WATER MANAGEMENT FROM THE ENVIRONMENTAL CERTIFICATION PERSPECTIVE: A NEW PROPOSAL FOR CRITERIA AND WEIGHT RATES FOR APPLICATION IN REGIONS OF BRAZIL

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ABSTRACT

Several countries have developed tools with criteria and evaluations to grant, through environmental certification, a more sustainable undertaking, with quality and productivity for its users. The tools were developed for different needs and objectives, which makes it difficult to make a direct comparison, in addition to having specific demands for each region. This study aims to make a comparative analysis between some tools of greater international knowledge and propose new parameters for the category of water use and management, taking into account the design and operational phase, the water distribution and the demands for 2025. Consequently, this study proposed the creation of an exclusive environmental tool for the management and water use, providing a seal that can be applied to any project and adopted by the water concessionaires as an incentive to reduce the consumption of drinking water, use of alternative sources and reduction of liquid effluents.

Keywords: environmental assessment tools; water efficiency, sustainability, green buildings, water reuse, alternative water source

RESUMO

Vários países desenvolveram ferramentas com critérios e avaliações para conceder, por meio de uma certificação, um empreendimento mais sustentável, com qualidade e produtividade para seus usuários. As ferramentas foram desenvolvidas para diferentes necessidades e objetivos, o que dificulta a comparação direta, além de ter demandas específicas para cada região. Este estudo tem como objetivo fazer uma análise comparativa entre alguns ferramentas de maior conhecimento internacional e propor novos parâmetros para a categoria de uso e gestão da água, levando em conta a fase de projeto e operação, a distribuição de água e as demandas para 2025. Consequentemente, este estudo propôs a criação de uma ferramenta ambiental exclusiva para o gestão e uso da água, proporcionando um selo que pode ser aplicado a qualquer projeto e adotado pelas concessionárias como incentivo à redução do consumo de água potável, uso de fontes alternativas e redução de efluentes líquidos.

Palavras-chave: ferramentas de avaliação ambiental; eficiência hídrica, sustentabilidade, construções verdes, reuso de água, fontes de água alternativas

1 INTRODUCTION

The world faces a serious and growing water problem, which can particularly compromise supply in countries with water crisis and constant shortage mainly due to urban growth, increasing the demand for water. According to Taylor (2017), water crises tend to deepen severely and unpredictably, being affected by uncontrolled population growth, demand for water, droughts and events associated with global climate change.

In order to reduce and mitigate the impacts caused by construction to the environment, several environmental assessment tools have emerged to certify green buildings. Andrade (2016) says that the concept of sustainability is not consensual because it is subjective and because the differences between tools can make it difficult to be used or to compromise users' confidence. This author reminds us that even the terminology adopted is different from tool to tool.

Water is extracted from natural sources daily and processed in large amounts to obtain high quality drinking water. The corresponding wastewater should be treated before being released into the wild, minimizing interference with the springs. A sustainable building can and should be economically feasible, considering that the certificates also have a market role and comply with legal requirements, which go beyond environmental causes. The reasons that lead an entrepreneur to opt for a certain tool or another are defined by several factors that can vary per region, legal constraints and intended results.

In order to reduce and mitigate the impacts caused by construction to the environment, several environmental assessment tools have emerged to certify green buildings. Andrade (2016) says that the concept of sustainability is not consensual because it is subjective and because the differences between tools can make it difficult to be used or to compromise users' confidence. This author reminds us that even the terminology adopted is different from tool to tool.

According to Darko (2016) and Yuan (2011) there is a great interest by researchers in identifying the regional contributions to better performance of green buildings. Due to the need to address issues in local settings of particular countries or regions, different classification systems have a different emphasis, says Doan (2017).

Ozge (2015) emphasizes that some nationally developed certification systems are used without regional adaptations, which may lead to results that do not correspond to the purposes of local sustainability or construction, and that further adjustments in the system structure for regional variations between countries should be introduced in order to facilitate their international application. Pahl-Wost (2015) points out that the greater relations between humans and the natural world are directly affected when there are crises in water, as they are also crises of sustainability.

Islam (2015) corroborates that tools need adaptation, modification, and perhaps aggregation with other tools to reflect reliable performance. The importance and priorities are different between the regions and the local environment, and it is essential to adjust the assigned credits. Thus a baseline for analysis of issues related to water efficiency is proposed in the area of the United Arab Emirates. The author also says that input, output and process methodologies should be reviewed and new priorities should be considered individually in each region and country before they are implemented and approved.

Assessment tools are continuously in the process of improving regarding reliable data on water consumption and water supply. There is no way to previously measure the practices of use in constructions in operation, since even an enterprise that has been contemplated with concepts to reduce the consumption of drinking water and use of alternative sources; even with a good action plan to contain losses and wastes, it is the use with parsimony that can guarantee a good result in terms of reduction of consumption and reduction of liquid effluents.

