Neighbourhood Sustainability Assessment: Connecting Impact with Policy Intent

by

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Abstract

While sustainable urbanization is now widely recognized as integral to achieving global sustainability goals, no one framework for monitoring the sustainability performance of urban areas has been adapted into planning practice by multiple scales of government. This research introduces a new sustainability assessment tool, the Sustainable Communities Rating (SCORE) Tool, under development by the Centre for Sustainable Community Development at Simon Fraser University, which addresses a missing link in assessment tools by evaluating the performance of neighbourhoods that have already been developed, against a six-capital framework through a sustainable community development lens. The SCORE Tool is piloted in the UniverCity neighbourhood in Burnaby, B.C., then it is discussed in detail with a view to how the tool worked in its inaugural application. Finally, a discussion about the strengths and comparability of neighbourhood sustainability assessment systems is structured as a comparative analysis between the SCORE Tool and the Dutch Foundation for Sustainable Area Development FSA Tool.

Keywords: Neighbourhood sustainability assessment, comparative analysis

Dedication

For my mother, crazy and amazing, Anne Bird. My academic inspiration and so much more.

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List of Acronyms

BC	British Columbia
BMRA	Burnaby Mountain Resident Association
CSCD	Centre for Sustainable Community Development
CSD	Census Sub-Division
CMHC	Canada Mortgage and Housing Corporation
DA	Dissemination Area
DU	Dwelling Units
EIA	Environmental Impact Assessment
FSA	Foundation for Sustainable Area Development
GFA	Gross Floor Area
GHG	Greenhouse Gas
GNH	Gross National Happiness
ICBC	Insurance Corporation of British Columbia
ISO	International Organization for Standardization
NSA	Neighbourhood Sustainability Assessment
SA	Sustainability Assessment
SCORE	Sustainable Communities Rating Tool
SEA	Strategic Environmental Assessment
SFU	Simon Fraser University
STIR	Shelter-to-income-cost Ratio

Glossary[1]

Sustainable Development	Sustainable development described by the Brundtland Commission in 1987 is 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs.' It contains two key concepts: (1) the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and (2) the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs (WCED, 1987).
Sustainability	Sustainability, for the purpose of this assessment, is a state of existence achieved when a neighbourhood scores satisfactorily evaluated against a framework of balanced community capital assets.
Sustainability Assessment	Sustainability assessment (SA) is a process by which the implications of sustainability initiatives are evaluated, where the initiative can be a proposed or existing policy, plan, program, project, piece of legislation, or a current practice or activity (Pope, Annandale, & Morrison-Saunders, 2004).
Neighbourhood Sustainability Assessment	Neighbourhood Sustainability Assessment (NSA) tools evaluate and rate the performance of a given neighbourhood against a set of criteria and themes to assess the neighbourhood's position on the way towards or success in approaching sustainability goals (Sharifi & Murayama, 2013).
Neighbourhood	A neighbourhood is a smaller subset of a broader community. It consists of a mix of residential and non-residential buildings and land uses within a radius of approximately 400 meters - corresponding to a comfortable five minute walking distance from centre to edge or approximately 50 hectares (Kellett et al., 2009).
Sustainability framework	Sustainability frameworks are schemes that combine sets of targets and indicators (Joss, 2012).
Domain-based framework	See multi-criteria framework
Multi-criteria framework	Multi-criteria frameworks start with the key dimensions of sustainability and then identify criteria and indicators for each (Maclaren, 1996).

[1] Glossary is organized beginning with large-scale concepts to small details of sustainability assessments tools.

Indicators	Indicators are conceptual tools that measure progress toward (or away from) a goal or objective (Kellett et al., 2009)
Benchmark	A benchmark is a standard or point of reference (Kellett et al., 2009).
Target	A target is an objective or result aimed at. In the case of sustainability assessment a target moves the bar higher towards an ultimate sustainability goal (Kellett et al., 2009).
Threshold	A threshold is a boundary. In the context of sustainability assessment, a threshold represents the boundary between good and poor sustainability practice. Some thresholds are well defined in research, while others are based on current practice (Kellett et al., 2009).
Median	The median is the midpoint of a frequency distribution (O.E. Dictionary, 2004).
Quartile	A quartile is one of three values of a variable dividing a population into four equal groups as regards the value of that variable (O.E. Dictionary, 2004).

Executive Summary

Over half of the world's population currently lives in cities and that number is predicted to increase to 70% by 2050 (EIU, 2012). With 60% of their area still to be built before 2030, the role of cities in proactively guiding sustainable global resource use is more important than ever (Roseland, 2013). In this age of urbanization, sustainability assessment tools are used to evaluate the success of our plans, policies and regulations for achieving sustainability in practice. These tools can help us to translate our sustainable development aspirations into achievable actions for the urban context by supporting evidence-based policy making, and also by promoting social learning and knowledge exchange (Joss, 2012; ISO, 2014).

In recent years, there has been a resurgence of interest in sustainability frameworks at the neighbourhood or community scale. A comprehensive list of 43 SA frameworks is documented in “Eco-City Frameworks – A Global Overview”, of which 35 were released in the five years preceding the research (Joss, 2013). At the same time, neighbourhood-scale planning has become a focus of Canadian efforts nationally, with the Federation of Canadian Municipalities focusing Green Municipal Fund resources at that scale and many municipalities finding it a useful scale at which to plan, deliver programs, and engage with citizens (FCM, 2013). The intersection of these two trends is the application of tools that assess how sustainable neighbourhoods are or are expected to be.

Although neighbourhoods are considered the building blocks of our cities, notably few sustainability assessment tools are used to evaluate existing neighbourhoods, and many of the common neighbourhood sustainability assessment (NSA) tools, such as those “spin-offs” of building assessment tools: CASBEE, BREEAM and LEED ND, tend to have a disproportionate coverage of the environmental aspects of sustainability, and don’t tend to adequately cover the economic and social aspects of sustainability (Sharifi & Murayama, 2013). Also, the majority of NSA tools use prescriptive or “enabling” indicators, which make recommendations for design or activities, mainly focusing on the

development stage (Kellett et al., 2009). Few of the existing tools adequately put people and place at the heart of sustainability assessment systems.

Researchers at the Centre for Sustainable Community Development (CSCD) at Simon Fraser University (SFU) identified a missing link in assessment tools that evaluates the performance of existing urban developments at the neighbourhood scale using a lens of sustainable community development. In response, the CSCD began development of the Sustainable Communities Rating (SCORE) Tool, which fills this gap by assessing the performance of existing neighbourhoods against a multi-criteria sustainability framework. Built upon the Community Capital Framework (Roseland, 2012), the SCORE Tool conceptualizes sustainable community development in terms of six mutually reinforcing forms of community capital (natural, social, economic, physical, human, and cultural capital), with specific target-based indicators attached to each. This approach enables users to think systematically and holistically with regard to existing community capacity (Roseland, 2012), sustainability principles, and evaluate the actual impact of policy design choices in terms of outcomes rather than activities, helping municipalities and developers learn how best to support sustainable outcomes. Unlike tools that use prescriptive indicators or checklists, the SCORE Tool gathers primarily quantitative evidence about sustainability outcomes of neighbourhoods based on readily available statistical data and/or geospatial data coupled with statistically valid survey.

The purpose of this study is to (1) pilot the SCORE Tool in a community setting, (2) discuss how the SCORE Tool worked in its inaugural application, and (3) compare the results of the SCORE Tool assessment with the results of the Foundation for Sustainable Area Development's (FSA) Tool, previously applied to the same study site in September 2013, in order to learn from this unique Canadian application of new and different NSA tools. The SCORE Tool assessment was carried out between June and September of 2014 and the analysis between September and December of 2014.

Chapter 1 of this paper introduces sustainable community development, sustainability assessment principles, popular NSA tools, and the study site, UniverCity. Chapter 2 provides an in-depth explanation of the SCORE Tool, the UniverCity assessment methodology and the assessment results. Chapter 3 performs a

comparative analysis of two neighbourhood sustainability assessment systems applied in the UniverCity community: the SCORE Tool and the Dutch Foundation for Sustainable Area Development's FSA Tool. Chapter 4 presents the findings of Chapter 2 and Chapter 3. The final chapter of this paper, Chapter 5, presents the major conclusions of the work and will suggest some potential implications of this research for connecting neighbourhood sustainability assessment to achieving broader municipal, national, and global sustainability goals.

The objectives of the pilot assessment were to:

- prove the concept for the SCORE Tool to measure sustainability outcomes against a six capital framework;
- refine an indicator set that is broadly comparable across neighbourhoods;
- define to what extent it is possible and useful to measure sustainability outcomes at a neighbourhood scale; and
- determine whether there are substantial gaps between what we want to measure, and what data is available.

The pilot assessment of the SCORE Tool in the UniverCity neighbourhood was by and large a success. The SCORE Tool delivered a set of 66 meaningful indicators for neighbourhood sustainability assessment, organized in a multi-criteria assessment framework, based on a six capital model for sustainable community development. 77% of indicators were answered with neighbourhood scale data. In some cases where data was unavailable at the neighbourhood scale, a wider area was used as a proxy for study area performance. More research is needed in order to determine whether data at higher scales is a reliable or valid way of representing performance of a neighbourhood. In terms of gathering quality data, 85% of indicators were gathered from valid government databases or third party organizations such as Walk Score. These indicators are broadly comparable across BC, and so there is a strong case for the comparability of the SCORE Tool between neighbourhoods.

The pilot assessment also revealed some strengths and weaknesses of the tool. For example, the indicators answered by the Gross National Happiness (GNH) Index survey proved to be an important contribution to SCORE Tool by integrating measures of resident quality of life. The GNH Index survey quantifies neighbourhood residents'

subjective, personal assessments of their own emotional, physical and relational well-being. This practice reflects a growing awareness that tools for evaluating progress must look beyond economic indicators or environmental targets to a more integrative and holistic approach to sustainability, one which also optimizes for happiness and well-being (Costanza, 2014).

The pilot assessment also surfaced areas for improvement. In terms of the sustainability coverage of the SCORE Tool, a few adjustments should be made. The SCORE Tool must find a way to include energy consumption data via information sharing agreements with BC Hydro and Fortis. Also, there are missing measures of housing/job connectivity, financial sustainability, and further consideration of the institutional sphere of sustainability.

The major weakness of the pilot assessment is that the SCORE Tool currently lacks a rigorous and transparent method of scoring indicators. Each indicator's target should be based on a clearly defined international standard for sustainability assessment. Furthermore, the SCORE Tool must adopt a peer-reviewed methodology for defining thresholds. The pilot assessment of the SCORE Tool at UniverCity suggests a methodology for scoring indicators – explained in detail in section 2.2.4 - but the solutions proposed should still be considered under development. As such, it is recommended that a formal peer review of all criteria and indicators, targets and thresholds, should take place.

