ways. The basis of these different orientations of the world construction sector would be found in the divergent demand of the developed and developing countries†.

The analysis of the construction investments in the global scenario, see Fig.1, highlights that before the global crisis the developed countries were the main actors in the construction investments, but during the global crisis the new "customers" of the world construction sector are the developing countries. An interesting data is show for the 2016, where the construction demand of the developing countries exceeds those of the developed countries.

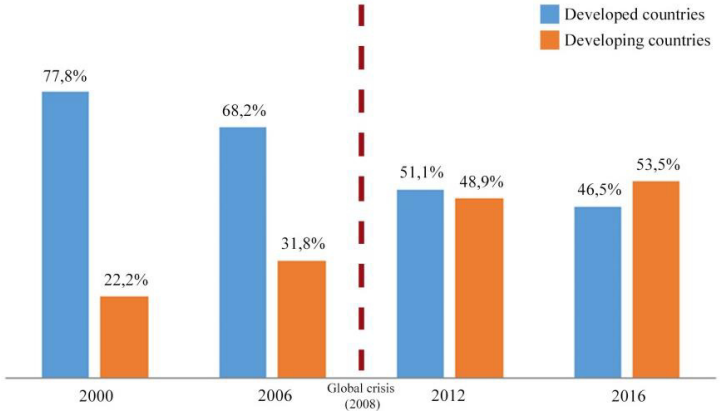

Fig. 1 The evolution of the construction investments in the developed and developing countries.

The economic and population growth of the developing countries will have to be supported by requalification of the existing urban areas as well as the construction of new infrastructures, commercial and business spaces and housings. The energy consumption produced by the growth of new buildings has led to serious environmental problems in these countries, such as increasing energy demand, global warming, air pollution and acid rain [2]. An important issue highlighted by [3], concerns the energy prices and the market conditions of the developing countries that often do not encourage the use of efficient technologies. This sentence takes in evidence one of the most bigger paradox of the contemporary construction planning: the new building philosophy, that has also called "Green Building philosophy"‡, is not yet perceived as attractive construction project method for builders of developing countries, because most of them associate green features with expensive technologies that add cost (e.g., photovoltaic panels, greywater reuse systems) [4,5].

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† The World Bank classifies the Countries using the Gross National Income (GNI) criteria and it divides them in four categories. The developing countries are included in the low- and middle-income types. It is important to take in evidence that the World Bank notes "The use of the term is convenient; it is not intended to imply that all economies in the group are experiencing similar development or that other economies have reached a preferred or final stage of development. Classification by income does not necessarily reflect development status." [22]

‡ The Green Building philosophy has emerged in order to mitigate the impact of buildings along their life cycle.

In order to reduce building energy consumption, the above mentioned awareness for the development of sustainable buildings had been produced energy regulations implemented by most of the developed countries (e.g. energy standards, codes etc.). On the other hand, more and more developing countries are currently introducing such legislation, but often the building energy standards in that states are only on paper [2,6,7]. This weakness raises from the sceptical point of view of the builders on the potential value added of the "Green Building philosophy" and, rather than technical problems, from the institutional barriers and market failures properly of the developing countries§.

2. The role of the buildings energy regulations in developing countries

Energy regulation has a perceptive character, and its objective should be to establish and limit the upper bound for the buildings energy consumption [8]. [9] divided the building energy regulations in two main types:

- Energy codes: they specify how buildings must be constructed or performed. They are written in mandatory, enforceable language. States or local governments adopt and enforce energy codes for their jurisdictions
- Energy standards: they describe how buildings should be constructed to save energy cost-effectively.