The performance of constructions contributes to sustainable development and environmental impacts, as stated by Ding (2008), who stresses that there are two environmental types of evaluation, one based on criteria and others that use life cycle assessment as methodology, according to Ali *et al.* (2009).

The use of the methodology that evaluates life cycle, makes the process more complex and with future data based on assumptions related to the long life of an enterprise. Zabalza et al. (2009) commented that the certifications should make use of the life cycle evaluation, but due to its complexity, it becomes unfeasible, since it does not always have access to the necessary inventories and information to meet the needs of a life cycle analysis.

Islam (2015) maintains that the World Green Building Council (WGBC) states that each country has different climatic and environmental conditions and that a single tool may not be suitable for global use, as regional differences may affect categories such as water resources and availability. According to Aysin (2011) regional and cultural differences, as well as priorities must be considered, making the system feasible and

applicable with real conditions and accuracy. Defining regional system boundaries is also important for customizing and determining the priority of each performance criterion.

~~The methodology of this study consists in the comparative analysis between the tools of environmental certification, reviewing published literature and citations for a scenario with a holistic view of how the issue of water use and management is considered and weighed in the tools.~~

As a methodology, 12 environmental certification tools were analyzed and compared, according to table 1, and searches were done on databases such as, ScienceDirect (Elsevier), SCOPUS (Elsevier), Google Scholar, using strategic key words, focusing on published citations to a holistic scenario of how the issue of water use and management is considered and weighted by the tools. The research basis was the already available, internationally acknowledged, and currently in use tool methods.

Faced with the gap in research directed to local realities, this study aimed to make a comparative analysis between some existing tools and propose new parameters for the category of water use and management, taking into account the design and operational phase. As a consequence, a new tool was proposed considering the regional differences of Brazil that could be used by the water concessionaires and as a complement to the water criterion in other tools when used in Brazil.

Comentado [CB1]:
Comentário 1:
1-A justificativa teórica na introdução informa que foi realizada uma revisão da literatura, porém é necessário esclarecer quais bases foram pesquisadas e como foi feita a busca.

Resposta:
Alterado o parágrafo, sendo:
As a methodology, 12 environmental certification tools were analyzed and compared, according to table 1, and searches were done on databases such as, ScienceDirect (Elsevier), SCOPUS (Elsevier), Google Scholar, using strategic key words, focusing on published citations to a holistic scenario of how the issue of water use and management is considered and weighted by the tools.

2 CERTIFICATIONS, PURPOSES AND INTERESTS

According to the guide of Core Net Global (2014), there are some factors that guide the entrepreneur to define whether or not to certify and what would be the best system for the future enterprise, such as legal requirements, investor or renter profile, economic factors, market dynamics and incentives for both taxes and urban rates.

In some countries, such as Australia, Canada and the USA, there is an obligation to comply with environmental requirements that, depending on the case, will be the initial factor for directing a system that complies with the law. In Brazil, environmental certifications for construction are voluntary, even for public buildings, which does not exempt, in many cases, the obligation to develop an environmental control plan and a neighborhood impact study, which has nothing to do with certifications, but that meets some criteria of existing systems, except for the National Program of Conservation of Electric Energy - Procel, which in the field of energy, is mandatory in public buildings.

The market also dictates decisions. An investor, owner or tenant, may opt for an enterprise that fulfills expected performance of a sustainable construction, which in some cases may be linked to the need for its activities, as well as provide a more productive and quality environment for its users. There is the preference at the time of the choice, for a certified work, which means faster sales and valuation of the property.

In short, the minimum legal and market requirements can define the level of certification. The market may have an above-legal expectation, leading the entrepreneur to define it by a goal above the one originally planned, protecting the entrepreneur against the risk of future obsolescence as a result of increasing demands for sustainability.

Cole (2005), comments that there is no way of not recognizing that the application of systems that categorize undertakings through their performance brings positive gains in the social, economic and environmental area, leading to a growing practice in developing countries. The decision for a certification involves the entire production chain, which means that manufacturers, suppliers, buyers, designers and builders are engaged in a holistic way in every process of compliance with the requirements of the system.

Piccoli (2010) says that the design phase is the main driver of the whole process. The detailed specifications, containing materials of proven ecological provenance and technical memorials must comply with the requests of the method, which may be a completely different procedure from the one used by the company in its day to day work.

Besides the organization practices of the construction site, the purchase of materials and the rigor of inspection and documentation, suppliers also need to adapt to the requirements of the system and emphasize

the importance of a systemic approach to the process of enterprise management, with probable need of requalifying all actors involved, from the workers to the supply chain of materials and components. To conclude, he mentions that a new way of looking at civil construction will lead to the search for a certification.