Finally, one major finding of the comparative evaluation is that there is a gap in sustainability assessment literature that deals with how to organize sustainability indicators into multi-criteria frameworks. There are unclear definitions and uses of the terms themes and criteria in NSA literature and practice. Further research is needed to develop a common criteria and organizational framework, so as to make sustainability assessment practices and their certified developments broadly comparable across the globe.

This paper hopes to emphasize that applying an evaluative approach to sustainability planning is key to sustainable urbanization. If we can manage to further develop the indicators of the SCORE Tool and their associated targets and thresholds,

then we can relate the results of this tool to broader municipal, and global sustainability targets, effectively connecting impact with policy intent.

Chapter 1.

Introduction

Over half of the world's population currently lives in cities and that number is predicted to increase to 70% by 2050, placing additional pressure on existing energy and water resources, waste management, sewer systems and transport networks (EIU, 2012). Consequently, urbanization is a major concern due to its detrimental effects on the environment, which include climate change, biodiversity loss, and environmental pollution (Haapio, 2012; Luederitz, Lang, & Von Wehrden, 2013; Roseland, 2013). Yet with 60% of their area still to be built before 2030, there is enormous opportunity to proactively guide the shape of future cities to bring our global resource use within planetary boundaries and reach our global *sustainability* goals (Roseland, 2013; UNTST, 2012; SCBD, 2012).

In the international policy arena, the 2015 United Nations Sustainable Development Goals are now underway, set to replace the Millennium Development Goals. Proponents of developing an Urban Sustainable Development Goal argue that policymakers need to adopt a wider view of cities' use of space and resource footprints, and recognize urban areas as drivers of environmental change at various scales (Roseland, 2013; UNTST, 2012). Cities have direct influence over the natural environment, the social condition of the population, and the economic activities of communities because they have the power to shape the design of the built environment by authorizing the construction of a new buildings or modifying public services (Berardi, 2011). Although local governments are not necessarily the only agencies charged with community planning and development, they are the only locally elected, representative and accountable bodies responsible for community decision-making (Roseland, 2000). As cities grow, municipal governments have an increasingly important role to play in

pursuit of sustainability as incubators of innovation and scaled implementation, agents of change, and as the sphere of government closest to the people (ICLEI, 2012).

Sustainable urbanization is now widely recognized as integral to achieving global sustainability goals (Briassoulis, 2001; Clos, 2014; Haapio, 2012; Joss, 2012; Moore & Rees, 2013; Roseland, 2013; Shen et al., 2011). However, *sustainable development* is a long-term goal, and moving towards this complex goal will require taking incremental steps (Roseland, 2013). Sustainability plans, policies and regulations attempt to translate sustainable development aspirations into implementable actions. However, no one *framework* for evaluating the success of policies, regulations, and programs in achieving sustainability has been adopted into planning practice by multiple scales of government. Just as financial accountability is achieved through reporting, monitoring, controlling and auditing programs and initiatives, from a planning perspective, sustainability assessment helps us know if our efforts towards sustainability are actually producing proportionally constructive results.

1.1. Background

1.1.1. Sustainability Assessment

One of the formal ways to measure levels of sustainability is through a formal instrument of measurement (Kellett et al., 2009). *Sustainability assessment* (SA) tools are increasingly recognized as important instruments for moving towards sustainability goals (Joss, 2012). SA tools are designed to ensure that outcomes of plans and activities make an optimal contribution to urban sustainability and create the possibility to compare one project to another (Pope et al., 2004). They do so by providing information, generating knowledge, serving as tools for performance management and engaging various actors in 'social learning' and knowledge exchange (Joss, 2012.; Mori & Christodoulou, 2012; Pope, Annandale, & Morrison-Saunders, 2004). With an eye to fiscal accountability, evidence of positive progress is important for justifying past expenditures on sustainability initiatives and building support for new initiatives (Maclaren, 1996). SA tools are built on *frameworks* and *indicators*, which are both tools for guiding sustainability initiatives. Indicators are used for defining *targets* in measurable

ways and monitoring performance, while frameworks are schemes that combine sets of indicators and targets (Joss, 2012).

A variety of actors, including non-governmental organizations, professional organizations and government agencies, have developed sustainability indicators, frameworks and assessment tools. A comprehensive list of 43 SA frameworks is documented in "Eco-City Frameworks – A Global Overview" (Joss, 2013), of which 35 were released in the five years preceding the research. The proliferation of SA tools has led to many schemes competing for recognition at the international level, with many more deployed at national and sub-national levels. While these indicator schemes share a common goal of capturing and measuring various urban sustainability dimensions, at the same time they differ significantly in terms of conceptual definitions, methodological approaches and modes of operation (Joss, 2012). While sustainability indicator systems have been proven to be valuable tools for improving the availability of information related to the relationship of cities and communities to natural limits, the indicators movement has achieved limited instrumental uptake in policy (Holden, 2014), and no one framework for monitoring the sustainability performance of urban areas has been adapted into planning practice by multiple scales of government. Consequently, there is a need to generate more systematic knowledge and policy analysis of how various SA tools compare; whether there is scope for closer integration to achieve international standards; and the associated implications for policy-making (Joss, 2012).

In the literature, SA is generally viewed as a tool in the 'family' of impact assessment processes, closely related to project scale Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) applied to plans, policies and regulations (Pope et al., 2004). SA of the built (urban) environment has been addressed by rating tools for buildings for more than two decades (Häkkinen, 2007). Although there is a high demand and attention paid to green buildings, these building assessment tools have demonstrated to be insufficient to guarantee the sustainability of the built environment, with respect to the social, environmental, and economic spheres of sustainability (Berardi, 2011; Cole, 2011; Conte & Monno, 2012; Häkkinen, 2007). Recent literature has discussed the importance to go beyond the sustainability assessment of single buildings and to enlarge the assessment scale to

communities and cities (Berardi, 2011; Conte & Monno, 2012; Sharifi & Murayama, 2013; Turcu, 2013). Scaling sustainability assessment up to the *neighbourhood* and city-wide levels is regarded as an effective way of taking account of the complexities of an urban system (Sharifi & Murayama, 2014).

1.1.2. Neighbourhood Sustainability Assessment

SA tools can be classified based on their geographical scale, with many examples developed for application at national, regional and local scales. The tools are generally developed and operated by green building associations or sustainability non-profits that support themselves, in part, on certification fees; while others offer simple, no-cost checklists or web-based rating processes (Allan, 2014). Examples of internationally-applicable SA frameworks that apply at the city scale include the grassroots Eco2Cities, which is an open-access framework that incorporates process-oriented indicators with content-related indicator targets that are locally adapted; and the Green City Index, a technical tool for assessing and comparing the sustainability of over 120 populous cities based on global data. In May 2014, The International Organization for Standardization (ISO) released a definitive list of city-scale indicators and assessment methods known as ISO 37120, which are likely to be integrated to future assessment systems.

At the neighbourhood scale, *neighbourhood sustainability assessment* (NSA) tools evaluate and rate the performance of a given neighbourhood against a set of criteria and themes to assess the neighbourhood's performance in relation to sustainability goals (Sharifi & Murayama, 2013). Focusing on the neighbourhood scale places importance on the interactions between the built environment and the surrounding infrastructure and natural landscape (Berardi, 2011). The neighbourhood is also the scale at which land development takes place and new buildings and facilities are proposed, debated, and constructed (Sharifi & Murayama, 2013). Neighbourhood-scale planning has become a focus of efforts nationally, with the Federation of Canadian Municipalities strictly focusing Green Municipal Fund resources at that scale, and many municipalities finding it a useful scale at which to plan, deliver programs, and engage with citizens.

At the neighbourhood scale, there are two broad categories of sustainability assessment systems: (1) the systems emerged from existing third-party building assessment systems, and (2) the decision-making tools embedded into neighbourhood scale planning (Sharifi & Murayama, 2013; Orova & Reith, 2013). In the first category, three frameworks, which are internationally well-known include CASBEE for Urban Development from Japan, BREEAM Communities from UK, and LEED ND from USA (Haapio, 2012). These three frameworks are multi-stage rating and certification schemes for urban developers that can be classified as "spin-offs" of building environmental assessment tools (Sharifi & Murayama, 2013). In the second category, are mostly sub-national frameworks, such as EcoDistricts from the USA, and Green Star Communities from Australia. Joss' list of Eco-City Frameworks and their geographical scales is summarized in Table 1 below.

Table 1 List of Eco-City Frameworks (Joss, 2013)

Framework	Scale
Tianjin Binhai Ecocity	National
Eco-city Development Index System	National
ASEAN ESC Model Cities	Regional/National
Biosphere Eco-City	City
City Biodiversity Index ('Singapore Index')	City
Eco2 Cities	City
European Common Indicators	City
Global Urban Indicators	City
Green Cities Programme	City
RFSC	City
Eco-Model Cities	City
Indicators fo National Eco-County/Eco-City/Eco-Province	City
National Eco-Garden City	City
Charter of Eco Mayors	City
Green Climate Cities	City
Green City Index	City
Smarter Cities Challenge	City
CityGrid	City
Global City Indicators Facility	City
SilmCity	City

Sustainable Cities Index	City
Urban Sustainbility indicators	City
REAP for Local Communities	City
Star Community Rating System	City
Sustainable Communities	City and private communities
EcoQuartier	Neighbourhood
Green Communities	Neighbourhood
Selo Casa Azul	Neighbourhood
EcoDistricts	Neighbourhood
Climate Positive	Neighbourhood
FSA	Neighbourhood
IEFS	Neighbourhood
BREEAM Communities	Neighbourhood
CASBEE for Urban Development/Cities	Neighbourhood
DGNB NSQ	Neighbourhood
Green Star Communities	Neighbourhood
IGBC	Neighbourhood
Estidama	Neighbourhood
Community Capital Tool	Neighbourhood
Enterprise Green Communities	Neighbourhood
LEED ND	Neighbourhood
One Planet Communities	Neighbourhood
Living Building Challenge	Unique building

1.1.3. Sustainable Community Development

The first definition of sustainable development came from the 1987 Brundtland Report, “Our Common Future”, and is still one of the most widely accepted definitions: “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. This definition contains within it two key concepts: (1) the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and (2) the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs (WECD, 1987). The publication of “Our Common Future” and the work of the World Commission on Environment and Development laid the

groundwork for the convening of the 1992 Earth Summit and the adoption of Agenda 21, the Rio Declaration and to the establishment of the Commission on Sustainable Development. More than 25 years later, sustainable development is a household concept, widely accepted by a global population, and is understood to have three core components: the environment, the economy and society (Roseland, 2000). However, sustainable development is still often thought of as a long-term goal, and applied broadly to the planet as a whole (Roseland, 2000; Roseland, 2013).

