

**Moving Forward towards Sustainability:
Contributions of the Living Building Challenge to Triple Bottom Line
Reporting**

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Moving Forward towards Sustainability: Contributions of the Living Building Challenge to Triple Bottom Line Reporting

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Sustainability-related reporting by companies and organizations has been developed with the growth of the notion of sustainability since the 1970s. More recently, Triple Bottom Line (TBL) reporting, one form of sustainability-related reporting which looks at a company's environmental, social and economic aspects, has been widely researched and discussed. The G4 Sustainability Reporting Framework (Framework) put forward by the Global Reporting Initiative, is the most recognized and practiced TBL reporting structure. More and more companies worldwide, especially big multinational firms such as the Fortune Global 500, do TBL reporting under the Framework, aiming to keep on track with their vision and mission, to assist decision-making, to promote their public image, to share information with stakeholders, and to gain positive economic benefits. However, among these sustainability pioneer companies, no construction or real estate companies are seen.

The real estate and construction sectors, together with the many fields and industries associated with them, make up one of the larger components of the global economy (Plunkett Research 2014). As of 2012, the U.S. Bureau of Labor estimated that 5.64 million Americans were employed in the construction industry. About \$885.1 billion in new American construction was put in place during 2012, according to the U.S. Bureau of the Census (Plunkett Research 2014). As the construction and real estate sector also has a high impact on climate change,

natural resources and natural ecosystems, if the sector notices the benefits of doing sustainability reporting, it will push forward their sustainability agenda.

The construction and real estate sector puts sustainability into practice by means of reaching standards such as building and planning codes, Leadership in Energy & Environmental Design certification and affordable housing. The Living Building Challenge (LBC) is the “greenest” one among them, and it concerns all three bottom lines of TBL reporting. This thesis aims to answer the question: How does the LBC Prepare Developers for TBL Reporting? If we can bring the LBC and the Framework together, the combination will facilitate TBL reporting of the construction and real estate sector.

The paper concludes that the LBC has excellent performance on the environmental aspect, the data of which are appropriate for environmental performance reporting. The LBC includes less data about economic and social performance, but assists TBL reporting indirectly. The LBC helps to ensure reporting contents and quality as well. Apart from criteria listed on the Framework, the LBC also identifies criteria specific for the construction and real estate sector, such as beauty of the project and car free living, which may add value on a building projects’ sustainability performance.

The research results suggest that developers or property managers who construct or manage buildings meeting the LBC to think about preparing TBL reporting. The reason is that the LBC data collected from the buildings are adequate to start TBL reporting and environmental data are quite resourceful and detailed. Further, the research findings are helpful to equip other interest groups, such as designers, planners and policymakers, to design and construct more sustainable buildings and communities.

Table of Contents

INTRODUCTION.....	1
LITERATURE REVIEW	4
Triple Bottom Line and Global Reporting Initiative	4
Living Building Challenge	24
METHODOLOGY	33
Hypothesis	35
Comparison between the GRI Framework and Living Building Challenge	36
RESULTS.....	41
What Do Interviewees Say	41
The Circumstances of Application	42
Comparison between the Living Building Challenge and the GRI Criteria.....	44
Function of Living Building Challenge Supplemental Resources	54
Living Building Challenge’s Contribution to Overall Reporting Contents and Quality	55
DISCUSSION	59
CONCLUSION	62
REFERENCES.....	65
Appendix 1: Definitions of Key Terms of the Framework	70
Appendix 2: Living Building Challenge Criteria.....	71
Appendix 3: Interview Questions.....	73
Appendix 4: G4 Sustainability Reporting Framework Criteria	75

Figures

Figure 1 Triple Bottom Line Idea	6
Figure 2 Triple Bottom Line Maximizes Business Value	8
Figure 3 Relationship Between Sustainability Reporting and Sustainability Accounting.	13
Figure 4 Structure of the GRI Sustainability Reporting Framework and Its TBL Contents	18
Figure 5 Benefits of Sustainability Reporting	23
Figure 6 Various Requirements of Buildings' Performances as to Sustainability.....	27
Figure 7 Concept Diagram of Thesis Methodology	34

Tables

Table 1 Comparison between GRI Framework and the LBC.....	35
Table 2 GRI Framework and LBC Criteria Comparison.....	46
Table 3 Indirect Contributions of the LBC to the GRI Framework.....	48
Table 4 LBC's Contribution on Reporting Content and Quality.....	57
Table 5 LBC's Contribution to Triple Bottom Line Reporting.....	62

INTRODUCTION

Sustainability has evolved since the 1970s. Sustainability-related reporting has developed with the growth of the notion of sustainability. There is a trend among companies worldwide, especially big multinational firms such as the Fortune Global 500, to do sustainability-related reporting (Hahn and Kühnen 2013, 9). Triple bottom line reporting, one form of sustainability-related reporting, is also widely researched and discussed. Triple bottom line reporting is an integrated reporting of an organization's economic, environmental and social performance. By integrating triple bottom line reporting, organizations push forward their sustainable agenda. Among all currently widely used sustainability-related reporting systems, the G4 Sustainability Reporting Framework (GRI Framework) put forward by the Global Reporting Initiative (GRI), is the most recognized and practiced one. The GRI Framework provides general guideline and sector guidance specifically for ten sectors, including construction and real estate.

The construction and real estate sector has a high impact on climate change, natural resources and natural ecosystems. In socio-economic terms, the built environment has significant direct and indirect impacts on social wellbeing and the livelihoods and prosperity of local communities and individuals. Through its various activities as a major employer, the sector can impact local economies by providing jobs, training and industry. It provides homes, education and recreational facilities for communities, yet it can also be responsible for displacing people (GRI 2011). It is important for developers, property managers, planners and policy makers to better understand the potential utility of triple bottom line reporting in the built environment field.

The Living Building Challenge is a pioneer in the built environment field to encourage the creation of next generation sustainable buildings, sites and communities. The Living Building Challenge may supplement triple bottom line reporting in that the Living Building Challenge

tries to offer practical responses to environmental, social and economic difficulties (LBC 2014b). Since the Living Building Challenge was put forward in the 1990s and promoted in 2000s, there has been little study into it. However, the Living Building Challenge became more prominent, with the completion of the Bullitt Center in March 2014. The Center is the largest building so far designed to reach the Living Building Challenge standards. The Center brings the Living Building Challenge into practice and pushes forward sustainability agenda.

This thesis aims to answer the question: “How does the Living Building Challenge prepare developers for triple bottom line reporting?” It tries to impart to readers with an understanding of triple bottom line reporting, using the GRI Framework as a role model of reporting, and how the Living Building Challenge can be integrated into triple bottom line. Further, it aims to better equip developers and other interest groups, such as planners and policymakers, to design and construct more sustainable buildings and communities.

The initial audience of this thesis is developers or property managers who construct, own and operate buildings. Planners and policy makers interested in sustainability and sustainable buildings, and wondering how the Living Building Challenge can be combined with triple bottom line reporting, may also find this thesis helpful. Any organizations baring sustainability in mind and working in the built environment field, such as green building construction companies, architecture firms designing sustainable buildings, or triple bottom line community development funds, can find this thesis helpful to their organizations to track their performance and fulfil their missions.

The purpose of this research is to examine the relationship between the Living Building Challenge and triple bottom line reporting. This thesis does not try to prove the justification of

the Living Building Challenge or the GRI reporting framework; neither is it guidance for developers on how to use triple bottom line reporting.

The paper's organization is as follows: "Chapter 1 Introduction" introduces the background of triple bottom line and the Living Building Challenge, puts forward the research question, and offers information on the audience and organization of the thesis. "Chapter 2 Literature Review" lists the literature regarding the history of triple bottom line, how triple bottom line has been practiced, and how organizations do triple bottom line reporting. It also looks at the development of the Living Building Challenge, standard and criteria of the Living Building Challenge, and the Living Building Challenge in practice. "Chapter 3 Methodology" introduces the research methods of the thesis. "Chapter 4 Results" presents the results drawn from the research. "Chapter 5 Discussion" analyzes and synthesizes the research findings, and discusses the significance of the findings. "Chapter 6 Conclusion" summarizes the thesis context.

LITERATURE REVIEW

Triple Bottom Line and Global Reporting Initiative

Starting from Sustainability

The concept of sustainability has evolved for about a half century. The most commonly acknowledged definition of sustainable development was given by Brundtland Commission in its 1987 report *Our Common Future*: “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

Sustainability-related reporting has been developed alongside the emergence and development of the notion of sustainability. In the 1970s, social reports appeared to complement companies’ traditional financial reports (Hahn and Kühnen 2013; Daub 2007). In the 1980s, environmental issues drew the public eye and companies started to bring in environmental reports alongside their financial reports (Kolk 2004, 51; Kolk 2010, 368). In 1998, for example, 35% of the 250 biggest Fortune Global 500 companies were already producing environmental reports (Kolk 2010, 367; Kolk et al. 2001, 17). In the 1990s, researchers such as John Elkington started to advocate for triple bottom line thinking which integrates economic development, environmental protection and social equity (Elkington 1998). Since his groundbreaking work, there has been a trend for annual reports to include more information on social and environmental aspects of the companies’ activities (Daub 2007, 78). This type of reporting has evolved to multidimensional reporting (Kolk 2010,368), and recently even integrated reporting, which brings sustainability information together with traditional financial information in a single report to provide a holistic picture of value creation over time (KPMG 2011, 3). Today there are several worldwide sustainability-related standards such as the Global Reporting Initiative (GRI),

ISO 14000 series, SA 8000 and AA 1000. These standards provide relatively big companies with options for sustainable reporting (Morhardt et al. 2002, 220). However, the GRI Framework is the only widely-recognized standard that integrates all three aspects of triple bottom line (Rodrigo and Huisingh 2011, 101).

Although on some occasions, the notion of sustainability covers economic, ecological, political and cultural aspects (Global Compact Cities Program 2014), the commonly acknowledged goals of sustainability were identified in the 2005 World Summit on Social Development. The goals are economic development, social development and environmental protection (United Nations General Assembly 2005). These goals coincide with the contents of triple bottom line. Researchers in many cases use triple bottom line reporting and sustainability reporting interchangeably (Kolk 2001; Hahn and Kühnen 2013). Sustainability reporting is defined as a public report that “contains qualitative and quantitative information on the extent to which the company has managed to improve its economic, environmental and social effectiveness and efficiency in the reporting period and integrate these aspects in a sustainability managements system” (Daub 2007, 76). In this thesis, sustainability reporting and triple bottom line reporting are equivalent to one another, and both of them cover economic, environmental and social aspects. Research looking at only one or two bottom lines of triple bottom line thinking inadequately defines sustainability reporting. However, in this thesis, sustainability-related reporting that only covers one or two bottom lines is considered a report that is not complete.

Development of Triple Bottom Line

Triple bottom line thinking was first put out by John Elkington in his book *Cannibals with Forks*, aiming to put forward a term in the sustainability field to resonate with the business world (Elkington 1998). At that time, social and economic dimensions of sustainability drew people's attention after being put forward in 1987's Brundtland Report, but there is no link of sustainability agenda with corporate social or environmental efforts (Henriques and Richardson 2004, 1). In his book, Elkington argues that sustainable development involves the simultaneous pursuit of economic prosperity, environmental quality, and social equity. "Companies aiming for sustainability need to perform not against a single, financial bottom line but against triple bottom line" (Elkington 1998, 387). Figure 1 is a simple illustration of triple bottom line idea.

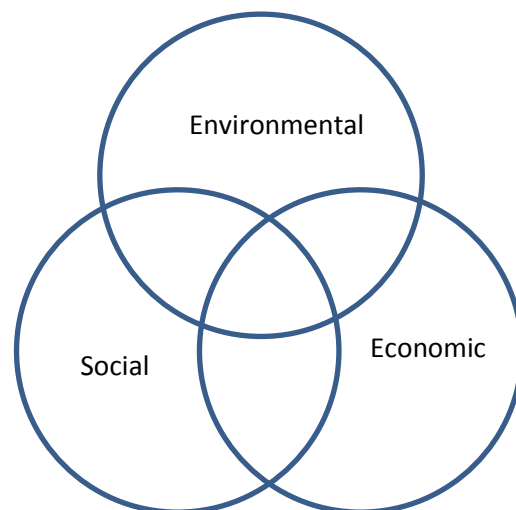


Figure 1 Triple Bottom Line Idea

Elkington argues that seven revolutions cause sustainable capitalism transition, they are: markets, values, transparency, life-cycle technology, partnerships, time and corporate governance (Henriques and Richardson 2004, 3). The first revolution of market is driven by competition. For the foreseeable future, business will operate in markets that are more open to

competition, which forces companies to learn to spot the market conditions and appeal to the market. Competitiveness of the market challenges companies about their triple bottom line commitments and performance. The second revolution is driven by the worldwide shift in human and societal values from taking values as a given, to soft values. According to precedents such as Shell's experience during the Brent Spar and Nigerian controversies and Texaco's huge effort to bury the controversy about its poor record in integrating ethnic minorities, companies may crash because of values-based crises. The third revolution is fuelled by growing international transparency. As a result, companies will find their thinking, commitments and activities under increasingly intense scrutiny worldwide. Companies, in the meanwhile, are increasingly using disclosed information to compare, benchmark and rank the performance of competing companies. The fourth revolution, life-cycle technology, switching from product oriented to function oriented, is driven by the transparency revolution. Companies are being challenged about triple bottom line implications either of industrial activities far back down the supply chain or about the implications of their products in transit, in use and after their useful life has ended. The fifth revolution will dramatically accelerate the rate at which new forms of partnership spring up between companies. Organizations will increasingly build new relationship forms with opponents who are seen to hold some of the keys to success in the new order. The sixth revolution will promote a profound shift in the way that companies perceive and manage time, because the sustainability agenda is pushing companies towards 'long' time. The seventh revolution of corporate governance is driven by each of the other revolutions. Elkington argues: "The better the system of corporate governance, the greater the chance that we can build toward genuinely sustainable capitalism. (Henriques and Richardson 2004, 6)"

Based on his perspective that the companies are facing such revolutions, Elkington proposes a learning process for business to better face challenges and improve performance. The process includes 5 steps: invasion of new technology/business model that causes new impacts, internalization of externalities to society or the environment, inclusion of wider range of stakeholders, integration of new priorities in business, such as health, environment, and safety, and incubation of new technology/business models. Advocates of triple bottom line believe the introduction of triple bottom line to the business world will optimize the integration of social capital, natural capital and economic capital, thus maximizing business value (Brian and Cohen 2002). Figure 2 illustrates this opinion.