The extended durability of a building, as said, will bring lower maintenance costs over the years due to its longer service life. As a consequence, it will spare the natural resources for the repair, demolition and reconstruction process. There is no denying the need to reduce the environmental impact caused by the construction industry. This is a new concept applied and constantly updated, where everyone should be engaged, regardless of market issues or in compliance with current legal requirements. Environmental assessment tools play the role of efficiently guiding how these concepts can be applied, and how an enterprise can gain in terms of durability, performance, and value. (GRÜNBERG *et al.*,2014; MEDEIROS *et al.*,2011).

~~Several studies and surveys carried out by green building segments confirm the fact that companies which adopt "good practices" reduce risks to investors; reduce the vacancy rate; value real estate rent; and reduce the condominium fee in certified buildings due to greater efficiency and durability~~.
Facing this context, segments of green construction, such as the Brazilian Council of Sustainable Construction-CBCS, the Green Building Council-GBC Brazil and the real estate market, corroborate the fact that companies adopt "good practices" reduces risks to investors; reduce the vacancy rate; value real estate rent; and reduce the condominium fee in certified buildings due to greater efficiency and durability. Islam (2015) understands that using an environmental assessment tool is not an obvious thing and that the place, the time, by whom and how to apply the evaluation results, should be very clear so that the results can bring the expected benefits in the areas of environmental commitment and of the basic pillars of sustainability.

Environmental assessment systems promote gains in relation to reductions in the impacts caused by construction and consequently increase the performance and service life of an undertaking. In addition, Bastos and Rebello (2016), considers that the green certificates achieved by the certification methods, whether driven by demand or committed to environment or market issues due to competitiveness, should be adapted to the scenarios of each region where they are intended to be applied.

3 TOOLS, CRITERIA AND WEIGHT RATES

Every certification tool aims to improve the environmental performance of buildings and reduce the impacts caused during construction and after occupation. Through the tools, designers can consider various aspects of sustainable design that are not addressed by building codes, including the manufacturing of materials and products. to carry out a comparison between the methods related to water use, we have selected some of the tools most used in most of the countries committed to the performance of projects and their economic, environmental and social impacts, as shown in **tabela 1.**

Each tool assesses the use of water from a perspective defined for the country of origin, but also it is possible to be adjusted to other regions such as LEED, which added a credit to regional priorities and the DGNB that offers the possibility of creating a specific method for use in the intended region. Brazil, which already had the AQUA evaluation system, now has the new version of 2016, the AQUA - HQE, which gains international recognition and the possibility of regional adjustments as per local reality and culture. **Figure 1** shows the percentages for each criterion defined in each certification system.

Comentado [CB2]:
1-Também nesta seção é utilizado o "apud", para um trabalho científico não é recomendado a utilização.
Resposta:
Obrigado, o "apud" foi usado indevidamente, segue a correção: (GRÜNBERG *et al.*,2014; MEDEIROS *et al.*,2011).

Corrigido conforme NBR 10520

Comentado [CB3]: Comentário 2:
1-No penúltimo parágrafo da seção 2 é informado "diversos estudos", é necessário citar tais estudos.

2-(CORREÇÃO) Facing this context, segments of green construction, such as the Brazilian Council of Sustainable Construction-CBCS, the Green Building Council-GBC Brazil and the real estate market, corroborate the fact that companies adopt "good practices" reduces risks to investors; reduce the vacancy rate; value real estate rent; and reduce the condominium fee in certified buildings due to greater efficiency and durability.

Table 1: tools, category, weight rates and certification.