Sustainable *community* development puts people and place at the heart of sustainable development. Recognizing that our planet is made up of a giant network of interconnected communities, sustainable community development emphasizes mobilizing the power of citizens at the local level to drive change on a global scale (Roseland, 2012). Sustainable community development asserts that global threats to environmental sustainability are often most effectively resolved by local strategies, and the best way to attain global sustainability is to implement and monitor small-scale initiatives administered by governmental, private, and non-profit actors (Roseland, 2012). Influenced by theories of ecological economics, international development, natural and social sciences, and planning, sustainable community development strategies favour bottom-up over top-down approaches, a local over larger scale focus, and seek to equally improve society and the environment, as well as the economy (Roseland, 2012; Brohman, 1996).

Furthermore, sustainability can be considered in terms of weak and strong sustainability. Conceiving of sustainability in economic terms, weak sustainability implicitly aggregates all types of assets, reflecting the neoclassical economic assumption that non-natural assets can substitute for natural assets, and would not see it as problematic if natural assets were used up as long as the profits they generate provide an equivalent endowment to the next generation (Roseland, 2012). Strong sustainability recognizes that, in most cases, non-natural assets cannot be substituted for natural assets, because of irreversible processes, such as environmental degradation (Roseland, 2012). Sustainable community development criticizes the weak sustainability perspective that many policies and projects pursue, in which the declining health of natural systems is compensated for by the growth of built capital and innovation

(Roseland, 2012). In this way, sustainable community development assumes a strong sustainability perspective, arguing that societies around the world should maintain or regenerate life-support services, such as clean water, air, and biodiversity, while improving social and economic priorities (Hendrickson et al., 2011). These natural support systems have no substitutes because they are essential to human survival (Hendrickson et al., 2011).

Roseland and others at the Centre for Sustainable Community Development (CSCD) at Simon Fraser University (SFU) in BC, Canada, argue that for sustainable community development, it is useful to think of community in terms of so-called capital (Roseland, 2012). *Capital* can be defined as a collection of local assets or community resources that can produce other benefits through investment (Flora et al., 2004). Building off of the three cornerstones of sustainability: the environment, the economy and society, researchers at the CSCD introduce a more nuanced theoretical construct of sustainable communities, which they call the Community Capital Framework (Roseland, 2012). The Community Capital Framework describes sustainable community development as the balanced development of six forms of capital: natural, physical, economic, human, social and cultural capital.

The Community Capital Framework is a *domain-based* or *multi-criteria framework* (Maclaren, 1996) that teases out the key components of sustainability in order to provide comprehensive sustainability coverage. In sustainability assessment, multi-criterion frameworks are gaining increasing attention as they are easily understood and allow a step implementation for each criterion (Berardi, 2013).

1.1.4. A New NSA Tool: SCORE Tool

Although neighbourhoods are considered the building blocks of our cities, notably few sustainability assessment tools are used to evaluate existing neighbourhoods, and many of the common NSA tools, such as “spin-off” tools CASBEE, BREEAM and LEED ND, tend to have a disproportionate coverage of the environmental aspects of sustainability, and don’t tend to adequately cover the economic and social aspects of sustainability (Sharifi & Murayama, 2013). Also, the majority of these tools use

prescriptive or “enabling” indicators, which make recommendations for design or activities, mainly focusing on the development stage (Kellett et al., 2009). Few of the existing tools adequately put people and place at the heart of sustainability assessment systems.

Owing to analysis of Joss’ “Eco-City Frameworks”, researchers at the CSCD identified a missing link in assessment tools that evaluates the performance of existing urban developments at the neighbourhood scale using a lens of sustainable community development. In response, the CSCD began development of the Sustainable Communities Rating (SCORE) Tool, which fills this gap by assessing the performance of existing neighbourhoods against a multi-criteria framework. Built upon the Community Capital Framework, the SCORE Tool conceptualizes sustainable community development in terms of six mutually reinforcing forms of community capital, with specific target-based indicators attached to each. This approach enables users to think systematically and holistically with regard to existing community capacity, sustainability principles, and evaluate the actual impact of policy design choices in terms of outcomes rather than activities, helping municipalities and developers learn how best to support sustainable outcomes (Roseland, 2012). Unlike tools that use prescriptive indicators or checklists, the SCORE Tool gathers primarily quantitative evidence about sustainability outcomes of neighbourhoods based on readily available statistical data and/or geospatial data coupled with statistically valid survey.

1.2. Objective

The purpose of this study is to (1) pilot the SCORE Tool in a community setting, (2) discuss how the SCORE Tool worked in its inaugural application, and (3) compare the results of the SCORE Tool assessment with the results of the Foundation for Sustainable Area Development’s (FSA) Tool, previously applied to the same study site in September 2013, in order to learn from this unique Canadian application of new and different NSA tools.

In this research, the SCORE Tool will be piloted in the UniverCity neighbourhood, a master-planned 'complete community' on Burnaby Mountain, BC, overseen by SFU Community Trust. The objectives of the pilot assessment are to:

- prove the concept for the SCORE Tool to measure sustainability outcomes against a six capital framework;
- refine an indicator set that is broadly comparable across neighbourhoods;
- define to what extent it is possible and useful to measure sustainability outcomes at a neighbourhood scale; and
- determine whether there are substantial gaps between what we want to measure, and what data is available.

Following its commitment to environmental stewardship and education, SFU Community Trust has contracted the SCORE Tool pilot assessment in order to (1) assess sustainability performance of UniverCity, and (2) to participate in the development of a pioneering neighbourhood sustainability assessment system. SFU Community Trust interest in sustainability assessment dates back to Cynthia Girling's 2009 performance report of the East Highlands Neighbourhood Development (Girling, 2010), and more recently the September 2013 Foundation for Sustainable Area Development symposium on urban area assessment (FSA, 2013). SFU Community Trust also performed a LEED ND assessment in 2012, but never sought official certification.

This study will also conduct a comparative analysis of the SCORE Tool and FSA Tool. The comparative analysis will contain an outcomes evaluation and a process evaluation. The outcomes evaluation is concerned with comparing the assessment results of the SCORE Tool and FSA Tool. The objective of this exercise is to either provide some triangulation of the assessment results or highlight ambiguities in the data. The process evaluation is concerned with the methodology and application of each of the tools. The objective of this exercise is to learn from different approaches to sustainability assessment. This research will leverage this unique Canadian application of new and different NSA tools to compare and learn from the experience. Amidst the concurrent development and implementation of a multitude of assessment systems, comparative case studies help researchers to understand strengths and weaknesses

between different assessment systems and contribute to a growing body of evidence for best practices in assessment framework structures and processes.

1.3. Study Site

UniverCity is a master-planned, 160-acre high-density community situated on Burnaby Mountain, BC, adjacent to SFU. Currently Phases 1 and 2 of the development are complete, Phase 3 is under development and Phase 4 is in planning. Roughly 3500 people live at UniverCity (3118 from the 2011 census), which will ultimately be home to approximately 10,000 people. About 47% of the residents have an affiliation with SFU as students (24%), faculty (17%) or staff (19%) members (Mustel Group, 2012).

In the mid-1990's SFU Community Trust was established to oversee the development and transitional management of a 65-hectare parcel adjacent to Simon Fraser University into 'UniverCity'. UniverCity would be a model sustainable 'complete community' with a diverse range of housing choices, shops, services and amenities. Developing the land would also make SFU itself more sustainable, both by creating a supportive enclave for students, faculty, staff and others who wanted to live in a quiet, beautiful and ecologically responsible community, and by directing net revenues into an SFU Endowment Fund that would support teaching and research over the long term (Roseland, 2012).

The UniverCity Official Community Plan was adopted by Burnaby City Council in September, 1996. UniverCity's first residents moved into the new neighbourhood in 2004. 10 years later, the SFU Community Trust is interested in knowing whether they are delivering on sustainability goals and performance targets, as defined by the SCORE Tool.

UniverCity is a master-planned community – compact, mixed use, and transit-oriented – built upon Four Cornerstones of Sustainability: Environment, Economy, Equity and Education. Each cornerstone is guided by a number of goals, listed below:

1. Environment

- Provide a full range of transportation choices
- Preserve and improve the natural heritage of Burnaby Mountain
- Design buildings and public spaces that respond to local context
- Provide sustainable, cost-and resource-efficient infrastructure and buildings

2. Economy
    - Maximize the long-term value of SFU's endowment fund
    - Encourage opportunities for innovative commercial and community economic development by working with all stakeholders

3. Equity
    - Create a healthy, safe, livable, and complete community
    - Provide an appropriate mix of housing types and tenures that reflect the entire lifecycle

4. Education
    - Enhance university life, academic structure, and activities
    - Create a model sustainable community that educates and inspires residents to pursue lifelong learning

UniverCity's goals and some performance targets have been set out in adopted plans, including the “Simon Fraser University Official Community Plan” (City of Burnaby, 2002), “Development Guidelines and Requirements” (SFU Community Trust, 2012), “Watercourse and Stormwater Management Plan” (CH2M HILL, 2003) and guiding documents including the “Community Character and Social Composition Report” (SFU Community Trust, 2002). Progress on these goals is reported on in progress reports such as “Four Cornerstones of Sustainability: A UniverCity Progress Report” (SFU Community Trust, 2011).

Girling (2010) produced a third party peer reviewed evaluation of the East Highlands Neighbourhood or Phase 1 of the UniverCity development, using an evaluative framework based in theory of smart growth, against measures of density, completeness, connectivity, accessibility, habitat preservation, hydrology and water quality (Girling, 2010). The SCORE Tool assessment at UniverCity complements the work done by Girling by using a comprehensive evaluative framework based in

sustainable community development theory: the Community Capital Framework, a multi-criteria measuring system, developed by Mark Roseland (Roseland, 2012).

Chapter 2.