As above argued, the effectiveness of the building energy regulations is different from country to country. The worldwide status of the building energy regulations has been identified by [10] since 1993. In later years, she updated the research and she defined the current trends of the development of the energy standard in the global scenario. The interesting results concerned that the number of countries that achieved a mandatory standard was nearly duplicated and the number of countries that did not have developed standards was slightly reduced. In the light of the sample used by Janda in her research, [2] argued that the limited information about developing countries reflects an information gap surrounding the development, use and effectiveness of building energy regulations for building energy conservation. For that reason and on the basis of the research framework of Janda, they analysed 60 developing countries and their study revealed that the 42% of countries surveyed have no energy standards in place. On the other hand, [2] found that the level of progress on energy regulation activities is increasing in Africa, Latin America and Middle East. The raising awareness of the governments of the developing countries in this field outlines and important consideration developed by [8]: with its normative character, energy regulation establishes the minimum, and often the only, building energy assessment tools that will be introduced in the sector, and has therefore a high responsibility in the internalization of energy assessment. In this sense the development of international building performance assessment tools would play a key role in the improvement of the building energy regulations in the developing countries.

3. The international building performance assessment tools

The measurement of the environmental performance of new and existing buildings is fundamental to weigh up the effects and the potential improvements of the building energy regulations. In according with [1] the evaluation of the environmental impact can be divided in two slightly different points of view:

- The measurement of design, construction and property management activities (as services or industrial production processes)
- The measurement of buildings (as products)

Two basic methodological frameworks are linked with the above types of measurement of the environmental impact and they are:

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§ The impediments related to the institutional barriers and market failures are pointed out by [23]

- The Environmental Impact Assessment (EIA) that aims to assess the current environmental impacts of an object in a precisely context
- The Life Cycle Assessment (LCA) that aims to assess the potential environmental impacts of a product in a non-specific context

Both the EIA and the LCA are useful for the evaluation of the environmental impact of buildings because they would be considered as an object dependent from the context where they are established and, besides, they can be seen as a generic industrial products.

On the basis of the two methodological frameworks for measuring the environmental impacts of buildings, in last decades research groups developed assessment methods in which aim to verify by third-party the performance of the new and existing constructions. In this field the use of terms such as "method" and "tool" is often interchangeably and, even, the terms "certification", "rating" or "labelling" are used, again, often interchangeably to indicate extended outputs from the assessment process [11]. Since the development of the Building Research Establishment Environmental Assessment Method (BREEAM) in 1990, the United Kingdom (UK) research group Building Research Establishment (BRE)** has been started the creation of a wide number of building performance assessment tools all over the world. Few years later, in 2001, the International Energy Agency (IEA) has examined the tools and decision-making aids for improving the environmental performance of buildings and buildings stocks. In the publication of the Annex 31, the IEA categorize the different worldwide types of tools and it divided them by country. Besides, the [12] takes in evidence some main building environmental assessment methods such as the above citied BREEAM from UK, the Leadership in Energy and Environmental Design (LEED) from U.S.A, the National Australian Built Environment Rating System (NABERS) from Australia, the Green Building Tool (GBTool)†† from Canada and the Comprehensive Assessment System for Building Environmental Efficiency (CASBEE) from Japan. Different systems have greater strengths and weaknesses than others, and later systems draw on these to include features and elements that permit more effective use [11]. In this wide and fragmented distribution of the building performance assessment tools scenario it is possible to identify an important guide thread: many rating tools have been modified and adopted from earlier models that were originally developed in other countries [13]. For example, BREEAM, LEED and GBTool use similar frameworks with a credit-weighting scale to assess buildings [14].

For sum up, in almost of the developed countries the energy codes and standards are a robust pillar of the government policies for supporting the sustainable development of the entire life cycle of buildings. The role of the building performance assessment tools is strictly related with the mandatory role of the energy regulations. In this sense in developing countries, the transformation of the building energy regulations from the "no standard" status to the "mandatory" one, had been raising an interesting phenomena where the voluntary organizations devoted to raise the awareness of the environmental impact of the buildings is playing an important role. The aim of these organizations is to support the worldwide governments in the development of sustainable regulations for buildings, thank you to the promotion of green building practices, strategies, and education. Actually, the most important network of non-profit and non-government organizations is the World Green Building Council (WorldGBC) that was founded in 1999 by a representatives from 8 nations of the Green Building Council (GBC)‡‡. The related green building certification program, that is the Leadership in Energy and Environmental Design (LEED) system, is considered one of the most popular in worldwide. In the developing countries scenario many tools rose from the LEED system, that is one of a reference framework for researches.