SYSTEM	ORIGIN	YEAR	DEFINITION	DESCRIPTION	WATER ASSESSMENT CATEGORY	100 % CONSIDERATION	CERTIFICATION
AQUA-HQE www.vanzolini.org.br	BRAZIL	2014	High Environmental Quality	It is an international certification of sustainable construction developed from the French certification Démarche HQE (Haute Qualité Environnementale) and applied in Brazil exclusively by the Vanzolini Foundation. The evaluation of the Environmental Quality of the Building is made for each of the 14 categories of environmental concern. For an undertaking to be AQUA-HQE certified, the entrepreneur must achieve at least a performance profile with 3 categories at the BEST PRACTICE level, 4 categories at the GOOD PRACTICE level and 7 categories at the BASE level.	WATER MANAGEMENT	12.22	Baseline, good practices and best practices
BEAM PLUS www.hkgbc.org.hk	HONG KONG	2012	Building Environmental Assessment Method	HK-BEAM was one of the first schemes to be developed and launched in 1996 to guide the design and evaluation of the overall performance of new and existing buildings in Hong Kong. Since then, it has undergone several upgrades to reflect continued industry improvement, with the latest version, BEAM Plus (v1.2) released in July 2012 by the Hong Kong Green Construction Council (HKGBC).	WATER USE	6.99	one star = 10-19; two star=20-29; three star=30-44; four star=45-59; five star=60-74; six star= 75+
BREEAM tools.breeam.com	UK	1990	Building Research Establishment Environmental Assessment Metho	BREEAM sets the standard for best practices in sustainable building design and construction. Its main objectives are: 1-to mitigate the impacts of the life cycle of buildings on the environment 2 -to allow buildings to be recognized according to their environmental benefits 3-provide a credible environmental label for buildings 4- To stimulate demand for sustainable buildings.	WATER	5.45	<30 unclassified; >/30 pass; >/45good; >/55very good; >/70excellent; >/outstanding
CASBEE 1-NC www.ibec.or.jp	JAPAN	2010	Comprehensive Assessment System for Built Environmental Efficiency	It is a comprehensive assessment of the quality of a building, assessing features such as interior comfort and scenic aesthetics in consideration of environmental practices that include the use of materials and equipment that save energy or reach more expensive environmental loads.	LR2-resources and materials - water resources	2.63	superior(S); very good (A); good (B+), slighty poor (B-); poor ©
DGNB www.dgnb-system.de/en	GERMANY	2014	Deutsche Geesellscharft für Nachhaltiges Bauen	The DGNB System covers all fundamental aspects of sustainable construction: environmental, economic, socio-cultural and functional aspects, technology, processes and sites.	DRINKING WATER DEMAND AND WASTE WATER VOLUME	2.25	<35% Bronze; 35% to 50% silver; 50% to 65% gold; 65% to 80% platinum
GPRS egypt-gbc.org/ratings.html	EGYPT	2011	Green Pyramite Rating System	The classification system has three levels for certification of ecological buildings according to the Egyptian GPRS	WATER EFFICIENCY	27.27	Green Pyramid, Silver Pyramida and Golden Pyramid

GREEN MARK www.bca.gov.sg	SINGAPORE	2005	BCA Green Mark (Singapore´s Building Construction Authority-BCA)	Voluntary certification in Singapore with the aim of promoting "sustainability in the built environment and increasing environmental awareness among developers, designers and builders."	WATER EFFICIENCY	8.97	50 a 74 pontos = Certified; 75 a 84 = Gold; 85 a 90 = Gold Plus e igual ou acima de 90 pontos = Platina
GREEN STAR new.gbca.org.au	AUSTRALIA	2009	Green Star by Green Building Council of Austrália (GBCA)	Green Star rating system looks at the management of a building, internal environment, energy consumption, water consumption, selection of materials and ecology degradation to give a building star rating based on project design with no requirement for Prove the results in progress Operation.	WATER	8.45	one star = 10-19; two star=20-29; three star=30-44; four star=45-59; five star=60-74; six star= 75+
ITACA /www.iisbeitalia.org	ITALY	2001	ITACA. (Federal Association of Regions of Italy)	It is an environmental assessment tool of construction for use by the public administration. ITACA chose to refer to GBTool because of its international character and the flexibility of the evaluation framework.	CONSUMPTION OF RESOURCE-INTERNAL USE OF DRINKING WATER	18.2	<40 = D (not certified); 40 -<55 = C; 55-<70=B; 70-<85=A; 85-100 =A+
LEED -NC v4 ww.usgbc.org	USA	2014	Leadership in Energy and Envirnmental Design	The LEED International Certification has 7 dimensions to be evaluated in the buildings. All of them have pre requisites (compulsory practices) and credits, recommendations that when answered guarantee points for edification.	WATER EFFICIENCY	10.9	Certified 40 to 49; Silver from 50 to 59; Gold from 60 to 79 and platinum over 80 credits
PRS www.upc.gov.ae	EMIRATES	2010	Pearl Rating Sustainable	The PRS was regionalized to emphasize the particular concerns of Abu Dhabi and the United Arab Emirates. Ossui 5 levels of prizes.	WATER	24	20 points = a pearl; 60 = two; 85 = to three; 115 = four and 140 points = five pearls
SBTOOL PT-H www.sbtool-pt.eu	PORTUGAL	2009	Sustainability Bulding Tool	Voluntary system for the evaluation and recognition of the sustainability of various types of buildings, developed by iiSBE (International Initiative for a Sustainable Built Environmental.	CONSUMPTION OF RESOURCE-INTERNAL USE OF DRINKING WATER	6	A+, A, B, C, D e E

Source: Our

Figure 1: criterion and consideration

Source: Our own

All building classification systems have evolved over the years and have been updated to become more demanding, in line with technological advances. Technological advances have led to the evolution of building classification systems, making them more demanding and more notorious, attracting the attention of several countries, including developing countries like Brazil, Doan (2017).