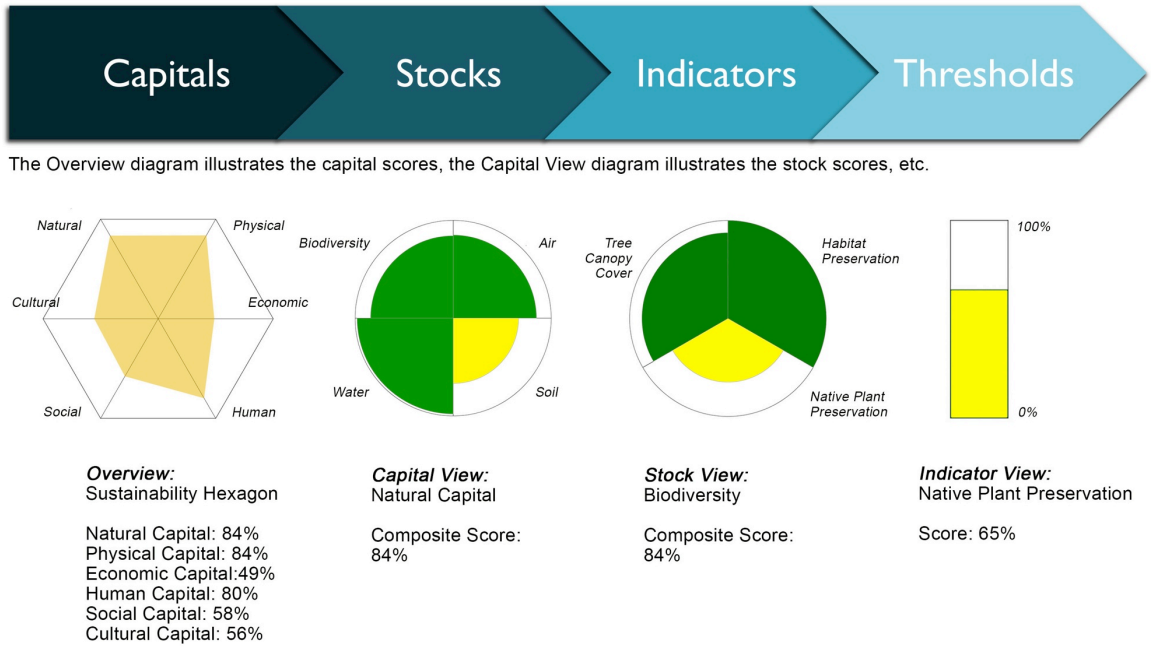
SCORE Tool UniverCity Assessment

2.1. About the Tool

Version 1 of the Sustainable Communities Rating (SCORE) Tool was developed collaboratively by a team of graduate researchers at SFU - Julia Berry, Kiri Bird, Ashley Hardill, Sarah Wongkee, and Terry Sidhu—under the supervision of Mark Roseland with assistance from Peter Whitelaw—in the context of an Advanced Planning Workshop within the department of Resource and Environmental Management at Simon Fraser University. The SCORE Tool was then peer-reviewed by Mark Roseland, Peter Whitelaw, and external advisor, John Davegos. The sustainability criteria and indicator set were then refined prior to its inaugural community application at UniverCity in June 2014.

The SCORE Tool measures the actual outcomes of sustainability initiatives at the neighbourhood scale against a six capital framework. Intended for use by academics, professional planning consultants, land developers, and local government authorities, the SCORE Tool helps to monitor and ultimately enhance sustainability performance by connecting sustainability outcomes with policy intent. The SCORE Tool evaluates existing neighbourhoods in order to determine the actual impact of policy design choices, helping municipalities and developers learn how best to support sustainable outcomes. Like many assessment systems, the SCORE Tool relies on a scheme of themes (capitals), criteria (stocks), indicators and *thresholds* to account for sustainability challenges facing urban communities (see Figure 1).

Figure 1 SCORE Tool scheme



2.1.1. Sustainability Framework

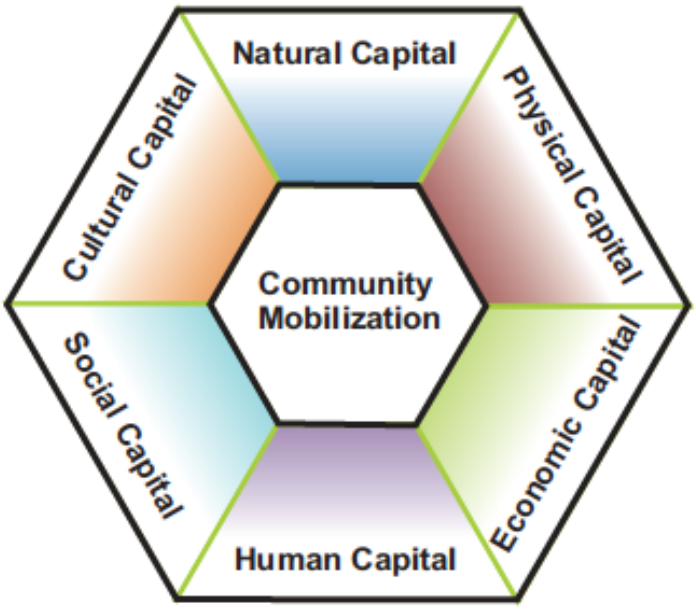
Sustainability is a holistic concept. In order to develop and select appropriate indicators for measuring sustainability performance, it is helpful to situate indicators within a larger sustainability framework (Kellett et al., 2009). Frameworks define sustainability comprehensively, provide a standard approach to implementing sustainability initiatives, and offer an integrated management approach (Joss, 2012). Domain-based or multi-criteria frameworks start with the key dimensions of sustainability and then identify criteria and indicators for each. Domain-based frameworks are most effective for ensuring a comprehensive coverage of sustainability issues (Maclaren, 1996). The sustainability framework used to organize the SCORE Tool is the multi-criteria Community Capital Framework developed by Mark Roseland, which considers six forms of community capital (Roseland, 2012).

The Community Capital Framework explains sustainable community development as the balanced development of community capital, meaning that each form of capital is mutually reinforcing. Capital is defined as a number or collection of local assets or community resources that can produce other benefits through investment (Flora, Flora & Fey, 2004). The Community Capital Framework considers six forms of community capital: Natural, Physical, Economic, Human, Social, and Cultural Capital (see Figure 2). This measuring system ensures a comprehensive coverage of sustainability issues, firmly grounded in sustainable development theory.

The Community Capital Framework has been designed with a systems thinking perspective that regards each form of community capital as a sub-system of the larger whole community system (Flora, Flora & Fey, 2004). The sustainability framework encourages users to consider the effects of decision-making on each form of community capital, as well as to think strategically and holistically with regard to existing community capacity (Roseland, 2012).

The SCORE Tool relies on a scheme of themes (capitals), criteria (stocks), indicators and thresholds to account for sustainability challenges facing urban communities. The Tool presents the results of its assessment in the form of a spider diagram, which becomes more whole as you move closer to a sustainable community. 'Sustainability' is achieved when each of the criteria (stocks) are satisfied above a defined threshold.

Figure 2 Community Capital Framework



2.1.2. Capitals

The Community Capital Framework uses six forms of capital to describe sustainable community development: Natural, Physical, Economic, Human, Social and Cultural Capital. Each of the capitals are explained in detail below.

Natural Capital refers to any stock of natural assets that yields a flow of valuable goods and services – "ecosystem services" – into the future. These stocks are air, soil, water and biodiversity. At a neighbourhood scale, emissions of pollutants such as heavy metals, greenhouse gases (GHG), and nitrogen oxides can damage these stocks, as can development and overuse of natural green spaces. Practices that limit the use of toxic chemicals, remove toxins from waste streams, and create habitat can conversely enhance Natural Capital.

Physical Capital is the familiar set of built assets that make up the urban environment of a neighbourhood and which enable residents to meet their basic needs and that support their daily activities. The physical assets of a neighbourhood include land, buildings, infrastructure, transportation and waste management systems. The

design of the physical environment has a significant influence on the other forms of capital because it directly serves human needs (e.g. water infrastructure meets the need for drinking water) and affects the natural environment (e.g. public transit reduces traffic congestion consequently air pollution). Nevertheless, Physical Capital is a distinct and important class of community assets in its own right.

Economic Capital refers to the ways in which a community is earning income for private and community purposes by allocating scarce resources and (financial) means. The way that income is generated and the distribution of it are essential for building a stable and viable economy. Economic Capital within a neighbourhood consists of its business and labour stock, and the financial resources available to households and neighbourhoods.

Human Capital is the knowledge, skills and other attributes embodied in individuals that facilitate the creation of personal, social and economic well-being. Access to health and education services is likely to produce healthier and more educated neighbourhoods.

Social Capital constitutes the glue that holds our communities together. It is community cohesion, connectedness, reciprocity, tolerance, compassion, patience, forbearance, fellowship, love, commonly accepted standards of honesty, discipline and ethics and commonly shared rules, laws and information (Roseland, 2012). Basic needs such as personal security and affordable housing are foundational to the development of Social Capital.

Cultural Capital is the product of shared experience through traditions, customs, values, heritage, identity, and history. It is the cultural and traditional resources of a community, including built and natural heritage, as well as a sense of place and identity. Policies that preserve, promote and maintain built cultural heritage, and subsidize arts, culture and recreation help to enhance Cultural Capital at the neighbourhood scale.

2.1.3. Stocks

Each of the capitals becomes a 'theme' area, under which to organize criteria (stocks), indicators and thresholds. Each of the six forms of capital is broken down into stocks, which in turn are broken down into indicators. Stocks can be defined as universal subsystems that influence the state and development of each capital as a whole. Born out of empirical research and scientific evidence and moderated by local factors, stocks are assets within a capital that influence its quantity and quality (Roseland, 2012).

The performance for each stock is calculated by totaling the performance for each component indicator, and the performance for each capital is calculated by totaling the performance for each component stock. This method maps sustainability outcomes as the total of the community capital assets.

2.1.4. Sustainability Indicators

Situated in the context of a sustainability framework, indicators are tools that measure progress toward (or away from) a goal or objective. Their role is to 'indicate' performance and as such they provide a basis for setting targets and for comparing one means to achieve that target relative to another. An indicator consists of two major components--the concept (description) and metrics (how performance for the indicator is measured) (Kellett et al., 2009). Each indicator finally delivers a value, however in order to rate the actual performance of that value against standards, targets and thresholds must be established.

2.1.5. Scoring Indicators

In order to score indicators, effectively evaluating the performance of the subject being measured, targets and thresholds must be defined. A *target* describes an ultimate sustainability goal whereas a *threshold* describes a boundary. For each indicator, five boundaries are established in order to rate the actual performance against standards. Each threshold is colour coded to signal sustainability performance (see Figure 3). Methods for determining targets and thresholds are explained in detail in Section 2.2. In

Figure 3, the target is 100, and there are four thresholds established at 0, 25, 50, and 75.

Figure 3 SCORE Tool Targets and Thresholds

2.1.6. SCORE Tool Stocks and Indicators

In total 66 indicators are used to measure neighbourhood sustainability performance. The indicator set is stratified across the six forms of capital, and includes 55 objective, quantitative indicators with data collected from public and open source databases, and 11 subjective, quantitative indicators answered by prime survey data. These indicators broken down and numbered in Table 2, under their respective stocks and capital areas.