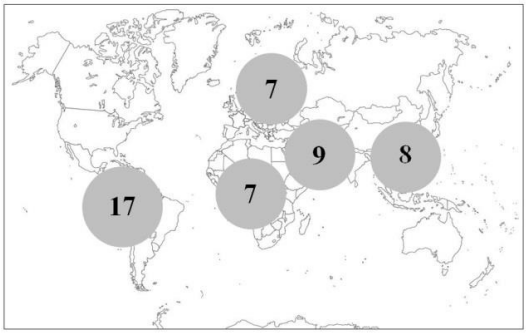
** BRE was born as a former UK government establishment, but now is a private organisation that carries out research, consultancy and testing for the construction and built environment sectors in the United Kingdom.

†† Since 2002 has been recalled SBTool and it is provided by the international institution for a Sustainable Built Environment (iiSBE).

‡‡ The nations were: Australia, Canada, Japan, Spain, Russia, United Arab Emirates, United Kingdom and United States.

3.1. The LEED system as a reference tool in developing countries

One of the objectives of the World GBC is to supply tools and strategies for supporting green building practices provided by existing and emerging GBCs. An interesting data is see in Fig. 2 that shows the increment of the number of GBCs from developing countries that participate to the World GBC. If in 1999 only one funder was from a developing country (United Arab Emirates), in 2015 the organizations that have achieved the World GBC membership[§§] are more or less fifty times more numerous.



Americas
1. Argentina
2. Chile
3. Colombia
4. Costa Rica
5. Dominican Republic
6. Ecuador
7. El Salvador
8. Bolivia
9. Brazil
10. Guatemala
11. Nicaragua
12. Panama
13. Paraguay
14. Peru
15. Mexico
16. Trinidad
17. Uruguay

Asia Pacific
1. Indonesia
2. Sri Lanka
3. India
4. Kazakhstan
5. Malaysia
6. Pakistan
7. Philippines
8. Chinese Taipei

Africa
1. Ghana
2. Namibia
3. Nigeria
4. South Africa
5. Kenya
6. Mauritius
7. Tanzania

Europe
1. Bulgaria
2. Croatia
3. Georgia
4. Hungary
5. Macedonia
6. Poland
7. Turkey

Middle East and North Africa
1. Bahrain
2. Egypt
3. United Arab Emirates*
4. Jordan
5. Kuwait
6. Lebanon
7. Oman
8. Palestine
9. Qatar

*founder

Total WorldGBCs (over 100 GBC members)
World GBCs from developing countries: 48

Fig. 2 The distribution of the GBCs in developing countries in 2015.

Often, the international donor agencies supports promotion of the building energy standards in developing countries, but this strategy has to cover all the implementation period for achieving successful results.

Regarding the building performance assessment tools raised by the World GBC, the LEED system, that is developed by the U.S. GBC in 1994, is considered one of the most popular green building certification program used in worldwide [15].

Furthermore, the LEED system is being proposed as a reference framework for countries in which there is no current method of building environmental assessment, such as the case of Colombia, where a national council for sustainable construction is being formed to start operations in 2008 [4].

The LEED rating system evaluates the performances of new and existing buildings in every step of their life cycle. The tool is divided in two main areas of assessment: energy and indoor environment quality. On the basis of this areas, the rating system awards points for every requirement reached (such as sustainable sites and materials and resources) and credits for the performance of the candidate building achieved.

4. The building performance assessment tools in developing countries

4.1. The LEED-based rating system in Colombia

The case study developed by [4] is based on the application of the LEED for rating the materials used to build 11 story office building in Bogota´, Colombia. The focus on this area was justified by the researches because the selection of environmentally responsible materials considers material accessibility by encouraging the use of materials extracted, processed, and manufactured regionally, and, at the same time, promoting the development of regional economies. [4].