For Binh (2011), the most rigorous tools in environmental issues are BREEAM and LEED, but all provide designers and entrepreneurs with a systematic and valuable reference source for various research studies related to sustainable development. Lee (2013) has a similar opinion and adds that the data obtained through the criteria of the tools favor adaptations according to the characteristics of each region.

As shown in **figure 1**, the disparity between the criteria and the necessary weights in relation to the criterion of water use and management is noted, even in countries with a history of water scarcity in part of its territory Tools such as PRS and GPRS have been developed considering the demands for water in its territory, due to the serious problem that is today in the United Arab Emirates and in Egypt. Applying a tool without adequate adaptation to the realities of the country certainly will not lead to satisfactory results.

Table 2 summarizes the criteria for water use and management and the weighting applied. The percentage does not reach 30% for the criterion of water use, being the GPRS tool with the highest index of 27.27%.

Table 2: Summary of weighting per tool

TOOLS	WATER
AQUA-HQE	12,22%
BEAM PLUS	6,99%
BREEAM	5,45%
CASBEE	2,63%
DGNB	2,25%
GPRS	27,27%
GREEN MARK	8,95%
GREEN STAR	8,95%
ITACA	18,20%
LEED v4	10,09%
PRS	24,00%
SBTOOL PT	6,00%

Source: Our own

As shown in **Figure 1 and Table 2**, the GPRS tool, developed to be applied in Egypt, has the highest weighting among the others, since it was designed for use in a hot and dry region where problems with water scarcity are common and may increase with the possibility of global warming. Asdrubali (2015), comparing the ITACA method with LEED in two residences, identified similar results, awarding a B seal and a green seal, respectively, being the Italian seal with the highest score in the water use category. There is a clear concern about energy issues in relation to water consumption, even in places with a history of shortages.

4 REGIONAL DIFFERENCES IN BRAZIL

Comentado [CB4]: Corrigido para 4

Brazil is considered a country of continental dimensions, with territorial extension of 8,516,000.00 Km². The large-scale regional and climate variations in the various regions of Brazil can be understood in terms of the general circulation of the atmosphere, given by the behavior of *Hadley-Walker* convective cells and frontal systems. These cells cause variations in precipitation distribution and are associated with latent heat release during precipitation, with *Hadley* north-south and *Walker* east-west.
The interannual variations of precipitation in Brazil are also related to the El Niño and La Niña phenomena.

The Amazon basin – which covers Amazonas, Amapá, Acre, Rondônia, Roraima and a large portion of Pará and Mato Grosso – is equivalent to 45% of the national territory and holds 81% of water availability. The coastal regions, which account for only 3% of the national supply, are home to 45% of the country's population, that is, Brazilians are increasingly concentrated in areas where water supply is unfavorable. **Figure 2** shows the Brazilian mapping and its regional divisions.

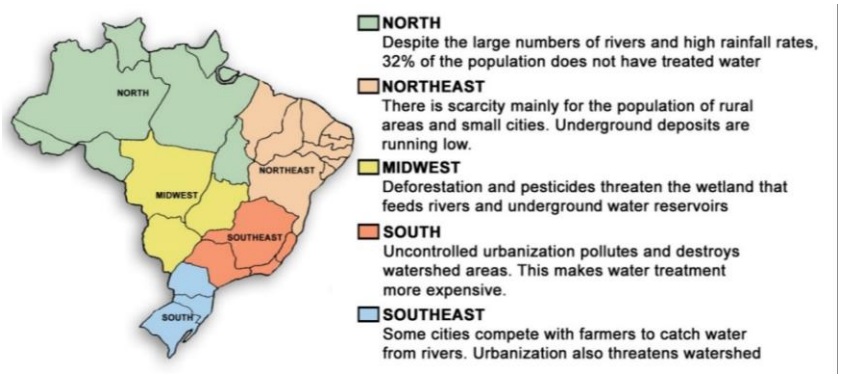


Figure. 2: Regions of Brazil
Source: Our own

Figure 3 shows a graph with the serious history of January 2016, comparing with the average of the year per capital city. It is noted that in the northeast region rainfall rates are the lowest in the country, and the severe droughts scourge the entire region and the northeastern population. The majority of the northeastern population inhabits the coastal areas where the water supply is greater than inland, but still below other regions of the country.