Table 2 SCORE Tool Stocks and Indicators

1. Natural Capital	
Stock	Indicator
1.1 Air	1.1.1 Air quality
1.2 Soil	1.2.1 Contaminated sites
	1.2.2 Farmland preserved
	1.2.3 Growing Space
1.3 Water	1.3.1 Water availability
	1.3.2 Surface water quality
1.4 Biodiversity	1.4.1 Habitat preservation
	1.4.2 Native plant preservation
	1.4.3 Tree canopy cover
2. Physical Capital	
2.1 Land Use	2.1.1 Floodplain avoidance
	2.1.2 Mix of use
	2.1.3 Compact development

	2.1.4 Population density
2.2 Built Environment	2.2.1 Access to public space
	2.2.2 Quantity of residential building stock
	2.2.3 Quality of residential building stock
	2.2.4 Green residential building stock
2.3 Infrastructure	2.3.1 Access to energy
	2.3.2 Access to clean potable water
	2.3.3 Access to safe sanitation
	2.3.4 Access to reliable communications
	2.3.5 Stormwater management: volume of runoff
	2.3.6 Stormwater management: peak flows
2.4 Transportation Systems	2.4.1 Access to transit
	2.4.2 Modal split
2.5 Materials and Waste	2.5.1 Access to waste management systems
	2.5.2 Waste diversion rate
	2.5.3 Waste disposal rate
3. Economic Capital	
3.1 Labour	3.1.1 Unemployment rate
	3.1.2 Dependency on the safety net
	3.1.3 Age composition of the labour force
3.2 Households	3.2.1 Living wage
3.3 Business	3.3.1 Incorporations
	3.3.2 Bankruptcies
	3.3.3 Local ownership
4. Human Capital	
4.1 Education	4.1.1 Access to primary education
	4.1.2 High school completion
	4.1.3 University attainment
4.2 Health	4.2.1 Access to a General Practitioner
	4.2.2 Composite Health Index
	4.2.3 Health practices
	4.2.4 Perceptions of physical health
	4.2.5 Perceptions of environment
	4.2.6 Time balance
4.3 Well-being	4.3.1 Life satisfaction
	4.3.2 Positive-negative experience

	4.3.3 Material well-being
	4.3.4 Mental well-being
5. Social Capital	
5.1 Citizenship	5.1.1 Voter participation
	5.1.2 Confidence in government
5.2 Community Cohesion	5.2.1 Social support
	5.2.2 Social cohesion
5.3 Safety	5.3.1 Traffic accidents
	5.3.2 Break & Enter
	5.3.3 Auto crime
	5.3.4 Robbery
5.5 Housing	5.4.1 Core housing need
	5.4.2 Rental vacancy rates
	5.4.3 Shelter-cost-to-income ratio
	5.4.4 Resident turnover
	5.4.5 Resident satisfaction
6. Cultural Capital	
6.1 Cultural Vitality	6.1.1 Cultural access
	6.1.2 Public Programing
6.2 Diversity	6.2.1 Ethnic diversity
6.3 Built Cultural Heritage	6.3.1 Public art
	6.3.2 Registered heritage sites

2.2. Methods

The methods section will cover the methodology applied in order to pilot the SCORE Tool at UniverCity, with respect to neighbourhood typology, data sources, survey implementation and the scoring of indicators.

2.2.1. Neighbourhood Typology

In order to collect the data necessary to perform a measurable sustainability assessment we must first define the neighbourhood boundaries. For the purpose of this assessment, we define a neighbourhood as a smaller subset of a broader community. It

consists of a mix of residential and non-residential buildings and land uses within a radius of approximately 400 meters - corresponding to a comfortable five minute walking distance from centre to edge or approximately 50 hectares (Kellett et al., 2009).

As a master-planned neighbourhood, UniverCity's neighbourhood boundaries are defined by the development area boundary (see Figure 4). Ideally, the data collected for each indicator of the SCORE Tool assessment would correspond to this standard geographic area.

Figure 4 UniverCity Neighbourhood: Development Area Boundary

Survey data, and data provided by the SFU Community Trust and private environmental consultants correlates to the development area boundary (Figure 4). However, census data, and data made available by various levels of government, are collected and reported upon at different scales, or standard geographic areas, and so data was not always available at our ideal 'neighbourhood scale'.

The most common standard geographic areas used for data collection in the SCORE Tool UniverCity assessment are Dissemination Area (DA) developed by Statistics Canada, the Canada Post Forward Sortation Area, and the City of Burnaby or Census Subdivision. Relating to the UniverCity neighbourhood, these parameters are

illustrated in Figures 5-7. Each DA is assigned a four-digit code. In order to uniquely identify each DA in Canada, the two-digit province/territory (PR) code and the two-digit census division (CD) code must precede the DA code. The code associated with UniverCity is 59 15 3695, or DA 3695 for short. Forward Sortation Area codes are based on the first three characters of a postal code. The Forward Sortation Area that relates to the UniverCity neighbourhood is V5A, illustrated in Figure 6. Finally, some indicators use data at the Census Subdivision (CSD) scale. CSD is synonymous with the city scale. Figure 7 shows a map of Burnaby, BC. A detailed explanation of scale of data availability for each indicator is available in Table 17 in Section 4.2.1. Figure 8 shows a comparison of these four standard geographic areas.

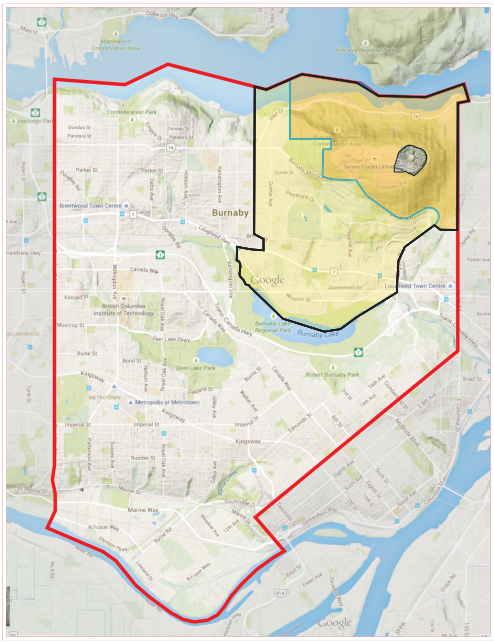
Figure 5 DA 3695

Figure 6 Forward Sortation Area V5A

Source: Canada Post

Figure 7 City of Burnaby

Figure 8 Comparison of Boundaries



2.2.2. Indicator Selection

The assessment process used to select the appropriate indicators was iterative, involving identifying metrics and data sources for all indicators, and then refining indicators based on three criteria: data availability, relevance of available data, and data quality.

The indicators selected focus on sustainability performance of completed parcels of the UniverCity development, post-occupancy. The metrics used are mostly directionally positive: framed in such a way that an increase in each indicator will contribute to an increase in neighbourhood assets, and thus filter up to an increase in community capital, and ultimately sustainability. This framing is intentional; the SCORE Tool depicts the assessment results in a series of spider diagrams, which become more whole as you move closer to a sustainable community. The reporting period considered for most indicators is 2013 or earlier, the latest period for which performance data is available.

2.2.3. Data Collection

In total, the SCORE Tool contains 66 indicators. A comprehensive picture of sustainable social well-being should integrate subjective and objective indicators (Costanza, 2014). Therefore the SCORE Tool combines objective variables such as income, housing, and labour statistics with subjective variables such as personal life satisfaction, perceptions of environment, and confidence in government. 55 (83%) indicators are objective and quantitative – calculated using data acquired from public or open source databases. Data sources include the 2011 Canadian Census Survey, 2011 National Housing Survey, City of Burnaby, ICBC, CMHC, Environment Canada, BC Stats, Walk Score, peer-reviewed literature, and SFU Community Trust's own offices, which includes data from privately contracted firms.

The remaining 11 (17%) indicators are subjective and quantitative, assessed via a Gross National Happiness (GNH) Index survey developed by the Happiness Alliance

in Seattle (Happiness Alliance, 2014). The GNH Index survey method takes a non-monetary multidimensional approach that measures satisfaction and advancements across various life domains. This opt-in, anonymous survey was administered online, accessed by a link posted on the SFU Community Trust website. The survey was promoted to UniverCity residents through an email sent by the SFU Community Trust to their community email list, as well as through a mail out invitation inserted to UniverCity's August 2014 Community Update. The survey link was active between July 28 and August 15, 2014. Aggregate responses were calculated by The Happiness Initiative in Seattle and provided to the research team. A 2% response rate was considered to be a statistically relevant sample size, representing 68 people for UniverCity's population. In total 99 residents completed the survey, with an attrition rate (proportion of respondents who did not finish the survey) of just 2%.

2.2.4. Scoring Indicators using Targets and Thresholds

In order to score indicators, effectively evaluating the performance of the subject being measured, targets and thresholds must be defined. While targets and thresholds are key to delivering results on sustainability initiatives, internationally recognized targets for sustainable urbanization are still under development, with thresholds even less common. During the preparation of this research, the International Organization for Standardization (ISO) released a set of city indicators with calculation methods for service delivery and quality of life: ISO 37120. It is yet to be determined if the ISO 37120 indicator set can be scaled down for use at the neighbourhood scale, and that research question was outside of the scope of this work. Notably, the ISO 37120 does not define targets nor thresholds as part of their scheme.

Initially the research team wished to use City of Burnaby targets as a reference for establishing thresholds. However, the City of Burnaby, as a general policy, does not define performance targets. Since we do not yet have one widely agreed upon comprehensive list of sustainable development indicators with clearly defined targets and thresholds available to inform sustainability assessment globally, this research has attempted to develop a methodology for scoring indicators that is relevant to the SCORE Tool. The indicator targets and threshold calculation methods should be considered

under development. The four methods used to define targets and thresholds in the UniverCity assessment are described in detail below. Preference was given to methods 2 and 4, based upon data availability. Where research, policy and comparative data was unavailable, Method 3 was used. Method 1 was principally used for population and geospatial data when Method 2 was impossible. Method 1 was also used for survey data because participants were asked to score their answers against a 1 to 10 scale. Together, these four methods constitute a cohesive scoring system to evaluate the outcomes of sustainability initiatives.

Method 1: Targets and thresholds are based on a percentage/scale of 0 to 100; thresholds are divided evenly

Method 1 frames indicators so their metrics are directionally positive, and a proportion of a whole (100%), or a score between 0 and 100 - rather than a rate, or an abstract value. This allows us to clearly define the lowest point on the scale as 0 and the highest point as 100, and divide this range evenly by four in order to define thresholds. Method 1 was used to define targets and thresholds for 31 (47%) indicators. Examples include: the GNH Index survey questions, Walk Score indicators, and indicators concerning a proportion of population – such as, the proportion of neighbourhood residents earning a Living Wage, or a proportion of area – such as the proportion of parcels outside of the floodplain.

Method 2: Targets are well defined in research or in policy; thresholds may be estimated

Method 2 was applied to cases where research supports targets and/or thresholds for the indicator. Method 2 was used to define targets and thresholds for 15 (23%) indicators. Examples include: the unemployment rate, stormwater management runoff coefficient, and indicators of biodiversity: tree canopy cover, native habitat retention and native plant preservation. This assessment made use of a number of targets and thresholds for neighbourhood sustainability assessment published in a white paper produced for the Canada Mortgage and Housing Corporation (CMHC), “Specification of indicators and selection methodology for a potential community demonstration project” (Kellett et al., 2009).

Method 3: Targets are based on current practice and expert opinion; thresholds may be estimated

Method 3 was applied to indicators that were custom developed for UniverCity SCORE Tool assessment. Method 3 was used to define targets and thresholds for 6 (9%) indicators. Examples include: the two indicators of water quality and availability, which were developed with the input of environmental consultants Nancy Hill and Ron Kistritz. Another example would be the health practices indicator, which was developed with input from the Fraser Health Authority. Further research is needed to formally validate these indicator metrics and valuation methods.