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§§ World GBC membership is made up of three different levels (Established, Emerging and Prospective). Each level reflects the maturity of the GBC as an organisation [15]

In order to achieve the main objective of their research, that is the development of a tool for helping decision-makers with the selection of the right materials, [4] proposed a LEED mixed integer optimization model based on the material performance, design and budget standards for rating the buildings case study in Bogotá. On the basis of the existing LEED rating system for new construction and major renovations, the researchers developed the tool composed by the following categories:

- Site
- Material and resources
- Indoor environmental quality
- Cost and economic

The proposed rating system uses the LEED credits for evaluating the performance of the buildings case study and it awards points from 0 to 11 in relation with the level of requirements reached. The proposed LEED-based rating system takes in consideration two main aspects properly of the Colombian market: the first is related to the credits attributed to recycled content in which do not differentiate between pre-consumer or postconsumer. This because the data available in this field are only on the total recycles contents of materials. The second aspect concerns the availability of the material properties required by the LEED system. [4] obtained data using the Building for Environmental and Economic Sustainability software (BEES) and, where the information on specifically materials of the Colombian market were not included in the BEES software, they used local studies to complement the main data source.

The relevance of this research in the development of major awareness in the construction of green buildings in Colombia is clear: the development of a rating system based on the LEED wants to support the improvement of the green practices of the builders and designers. The maturity of the Colombian green building market would improve data availability and quality, helping designers apply not only green rating systems, but more sophisticated assessment methods of environmental impact such as life cycle analysis (LCA) [4]. The considerations argued by the researches are supported by the information outlined by [2] on the building performance regulations in Colombia in which are at the "Proposed" level and, besides, to the presence of the GBC in the country since 2009.

4.2. The Qatar Sustainability Assessment System

Another developing country characterize by a "Proposed" level of building energy regulations and the emerging establishment of the GBC is Qatar. One year before the foundation of the non-profit organization (2009), the Qatar Government has been supported the development of the Qatar National Vision 2030 (QNV 2030), a "road map" that wants to guide the current and future economic, social, human and the environmental development of the country in a sustainable way [16].

Regarding the "environmental pillar" of the QNV 2030, the Gulf Organization for Research and Development (GORD) developed one of the most interesting initiative; the Qatar Sustainability Assessment System (QSAS). The tool aims to measure the performance of buildings designed, constructed and managed in the Qatari environment. The QSAS combines the best methods from six established systems resulting in a customized tool specific to the requirements and needs of Qatar [17]. The international rating system used to develop the QSAS are: BREEAM, LEED, Green Globes, CEPAS, CASBEE and SBTool. In addition to the international rating systems, GORD used the energy standard regulation from the European Union (CEN-ISO) and the United States (ASHRAE) for implementing the groundwork of the QSAS. The reason why they did not use their own energy regulation is above citied: the building energy regulation of the Qatar are at the proposed level, while the EU and U.S. regulation are at the mandatory level therefore more efficient in their contents.

The QSAS consists of several categories, criteria, and measurements that are associated with environmental goals [17]. The QSAS bases the evaluation of the sustainable performances of the residential, commercial and school buildings on eight main categories and related criteria. Each criteria is associated to the values achievable for the development of a lower-impact environment building. The criteria should award points from -1 to 3 and the final score achieved by the measurement of the building performances outlines the certification level.

In the light of its characteristics the QSAS is chosen as a case study by [18]. The researchers developed a methodology that uses the LCA as an efficient tool for validating the evaluation performances of the rating system. The studies are based on the QSAS criteria included in 5 of the 8 categories, that are:

- Urban connectivity
- Site
- Energy
- Water
- Indoor Environment

Such as the Colombian case study, the results achieved by [18] reveal the importance of the LCA in the development of efficient rating systems. Again, the researches underline the needed to develop an LCA database for the specific Qatari environment.