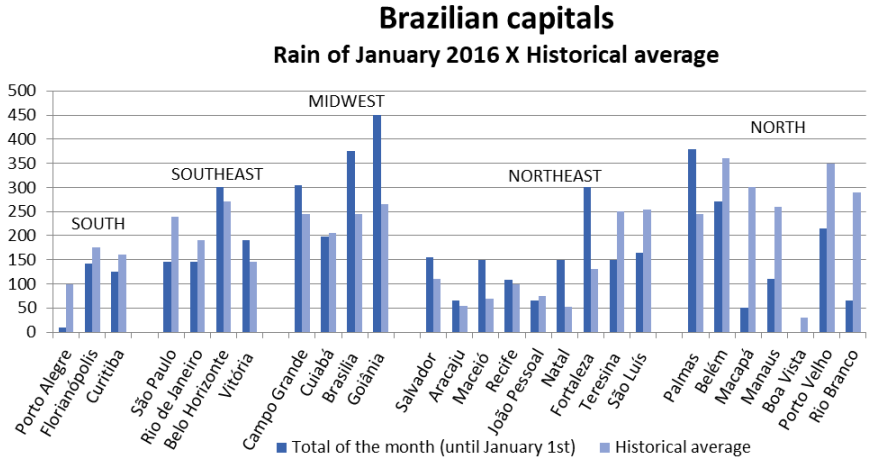


Figure 3: Precipitation of January 2016 by regions of Brazil x Historical average
Source: Adapted from website <http://www.climatempo.com.br>(accessed 04 March, 17).

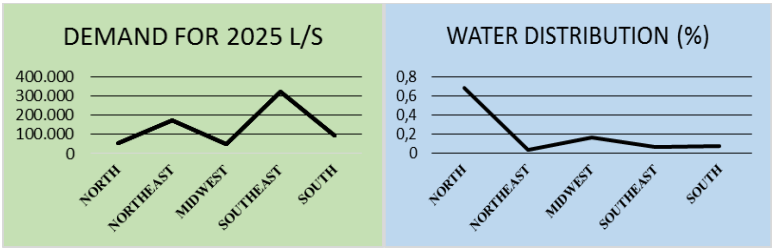
Analyzing **Table 3**, we can see the regional discrepancy between expected demand and water distribution. The deficit in sanitation in Brazil can also be observed. Considering that one of the objectives of the tools is the reduction of environmental impacts caused by the civil construction, it is essential to consider the situation regarding the demands and offers for water and to work to preserve the sources, seeking alternative solutions to meet the current and future demands. In this sense, this study proposes parameters for the development of more sustainable projects and includes indispensable procedures in the operation and maintenance phase, always seeking to reach the basic concepts of sustainability that include the economic, environmental and social side.

Table 3: National Demand and Distribution Scenario.

NATIONAL DEMAND AND DISTRIBUTION SCENARIO			SANITATION DEFICIT	
REGION	**DEMAND FOR 2025 L/s**	**WATER DISTRIBUTION (%)**	**POTABLE WATER (%)**	**SEWER (%)**
NORTH	54.727	68%	32,53	98,28
NORTHEAST	170.273	3%	21,74	86,78
MIDWEST	48.918	16%	20,29	66,73
SOUTHEAST	322.546	6%	6,47	29,55
SOUTH	91.189	7%	9,38	82,15

Source: <http://www.atlas.ana.gov.br>
(accessed March 23, 2017)

As shown in **Table 3**, if we compare the predicted demand with the water distribution, it is clear that the greatest concern for lack of water is not always in regions with less availability. If we compare what will be necessary to what is available, the North region will need something around 0.8% of its availability; the Northeast region, 57 times its availability; the Central West region, 3 times its Availability; the Southeast region 54 times its availability and lastly the South region with 13 times the water availability.
Figures 4 and 5 present the indices with the demands for 2025 and the water distribution per regions of Brazil.



Figures 4 and 5: National Demand and Distribution Scenario.
Source: Our own

The highest demand for water comes from the great centers of the Southeast region, where more and more water is being withdrawn from more distant places. The environmental assessment tools applied to the buildings need to be stricter in order to be more efficient in the use and reuse of water. Many tools turn to energy issues and only encourage control over water consumption, but not exactly in what activity this control should be applied.

5 PROPOSAL FOR A NEW WATER MANAGEMENT TOOL

Considering that an environmental certification should confer a green seal after verifying and proving the results proposed in the project, this study proposes new criteria and specific weighting for the design and operational phases, as presented in **tables 4 and 5**, in order to guarantee greater efficiency for water conservation and management, which can be included in any tools presented in the item corresponding to water efficiency mainly when used in countries with water problems such as several regions of Brazil.

Table 4: Project Criteria

	PROJECT CRITERIA - HYDROSANITARY	
	PARAMETERS	**POINTS**
1	- Sectorized measuring	.....
	1.1 - systems	5
	1.2 - subsystems	5
2	- Water-saving equipment	5
3	- Reuse of alternative sources	.....
	3.1 – greywater	5
	3.2 - blackwater	3
	3.3 – rain water	5
	3.4 – condensation water	5
	3.5 – purge water	2
	3.6 – reclaimed/industrial water	4
4	- Leakage detection system	5
5	- Increase in permeable area	5
6	- Hot water consumption reduction	3
7	- Fire reservoir with reuse/industrial water	3
8	- Greywater and dark greywater (fat) separation	5
	TOTAL	60

Source: Our own

In this context, the use of alternative sources of water, especially for demands that do not depend on drinkability, has become part of water conservation practices, since they reduce pressure on natural resources (MUN *et al.*2012; NETO *et al.*2012; NICOLETTE *et al.2013;* SINGH *et al.*2014; WIENER *et al.*2014).