Method 4: Targets and thresholds are based on relative norms, drawing on comparative data from municipalities across Metro Vancouver

Method 4 was applied to cases where no research or policy was found to support targets and/or thresholds for the indicator, however, Statistics Canada could provide comparable values for other neighbourhoods (DAs) or municipalities (CSDs) across the province. Method 4 uses an interquartile range calculator to establish the lowest point, highest point, *median*, and first and third *quartile* points of regional datasets. Method 4, which is also referred to as using *relative norms,* thus tells us how the neighbourhood performs in the regional context. Method 4 is used to define targets and thresholds for 14/66 (21%) of indicators. Examples include core housing need, number of bankruptcies, voter participation and number of registered heritage sites indicators.

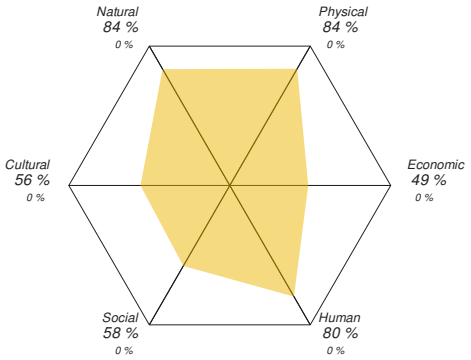
Combining these four methods of defining targets and thresholds poses some difficulty in standardization of the SCORE Tool. However, the nature of data available for each indicator makes it such that one uniform method of evaluating targets and thresholds is not logical – for example, in cases where the target is based on spatial analysis, it would not make sense to base thresholds on relative norms. The SCORE Tool should nevertheless be considered under development and further adaptations of the tool should strive to refine the methods of defining targets and thresholds, with an eye to standardization. Further explanation of each method is given below.

2.2.5. Presentation of Results

The SCORE Tool depicts the assessment results in a series of spider diagrams, which become more whole as you move closer to a sustainable community.

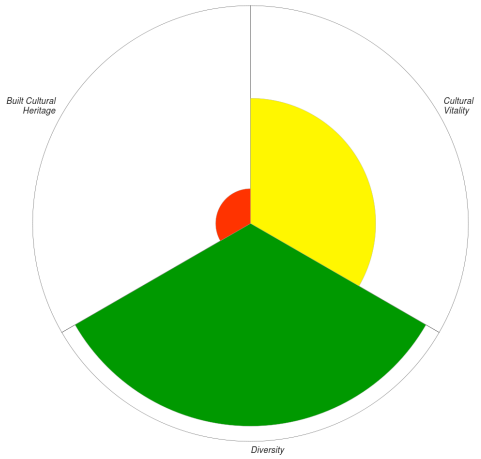
At the most Meta level, the scores of the six capitals are shown as a hexagonal spider diagram, known as the 'sustainability hexagon'. The sustainability hexagon articulates each capital score along one of its axis. The SCORE tool does not provide an aggregate score because the community capital approach does not support balancing one kind of capital asset against another: the aim of sustainable community development is to develop capital in all asset classes, in contrast to conventional development, which often seeks to develop financial capital without regard for other forms of capital.

Figure 9 Sustainability Hexagon



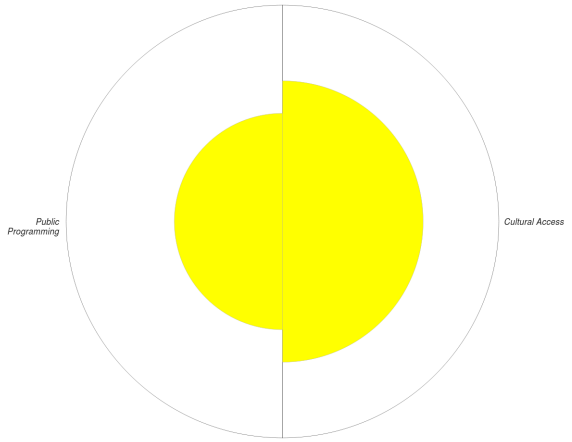
At the capital scale, the results diagram more closely resembles a pie chart. A composite score is given for each capital and along with a summary table of each of the stocks within that capital, highlighting strengths and weaknesses.

Figure 10 Example Capital



At the stock scale, the results diagram similarly resembles a pie chart and is accompanied by a composite score for each stock, as well as a written summary of the indicators that supports each stock. The written summary gives background on how data was collected, and how the indicators were measured against identified targets and thresholds to produce the assessment results. The written summary may also highlight information that is not quantifiable in the assessment. Attention is drawn to unique situations and best practices in the written summary.

Figure 11 Example Stock



At the indicator scale the indicator description, value, unit of analysis, scale, data source, reporting period, target, target source and threshold calculation method are provided. The indicator dataset can be found in Appendix A.

2.2.6. Limitations

The SCORE Tool pilot assessment exposed several limitations with respect to data availability at the neighbourhood scale. The standard geographic area of measurement differed depending on the indicator, so in some cases, a wider area was used as a proxy for study area performance. A comparison of neighbourhood boundaries used to evaluate study area performance is shown in Figure 8. Given the large variation in scale, more research is needed in order to determine whether data at such varying scales is a reliable or valid way of representing performance of a neighbourhood. Therefore, the lack of data availability at the neighbourhood scale is a fundamental challenge in translating global sustainable development goals into implementable actions for communities.

As previously stated, the methods used for scoring indicators used in the SCORE Tool pilot assessment should be considered under development. Since we do not yet have one widely agreed upon comprehensive list of sustainable development indicators with clearly defined targets available to inform sustainability assessment globally, it is difficult to report on the successes or failures of our local sustainability plans, policies and regulations in achieving proportionally constructive results.

The SCORE Tool only provides a snapshot of sustainability performance at UniverCity in 2013. As a measurement at a single point in time, it does not provide information about whether UniverCity is on the path to sustainability. Repeating the assessment over time as the neighbourhood reaches build out is necessary to determine if UniverCity is making progress on its sustainability goals.

Although we acknowledge there are conceptual and empirical problems inherent in producing such a snapshot, the research team believes this was a useful exercise to make the range of targets and thresholds for NSA more apparent, establish at least an approximate baseline for future assessments, set up a framework for further analysis, point out areas in need of more research, and stimulate additional research and debate (Costanza, 1997).

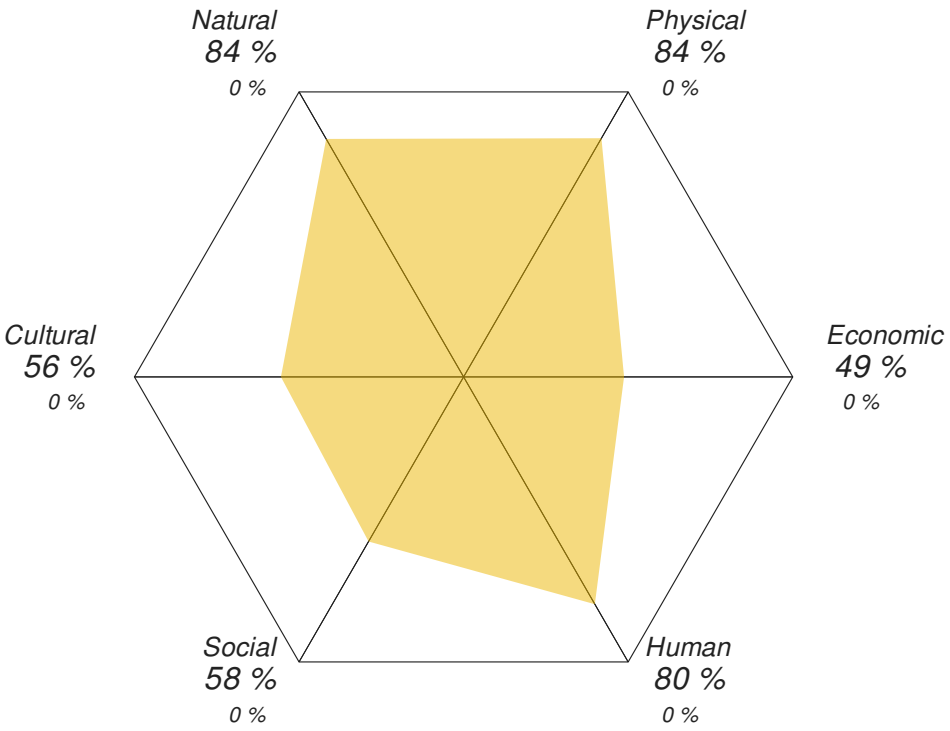
2.3. Assessment Results

The overall assessment results, known as the sustainability hexagon, are shown in Figure 12. The SCORE Tool assessment results highlight many positive outcomes of sustainability planning at UniverCity. UniverCity achieves a high score in Natural Capital because UnverCity's Development Guidelines and Requirements have done an excellent job of ensuring the preservation and improvement of the natural heritage of Burnaby Mountain. UniverCity achieves a high score in Human Capital because residents are healthy, very educated, and quite happy overall. The high Physical Capital score reflects UniverCity's human scale design, and access to parks and wilderness for residents to enjoy. The Social Capital score reflects notably few vehicle accidents - indicating that streets are safe for pedestrians and cyclists. The community however, lacks a culture of engagement, demonstrated through low scores in community cohesion

and citizenship. UniverCity does not score particularly well in Economic Capital, attributed to the low median income, small residential population, and large commuter population. However, as the neighbourhood is built out and approaches its target population of 10,000 people, UniverCity will likely stabilize, increasing Economic Capital. Similarly, as a new neighbourhood with little cultural heritage, UniverCity's Cultural Capital score will improve with increased investment in public art and cultural amenities over time.

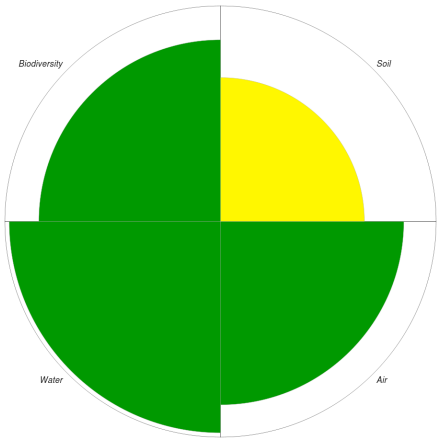
At this time, we do not know how UniverCity, a model sustainable "complete community", scores against a typical neighbourhood built in the last 20-30 years. Future applications of the SCORE Tool to a variety of neighbourhood types may provide a reference point for understanding the achievements made within a master planned eco-neighbourhood such as UniverCity.

Figure 12 Tool UniverCity Assessment Results



2.3.1. Natural Capital

Composite Score: 84%



Overall, UniverCity has substantial Natural Capital, a result of its location on clean land removed from major sources of air pollution and surrounded by the Burnaby Mountain conservation area, which was protected as part of the agreements that enabled the development, and initiatives such as stormwater management that serve to reduce impacts on the receiving environment.