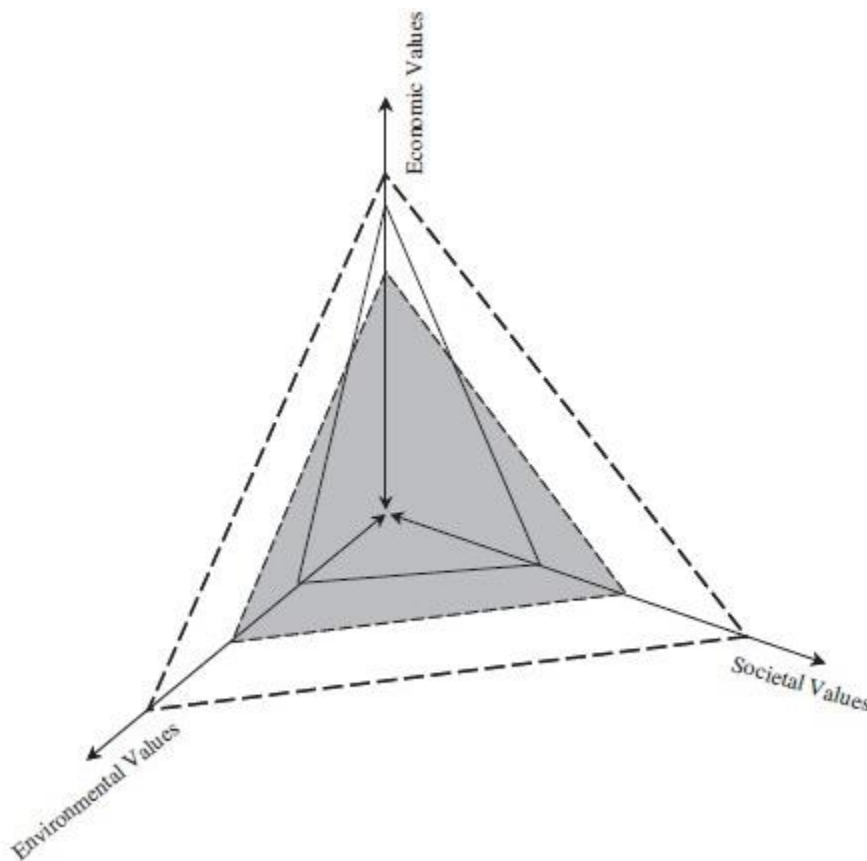


Figure 2 Triple Bottom Line Maximizes Business Value (Brian and Cohen 2002, 129)

Triple Bottom Line and Corporate Social Responsibility

Many companies do sustainability-related reporting, in response to changes that they bring to society. In academic discourse, this is called “corporate citizenship”, “corporate social responsibility” and “corporate responsiveness” (Daub 2007, 77). These terms describe the wide-ranging responsibility of a company towards its stakeholders and society as a whole. Dyllick and Hockerts assert companies need to maintain their economic, social and environmental capital base to achieve corporate sustainability (Thomas and Hockerts 2002, 132). The European Commission defines Corporate Social Responsibility (CSR) as “the responsibility of enterprises for their impacts on society...to integrate social, environmental, ethical, human rights and consumer concerns into their business operations and core strategy” (Hahn and Kühnen 2013,6). Based on this similarity, this thesis considers CSR reporting as triple bottom line reporting when it covers all three economic, environmental and social aspects consistent with companies’ sustainable performance.

Although both CSR and triple bottom line generally cover economic, environmental and social aspects, they are slightly different. The definition of CSR contains more meaning in the social aspect than merely social equity. For example, it includes consumer concerns, direct and indirect stakeholders, and future stakeholders. The central element of CSR, a concern with stakeholders, is inevitable in triple bottom line. For organizations to ensure that no important sustainability issues have been overlooked, it is crucial for them to work with the full range of their stakeholders (Henriques and Richardson 2004, 27). In terms of economic aspect, profitability, which is of central concern to shareholders, is one element of the economic aspect, but not all of it (Henriques and Richardson 2004, 29). This means that the financial aspect is only one component of economic impact/performance of a company. Two consequences of this

should be borne in mind. The first is that the scope of the economic aspect must be distinguished from the expression of environmental or social impacts in financial terms. The second is that unlike the other two aspects, the externalities of the economic aspect are hard to identify. In the GRI Framework, which is a major literature studied in this thesis, the economic dimension of sustainability concerns the organization's impacts on the economic conditions of its stakeholders and on economic systems at local, national, and global levels. It does not focus on the financial condition of the organization (GRI 2013a, 4). Triple bottom line thinking also means more than social equity in the traditional sense when it refers to social equity or social justice. Elkington deems "(social equity) in the form of public health, skills and education. But it also must embrace wider measures of a society's health and wealth-creation potential. (Elkington, John. 1998, 85)" In this paper, the social bottom line not only takes into account traditional social equity groups such as low-incomes and politically under-representatives, but also the broader meaning of social benefits which contains the benefit of consumers, direct and indirect stakeholders, and society as a whole.

Accounting for Sustainability

Sustainability or CSR is measured by means of sustainability accounting, which aims to gather data that support internal decision-making concerning corporate sustainability. Traditional accounting is strictly regulated by external legislation and professional standards. This is not the case for social and environmental accounting, where indicators are often determined inside the organizations, leading to low information quality and causing low-quality reports (Henriques and Richardson 2004, 21). Both business and accounting professions have been trying to create new metric to gauge corporate sustainability. Much of the focus has been on accounting for the

environmental aspect of triple bottom line. Bennett and James identify six domains of firm-level environmental accounting: energy and materials accounting, environment-related financial management, life-cycle assessment, life-cycle cost assessment, environmental impact assessment, and environmental externalities assessment (Bennett and James 1998; Henriques and Richardson 2004, 168). If a firm is seriously committed to the idea of environmental accounting, it need to manage and control both its internal environmental costs and reduce the external environmental costs resulting from its activities (Henriques and Richardson 2004, 101).

Environmental accounting researchers have been adopting and developing traditional accounting methods to environmental accounting. Full cost accounting is an emerging accounting practice, which attempts to integrate the total cost of corporate economic activities, including social and environmental costs (Hahn and Kühnen 2013, 7). O'Dwyer notes that by internalizing external costs, through tools such as eco-taxes, full cost accounting enables prices to reflect their full environmental costs, which would then flow to the consumption and production chain, consequently reinforcing more sustainable patterns of behavior (Henriques and Richardson 2004, 174). More recently, there has been renewed interest in developing social indicators and various experiments in full cost, triple bottom line and sustainability accounting (Bebbington et al. 2007, 228). Another genre of emerging sustainability accounting practice is input–output analysis, which involves accounting for the physical flow of materials, energy inputs and products including waste outputs in physical units. This is facilitated using the accounting principle of double entry and transparency (Henriques and Richardson 2004, 174).

While actively putting triple bottom line thinking into practice, triple bottom line accounting raises critiques. The majority of the critiques focus on the validity of applying accounting methods to environmental and social bottom lines and how to integrate the three

bottom lines. Norman and MacDonald argue that “what is sound about the idea of triple bottom line is not novel, and what is novel about the idea is not sound” (Norman and MacDonald 2004, 243). Ngwakwe, in the meantime, emphasizes that in order to address environmental and social challenges, accounting requires a more pragmatic paradigm (Ngwakwe 2012, 29). Although triple bottom line accounting has spurred some element of sustainable development from both the accounting profession and the corporations, it seems that the voluntary nature of triple bottom line and its framework is acting as a setback and as such weakens sustainable development efforts from the accounting and corporate sector. Hence triple bottom line is currently practiced according to the whims of corporate executives. What is commonly orchestrated today as sustainability accounting within the accounting profession is more of a weaker form of triple bottom line and appears to contribute limitedly to the ideals of sustainable development (Ngwakwe 2012, 34).

Triple Bottom Line as a Reporting Tool

On the basis of reliable accounting data, sustainability reporting then provides and substantiates information about the status and progress of corporate sustainability. Triple bottom line reporting informs internal and external stakeholders through formalized means of communication (Burritt and Schaltegger 2001; Hahn and Kühnen 2013, 5; Elkington 1998, 171). The relationship of sustainability accounting and reporting is shown in figure 3.

responsibility and desire to adhere to societal norms (Morhardt et al. 2002, 216). A KPMG 2011 study shows that reputation or brand, ethical considerations, employee motivation and innovation and learning are top four reasons for Fortune Global 250 (G250) companies to do corporate reporting (KPMG 2011, 19). According to this report, 70% of G250 published sustainability reports in 2011, while the number is 50% in 2002 and 37% in 1999 (KPMG 2011, 3). The study indicates almost half of the G250 companies reported gaining financial value from their CSR initiatives (Henriques and Richardson 2004, 19). Given all the advantages mentioned above, the possibility for companies in the built environment field to gain benefits from their triple bottom line reporting if they decide to do so.

Triple bottom line thinking is receiving increasing attention. Elkington notices the frequency of mentions of triple bottom line increased dramatically from year 1999 to 2001 (Henriques and Richardson 2004, 2). One review of triple bottom line indicates that in 2004 and 2011, research in the topic of triple bottom line showed a significant boom (Hahn and Kühnen 2013, 9). This study, based on 108 articles analyzing determinants of sustainability, shows that companies' social and environmental performance has little relationship with whether or not they do reporting (Hahn and Kühnen 2013, 10). On the one hand, companies may want to signal good performance, implying a positive effect on reporting. On the other hand, companies with a weaker performance may face greater stakeholder pressure, thus they may be more actively engaged in reporting to mitigate legitimacy threats (Hahn and Kühnen 2013, 12). The research shows that large companies tend to do more reporting than smaller companies, likely because larger companies cause greater impacts, become more visible, and therefore face greater stakeholder scrutiny and pressure. Meanwhile small companies might have higher marginal costs of disclosure (Henriques and Richardson 2004, 10). However, the research also shows that there

is a strong focus, in the reviewed literature, on large and multinational enterprises. Among the 108 articles, merely 11 address small and medium-sized enterprises and only 3 of them do so exclusively (Henriques and Richardson 2004, 15). To keep up with the worldwide trend of increasing attention to triple bottom line reporting, and to draw scholars' attention to triple bottom line reporting in the built environment field, it is worth researching the possibility of adopting triple bottom line reporting in construction and real estate sector.

Although sustainability accounting and reporting have received increased relevance in business and academia, this thesis focuses on reporting because the disclosure and the internal/external communication of triple bottom line/sustainability information directly contribute to a company's supply of critical resources from various stakeholders (Hahn and Kühnen 2013, 13). Sustainability reporting meets Elkington's proposal of companies practicing transparency and engaging stakeholders (Elkington 1998, 159). Moreover, the GRI Framework, the major method of this thesis, is a reporting structure aiming at creating triple bottom line reporting for disclosure. The GRI Framework offers a unilateral standard for non-financial reporting which can be voluntarily used to create reports to achieve certain standardization in the field (Hahn and Kühnen 2013, 7).