Table 5: Operating Criteria

OPERATING CRITERIA		
	PARAMETERS	**POINTS**
1	- Water use awareness campaign	3
2	- Water leakage action brigade	4
3	- Regular adjustment of toilet flush and valves	5
4	- Irrigation and general washing with reused water	5
5	- Replenishing water tower with reused/industrial water	5
6	- Goals for reducing monthly consumption of drinking water	5
7	- Continuous training of the professionals involved	4
8	- Reduction of liquid effluents	3
9	- Guaranteeing drinking water quality after intake	3
10	- Other	3
	TOTAL	40

Source: Our own

As shown in **Figure 1**, there is in most tools a low weighting for the water criterion, even in countries with a history of shortages and supply crises such as the USA and Australia. The design definitions, when conceived

Comentado [CB5]: Comentário 4:
1-As seções 4 e 5 possuem o mesmo título, isso deve ser corrigido.
Resposta:
Agradecemos pelo alerta, houve realmente um engano e o título ficou repetido, o mesmo ocorreu na sequência de numeração dos parágrafos e foram corrigidos.

Comentado [CB6]: Comentário 6:
1-A seção da proposta da ferramenta deve ser melhor estruturada, isso deve ser realizada com uma fundamentação teórica, dados estatísticos, testes ou discussão com outras ferramentas de outros países.
Resposta: O artigo trata de um pesquisa com uma proposta de ferramenta de certificação criada através de parâmetros e ponderações revisados nas ferramentas citadas, reconhecidas como de maiores relevância internacional, e tem por objetivo, colaborar com a gestão da água em empreendimentos, reduzindo o consumo e os impactos ambientais. A proposta não foi testada e nem utilizada, não possuindo ainda portando, dados estatísticos e aplicações. Os autores se basearam na constatação da carência e da necessidade em adaptar os critérios das ferramentas, referência ao uso da água à realidades regionais, principalmente num país continental como o Brasil, com diversas características físicas, diferentes vazões e demandas por água. A ferramenta proposta, poderá servir como parâmetros projetuais e operacionais aos profissionais de arquitetura e engenharia, para as concessionárias de água e esgoto, bem como server de diretrizes municipais e estaduais, em relação as normas e recomendações para construções em parcimônia ao consumo de água em momentos que convivemos com a crise hídrica e escassez, onde, segundo a Agencia Nacional de Águas-ANA, 38 milhões de pessoas foram afetadas por secas e estiagens no Brasil em 2017, conforme publicação no relatório Conjuntura dos Recursos Hídricos no Brasil-informe 2018.(https://www.tratamentodeagua.com.br/ana-lanca-conjuntura-recursos-hidricos/).

Comentado [CB7]:
Comentário 5:
1-Também a citação de Neto deve ser corrigida conforme as normas.
Resposta:

ATUAL: (NICOLETTE; BURR; ROCKEL, 2013; SINGH; KHEDUN; MISHRA, 2014; WIENER; JAFVERT; NIES, 2016; MUN; HAN, 2012; NETO et al., 2012).

CORREÇÃO: (MUN *et al.*2012; NETO *et al.*2012; NICOLETTE *et al.2013;* SINGH *et al.*2014; WIENER *et al.*2014). According: NBR 10520 (2002).

CORRIGIDO A CITAÇÃO DE NETO CONFORME NBR 10520

with concepts of low environmental impact, tend to guarantee a result of greater efficiency compared to adapted projects after their execution.

Operational criteria are essential for efficient water management. An undertaking by itself will not guarantee savings only with the projects, even if they have been considered sustainable concepts to reduce the impact of construction on the environment. A holistic view with compatibility between project and operational actions is what is expected for real gain.

Based on the data published by the Brazilian National Water Agency (ANA) regarding the prediction of demands for 2025 in all regions of Brazil and with water availability for the same regions, this study proposes the creation of a new tool with parameters and weighting for water use and management to be applied in project designs and to be adopted during the stage of operation and maintenance of the projects in the cities of Brazil.

The new certification was denominated "+**água**" (+water) in this proposal and a visual identity as illustrated in **figure 6** was created. With focus on the national reality, the tool can be adopted by water and sewage concessionaires in all cities of Brazil to encourage the application of environmental concepts in constructions. Meeting the proposed parameters may bring, in addition to economic gains with the reduction of consumption of drinking water, social and environmental benefits.