Table 3 Natural Capital Stocks

Stock	Score	Strengths	Weaknesses
Air	85%	Air quality	
Soil	67%	Soil contamination	Dedicated space for urban agriculture
Water	98%	Water quality	
Biodiversity	84%	Habitat retention, Native plant preservation	

Dataset Limitations

In measuring air as a community asset, we initially planned to measure light and noise pollution, and GHG emissions. However, there is little or no data available to

support measurement of these indicators. Light pollution, typically considered to have a negative impact on wildlife and hence a liability to biodiversity (Longcore, 2004) is not centrally monitored in Canada, and available data (e.g. http://www.jshine.net/astronomy/dark_sky/) does not offer enough granularity to be useful for a neighbourhood sustainability assessment. Similarly, noise in the City of Burnaby is only measured on a complaints basis - meaning there are no continuous noise monitoring stations on which to base performance measurement. For GHG emissions, energy use data is collected by utilities, but it is protected as private data when aggregated at a building scale in British Columbia (under the Freedom of Information and Protection of Privacy Act), and to date utility companies were not willing to aggregate their data to the neighbourhood scale, where it would not be protected. While GHG emission data is available at the municipal scale, as calculated by LiveSmart BC's Community Energy and Emissions Inventory reporting, we did not use this data because it would not help distinguish UniverCity from other neighbourhoods.

Unique, detailed data was available from SFU Community Trust for Water and Biodiversity stocks. As a result, performance measurements in these areas are more detailed than would be possible for a typical neighbourhood. Future applications of the SCORE Tool may have to identify alternative measures for these indicators. This pilot suggests that efforts to monitor in these areas more consistently, as envisioned in some Integrated Stormwater Management Plans, would be a useful management tool and should be a focus for investment.

Conclusions

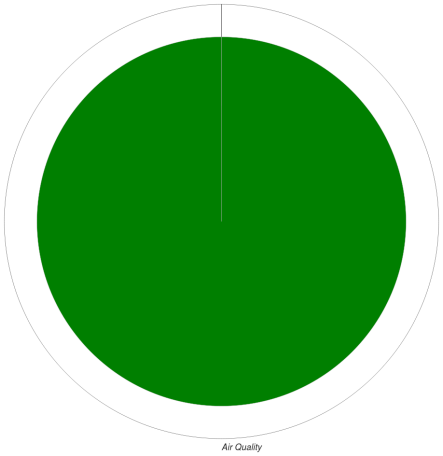
UniverCity scores highly in Natural Capital because it has from its outset set a goal of preserving and improving the natural heritage of Burnaby Mountain. The development's commitment to environmental stewardship has framed planning, implementation, monitoring and reporting in practice to positive ends. The analysis of Natural Capital at UniverCity suggests that their pioneering environmental policies are in fact contributing to the intended sustainability outcomes. As well, because protecting and improving the natural environment is a technical process within the influence of the development corporation SFU Community Trust, it is better defined and better managed as a result.

The SCORE Tool UniverCity Assessment also suggests areas for some improvement, such as institutionalizing the use of 100% native plants in their development guidelines and significantly increasing the amount of growing space per dwelling unit for agricultural production. At a neighbourhood scale, productive land is usually focused in community or private food gardens, which are an important way to support a local food system that helps respond to major shifts in the global food system.

In conclusion, UniverCity's environmental policies, institutionalized through their Development Guidelines and Requirements, appear to be having a positive effect on the Natural Capital of the development area, and in turn on sustainability at the neighbourhood scale.

Air

Composite Score: 85%



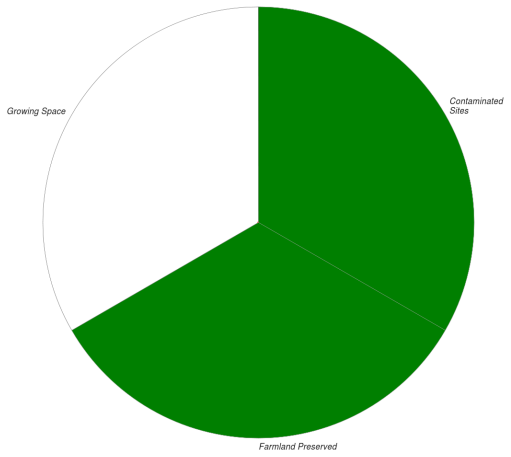
Air is an essential asset to biological life. Air can become a liability to other forms of capital when it is polluted by harmful particulates, and ecosystem disrupting noise and light. Greenhouse gases could also be included in this stock because they are components of air and influence its temperature, which is an important characteristic of this stock. Unfortunately, noise pollution and light pollution are not centrally monitored on

an ongoing basis so there is no data for these indicators. The research team also encountered problems in collecting energy use data for the community.

Due to the availability of data at the neighbourhood scale, air quality was measured for UniverCity with a single indicator: the Air Quality Health Index (AQHI). The AQHI was developed by Environment Canada as an aggregate measure of a number of pollutants. The AQHI is calculated every hour, and averaged across 3 to 4 regional monitoring stations; the value used for this report is the average AQHI for all of 2013. However, this index is calculated based on a very large area – the Northeast quadrant of Metro Vancouver – and is not available at a smaller scale. Therefore neighbourhood air quality performance is inferred from regional air quality performance. While other indicators were omitted when data was not available at a representative scale, ie. GHG Emissions, the Air Quality indicator was left in the tool because it was the only piece of measureable data representing the critical asset, air. The AQHI identifies thresholds at: Low Risk (1-3); Moderate Risk (4-6); High Risk (7-10); Very High Risk (10+).

Soil

Composite Score: 67%



Soil is essential to life, as healthy soil is needed to grow food and to support all vegetation and therefore the ecosystems that sustain human and other life. It can be

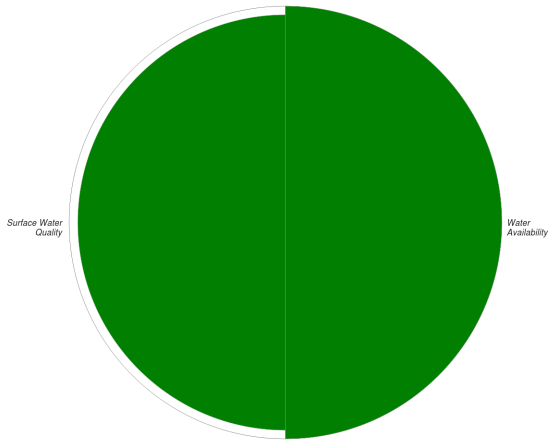
improved only slowly. Productive agricultural soil is a valuable community asset, while contaminated soils, especially those that restrict food production or release pollutants to be ingested by other organisms, are a significant long-term liability.

UniverCity has no registered contaminated sites and is situated on a mountain, where it did not displace any agricultural land. The neighbourhood therefore receives perfect scores on these indicators of sustainable neighbourhoods.

However, as of 2013 there was no formal gardening space available for community members. It is important to note that Phase 4 of the UniverCity anticipates 141.5 m2 of community gardening area in park space, plus an additional 69.7 m2 of gardening space at the Polygon Homes development, which would improve performance, but will fall well short of the target of 6.5-m2/DU suggested by LEED ND. SFU is also embarking on a campus wide strategy, including UniverCity, for community gardens that may create more growing space for residents in the future.

Water

Composite Score: 98%



Water is a neighbourhood asset when it is amply available for human and ecosystem use, and is free from pollutants. While both groundwater and surface water

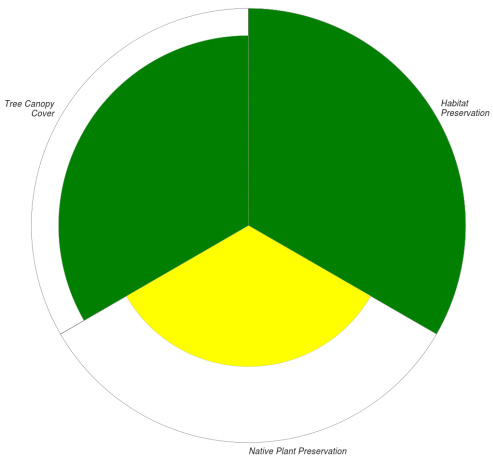
are important for communities, where groundwater is not extracted, it is not monitored in quantity or in quality. On Burnaby Mountain the groundwater is not accessible, and therefore there is no data on this indicator. As a result, measurement of the water stock focuses on surface water quantity and quality.

Surface water quantity is measured through downstream base flows. The monitoring station MA2, set up at the base of UniverCity's East Highlands development, demonstrated no drought conditions in the year 2013, earning the neighbourhood a perfect score in this indicator.

The water quality of streams is measured through exceedances of pollutant concentrations following storms. Water quality monitoring station MA2 also obtains discrete storm water samples using an ICO 3700 Auto Sampler during 3 storm events each year in Summer, Fall and Winter. Exeedances of pollutants are measured against Water Quality Guidelines for the Protection of Freshwater Aquatic Life set out by the Canadian Water Quality Guidelines. The number of exceedances during each storm event is an indicator of how much pollution from upstream urban development is moving into the aquatic environment. The indicator considers 10 exceedances per storm surge (30 total) a benchmark for low pollution (~10% of total samples taken). Downstream of the East Highlands neighbourhood, water quality monitoring reports showed low exceedances for the year 2013.

Biodiversity

Composite Score: 84%



The structure and biodiversity of ecosystems is an important aspect of natural capital, as they must remain intact for ecosystems to function. Critical elements of biodiversity at a neighbourhood scale typically include protection of riparian areas, reduction of invasive species, and the development of an urban forest.

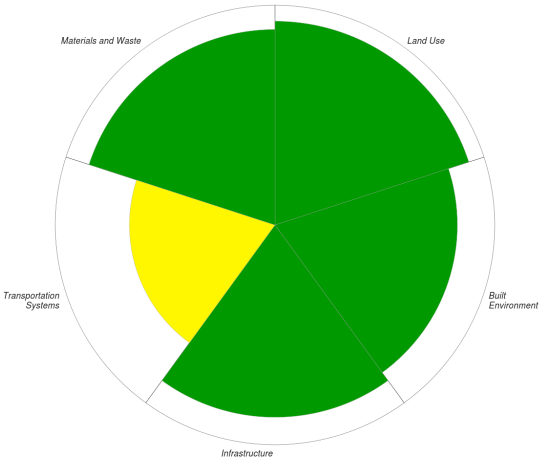
The benefits of conservation areas within urban developments include the provisioning of ecosystem services but can also have a positive impact on quality of life, human health and well-being (Goddard et al., 2010). Kellett et al. (2009) suggest that at least 20% of a neighbourhood's land area should conserve, preserve or create native habitat (Kellett et al., 2009).

The use of native plants is another important feature of maintaining biodiversity and hydrological systems. Since its beginnings, UniverCity has advocated for the use of native plant species in its development guidelines (later requirements) and in doing so has succeeded in replanting the East Highlands neighbourhood with 100% native vegetation, including over 220 young native trees (Girling, 2010). Overall the site has an average of 65% native vegetation, and this number is expected to increase as Phases 3 and 4 of the development are built out.