4.3. The SABA Green Building Rating System

Jordan is a developing country suffering from the global problems of energy and the increasing of pollution, especially with poor resources of energy and inefficient use of it [19]. The raising awareness of the sustainable issues has been established both devoted institutions and non-governmental organizations in the country. In addition, the need of green design practices for buildings is playing an important role in the re-transformation of the Jordanian construction practices from the use of the western building systems[***] to the innovation of the traditional ones. For that reasons [19] developed a research that aimed to analyze the most important green building rating systems in order to identify the characteristics useful for realizing a tool suitable for the Jordan context. The research method started from the collection of information and data from the Jordanian stakeholders that come from different fields such as architecture, urban design and renewable and energy efficiency. Besides, the analysis of the main rating systems such as LEED, CASBEE, BREEAM and GBTool outlined the structure of the rating system suitable for the Jordan context. In particular [19] extrapolated from the tools the weighting coefficient system and the related certification criteria for evaluating the following seven categories:

- Site
- Energy efficiency
- Water efficiency
- Material
- Indoor environment quality
- Waste and pollution
- Cost and economic

The result was a framework translated into assessment system ad hoc for the Jordan context, that is called SABA Green Building Rating System. In spite of the limitations declared by the researches that concern the application of the tool only to the preliminary stages of design of residential buildings, the results of the research suggests some recommendations. In general, the guide lines remarks the importance of the context in the development of the rating tools in different countries. In particular, the fourth recommendation of [19] explains that the assessment framework should suit the local context of the country in which depending on its culture, issues, players, practices and institutions. It will be essential for each country to design its own indicators in its own way to serve its shared goals [19].

[***] As cited by [19] in the last twenty five years the construction practices in Jordan were shifted from the use of mud and stone as major traditional materials to concrete, glass and steel, that are the construction materials properly of the modern or western building systems.

4.4. The common thread of the three building assessment tool case studies

The three researches on the building assessment tools in developing countries above described outlines some common topics. In spite of the focus on the construction materials, in the Colombian case study the building rating system used three different categories properly of the LEED for evaluating the performances of the different materials selected. The use of the LEED, that, as above citied, is developed on the similar framework of other famous rating systems, takes in evidence the first common thread. The categories adopted by the researches for developing the Colombian, Qatari and Jordan rating tools are based on the LEED system. This confirm the effectiveness of the World GBC tool in the evaluation of the building performances and, besides, the crucial role of the voluntary organizations in the evolution of the building energy regulations in developing countries.

Again, in the Colombian case study, the evidences developed on the relation between the sustainable characteristics of the materials and their weight in terms of construction cost effects, reveal the increasing role of the "Green building philosophy" in the design of construction projects in Colombia. As declared by the authors, the maturity of the green building market in Colombia would improve data availability and quality, helping designers apply not only green rating systems, but more sophisticated assessment methods of environmental impact such as life cycle analysis (LCA) [4]. The LCA is precisely the second common thread of the three case studies. All the researches support the use of LCA for validating the evaluation performances as well as they take in evidence the need to collect data from the specific environments in order to expand and specialize the LCA database. In these terms the researches developed confirm the positive raising of awareness and application of the green building practices in the construction scenario of the developing countries.

For sum up, the building assessment tools devoted to measure the sustainable performance of buildings have been contributed to develop the awareness of both the construction professionals and stakeholders. In the developing countries the role of the green rating systems is more important for the enhancement of the building energy regulations and, besides, for tearing down the skepticism on the "Green Building philosophy" of the professionals. In these terms, the following tool proposed wants to support the building assessment tools using a "transversal" point of view that embrace financial and economic skills properly of the real estate world.

5. The complementary role of the Building Rating Value (BRaVe) system

The development of the Building Rating Value (BRaVe) system started in 2008 under the supervision of the researches of the Laboratorio Gest.Tec of the ABC Department, Politecnico di Milano (Italy).

The reason behind the development of BRaVe system is justify by [20]: the majority of rating systems deal only with some of the variables considered fundamental for an overall valuation of the performance of a building: particularly spread are the aspects related to the containment of energy consuming and the compatibility with the environment.