Figure 6 – Tool Logo "+ ÁGUA"
Source: Our own

As seen earlier, some tools award green seals with, silver, bronze, gold and platinum stars. The proposed tool considered only for the efficient use of water. The number of drops will be proportional to the points reached, as shown in **table 6**, where five blue drops represent the highest score of the proposed criteria. The minimum to obtain a seal are two blue drops, conferred upon reaching 40 points, added to the project and operational phases.

Comentado [CB8]: Incluído table 6 no texto

Table 6: Credits for Certification

ÁGUA + CERTIFICATION - TOOL		
BLUE DROP SEAL	**DESIGN**	**OPERATION**
💧💧	30	10
💧💧💧	40	20
💧💧💧💧	50	30
💧💧💧💧💧	60	40

Source: Our own

Comentado [CB9]: Foi trocado o nome GREEN SEAL (SELO VERDE) POR BLUE DROP SEAL (SELO GOTA AZUL)

Regarding the project, the parameters should be adjusted according to the type of project because some items may not be configured with the characteristics of the construction assessed. The parameters connected to the phase of operation and maintenance, however, must be preferably fully met, because it is by operating that one can know if the expected results were reached. It is not possible to evaluate projects only because they may have been designed with all the concepts favorable to a more sustainable study, but their implementation has undergone modifications that compromise performance.

The criteria can be applied to any tools when comparing the proportionality of the existing weighting with the new weighting of the design and operational criteria proposed in this study. By making an equivalence of the parameters of the AQUA (High Environmental Quality) system where the maximum weighting reaches 12.22%, considering the Water Management category plus the Sanitary Quality category with the proposed system called +Água, the maximum value obtained would be close to 70%, that is, 12.22% would be equivalent to 8.55% when the parameters of the new tool were added. Thus, when the AQUA system was applied in Brazil, it would be necessary to adjust the parameters for the maximum recommended management in the regions of Brazil.

6 CONCLUSION

Applying a tool created in another country in a direct way will not bring good results and will not be reaching the real concerns, especially in the water issue. It is noted that the project should not only be adequate to environmental issues, its use and maintenance should also be in synergy with the needs of control of sources and demands for water. That is why operational criteria were proposed, which could guarantee significant gains in the saving of drinking water.

Civil construction is still mostly conservative in Brazil. The concept of performance, reduction of environmental impacts, use of material of environmental origin and concern with the increase in service life of the construction, are still new factors gradually inserted in the companies. As an incentive, compensation such as reduction of taxes or increase of urban rates could be applied by governments in certified undertakings.

Buildings with installation of water and energy saving equipment provided reduction in consumption and consequent lower costs. A construction that meets environmental requirements guarantees a long life and greater durability and consequently less maintenance fees charged even in recent buildings.

As shown in this study, the tools were developed for different needs and objectives in response to the realities of the country that created it, leading to the need for local adaptation for greater efficiency in results when applied in other regions. Legal and market factors can influence the decision of choosing a particular tool, which may not be the most environmentally appropriate. The projects are designed to meet the economic objectives of investors and comply with the laws in force in the region where they are intended to be built. Sustainability issues are not always taken into account.

Due to the serious and increasing problems of water scarcity, this study suggests that the criteria presented in tables 4 and 5, related to the design and operational phase, be included in other tools when they are used in Brazil, taking into account the regional demands. Due to the differences between the mentioned tools, it was not up to the authors, to define specific weighting to the criterion of water use and management. The variations presented in the comparisons between the tools, where many of the parameters are subjective and do not clearly show what can be done in relation to the water management and use, corroborated that a tool for national use was proposed and with this, to measure the performance of water use in built environments.

As a conclusion, based on what has been exposed in this paper and comments from various authors, no matter how much each tool evolves, the need to be appropriate to each region is inevitable. In developing countries such as Brazil, certification is easier to obtain in large cities in the Southeast region and it is probably out of the question in regions with serious social problems and low-skilled labor. A tool must be didactical for application, respecting each community, its culture and religion. Encouraging good consumption and reuse practices still presents a faster result. It is necessary to take to the academy to professionals the concepts of design and responsible use of this input. Every production chain must be engaged to meet the requirements of an environmental assessment system.

There is no better tool, probably the best result will come with the joint application of several tools. This includes both the ease of application and the costs for advice and commissioning, not to mention the market and legal requirements that may dictate the choice of the most appropriate system. Above the search for a certification, there should be concerns such as environmental and social issues, with the certificate as the

acknowledgment of a low environmental impact undertaking, with more performance and greater durability and mainly conferring internal quality to its user.

CONFLICT OF INTEREST.
On behalf of all authors, the corresponding author states that there is no conflict of interest.

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