Global Reporting Initiative

Among all the sustainability-related reporting frameworks, such as the ISO 14000 series on environmental performance, the SA 8000 on social aspect, and the AA 1000 on social and ethical aspect, the GRI Sustainability Reporting Framework (GRI Framework) comes to the fore (Lozano and Huisingh. 2011, 101). The GRI Framework is a self-defined triple bottom line reporting system. 95% of the 250 biggest Fortune Global 500 companies report their

sustainability performance, with 80 percent of these using the GRI Guidelines, which is the main body of the GRI Framework, according to the KPMG study (KPMG 2011, 12). GRI also has the only international reporting framework for organizational sustainability/triple bottom line performance that is designed to be applicable for public agencies. Public agencies including the Ministry for Environment, New Zealand, the NHS Purchasing and Supply Agency, the United Kingdom, the Department of Family and Community Services, Australia and the Architectural Services Department, Hong Kong SAR, China are adopting the GRI Framework (GRI 2004). The GRI aims at providing “globally shared frameworks of concepts, consistent language, and metrics” to “communicate clearly and openly about sustainability” (GRI 2011). However, the GRI focuses more on environmental and social bottom lines and only covers a few general economic indicators (Hahn and Kühnen 2013).

GRI promotes the use of sustainability reporting as a way for organizations to become more sustainable and contribute to sustainable development. GRI defines a sustainability report as a report published by a company or organization about the economic, environmental and social impacts caused by its everyday activities (GRI 2014a). GRI was founded in Boston in 1997, rooted in US non-profit organizations the Coalition for Environmentally Responsible Economies (CERES) and the Tellus Institute. The aim was to create an accountability mechanism to ensure companies were following the CERES Principles for responsible environmental conduct. Investors were the GRI Framework’s original target audience. In 1998, a multi-stakeholder Steering Committee was established with a pivotal mandate to report more than the environment aspect. On this advice, the GRI Framework’s scope was broadened to include social, economic, and governance issues. GRI’s guidance became a Sustainability Reporting Framework, with the Reporting Guidelines at its heart. The first version of the

Guidelines was launched in 2000. On the advice of the Steering Committee, CERES separated GRI as an independent institution in 2001. The second generation of Guidelines, known as G2, was unveiled in 2002 at the World Summit on Sustainable Development in Johannesburg. GRI was referenced in the World Summit's Plan of Implementation. The United Nation's Environment Program (UNEP) embraced GRI. In 2002 GRI was formally inaugurated as a UNEP collaborating organization, and relocated to Amsterdam as an independent non-profit organization. In the 2005 World Summit on Social Development, the GRI was introduced among all the other initiatives (Global Compact Cities Program 2014). The uptake of GRI's guidance was boosted by the 2006 launch of the third generation of Guidelines, G3. Over 3,000 experts from business, civil society and the labor movement participated in G3's development. In 2011, GRI published the G3.1 Guidelines – an update and completion of G3, with expanded guidance on reporting gender, community and human rights-related performance. In May 2013, GRI released the fourth generation of its Guidelines, G4, which is the theme of this thesis (GRI 2014a).

The GRI Framework consists of the GRI sustainability reporting guidelines and sector guidance (GRI 2014a). The reporting guidelines offer reporting principles, standard disclosures and an implementation manual for the preparation of sustainability reports by organizations, regardless of their size, sector or location. Reporting principles lay the big picture of a company's performance. Specific standard disclosure, which is part of the standard disclosure, is the major triple bottom line element of the reporting system. Definitions of key terms of the GRI Framework can be found in figure 4 below shows the structure of the GRI Framework, and how

triple bottom line is presented in the GRI Framework.

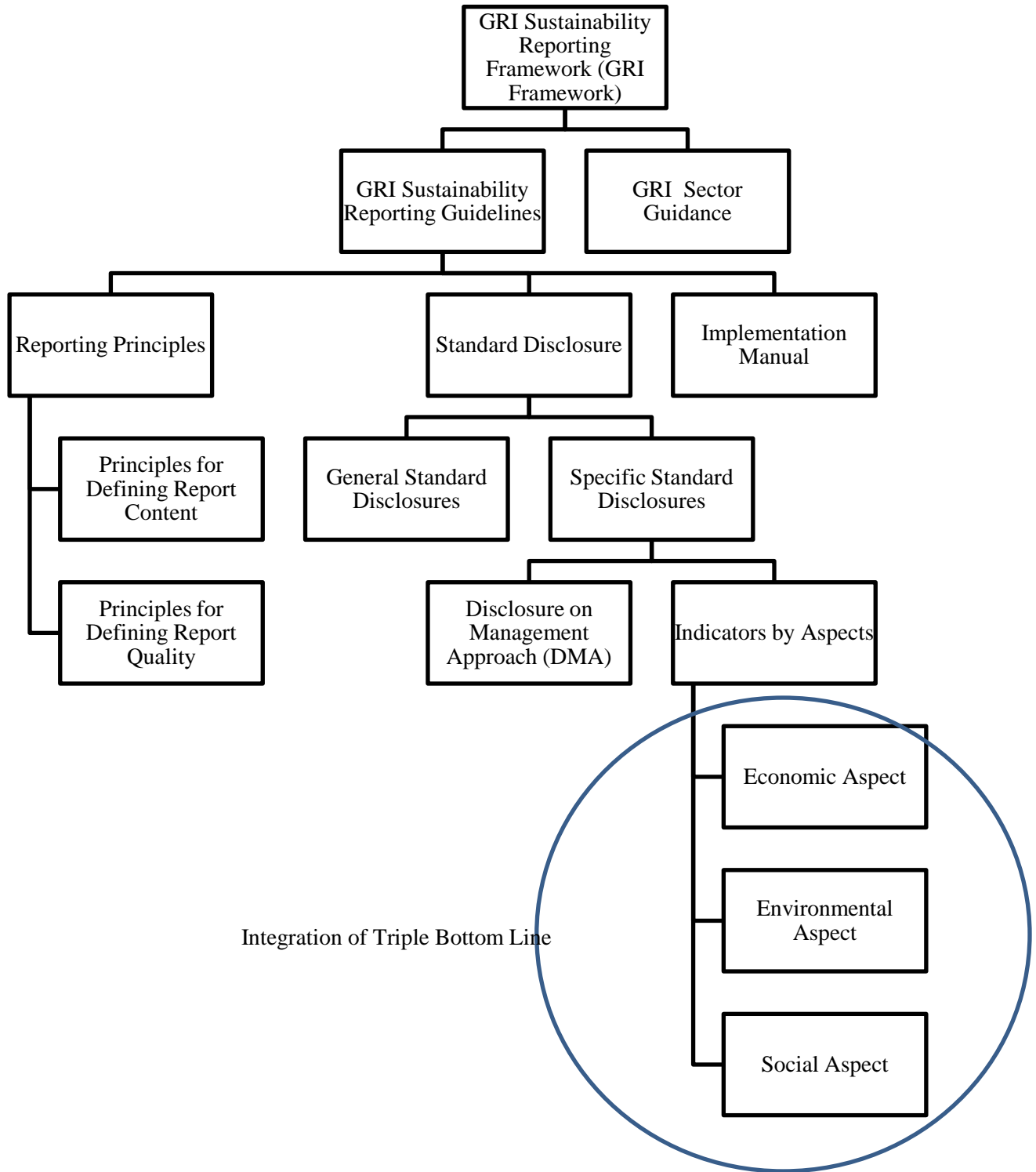


Figure 4 Structure of the GRI Sustainability Reporting Framework and Its Triple Bottom Line Contents

Reporting Principles

The reporting principles are fundamental to achieving transparency in sustainability reporting and therefore should be applied by all organizations when preparing a sustainability report. The reporting principles are divided into two groups: principles for defining report content (including stakeholder inclusiveness, sustainability context, materiality and completeness) and principles for defining report quality (including balance, comparability, accuracy, timeliness, clarity and reliability).

The principles for defining report content guide decisions to identify what content the report should cover by considering the organization's activities, impacts, and the substantive expectations and interests of its stakeholders. The principles for defining report quality guide choices on ensuring the quality of information in the sustainability report, including its proper presentation. The quality of the information is important to enable stakeholders to make sound and reasonable assessments of performance, and take appropriate actions (GRI 2013a, 8).

Standard Disclosures

The guidelines offer two options to an organization in order to prepare its sustainability report 'in accordance' with the guidelines: the *core* option and the *comprehensive* option. The *core* option contains the essential elements of a sustainability report, and provides the background against which an organization communicates the impacts of its economic, environmental and social and governance performance. The *comprehensive* option builds on the core option by requiring additional standard disclosures of the organization's strategy and analysis, governance, and ethics and integrity. Standard disclosures contain general standard disclosures and specific standard disclosures. No matter which option an organization chooses to

follow, core or comprehensive, it should report both the general standard disclosures and the specific standard disclosures. For the completeness of the research, the comprehensive option is been chosen for the thesis. In other words, all criteria are researched in this thesis.

The general standard disclosures are applicable to all organizations preparing sustainability reports. The disclosures include strategy and analysis, organizational profile, identified material aspects and boundaries, stakeholder engagement, report profile, governance, and ethics and integrity. The specific standard disclosures are organized into three categories - economic, environmental and social, which are in accordance with triple bottom line. The social category is further divided into four sub-categories, which are labor practices and decent work, human rights, society and product responsibility. Criteria of the GRI Framework are called material aspects, which reflect the organization's significant economic, environmental and social impacts; or substantively influence the assessments and decisions of stakeholders. The information reported for each identified material aspect can be disclosed as disclosures on management approach (DMA) and as indicator(s).

Implementation Manual

The implementation manual provides valuable information about:

- How to understand, interpret and implement the concepts mentioned in the reporting principles and standard disclosures;
- How to select and prepare the information to be disclosed in the final report; which references can be useful when preparing a report;

- How to apply the reporting principles;
- How to identify material aspects and their boundaries; and
- How GRI content helps to report on the organization's implementation of the organization for economic cooperation and development

According to the implementation manual, the economic dimension of sustainability concerns the organization's impacts on the economic conditions of its stakeholders and on economic systems at local, national, and global levels. It does not focus on the financial condition of the organization (GRI 2013a, 62).

Sector Guidance

G4 also has sector guidance for ten sectors: airport operators, construction and real estate, electric utilities, event organizers, financial services, food processing, media, mining and metals, NGO, oil and gas (GRI 2011). The sector guidance makes reporting more relevant and user-friendly for organizations in diverse sectors. The construction and real estate sector is the most relevant sector among ten sector disclosures offered by GRI. GRI creates geographically diverse, multi-stakeholder working groups by recruiting volunteer experts from around the world to develop sector guidance. Sector supplement working groups typically include approximately twenty members. Of these, 50% are from the industry and 50% come from non-industry organizations (GRI 2014b). The construction and real estate working group consists of faculty, researchers, engineers, realtors, and NGO/NPO staff from policy, real estate, energy, engineering, and labor protection industries from all over the world (GRI 2014c). The sector disclosures contain both general standard disclosures and specific standard disclosures (GRI 2014b). The

sector disclosures are on step forward to issue informative industry-specific reporting. This thesis includes the construction and real estate sector disclosure in the analysis.

The construction and real estate sector disclosures are intended for companies that (GRI 2011, 8) invest in, develop, construct, or manage buildings, and invest in, develop or construct infrastructure. For the purpose of these sector disclosures, infrastructure assets relate to new construction, and demolition and redevelopment of infrastructure only. Management and occupation of infrastructure is not included in the scope of these sector disclosures. Infrastructure asset types include transport infrastructure, social infrastructure, environmental infrastructure, energy infrastructure and other infrastructure including fixed or mobile telecommunication networks and broadcast facilities.

Global Reporting Initiative in Practice

About 6198 organizations do sustainability reporting under GRI Framework for above reasons (GRI 2014d). The list includes but is not limited to Hydro Quebec, Royal Dutch Shell, Bank Asia, Dell, SouthWest Airlines Co. Ltd. and Sterlite, Industries. Shell Company has been cooperating with GRI and issuing triple bottom line reports since 1997 (Shell Company 2014a). The *Shell Sustainability Report 2013* reports on the company's economic, social and environmental aspects (Shell Company 2013). The report summarizes data of year 2013, and presents past data for comparison. The report gives equal weight to all the three aspects, and particularly mentions spill accidents and labor safety, which are big concerns for oil companies. The GRI disclosures quick view indicates that the Shell Company fully reported one-third of all disclosures, partially reported one-third of the disclosures, and not reported about one-third of the disclosures (Shell Company 2014a). Data availability is constrained because of inherent

limitations to accuracy of environmental and social data, and timeliness of data, as the report only includes data available by the end of March 2014 (Henriques and Richardson 2004, 104).

GRI believes an effective sustainability reporting cycle should benefit all reporting organizations. Figure 5 summarizes the benefits mentioned by the GRI.

Internal benefits	External benefits
<ul style="list-style-type: none"> • Increased understanding of risks and opportunities • Emphasizing the link between financial and non-financial performance • Influencing long term management strategy and policy, and business plans • Streamlining processes, reducing costs and improving efficiency • Benchmarking and assessing sustainability performance with respect to laws, norms, codes, performance standards, and voluntary initiatives • Avoiding being implicated in publicized environmental, social and governance failures • Comparing performance internally, and between organizations and sectors 	<ul style="list-style-type: none"> • Mitigating – or reversing – negative environmental, social and governance impacts • Improving reputation and brand loyalty • Enabling external stakeholders to understand the organization’s true value, and tangible and intangible assets • Demonstrating how the organization influences, and is influenced by, expectations about sustainable development

Figure 5 Benefits of Sustainability Reporting (GRI 2014e)

For benefits mentioned above, it is worth doing the sustainability reports for the construction and real estate industry, however, unavailability of some environmental and social data may hinder the reporting process and lower reporting quality. Thus, this thesis intends to research how the Living Building Challenge helps companies prepare their sustainability reporting. The following section introduces the Living Building Challenge.