The research started from the analysis of the main methods used by the professionals of the construction and real estate sectors for evaluating the building performances. The results outlined that besides the building assessment tools, others systems are used by the stakeholders for measuring the characteristics of properties. These last kind of methods are strictly related to the economic and financial field of the construction and real estate sector and they are called building performance tools. The main difference between the two types of instruments concerns the base-framework: if the building assessment tools are developed using scientific criteria derived by the energy efficiency and low-environment impact of the construction materials and technologies, the building performance tools are characterized by the evaluation of the quality of buildings using their potential market-appeal factors. In other words the building performance tools evaluate the desirability of the buildings in the construction and real estate market during their entire life-cycle.

In this sense the objective of the research was to identify the parameters and criteria useful for evaluating the building characteristics using a "transversal" method that embrace both the sustainable fields and the financial and

economic value of the properties. The final result is the BRaVe system, a patented tool††† that identifies different areas of analysis, each of them distinguished by variables that contribute to determine the performance level of the building. The rating model is divided into 14 sections:

- Building frame
- Inner soundproofing energy
- Power
- Air conditioning
- Lighting
- Efficiency of surfaces
- Safety/ special plants systems
- Management
- Communication/wring systems
- Indoor finishes
- Urban facilities
- Lifting devices
- Water
- Certifications

It is possible to observe in Tab. 1 the topics of the BRaVe system sections shared with the categories properly of the building assessment tools above analysed. Some of the sections are clearly derived by parameters of the economic and financial evaluation of the properties (e.g. efficiency of surfaces and safety system management).

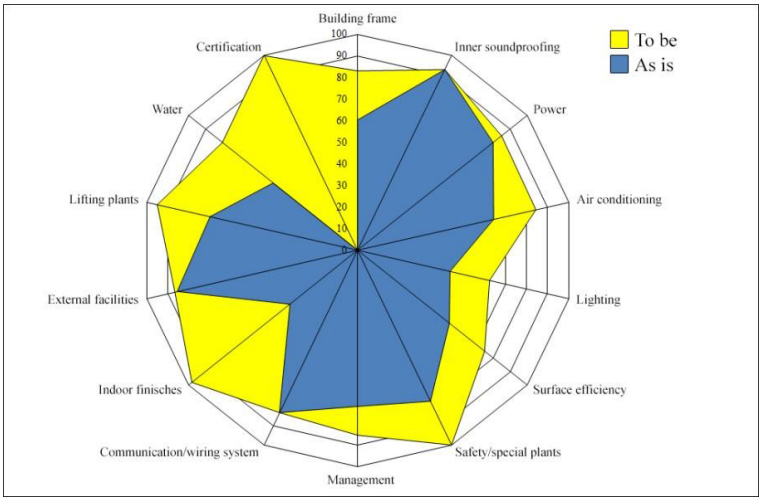
Tab. 1 The shared sections of the BRaVe system with the categories of the building assessment tools in developing countries analysed

Categories of the BRaVe system	Categories of the building assessment tools in developing countries (Colombia, Qatar and Jordan)							
	Urban connectivity	Site	Energy	Material and resources	Indoor enviornmental quality	Water	Waste and pollution	Cost and economic
Building frame			x	x			x	x
Inner soundproofing energy			x	x			x	x
Power			x				x	x
Air conditioning			x	x			x	x
Lighting			x	x			x	x
Efficiency of surfaces					x			x
Safety/ special plants systems					x			x
Management			x		x			x
Communication/ wring systems					x			x
Indoor finishes			x	x			x	x
Urban facilities	x	x						x
Lifting devices					x			x
Water						x		x
Certification	x	x	x	x	x	x	x	x

At the beginning of the research, the BRaVe system was developed and tested on office buildings. Today the rating system is even available for evaluating the performances of logistic and residential buildings, with particular reference to condominiums, social and student housings. The rating system is applicable to existing, new, or occupied buildings. As seen in the following Fig. 3, during the testing phase diverse simulations could be done in

††† The BRaVe system was patented in 2013 by Politecnico di Milano (Italy).

order to represent different scenarios following specific project interventions. The system, in fact, is able to represent graphically the actual status (AS IS) and the project status (TO BE) [21].