Living Building Challenge

Most practices in the built environment field focus on one or two bottom lines. LEED is a green building certification deals with environment and energy saving. At the local level, for example, the Seattle 2030 District is a high-performance building district in downtown Seattle that aims to dramatically reduce environmental impacts of building construction and operation. The City of Seattle enforces an Energy Benchmarking and Reporting Program that requires owners of non-residential and multifamily buildings in the City to track and report energy performance annually. Developers such as Common Ground particularly work in the affordable housing field, contributing to social equity. A community plan program called the Community Cornerstones taking place in south east Seattle focuses on economic and social bottom lines, seeking to build a new model for equitable development that supports the existing economically and culturally diverse residents and businesses while also welcoming new ones. Although still evolving, the Living Building Challenge, among others, is a certification that with the most consideration of all the three bottom lines. It aims to lead the transformation to a world that is socially just, culturally rich and ecologically restorative (LBI 2014a). The latest version of the Living Building Challenge is designed to address critical social and economic issues (McLennan 2009). The Living Building Challenge won the prestigious Buckminster Fuller Challenge Award in 2012, for its “solutions that address a pressing global problem, with a comprehensive approach taking in social, environmental, economic and cultural factors” (Rala 2014).

The idea for the Living Building Challenge emerged in the mid-1990s during an effort to produce the most advanced sustainable design project in the world: the EpiCenter in Montana, led by Bob Berkebile and Kath Williams. Working with Berkebile at BNIM, Jason F. McLennan guided the research and technology solutions for the EpiCenter. In the process, he also began to

conceptualize the requirements for what is now known as a living building. Although the EpiCenter was never built, Berkebile and McLennan continued to develop the idea and published several related articles. They brought in biomimicry notion into architecture in 1999 (Berkebile and McLennan 1999), and developed the idea of integrating technology with nature in 2004 (Berkebile and McLennan 2004).

In 2000, BNIM, hired by the David and Lucile Packard Foundation, examined the economic and environmental implications of a living building alongside the various levels of LEED certification. The findings were presented in a document called the Packard Matrix, which demonstrated that a Living Building was the smartest long-term choice economically, although it carried a hefty first-cost premium (Craig Scranton 2014). The Institute's *Living Building Financial Study* proved that first-cost premiums have diminished, and certain building types make immediate financial sense (Craig Scranton 2014).

With the effort of McLennan, the Living Building Challenge version 1.0 was formally launched to the public by the Cascadia Green Building Council in August 2006, and version 2.0 in 2007. The version 2.0 refined the requirements of the program and demonstrated how to apply the imperatives to different scales of development—from partial building renovations to whole structures, and from individual landscape and infrastructure projects to entire neighborhoods.

In response to the increasing global attention and interest, Cascadia founded the International Living Building Institute in 2009. The Institute certified the first projects in 2010, which changed the green building movement on a fundamental level. Groups from Mexico, Ireland, Australia, Germany, and other countries around the world reached out to learn more about the Living Building Challenge. This reflects that people from all parts of the world are

looking for practical, hopeful responses to environmental, social and economic difficulties (LFI 2012).

At the beginning of 2011, the Institute was renamed as the International Living Future Institute, with a mission to lead the transformation to a world that is socially just, culturally rich and ecologically restorative. Currently, the Institute is promoting the Living Building Challenge Standard 2.1, which is composed of seven performance areas, or petals: site, water, energy, health, materials, equity and beauty. Petals are subdivided into a total of twenty imperatives, each of which focuses on a specific sphere of influence (LFI 2012). *Appendix 2* presents every imperative and its definition and explanation. From the petals we can see that the Living Building Challenge focuses more on environment and less on equity. While the Living Building Challenge does not integrate economic efficiency directly, it does try to achieve economic benefits by applying advanced construction and financial techniques. The Institute explores alternatives that will “help shift limited investment capital towards a restorative built environment by integrating social and environmental benefits into investment models, appraiser methodologies, and supporting policies” (LFI 2012).

The Living Building Institute has been promoting and rounding-out the certification. A 2009 study’s primary finding is that living buildings can be built cost effectively in today’s market driven economy, given the rising costs of energy and water. The conclusion is supported by the relatively short payback period reported by the study for many of the thirty six buildings. Twenty-four of the thirty-six buildings had an average payback of less than twenty years (LFI 2013). Figure 6 shows how the various requirements of buildings act as to sustainability. The research also shows that the Living Building Challenge is also the only one among all the mentioned requirements that examines the actual building performance after it is constructed and

put into function, rather than modeled or anticipated, performance (Living Future Institute staff, interview). Therefore, projects must be operational for at least twelve consecutive months prior to evaluation. It dramatically increases the chance that the buildings will keep going with their sustainable operation.

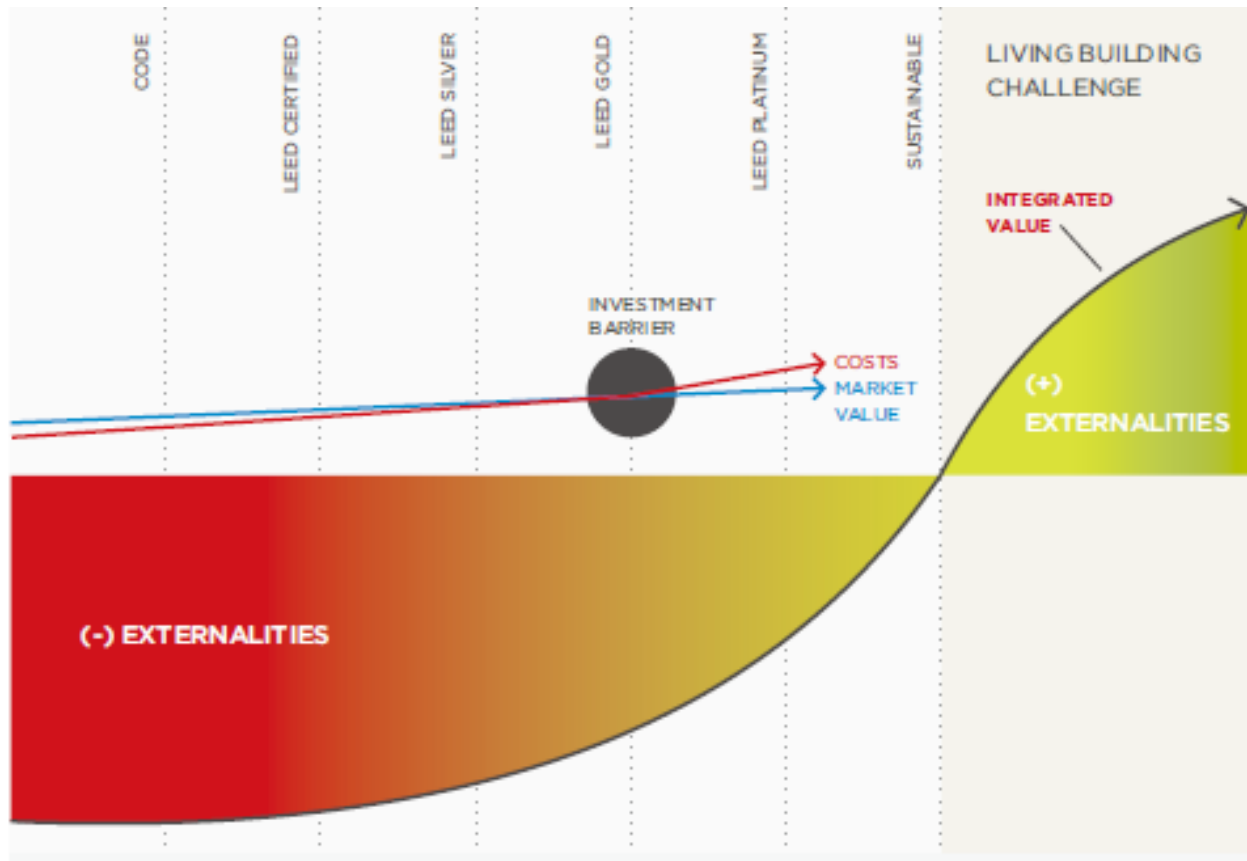


Figure 6 Various Requirements of Buildings' Performances as to Sustainability (The Living Future Institute, 2013)

The Living Building Challenge Standards

The facets of the Living Building Challenge are performance-based and position the ideal outcome as an indicator of success. The compilation of imperatives can be applied to almost every conceivable typology, or project type, such as a building (both renovation of an existing

structure or new construction), infrastructure, landscape or community development. The imperatives must be met for any type of project, at any scale, in any location (GRI 2013a, 5). Naturally, strategies to create living landscapes, infrastructure, renovations, buildings or neighborhoods will vary widely by occupancy, use, construction type and location, but the fundamental considerations remain the same (GRI 2013a, 7).

As the Living Building Challenge projects seek to generate their own energy and collect their own water, they more appropriately match scale to technology and end use, and result in greater self-sufficiency. Yet, the ideal scale for solutions is not always within a project's property boundary. Depending on the technology, the optimal scale can vary when considering environmental impact, first cost and operating costs. To address these realities, the Living Building Challenge has a scale jumping overlay to allow multiple buildings or projects to operate in a cooperative state – sharing green infrastructure as appropriate and allowing for various typologies as possible.

Transects

To encourage proper development in specific settings, the standard draws on the work of Duany Plater-Zyberk & Company, who created the new urbanism transect model for rural to urban categorization. The living transect, which applies to several imperatives throughout the Living Building Challenge, is an adaptation of the original transect concept. The Challenge promotes the transition of suburban zones either to grow into new urban areas with greater density, or be dismantled and repurposed as new rural zones for food production, habitat and ecosystem services. Every project must select a living transect category from the following options (LFI 2012, 8):

- L1. Natural habitat preserve (Greenfield sites)
- L2. Rural agriculture zone
- L3. Village or campus zone
- L4. General urban zone
- L5. Urban center zone
- L6. Urban core zone

The classification of transects does not affect the number of imperatives applied to each project. However, different transects do have different standards of imperatives, such as floor area ratio (FAR). For example, rural agriculture zone has $FAR \leq 0.09$, while Urban Core Zone's $FAR \geq 3.0$.

Typologies

Projects must identify the one of the four typologies: renovation, infrastructure + landscape, building and neighborhood, that aligns with the project to determine which Imperatives apply. Some typologies require fewer than twenty Imperatives because the conditions are either not applicable or may compromise other critical needs. However, participating teams are encouraged to integrate the optional imperatives into their projects wherever possible.

Petals

The Living Building Challenge is composed of seven performance areas called petals, which are subdivided into a total of twenty imperatives, each of which focuses on a specific sphere of influence. The petals and imperatives are listed as follows:

Site	01: Limits to growth 02: Urban agriculture	03: Habitat exchange 04: Car free living
Water	05: Net zero water	06: Ecological water flow
Energy	07: Net zero energy	
Health	08: Civilized environment 09: Healthy air	10: Biophilia
Materials	11: Red list 12: Embodied carbon footprint 13: Responsible industry	14: Appropriate sourcing 15: Conservation + reuse
Equity	16: Human scale + humane places 17: Democracy + social justice	18: Rights to nature
Beauty	19: Beauty + spirit	20: Inspiration + education

The Living Building Challenge certification is the only green building certification that is based on actual, rather than modeled or anticipated, performance. Therefore, projects must be operational for at least twelve consecutive months prior to evaluation. The performance-based certification makes sure the building is acting sustainability, instead of designing one way and performing the other (LFI 2012, 1).

Other Supporting Programs

The Living Building Challenge offers supplemental resources for participating projects (LFI 2014c). Handy petal handbooks are prepared for subscribers and project teams pursuing the Challenge. The handbooks have been developed to clarify and consolidate the Living Building Challenge rules to provide a unified reference for project teams.

The Living Building Challenge offers a forum of discussion on specific questions regarding the imperatives. The forum, called dialogue, serves as a direct line for subscribers of the community working on registered projects looking to consult with the Living Building Institute's technical staff. Only subscribers with registered projects can post questions, but all community subscribers can view questions and answers that have been posted (LFI 2014d).

The Living Building Challenge also provides technical assistance to developers and education opportunities to the general public. Other resources not included in the Living Building Challenge but part of the International Living Future Institute's function are (but not limited to): *Trim Tab* which serves as a community magazine, declare which offers Living Building Challenge project teams a materials guide for product specification, and ambassador network which offers opportunities for volunteers around the world to share up-to-date sustainability information and promote their ideas. These programs complement the Living Building Challenge toward the goal of sustainability. However, as these programs do not include criteria to be integrated in triple bottom line reporting, this thesis only focuses on the Living Building Challenge.

Bringing Living Building into Practice

Projects can achieve three types of certification: Full Certification, Petal Recognition or Net Zero Energy Building Certification, depending on the number of petals that projects achieve (LFI 2012). To date, thirteen projects have achieved certification through the Living Building Challenge, and many others have entered the twelve-month operational phase required prior to audit. Until May 2014, five buildings achieved full certification, four received petal recognition,

and eight received net zero energy certification. It is worth mentioning that all full certification projects are educational buildings. Bullitt Center, which is a commercial building designed for full certification, is a breakthrough in Living Building Challenge practice.

The greenest commercial building Bullitt Center, is located in Seattle Capitol Hill's highly walkable Pike/Pine neighborhood (Bullitt Center 2014). With building features such as solar panels, waterless toilets, greywater treatment, heavy timber structure and bike-friendly design, the Center keeps up with Living Building Challenge petal requirements. The Center also offers educational exhibits at the ground level of the building, and organizes tours to the building regularly. The Bullitt Center is 80% leased by March 2014, with one floor still available. Once the building is fully occupied, it can start the clock on Living Building certification, especially the Water and Energy petals. The cost of Bullitt Center is roughly about 20-25% more than the average of its type in the market, and it is leasing at a competitive market rate (Bullitt Center Developer, interview). The Bullitt Foundation, owner of the Center, looks at the building's long-term benefits (Planning Director, interview). If the Bullitt Center turned out to be success, it is a replicable role model in the construction and real estate sector and there will be more buildings following the Living Building Challenge standards. This thesis researches into the contributions of the Living Building Challenge to triple bottom line reporting, hoping to add value to the significance of the Living Building Challenge, and to bring triple bottom line reporting to the eyes of the developers and policy makers. The next chapter introduces how this research is conducted.

METHODOLOGY

This research intends to answer the question: “how does the Living Building Challenge help developers prepare their triple bottom line reporting?” The paper adopts comparative analysis between the GRI Framework, the worldwide recognized triple bottom line reporting framework, and the Living Building Challenge standards, sustainable building standards that covers economic, environmental and social aspects. As the GRI Framework and the Living Building Challenge have their own vocabulary of the whole systems and criteria, this thesis uses the term framework(s) when referring to both systems, and the term criteria when referring to standard disclosure of the GRI and imperatives of the Living Building Challenge.

When choosing data, this thesis adopts discriminate sampling, which chooses interviewees and documents, frameworks and supplemental resources. The data chosen enhance the possibility of comparative analysis to saturate categories and complete the study. Data for analysis is draw from both standards, including the GRI Framework, Living Building Challenge imperatives and its supplemental resources. GRI implementation manual and Living Building Challenge petal handbooks are referred to in order to understand the definition of criteria. Interviews are conducted as another research method, to gather information from professionals in the built environment field. One limitation of the research method is that the Living Building Challenge is still developing. The current Imperatives are not perfectly practiced by large-scale buildings. The Bullitt Center is the only large-scale commercial building designed to meet all the twenty imperatives. For this research, the latest version of the Living Building Challenge, version 2.1, is used for analysis. Information from the petal handbooks and interviews are helpful to gain the best understanding of the Living Building Challenge, and eliminate bias to the largest extend.

The research question is broken down to six sub-questions: 1) What are the similarities or differences of circumstances of applying the GRI Framework and the Living Building Challenge? 2) What are the similarities between the GRI Framework and the Living Building Challenge criteria? In other words, what imperatives of the Living Building Challenge directly answer the GRI Framework's criteria? 3) What criteria of GRI are not included in the Living Building Challenge? 4) What criteria does the Living Building Challenge put forward that are helpful to triple bottom line reporting? 5) How instrumental are the Living Building Challenge supplemental resources towards triple bottom line reporting? 6) Does compliance with the Living Building Challenge contribute to the contents and quality of triple bottom line reporting?

To answer these questions, the thesis first proposes its hypothesis, and then compares the two frameworks side-by-side, using all useful information from the frameworks, implementation manuals, petal handbooks and interviews. The results are presented in the next chapter. The concept diagram for the thesis is shown in figure 7.

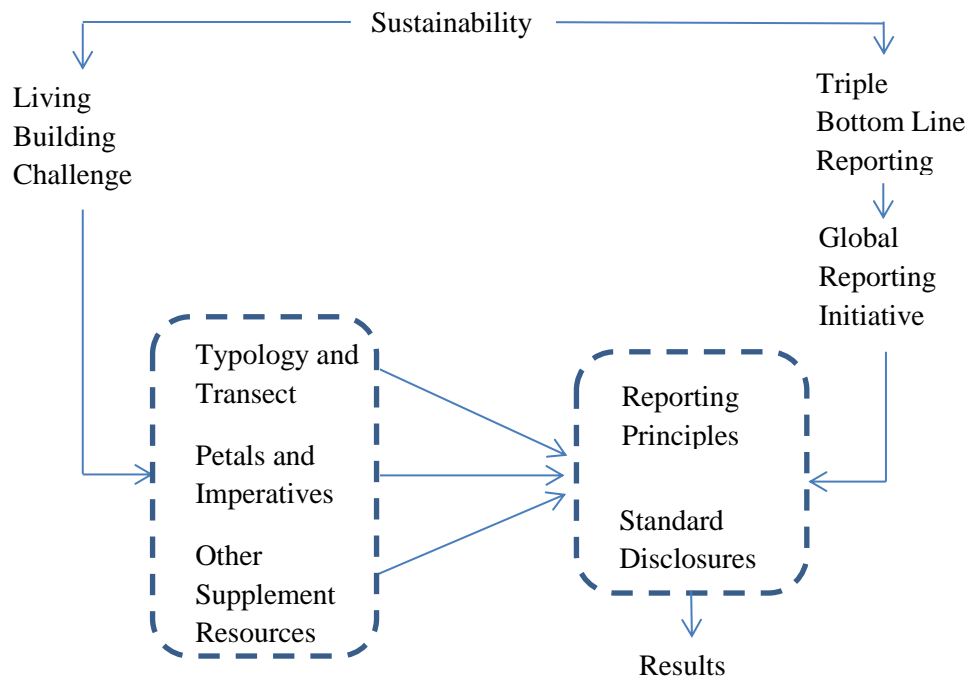


Figure 7 Concept Diagram of Thesis Methodology

Hypothesis

Table 1 summarizes a comparison between the GRI Framework and the Living Building Challenge on their contents. From the table we can see that the Living Building Challenge appears to have one economic imperative, while it has nine for the social aspect and nine for the environmental aspect. Table 1 shows that the Living Building Challenge emphasizes on the environmental and social aspects, and the economic aspect is only slightly addressed in the Living Building Challenge. The hypothesis of this paper is that the Living Building Challenge contributes a lot to the social and environmental aspects, but little to the economic aspect, of triple bottom line reporting.

Table 1 Comparison between GRI Framework and the LBC

GRI Framework Criteria	LBC Imperatives	Comments
Economic	14 Appropriate Sourcing	Only one imperative is related to the economic aspect. The Living Building Challenge does not emphasize on economy, although addressed.
Environmental	01 Limits to Growth 02 Habitat Exchange 04 Car Free Living 05 Net Zero Water 06 Ecological Water Flow 07 Net Zero Energy 11 Red List 12 Embodied Carbon Footprint 15 Conservation + Reuse	A total of nine imperatives belong to environmental protection category. Concerning there are only twenty imperatives, the environmental performance is a big part of the Living Building Challenge.
Social	08 Civilized Environment 09 Healthy Air 10 Biophilia 13 Responsive Industry 16 Human Scale + Human Places 17 Democracy + Social Justice 18 Rights to Nature 19 Beauty + Spirit 20 Inspiration + Education	Nine imperatives belong to social aspect. Similar to environmental aspect, this is a huge part of the Living Building Challenge.

Comparison between the GRI Framework and Living Building Challenge

Research Steps

This research tests the hypothesis by utilizing the two frameworks and interview information. Research steps include: 1) Introduce how it judges similarity or difference. This serves as guidance for later analysis. 2) Define the circumstance of application for both guidelines, compare the difference of their applicable fields, and find their intersection. 3) Read through the GRI guidelines, including the sector guidance for construction and real estate sector, which is exactly the target group we focus, extract all the reporting criteria of GRI. Read and synthesize the Living Building Challenge criteria. Compare the two sets of criteria and analyze which imperatives of the Living Building Challenge can help developers create meaningful information for their triple bottom line reporting. Contrast the two frameworks and find their differences. 4) Discuss how the Living Building Challenge supplemental resources contribute to reporting. 5) Discuss the Living Building Challenge's contribution to the contents and quality of triple bottom line reporting. The following sections describe how is each step conducted and presents information gathered.

What is Similarity and Difference

This thesis regards criteria of the same subject, such as the amount of water consumed, staff's wages, and direct economic value generated, as comparable. If the subject of a Living Building Challenge imperative is the same as its counterpart of the GRI Framework, and if by achieving the imperative, the developer/ building operation manager can have numerical, nominal, or descriptive data for triple bottom line reporting, the two criteria are considered similar. Similarity includes four types: 1) if both the subjects of the criteria and the way they are

measured are the same, these two criteria are considered; 2) if the subjects of criteria are same, and they are measured in different but interchangeable ways, they are considered similar. An example might be electricity consumption yearly versus monthly; 3) normative criteria are considered similar if they are of the same topic. For example, the GRI Framework requires community education facilities, which is covered by Imperative 20 Inspiration + Education; and 4) if fulfilment of one imperative meets the best practice of a category in GRI practice, and makes it unnecessary to file other criteria, the Living Building Challenge imperative is considered similar to GRI criteria. One example is that by doing greywater treatment and reuse, a building eliminates all the greywater it produces and there is no need to track its greywater discharge. Other than circumstances mentioned above, criteria are considered different. Criteria may be different in their subject or ways of measurement.

The Circumstances of Application

To understand both guidelines, this research first defines the circumstances of application for the two guidelines. The research compares differences and commonalities of terms, target groups, and the fields of application for each guideline, and tries to find differences and similarities of the background for both guidelines to be adopted. The results are presented in the next chapter.

Read, Compare and Contrast Living Building Challenge and the GRI Framework

This research summarizes fifty-eight general standard disclosures, ninety-two specific standard disclosures, and twenty imperatives of the Living Building Challenge. For the purpose of compare and contrast, this study scrutinizes all the criteria. The next step is to compare the

two, and to analyze which imperatives of the Living Building Challenge can help developers create meaningful information for their reporting. In this step, imperatives of the Living Building Challenge are studied against standard disclosures of the GRI.

Although the Living Building Challenge mostly provides data for the environmental aspect, it indirectly contributes evenly to the general standards and to all three aspects. The Living Building Challenge offer information about stakeholder disclosure, organization policy and reporting period at general level for reporting. For specific standards on economic aspect, the Living Building Challenge reveals how a project is significant to a local community, by bringing job opportunities, purchasing local products, and offering services at local level. A Living Building Challenge project also indirectly contributes to reporting of economic value generated, health and wellbeing of a community and industry-side innovation. For environmental aspect, the Living Building Challenge ensures habitat protection, water conservation and reuse, use of healthy and environmental-friendly materials. All these imperatives offer indirect data that serve as parts of criteria of the GRI Framework. The social aspect is also slightly addressed, for the Living Building Challenge projects bring in the notion of health, beauty and equity.

This step also discusses Living Building Challenge criteria that are not included in the GRI Framework, and sections from the GRI Framework that are not discussed in the Living Building Challenge. The results are presented in the next chapter in the format of a table.

Function of Living Building Challenge Supplemental Resources

After scrutinizing the Living Building Challenge's typologies, transects and imperatives, this research changes the view to supplemental resources, which are indivisible parts of the

Living Building Challenge. The research tries to find out how the supplemental resources complement the Challenge and assist company's reporting. The results are presented in *Chapter 4: Results*.

Living Building Challenge's Contribution to Report Content, Quality and Data Collection

Apart from standard disclosure mentioned above, GRI also mandates the organizations meet Reporting principles to ensure the contents and quality of reporting. While the Living Building Challenge, more like a bar for projects to research, it does not include a section specifically on how to issue good reports of project performance. This thesis goes through the Living Building Challenge criteria and supplement resources to invest whether and how the Challenge as a whole supports the contents and quality of triple bottom line reporting, helps with data collection, and improves the overall quality of reporting. The results are presented in *Chapter 4: Results*.

Interviews

Interviews are conducted to gather supplementary information of the two guidelines and ensure inclusiveness of the research. Interviewees include: the Living Building Challenge staff, developer of the Bullitt Center, director of the Runstad Center for Real Estate Studies at the University of Washington, director of the Department of planning and Development at city level, and executive vice president of Craft 3, a self-defined triple bottom line non-profit organization. This group of interviewees brings in resourceful and profound comments on triple bottom line reporting and the Living Building Challenge from various perspectives such as academic, policy,

developer and triple bottom line organization, etc. Also there is no chapter specifically on the interview outcome; this thesis keeps referring to their insights and comments. A list of interview questions can be found in *Appendix 3*. Interview information is summarized in the following chapter, which shows the results of analysis in detail.