RATING	SCORE
BRAVE 10 - AAA	100 - 90
BRAVE 9 - AA	89 - 80
BRAVE 8 - A	79 - 70
BRAVE 7 - BBB	69 - 60
BRAVE 6 - BB	59 - 50
BRAVE 5 - B	49 - 40
BRAVE 4 - CCC	39 - 30
BRAVE 3 - CC	29 - 20
BRAVE 2 - C	19 - 10
BRAVE 1 - D	< 10

Fig. 3 Improvement by the Building Rating: The yellow areas represent the potential optimization working on 3 particular investments. The "as is" situation is showed by blue areas

The development of the BRaVe system as a rating tool complementary to the building assessment tools is clear. The evaluation of building performances uses transversal criteria related to:

- tools devoted to measure the energy efficiency and the sustainable materials and technologies of buildings (e.g. LEED, BREEAM, etc.)
- instruments typical of the asset, property and facility management (e.g. Office Building classification, Building Class Moscow, etc.)

In this sense the BRaVe system becomes a governance system of the real estate assets that takes in evidence strength and weaknesses of the buildings. In the light of its characteristics, the BRaVe system allows professionals and stakeholders to have a complete overview of the performances of buildings, almost in specific social, cultural technological and environmental contexts such as the developing countries.

6. Conclusions

The analysis of the construction investments in the global scenario and the related trend of the demand has been outlined the importance of the development of the building energy regulations in developing countries. As cited by [2], more than the technical problems, the institutional barriers and market failures are the major impediments for implementing building energy regulations in developing countries.

In spite of the chronological distance between the research conducted by [2] and the last publication of the World GBCs members (5 years), the crossing of data outlines two considerations. The first is related to the major presence of GBCs in developing countries where the building energy regulations are at the "mixed" status. This data should reflect the influent, non-profit and non-government role of the GBCs in the development of policy decisions in this field. On the other hand, the sample of 60 countries analyzed by the researches and the localization of the members of the World GBC is not overlie. The 23 developing countries where the GBCs are established but they are not included in the cluster of [2] underline the second consideration in which suggest the development of an up-grade research of the building energy regulations and energy conservation policies status in developing countries.

The role of an international actor such as the GBC, in the development of energy regulations in developing countries takes in evidence the implicit exchange of know-how between the local public and private stakeholders

and the foreign professionals of the construction and real estate sector. The contribution of the partners from the developing country to understand and shoot down the institutional barriers takes cue from the deeper knowledge of their own economic, cultural and political structure, as well as the local technological systems and materials used for the construction of buildings. This knowledge would lead the foreign partners to introduce appropriate skills and knowledge able to develop green buildings. The analysis of the three researches on the development of building assessment tools in Colombia, Qatar and Jordan supports the relevance of the contribution of international actors in the enhancement of sustainable practices for the construction of buildings in developing countries.

In addition, the spread of the "Green Building philosophy" and the development of more efficient building energy regulations in developing countries would be strengthen by the integration of evaluation variables that comes from others thematic areas in addition to the energy efficiency ones.

The knowledge of the building characteristics using criteria that embrace not only the sustainable performances of materials and technologies but also the market-appeal and the related economic and financial value, would allow both the construction and real estate professionals and stakeholders of the developing countries to understand the real value of the "Green Building philosophy".

Finally, as supported by the above cited researches that declare the need to collect data from the specific environments of the countries in order to increase the LCA database, the BRaVe system requires the collection of information that would be useful for re-positioning the buildings in the market. This in order to give a value added competitive advantage of the properties even at the end of their life-cycle.

It would be interesting develop a collaboration with researches from developing countries in order to actualize the complementarity role of the BRaVe system.

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