RESULTS

This chapter displays results of analysis and answers the research question “how does the Living Building Challenge prepare developers for the triple bottom line reporting”. The research results test this paper’s hypothesis that the Living Building Challenge contributes a lot to the social and environmental aspects, but little to the economic aspect, of triple bottom line reporting.

This chapter displays results of analysis. To clearly answer research sub-questions, this chapter is organized into four parts. The first part describes the similarities or differences of circumstances of applying the GRI Framework and the Living Building Challenge. The second part is comparison between the two frameworks. It consists of similarities and differences of the two frameworks, and tells what the Living Building Challenge lacks and what it adds on to the GRI Framework. The third part is a discussion on supplemental resources of the Living Building Challenge. The last part analyzes the Living Building Challenge’s overall contribution to the contents and quality of triple bottom line reporting. All the Living Building Challenge imperatives can be found in *Appendix 2* and criteria of the GRI Framework in *Appendix 4*.

What Do Interviewees Say

The most prominent outcome of the interview is that all interviewees mentioned the outstanding performance of the Living Building Challenge on the environmental aspect. The economic aspect, however, suffers from doubt. All five interviewees noticed that the economic performance is not of priority in the Living Building Challenge, while three of them mentioned the high construction cost of Bullitt Center. Two interviewees suggest the social aspect of the Living Building Challenge is different from what people usually think of the social bottom line.

They think the Living Building Challenge does not consider low-incomes, neither aims at providing more local jobs or affordable housing. It is the case with the Bullitt Center, which is a commercial building. However, the Imperative 17 Democracy + Social Justice actually requires that “for the Neighborhood Typology, a minimum of 15% of housing units must meet an affordable housing standard. (LFI 2012, 38)” One interviewee asserts that social equity is not the major concern of the Living Building Challenge.

The Circumstances of Application

The GRI Guidelines have been developed through an extensive process involving hundreds of reporters, report users and professional intermediaries from around the world. Sustainability reporting helps organizations to set goals, measure performance, and manage change in order to make their operations more sustainable. The GRI Guidelines conveys disclosures on an organization’s impacts, which can either be positive or negative, on the environment, society and the economy, assisting in understanding and managing the effects of sustainability developments on the organization’s activities and strategy. The aim of G4 is to help reporters prepare sustainability reports that matter, contain valuable information about the organization’s most critical sustainability-related issues, and make such sustainability reporting standard practice. G4 is designed to be universally applicable to all organizations, large and small, across the world. Report formats varies, be they standalone sustainability reports, integrated reports, annual reports, reports that address particular international norms, or online reporting (GRI 2013a, 1).

The Living Building Challenge is a green building certification program launched by the International Living Building Institute. The Challenge is an attempt to raise the bar of sustainability in the built environment. The Living Building Challenge provides a guideline for design, construction and the symbiotic relationship between people and all aspects of the built environment, for all construction project forms such as a single building, a park, a college campus or even a complete neighborhood community. The twenty imperatives must be met for any type of project, at any scale, in any location around the world (GRI 2013a, 5).

The GRI Framework is designed for organizations to do performance reporting, while the Living Building Challenge is designed for building projects to meet certain standards. However, for developers and property managers, these distinctions are less important, in cases where building projects are the products or services. The data gained from performance of their products are applicable for compiling their organizational performances.

The GRI Framework is prepared for all organizations in the industry, no matter how sustainable they are. Meanwhile, the Living Building Challenge is prepared for pioneering sustainable projects that meet high level of sustainability. Thus, the different levels of sustainability practice and subject of reporting lessens the value of comparison. Even though the standards are high, the Living Building Challenge is the only system that considers all three components, thus, making it the best option for comparison.

The final difference is the duration of reporting. The Living Building Challenge examines building performance after twelve consecutive months of operation. After issuing the certification, the Living Building Institute does not keep tracking the performance of the building. As the Living Building Institute staff puts: “if a building performs well, I cannot see why people

do not keep up with the good performance. (Living Future Institute staff, interview)” For contrast, the GRI Framework proposes regular reporting, often mentioned as annual reporting. This requires developers and property managers to keep track of the building performance every year. While this is not compulsory in the Living Building Challenge, as long as the data tracking system is installed in the buildings as the Bullitt Center does, the data are easily accessible.

Comparison between the Living Building Challenge and the GRI Criteria

Similar Criteria

Table 2 below shows the comparison in detail. The buildings that meet the Living Building Challenge are not highly profitable, comparing to their comparatives on the market. Thus, most developers or property owners adopting the Living Building Challenge are those who have sustainability imbedded in their vision. If a project is decided to be built to meet the Living Building Challenge, it means that the property owner and the developer are taking a step toward sustainable buildings/projects. The adoption of the Living Building Challenge allows the organization to better clarify their strategy of sustainability on the GRI Framework item G4-1.

Living Building Challenge makes great contribution on reporting the environment aspect. The imperatives meet the reporting guideline’s requirement on sourcing from local markets, selecting materials and engaging suppliers, utilizing preferred or prescribed lists of products and materials. As shown in comparison item 3 in table 2 on page 46, Imperative 07 is a great resource responding G4-EN3, G4-EN6 and G4-EN7 on energy consumption. By using data of sum of annual kWh energy consumption and sum of floor area or number of people, the imperative helps to calculate Building Energy Intensity.

Water is another important element in the Living Building Challenge which contains water Imperatives 05 Net Zero Water and 06 Ecological Water Flow. As shown in comparison item 4, G4-EN8, G4-EN9, G5-EN10 and all the additional disclosure requirements under these three standards, about reporting water usage by sources, are met. Data for calculating building water intensity (sum of annual liters of water consumption over sum of floor area or number of persons) is collected. The data assists the report of G4-EN22 Total Water Discharge by Quality and Destination.

Imperative 01 on limits to growth answers to G4-EN11 shown in comparison item 5. This imperative is useful to providing issuers with information on geographic location, land ownership, protected area in, around, or adjacent to the site, type of operation of the project, size of operational site, biodiversity value, and listing of protected status. Imperative 01 also provides information about habitat conservation, which is one piece of information required by G4-EN12 shown in comparison item 5.

Imperative 12 on carbon footprint partly answers G4-EN15 shown in comparison item 6. The data may also be valuable when applied to G4-EN16, G4-EN17 AND G4-EN18, depending on how the organization defines indirect emission. Again, the carbon footprint data is valuable to calculate greenhouse gas emissions intensity from buildings (sum of annual kilograms CO₂ equivalent over sum of floor area or number of people) and greenhouse gas emission intensity from new construction and redevelopment activity (sum of annual CO₂ equivalent emissions over sum of annual turnover from the construction activities). However, the imperative does not include greenhouse gases other than CO₂.

What worth noting is that the sector disclosure demands organizations to report type and number of sustainability certification, rating and labeling schemes for new construction, management, occupation and redevelopment. If a developer or a property manager adopts the Living Building Challenge and meets the Imperatives, the certification they receive will meet this standard and add credit to the report.

Table 2 GRI Framework and LBC Criteria Comparison

Comparison Item Number	GRI Disclosure	LBC Imperatives	Similarities
1	G4-EN2 Percentage of Materials Used That Are Recycled Input Materials.	Imperative 15 requires a project team to strive to reduce or eliminate the production of waste during design, construction, operation and end of life phases. The team must divert wasted material to a certain percentage during construction.	The percentage of diverted wasted material helps the developer to offer data on G4-EN2
2	Additional disclosure requirements under G4-EN2 require the percentage of materials recycled by significant categories of raw materials, renewable materials, and manufactured products.	Imperative 15 breaks down materials to metals, paper and cardboard, soil and biomass, rigid foam, carpet and insulation, and all others	The categorization fits in well with that of the GRI Framework.
3	G4-EN3 Energy Consumption within the Organization, especially the additional disclosure requirements right after, with an emphasis on reporting production of electricity from renewable resources. G4-EN6 Reduction of Energy Consumption and the related	Imperative 07 mandates net zero energy, which means that one hundred percent of the project's energy need must be supplied by on-site renewable energy on a net annual basis.	Imperative 07 answers to G4-EN3, G4-EN6 and G4-EN7. In the meanwhile, the Bullitt Center keeps track of real-time energy consumption and production from its solar panels.

	additional disclosure requirements on energy savings for all assets. G4-EN7 Reductions in Energy Requirements of Products and Services.		
4	G4-EN8 Total Water Withdrawal by Source, G4-EN9 Water Sources significantly affected by withdrawal of water, G4-EN10 Percentage and Total Volume of Water Recycled and Reused.	Imperative 05 requires net zero water of the project, and Imperative 06 demands ecological water flow that one hundred percent of storm water and used, project water must be managed onsite to feed the project's internal water demands or released onto adjacent sited for management through acceptable method.	The LBC monitors the amount of rainwater collection, waste water treatment, reuse and discharge. These data directly answers to G4-EN8, G4-EN9 and G4-EN10
5	G4-EN11 on operational site location, size, and biodiversity value G4-EN12 on the nature of significant direct and indirect impacts on biodiversity	Imperative 01 Limits to Growth requires the project to locate certain distance away from sensitive ecological habitats such as wetlands and prime farmland.	Information from Imperative 01 can be applied to G4-EN11. Habitat conservation of Imperative 01 partly meets G4-EN12.
6	G4-EN15 Direct Greenhouse Gas Emissions, including reporting gross direct GHG emissions in metric tons of CO2 equivalent	Imperative 12 requires the project to account for the total footprint of embodied carbon from its construction through a one-time carbon offset tied to the project boundary.	The carbon footprint data partly meets G4-EN15, especially on reporting gross direct GHG emissions in metric tons of CO2 equivalent, and reporting biogenic CO2 emissions in metric tons of CO2 equivalent separately from the gross direct GHG emissions.

All above-mentioned criteria are ones that the Living Building Challenge offer direct data to assist reporting. The data put much more emphasize on the environmental aspect of reporting. Another contribution of the Living Building Challenge on the GRI reporting is that when

adopting the sustainability techniques of the Living Building Challenge, reaching the requirements of the Living Building Challenge, and preparing Living Building Challenge reports, the organizations are gathering necessary information for the GRI reporting. For example, since the Living Building Challenge requires healthy air, sunlight, and nature waterways for any member of society or adjacent developments. By accomplishing these imperatives, organizations are able to announce they take the sustainability impact on stakeholders into account, as required by GRI Framework's G4-2. Another example is that although it is not included in imperatives, a project's Living Building Challenge report may still include information about its developer/owner's basic information, which is applicable to the GRI organizational profile (G4-3 to G4-16) and additional disclosure requirement of the sector, such as gross leasable area and vacancy rate. Table 3 summarizes imperatives that indirectly contribute to triple bottom line reporting.

Table 3 Indirect Contributions of the Living Building Challenge to the GRI Framework

Comparison Item Number	GRI Disclosure	LBC Imperatives	What the Living Building Challenge Imperative Can Contribute
7	G4-24 additional disclosure requirements on stakeholder disclosure	The LBC as a whole	Involving the building project team and tenants as stakeholders
8	G4-28 on reporting period	No specific imperatives applied. The LBC requires the building to keep its performance for at least twelve consecutive months; the electricity and water reuse data are reported annually	The twelve-month observation period ensures the building at least provides data for one year. Electricity and water reuse data can be used for reporting every year.
9	G4-33 on organization's policy and current practice with regard to seeking external	No specific imperatives	The Living Building Institute is an external assurance to ensure the truthfulness and

	assurance for the report		credibility of reported performance
10	G4-EC1 on data about direct economic value generated (revenues), and economic value distributed (operating costs and payments to government)	The LBC Imperatives 05 Net zero water, 06 Ecological water flow and 07 Net zero energy, buildings calculate their operating costs and revenues from electricity sold to the government	Fulfillment of Imperatives 05, 06 and 07 provides data that can be applied to calculating operating costs and revenues from electricity
11	Community investments' G4-DMA Additional Guidance on the content of improved community health and wellbeing by adopting healthy environment requirements.	Imperatives 08 Civilized Environment, 09 Health Air, and 10 Biophilia	A building meeting the health and equity petals offer a healthy living and working environment for the tenants, and a healthy, accessible public space for the community.
12	G4-EC7 reports the extent of development and impact of infrastructure investments and services supported; it also reports the current or expected impacts on communities and local economies. G4-EC9 Proportion of Spending on Local Suppliers at Significant Locations of Operation	Imperative 14 Appropriate Sourcing advises the project contribute to local economy and choose sourcing locations for materials and services within certain distances.	Imperative 14 calls for projects' contribution to local economy. Information of an infrastructure project, or the infrastructure part of a project explains significant infrastructure investments made by the reporting organization in relation to the following: <ul style="list-style-type: none"> • Affordable and social housing; • Preservation and restoration of historic assets; • Publicly accessible open/recreation space; and • Community education and health facilities.
13	G4-EC8 on significant indirect economic impacts. Additional disclosure	No specific imperatives	The LBC imperatives ensure a healthier space for the tenants and the public. This echoes to criteria:

	requirements on enabling industry-wide innovation and increased productivity in the medium- to long-term, through technology transfer and research and development.		<ul style="list-style-type: none"> • Economic impact of improving or deteriorating social or environmental conditions; • Availability of products and services for those on low incomes; • Economic impact of the use of products and services; • The impacts in the context of external benchmarks. <p>The LBC is also an avant-garde practice of sustainable building in the industry, which may bring in industry-wide renovation.</p>
14	G4-EN13 Habitats Protected or Restored	Imperative 03 Habitat Exchange	The Imperative may offer detailed information for habitat exchange, depending on project properties
15	G4-EN23 Total Weight of Waste by Type and Disposal Method	Imperative 15 Conservation + Reuse records the total weight of hazardous and non-hazardous waste, by the following disposal methods: such as reuse and recycling of waste water, and how the waste water disposal methods has been determined	As the classification of waste for the two frameworks is different, the LBC answers part of the items listed by the Standard
16	G4-EN32 on the percentage of new suppliers that were screened using environmental criteria	Imperative 14 Appropriate Sourcing and Imperative 11 Red List	The LBC keeps tracking material suppliers among all the suppliers, to meet the materials petal. Any new material suppliers screened using

			environmental criteria can be reported. Here the environmental criteria refer to the red list items offered by the Living Building Institute.
17	G4-PR1 to report the percentage of significant product and service categories for which health and safety impacts are assessed for improvement	No specific imperatives	Projects can be considered as products produced by developers, and management is services offered by property managers. As long as a project meets the LBC during design, construction and operation, it can be considered as significant product and service for which health impacts are assessed.
18	Social aspect additional disclosure requirements: report quantifiable positive legacy impacts and quantifiable impacts from a pre-development benchmark, and disclose improvements over time.	Health, beauty and equity Petals	A LBC project that meets the Imperatives usually offers healthy, natural, walkable space for the tenants, ensures public accessibility and beautiful public arts, offers inspiring education on sustainability and tries to bring in wellbeing for low-incomes in the projects. These are positive legacy impacts that worth reporting.

GRI Criteria not Included in the Living Building Challenge

Apart from the similarities mentioned above, there are differences. Most of general standard disclosures, which are fundamental in the GRI Framework, are not addressed at all in the Living Building Challenge. For specific standard disclosures, the economic and

environmental aspects are partly addressed. The social aspect of the GRI Framework is comprehensive and the Living Building Challenge almost does not respond to any of the criteria. Below is a list of GRI Framework criteria that does not appear in the Living Building Challenge:

- General standard disclosures - identified material aspects and boundaries, governance, ethics and integrity
- Specific standard disclosures - disclosures on management approach
 - Economic: market presence
 - Environment: transport, environmental grievance mechanisms
 - Social: employment, labor/management relations, occupational health and safety, training and education, diversity and equal opportunity, equal remuneration for women and men, supplier assessment for labor practices, labor practices grievance mechanisms, investment, non-discrimination, freedom of association and collective bargaining, child labor, forced or compulsory labor, security practices, indigenous rights, assessment, supplier human rights assessment, human rights grievance mechanisms, local communities, anti-corruption, public policy, anti-competitive behavior, compliance, supplier assessment for impacts on society, grievance mechanisms for impacts on society, product and service labeling, marketing communications, customer privacy and compliance

Living Building Challenge Criteria not Mentioned in the GRI Framework

Unlike the hypothesis that there is only one imperative not shown in the GRI Framework, there are seven imperatives not applied to the GRI Framework. They belong to site, health, materials and equity petals. They are:

- 02: Urban Agriculture. The GRI Framework does not include any information about creating opportunity to get close to agriculture.
- 04: Car Free Living. Although reduced vehicle use contributes to the decline of greenhouse gases emission, the Living Building Challenge does not calculate the exact decrease of CO₂ that is caused by the car free living imperative. The aim of the imperative, however, is to offer a walkable, pedestrian-oriented community. This is why the imperative is not mentioned in the GRI Framework.
- 10: Biophilia. Although the good intension of the imperative is to bring people closer to nature, it is, according to the analysis of the GRI Framework, not in the scope of social aspect of the GRI Framework.
- 13: Responsible Industry. The GRI Framework does not mention or advocate for the use of raw materials.
- 16: Human scale + Human Places. Human scale does not fall in to the scope of the GRI Framework.
- 18: Rights to Nature. Although access to fresh air and sunlight is related to health element of the GRI Framework, the idea of rights to nature is not part of the GRI Framework.
- 19: Beauty + Spirit. This element does not appear in the GRI Framework

Although imperatives 10 Biophilia and 19 Beauty + Spirit are mentioned as indirect contribution to triple bottom line reporting, the main ideas of the two Imperatives are not addressed in any standard at all. This is the reason that they are considered as not shown in the GRI Framework.

Function of Living Building Challenge Supplemental Resources

The Living Building Challenge offers supplemental resources for participating projects. Resources include: the dialogue, petal handbooks, declare, technical assistance, Living Building Challenge education, and research (LFI 2014c).

The dialogue is an online space for the transparent exchange of ideas between project teams and the Institute. It is the official venue to request feedback on proposed strategies for meeting the requirements of the Living Building Challenge. While only active and registered project teams can submit requests to the dialogue, final published requests and responses are available to all Living Building Challenge community subscribers. The dialogue provides organizations with the flexibility to get information most relevant to their work, such as in-depth commentaries, compliance paths, clarifications and temporary exceptions.

Petal handbooks compile technical information, including definitions, clarifications and exceptions, contained within the Dialogue into concise, printable documents. The site, water and materials petal handbooks are currently available online, and there will be a dedicated handbook for each petal.

Declare aims to improve transparency and open communication of the marketplace by providing manufacturers and specifics of building materials with a clear, elegant and informative ‘nutrition-label’. Declare has been enriched during the construction of the Bullitt Center.

To help project teams technically succeed in fulfilling the imperatives, the Institute supports a project team’s process of adopting the principles of the Challenge by offering optional services that provide practical knowledge.

In addition to the technical support offered by the tools and resources listed above, the Living Building Challenge also offers educational opportunities. The flagship event is a full-day public workshop called Understanding the Living Building Challenge.

According to the Living Building Challenge (LFI 2014c) and a planning director (Director of the Planning Department, interview), the biggest barriers to accomplishing a Living Building Challenge building, as many innovative project teams have found, is regulatory and financial structures. The barriers can make it difficult to implement ecologically wise building practices that advance public health and enhance the long-term resiliency of the built environment. In responding to the barriers, the institute is implementing research and advocacy agendas.

Living Building Challenge’s Contribution to Overall Reporting Contents and Quality

After comparing the two sets of criteria, this research examines how the Living Building Challenge meets the principles for defining report context and principles for defining report quality. The developer or property manager invites designers to design sustainable buildings, suppliers to provide local, non-toxic materials, tenants to use the building sustainably and follow

certain rules (e.g. free car use), the general public to share the public space, and perhaps the low-incomes to live in the building. These are inevitable stakeholders for a developer or property manager to do triple bottom line reporting. With the attainment of the Living Building Challenge certificate, the developer or property manager naturally involve these stakeholders. Sustainability data disclosed when filing Living Building Challenge can be used for some criteria required by the GRI Framework, to contribute to the sustainability context, materiality and completeness of the report.

There are six principles on report quality: balance, comparability, accuracy, timeliness, clarity and reliability. Balance requires reporting both positive and negative information of the organization. The Living Building Challenge, as a performance bar, only records positive sustainability information. As the Living Building Challenge is a one-time certificate, it does not require projects to report its sustainability data regularly after certificating. However, as with the case of Bullitt Center, the building has a system to monitor its real time sustainability performance, especially data of water and energy, it is fairly easy for the property manager to keep track of the data and report them periodically. Some direct, numeric data from Living Building Challenge are ready to use in triple bottom line reporting. These data meets the accuracy required by the GRI Framework. This is also the case with timeliness and clarity, for the numeric data on water, energy and waste are easy to collect in time, while other qualitative data are a one-time fulfillment that the Living Building Challenge does not keep track of, and does not report following some hard standard. For example, the Living Building Challenge requires Imperative 19: Beauty + Spirit. This imperative is illustrated as: the project must contain design features intended solely for human delight and the celebration of culture, spirit and place appropriate to its function. However, the definition of the above mentioned terms are vague and

open to interpretation. In terms of reliability, this research believes that since the Living Building Institute is a third part independent from developers, property owners or property managers, the data examined and disclosed by the Institute is reliable. Meanwhile, projects work with the city governments on selling and buying electricity, which once again, ensures the credibility.

The Living Building Challenge also requires projects to report which transects and typology they belong to. The classification of transects and typology influences the categories of data each project reports. However, it does not influence the contents or quality of the report. Table 4 below shows how principles for defining report content and quality are met by the Living Building Challenge. If the Living Building Challenge contributes to one principle considerably, it is marked as “+”, but if the influence of the Living Building Challenge on one principle is negligible, or the Living Building Challenge clearly does not contribute to the principle, it is marked as “--”. If one principle is not particularly addressed by the Living Building Challenge, but the Living Building Challenge still turns out to contribute to it, the principle is marked as “+--”.

Table 4 Living Building Challenge's Contribution on Reporting Content and Quality

Reporting Content		Reporting Quality	
Stakeholder	+	Balance	--
Inclusiveness			
Sustainability Context	+	Comparability	--
Materiality	+--	Accuracy	+--
Completeness	+--	Timeliness	+--
		Clarity	+--
		Reliability	+

The research results test this paper's hypothesis that the Living Building Challenge contributes a lot to the social and environmental aspects, but little to the economic aspect, of triple bottom line reporting. According to the results, the Living Building Challenge contribute moderately to social and economic aspects of triple bottom line reporting, as the Challenge offers indirect data for the two aspects. The results justify that the Living Building Challenge directly contributes a lot to the environmental aspect. The next chapter discusses the findings based on comparative analysis and interview information mentioned in this chapter.

DISCUSSION

The comparison of the two frameworks shows that direct data from the Living Building Challenge does not contribute to the economic and social aspects of triple bottom line reporting. However, the Living Building Challenge indirectly contributes to reporting on the economic aspect more than interviewees reported. The major contribution of the Living Building Challenge on the economic aspect comes in the form of reporting on various projects' local economic contributions. This coincides with the economic dimension of the GRI Framework, which deals with the organization's impacts on the economic conditions of its stakeholders and on economic systems at local, national, and global levels. It does not focus on the financial condition of the organization (GRI 2013a, 4).

The social aspect of the Living Building Challenge is different from that of the GRI Framework. The Living Building Challenge emphasizes on providing a healthy and natural environment, human-scale projects, beautiful arts, fresh air and natural day light, and also social equity for the public by offering public infrastructure, public space, education materials for the public, and low-income housing. However, the social aspect of the GRI Framework focuses more on employee benefits such as wage, health, opportunities to convection and bargain, education opportunities, equality between genders, etc. Although different, both of them fall into triple bottom line's definition of social equity mentioned by Elkington as "(social equity) in the form of public health, skills and education. But it also must embrace wider measures of a society's health and wealth-creation potential. (Elkington, John. 1998, 85)"

The Living Building Challenge was inspired by the notion of biomimicry and developed the idea of integrating technology with nature. (Berkebile and McLennan 2004). Thus, the Living Building Challenge has a high standard for its environmental aspect. The environmental data of

the Living Building Challenge is valuable for reporting water usage, treatment and reuse, CO2 emission, energy use and savings, waste treatment, and land conservation. The Living Building Challenge has much stricter environmental requirements than the GRI Framework and the data collected is of good-quality and high performance. This means that as long as a project meets Living Building Challenge imperatives, the data of the project can be used for triple bottom line reporting. It should be noted that the first-hand data reveals projects' performance, not organizations' performance. Developers or property managers can use these data for the companies' triple bottom line reporting.

The Living Building Challenge provides great indirect data on project performance, which can be referred to by triple bottom line reporting issuers. Unlike direct data, indirect data also offer useful information on organizations' overall sustainability practice, economic impact and social influences. This information together with Living Building Institute's supplemental resources, which focus on information sharing and project team education, ensures that triple bottom line reporting is more resourceful and balanced. The Living Building Challenge brings in stakeholders such as building's tenants and local communities. This stakeholder involvement coincides with the central element of CSR, a concern with stakeholders, which is also inevitable in triple bottom line (Henriques and Richardson 2004, 27). The Living Building Challenge is designed for projects of any scale and constructed by any construction firms. After gaining all above-mentioned direct and indirect data, construction firms and property management firms, big or small, are ready to do triple bottom line reporting as long as their projects pursue the Living Building Challenge. This makes up for the current situation that large multinational firms do more triple bottom line reporting than small local firms (Henriques and Richardson 2004, 10). According to interviews, by doing Living Building Challenge projects, construction firms and

property management firms gain benefits such as reported environmental visibility of the firm, publicized active sustainability management, increasing reputation or brand, ethical considerations, employee motivation and innovation and learning (KPMG 2011, 19).

Future studies may look at triple bottom line reporting at the small company level to bring triple bottom line reporting together with firms in the real estate industry. Another field to explore is the possibility of generating direct economic and social data from the Living Building Challenge. Although economic and social aspects are not the original intention of the Living Building Challenge, they are inevitable parts of the Living Building Challenge. If more economic and social data is included in the Living Building Challenge, the Living Building Challenge itself is one step closer to sustainability.

CONCLUSION

This thesis answered the research question of how the Living Building Challenge helps developers and property managers to prepare for their triple bottom line reporting. The Global Reporting Initiative’s G4 Framework (GRI Framework) is used as guidance for triple bottom line reporting in this paper. Research findings are summarized in table 5 below, which shows how each petal contributes to the three aspects of triple bottom line reporting and reporting contents and quality. If a petal offers direct data or covers most of the information required by an aspect, the contribution is considered “high”. If a petal offers indirect data which is closely related to reporting, or the petal provides part of the required information of an aspect, it is considered of “medium” use. Finally, if a petal offers indirect data which slightly addresses the GRI Framework or several imperatives of the petal is not mentioned in the GRI Framework at all, the relationship between the petal with triple bottom line reporting is considered “low”.

Table 5 Living Building Challenge’s Contribution to Triple Bottom Line Reporting

Petals	Economic Aspect	Social Aspect	Environmental Aspect	Reporting Contents	Reporting Quality
Site	Low	Low	Medium	–	–
Water	Medium	Low	High	–	–
Energy	Medium	Low	High	–	–
Health	Medium	Medium	Medium	–	–
Materials	Medium	Low	High	–	–
Equity	Low	Medium	Low	–	–
Beauty	Low	Medium	Low	–	–

Supplemental Resources	Low	High	Low	–	–
Overall	Medium	Medium	High	Medium	Medium

The results of this paper show that the Living Building Challenge is very strong in the environmental aspect. Because they meet the imperatives, projects possess high-performance data for environmental reporting. The economic and social data fall behind in their value, clarity, and accuracy. However, the social and economic imperatives enhance each project’s performance, and they provide valuable information for reporting. Accompanied by supplemental resources of the Living Building Challenge, projects registering for Living Building Challenge still have a great chance to get the technology and education. In sum, the Living Building Challenge contains an integrated concern of triple bottom line, displaying more weight on the environmental aspect. The Living Building Challenge provides organizations with valuable direct and indirect data for reporting the three bottom lines separately, and for report as a whole, while their environmental data is of the most value. The Living Building Challenge also contributes to completeness and quality of triple bottom line reporting. The Living Building Challenge imperatives offer direct and indirect data for reporting and bring together stakeholders. For developers and property managers, who pursue economic benefits from their business, handy data provided by their projects are convenient resources to do triple bottom line reporting.

Both the GRI Framework and the Living Building Challenge have triple bottom line thinking imbedded in their original idea and structure. While both frameworks are in their infancy, this research brings the two sets together and shows their commonalities and differences. With the popularity of sustainability buildings, the construction and real estate sector will see the

benefits of a regular triple bottom line reporting, for it allows a checklist for companies to track their performance on sustainability, add weight to their vision, build a good public image, and potentially bring positive economic return for them. The Living Building Challenge, which now draws much attention, contributes to a large part of triple bottom line reporting for companies. Since sustainability is a world-wide trend and the Living Building Challenge provides techniques and support for completing a sustainable project, if a building decides to pursue the Living Building Challenge, the developer and operator or the building are suggested to think about issuing a triple bottom line report as their excellent project already prepares it to do so.

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Appendix 1: Definitions of Key Terms of the GRI Framework

Aspect: The word Aspect is used in the Guidelines to refer to the list of subjects covered by the Guidelines.

General Standard Disclosures: General Standard Disclosures offer a description of the organization and the reporting process.

Impact: In the Guidelines, unless otherwise stated the term ‘impact’ refers to significant economic, environmental and social impacts that are: positive, negative, actual, potential, direct, indirect, short term, long term, intended, unintended.

Material Aspects: Material Aspects are those that reflect the organization’s significant economic, environmental and social impacts; or that substantively influence the assessments and decisions of stakeholders. To determine if an Aspect is material, qualitative analysis, quantitative assessment and discussion are needed.

Reporting Principle: Concepts that describe the outcomes a report should achieve and that guide decisions made throughout the reporting process, such as which Indicators to respond to, and how to respond to them.

Specific Standard Disclosures: Specific Standard Disclosures offer information on the organization’s management and performance related to material Aspects.

Stakeholders: Stakeholders are defined as entities or individuals that can reasonably be expected to be significantly affected by the organization’s activities, products, and services; and whose actions can reasonably be expected to affect the ability of the organization to successfully implement its strategies and achieve its objectives.

Appendix 2: Living Building Challenge Criteria

Typologies: Renovation, Landscape or Infrastructure, Building and Neighborhood

Transect: L1 Natural Habitat Preserve, L2 Rural Agriculture Zone, L3 Village or Campus Zone, L4 General Urban Zone, L5 Urban Center Zone and L6. Urban Core Zone

Petals

Site

01: Limits to Growth

02: Urban Agriculture

03: Habitat Exchange

04: Car Free Living

Water

05: Net Zero Water

06: Ecological Water Flow

Energy

07: Net Zero Energy

Health

08: Civilized Environment

09: Healthy Air

10: Biophilia

Materials

11: Red List

12: Embodied Carbon Footprint

13: Responsible Industry

14: Appropriate Sourcing

15: Conservation + Reuse

Equity

16: Human Scale + Humane Places

17: Democracy + Social Justice

18: Rights to Nature

Beauty

19: Beauty + Spirit

20: Inspiration + Education

Appendix 3: Interview Questions

1. What is triple bottom line by Craft 3's definition?
2. How does Craft 3 do triple bottom line accounting?
3. How does Craft 3 measure things that are hard to measure?
4. Did you see any difficulties to do triple bottom line accounting?
5. By looking at the Living Building Challenge Petals, do you think it is triple bottom line? What aspects are stronger or weaker?
6. What is the current situation of the Bullitt Center (by March 7th)?
7. What are the differences and similarities between the Living Building Challenge and LEED?
How does the Living Building Challenge win against LEED?
8. Is there detailed implementation information for Petals?
9. Does it concern about people with low-incomes, local job opportunities and other equity issues, and how?
10. Based on your experience with the real estate industry and the academia, how do you evaluate and comment on the Living Building Challenge?
11. Do you think triple bottom line accounting can promote sustainability?
12. Do you think it is practical for developers to do triple bottom line accounting? If not, why?
13. Do you think that the Bullitt Center is replicable?
14. How is the Center operated and leased?

15. How profitable the Bullitt Center is? Does it break the owner's economic bottom line?
16. As a tenant, how do you feel about this building? Is your experience of working in the building pleasant?
17. Would you think it is possible for developers, especially sustainable building developers, to do triple bottom line reporting?
18. What are the policy difficulties during construction of Bullitt Center?
19. How does the Bullitt Center perform in terms of the economic, social and environmental bottom lines?
20. From policy perspective, is it possible to promote triple bottom line reporting? What if triple bottom line reporting is compulsory?
21. Are there any other triple bottom line standards or practices in the field at local level?

Appendix 4: G4 Sustainability Reporting Framework Criteria

Principles for Defining Report Content

Stakeholder Inclusiveness Principle: The organization should identify its stakeholders, and explain how it has responded to their reasonable expectations and interests.

Sustainability Context Principle: The report should present the organization's performance in the wider context of sustainability.

Materiality Principle: The report should cover Aspects that reflect the organization's significant economic, environmental and social impacts, or substantively influence the assessments and decisions of stakeholders.

Completeness Principle: The report should include coverage of material Aspects and their Boundaries, sufficient to reflect significant economic, environmental and social impacts, and to enable stakeholders to assess the organization's performance in the reporting period.

Principles for Defining Report Quality

Balance Principle: The report should reflect positive and negative aspects of the organization's performance to enable a reasoned assessment of overall performance.

Comparability Principle: The organization should select, compile and report information consistently. The reported information should be presented in a manner that enables stakeholders to analyze changes in the organization's performance over time, and that could support analysis relative to other organizations.

Accuracy Principle: The reported information should be sufficiently accurate and detailed for stakeholders to assess the organization's performance.

Timeliness Principle: The organization should report on a regular schedule so that information is available in time for stakeholders to make informed decisions.

Clarity Principle: The organization should make information available in a manner that is understandable and accessible to stakeholders using the report.

Reliability Principle: The organization should gather, record, compile, analyze and disclose information and processes used in the preparation of a report in a way that they can be subject to examination and that establishes the quality and materiality of the information.

General Standard Disclosures

Strategy and Analysis

G4-1 Provide a statement from the most senior decision-maker of the organization about the relevance of sustainability to the organization and the organization's strategy for addressing sustainability.

G4-2 Provide a description of key impacts, risks, and opportunities.

G4-3 Report the name of the organization.

G4-4 Report the primary brands, products, and services.

G4-5 Report the location of the organization's headquarters.

G4-6 Report the number of countries where the organization operates, and names of countries where either the organization has significant operations or that are specifically relevant to the sustainability topics covered in the report.

G4-7 Report the nature of ownership and legal form.

G4-8 Report the markets served.

G4-9 Report the scale of the organization, including total number of employees, total number of operations, net sales or net revenues, total capitalization broken down in terms of debt and equity, quantity of products or services provided, additional disclosure requirements, report additional information, for example, gross lettable area for assets under construction and management and vacancy rate.

G4-12 Describe the organization's supply chain.

G4-15 List externally developed economic, environmental and social charters, principles, or other initiatives to which the organization subscribes or which it endorses.

Report Profile

G4-28 Reporting period for information provided.

G4-33 Report the organization's policy and current practice with regard to seeking external assurance for the report.

Specific Standard Disclosure

Category: Economic

Aspect: Economic Performance

G4-EC1 Direct Economic Value Generated and Distributed

Aspect: Indirect Economic Impacts

G4-EC7 Development and Impact of Infrastructure Investments and Services Supported

Additional disclosure requirements: Explain significant infrastructure investments made by the reporting organization in relation to affordable and social housing, preservation and restoration of historic assets, publicly accessible open/recreation space, and community education and health facilities.

G4-EC8 Significant Indirect Economic Impacts, Including the Extent of Impacts

Aspect: Procurement Practices

G4-EC9 Proportion of Spending on Local Suppliers at Significant Locations of Operation

Category: Environmental

Aspect: Materials

G4-EN2 Percentage of Materials Used That are Recycled Input Materials

Additional disclosure requirements: Include reused input materials as part of the percentage of recycled input materials used to manufacture the organization's primary products and services. Break down the percentage of materials used that are recycled and reused input

materials by significant categories of raw materials, renewable materials and manufactured products.

Aspect: Energy

G4-EN3 Energy Consumption within the Organization

Additional disclosure requirements: Report onsite production of electricity from renewable sources by meaningful segmentation. Report total energy consumption by meaningful segmentation. Reporting organizations involved in new construction and redevelopment should report known or metered energy consumption in addition to listing non-metered sources.

G4-EN6 Reduction of Energy Consumption

Additional disclosure requirements: Report actual energy savings for all assets using recognized conversion factors. Report relevant financial data, actual or estimated. State methodology for calculations and estimations.

G4-EN7 Reductions in Energy Requirements of Products and Services

Aspect: Water

G4-EN8 Total Water Withdrawal by Source

G4-EN9 Water Sources Significantly Affected by Withdrawal of Water

G4-EN10 Percentage and Total Volume of Water Recycled and Reused

Additional disclosure requirements: Report the total volume of water recycled and reused by the organization linked to metered utility data.

Aspect: Biodiversity

G4-EN11 Operational Sites Owned, Leased, Managed in, or Adjacent to, Protected Areas and Areas of High Biodiversity Value Outside Protected Areas

G4-EN12 Description of Significant Impacts of Activities, Products, and Services on Biodiversity in Protected Areas and Areas of High Biodiversity Value Outside Protected Areas

Aspect: Emissions

G4-EN15 Direct Greenhouse Gas Emissions

Additional disclosure requirements: Provide a breakdown of the gross direct GHG emissions in metric tons of CO2 equivalent by meaningful segmentation, for example, portfolio, fund, location, asset type.

G4-EN16 Energy Indirect Greenhouse Gas Emissions

G4-EN18 Greenhouse Gas Emissions Intensity

Aspect: Effluents and Waste

G4-EN22 Total Water Discharge by Quality and Destination

G4-EN23 Total Weight of Waste by Type and Disposal Method

Aspect: Supplier Environmental Assessment

G4-EN32 Percentage of New Suppliers That Were Screened Using Environmental Criteria

CATEGORY: SOCIAL

Aspect: Customer Health and Safety

G4-PR1 Percentage of Significant Product and Service Categories for Which Health and Safety Impacts are Assessed for Improvement

Aspect: Product and Service Labeling

CRE8 Type and Number of Sustainability Certification, Rating and Labeling Schemes for new Construction, Management, Occupation and Redevelopment