In their set of neighbourhood sustainability indicators prepared for the Canadian Mortgage and Housing Corporation (CMHC), Kellett et al (2009) explain the benefits of tree canopy cover: tree canopy is fundamental to several key ecological functions, such as stormwater management, carbon sequestration (carbon capture and storage), “heat island” mitigation, habitat protection, and air quality improvement. Trees help to manage stormwater by absorbing rainfall and reducing surface run-off. They sequester carbon and improve urban air quality by absorbing carbon dioxide. They also increase urban habitat and mitigate the “urban heat island” effect through cooling and shading (Kellett et al., 2009). The report sets a benchmark of 20% tree canopy cover, with a target of 40% for urban areas. The UniverCity East Highlands neighbourhood boasts a ~30% tree canopy cover, an impressive figure, which will increase as trees mature and Phases 3 and 4 are built out.

2.3.2. Physical Capital

Composite Score: 84%



UniverCity's compact, low-impact development patterns, critical infrastructure and services articulate many of the qualities of sustainable urban neighbourhoods. While the composite score of Physical Capital captures the strength of UniverCity's urban design and buildings, it does not reflect the efficiency of building water, heat and electricity consumption because privacy and technological barriers limit access to data at the building or neighbourhood scale.

Table 4 Physical Capital Stocks

Stock	Score	Strengths	Weaknesses
Land Use	93%	Density, Mix of use	
Built Environment	83%	Quality housing, Living Building Challenge	More green buildings to be built
Infrastructure	88%	Access to core infrastructure, peak flows	Stormwater runoff
Transportation Systems	66%	Modal split	Access to transit
Materials and Waste	89%	Waste disposal	Waste diversion

Dataset Limitations

Likely the most unfortunate discovery of this pilot test: data on the efficiency of water and energy use was not available at the neighbourhood scale. In Burnaby, residential water use is not metered.

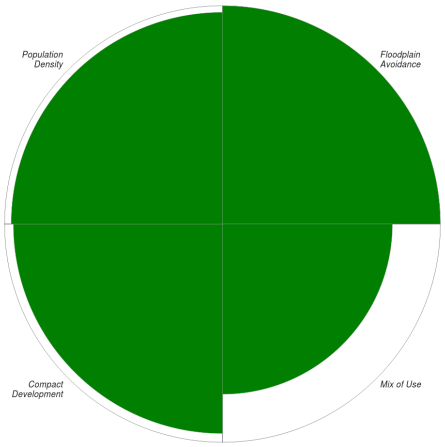
Conclusions

The lack of data availability pertaining to resource consumption at the neighbourhood scale proposes a challenge to neighbourhood sustainability assessment. This gap in data availability is conversely an opportunity to engage decision makers in a conversation about changing these restrictions so that we have a greater chance of success at achieving local, regional and global resource consumption goals. For example, reporting waste diversion and disposal rates for neighbourhoods could prove to be a promising tactic to influence occupant behaviour and help municipalities to reach their sustainability goals.

As we have seen, data availability is a crucial input to sustainability assessment frameworks, and in turn to the success of sustainable development initiatives. The difficulty accessing data suggests a need for improved data collection at the neighbourhood scale, as this is valuable data for encouraging behavioural change amongst residents.

Land Use

Composite Score: 93%



Land use describes the intensity of activity that takes place in a community, and the type of activity (e.g. living, shopping, working, and playing), described in terms of classes of use (e.g. residential, commercial, industrial). More intense developments enable residents to live close to jobs and services and enable the many human interactions that support social and cultural richness.

Mix and intensity of use is measured in this report by the Walk Score index, a valid and reliable tool for estimating access to nearby facilities (Carr, Dunsiger & Marcus, 2010), which assigns a numerical walkability score to neighbourhoods and unique addresses. The walkability index takes into account the proximity of daily destinations ranging from schools to restaurants and parks, as well as population density, average block length, intersection density, link/node ratio, and route directness. It is comparable across any address in Canada, United States, UK and Australia, giving us a broad basis for comparative analysis. Averaging Walk Score calculations for all the postal codes in the neighbourhood, UniverCity scores a 78/100 in mix of use, meaning that most daily errands can be accomplished on foot.

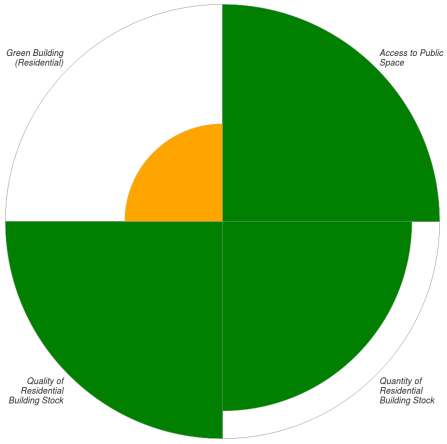
The built-up area that is exposed to natural hazards is an important aspect of the long-term resilience of a community. Flood risk, measured as the extent to which the neighbourhood is in a flood plain, has become an increasingly important indicator in light of research on climate change and sea level rise. It is also easily measured from widely available data, so is the natural hazard indicator of choice for this tool. Situated on top of Burnaby Mountain, UniverCity is not at risk of floods. Risks of other natural hazards, such as steep or unstable slopes, were not assessed because the data required is typically harder to obtain.

The indicator for compact development uses a LEED ND indicator and calculation method. The goal of compact development is to promote land development patterns that support a diverse regional economy and employment close to where people live. UniverCity's mix of commercial and residential density scores a 5.8/6, according to LEED ND's compact development indicator scoring system.

The indicator for population density has been developed by Kellet et. al (2009). Neighbourhoods of a scale similar to UniverCity are issued a 150-person/hectare density target. UniverCity achieves a high score in this indicator, given the current population density of 144 person/hectare.

Built Environment

Composite Score: 83%



The built environment is defined here not only as buildings but also of the space between them. Buildings are an essential community asset, both in terms of their condition and the total amount of space. The public space between buildings is equally important, because it supports social interaction, businesses, and recreation, and because it represents much of the public, community-owned space in a neighbourhood.

Access to public space is measured as the proportion of neighbourhood dwellings that lie within a 5 minute (400m) walk of a park or plaza. At UniverCity, due to its compact development and human scale design, that is 100% of dwellings. This indicator is drawn directly from LEED ND.

Residential buildings are used as a proxy of all buildings in a neighbourhood because consistent data is available for them, and it is easier to compare a single class of buildings across neighbourhoods. Both the quantity of suitable buildings in a neighbourhood and the quality or condition of those buildings factor in calculating the built environment stock as a neighbourhood asset. The Canadian National Housing Survey (NHS) measures both the quantity of suitable buildings and the condition of buildings in a federal reporting and monitoring initiative every four years.

Quantity of residential building stock: The 2011 NHS defines suitability as whether the dwelling has enough bedrooms for the size and composition of the household, as calculated using the National Occupancy Standard. Based on the 2011 NHS, 87.5% of dwelling units (DU) in UniverCity (corresponding with Dissemination Area (DA) 3695) are suitable for occupation.

Quality of residential building stock: Based on the 2011 NHS, 95% of DU in UniverCity are not in need of major repairs or improvements.

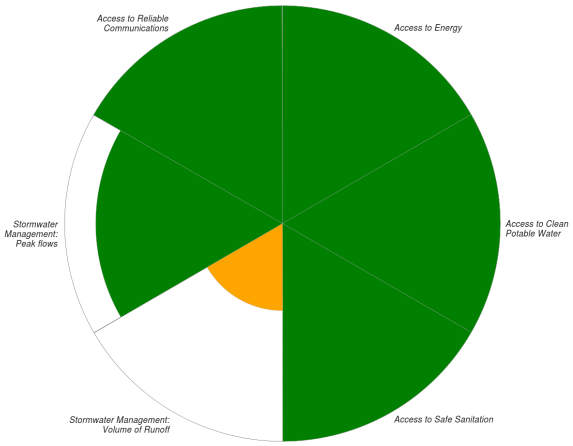
Green Buildings: Increasingly, cities are recognizing that buildings are sinks of natural resources throughout their lifecycle, including energy, materials, and water. Green building certification programs such as LEED in North America and BREEAM in Europe certify buildings based on their anticipated performance. To assess how “green” the building stock is, the proportion of DU built to LEED Gold standard or greater is used. The unit of measurement is tied to DU, not the number of buildings nor gross floor

area (GFA), because resource use is closely tied to occupant behavior, which relates most closely to the number of DUs. 45% of UniverCity's completed DUs are built to LEED Gold standard or higher, a significant proportion. With increased performance requirements for new phases of development, it is expected that this percentage will increase over time.

While the resource efficiency of public or commercial buildings is not taken into account in this measure, we note that UniverCity completed Canada's first Living Building Challenge certified building with the construction of the UniverCity Childcare Centre in 2013, demonstrating further leadership in green building practice.

Infrastructure

Composite Score: 88%



Infrastructure describes various shared systems that distribute resources through a community and collect wastes, including energy, water and sanitation, stormwater, solid waste, and communications. Most of these systems are an integral part of larger natural systems (e.g. water, sewer, and stormwater form part of the natural water cycle), so infrastructure describes those parts of the larger system that are distinct built assets. Because it is difficult to assess infrastructure condition and suitability at the

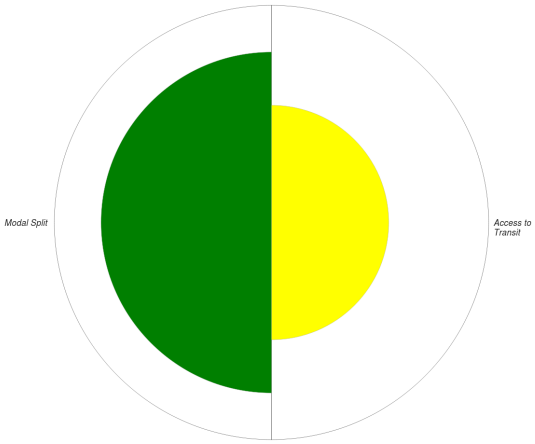
neighbourhood scale, as this data is not readily accessible via government databases, and because resource efficiency is a key concern for neighbourhood sustainability, the focus of this stock is on: access to safe, efficient and reliable infrastructure; and efficiency of resource use.

Because access to energy, potable water and safe sanitation are required by provincial building code and ensured through the municipal permitting process, every resident of UniverCity has access to every category of basic infrastructure. It would therefore be more meaningful to be able to measure the efficiency of resource use, especially water and energy, in order to gain a better understanding of how resident behaviours affect neighbourhood sustainability.

Another important aspect of infrastructure is stormwater management. In developed environments, unmanaged stormwater can be a liability for ecosystem health, the protection of individual property, and cost to municipalities in the form of insurance. Stormwater management systems can be measured using two metrics: volume of runoff and peak flow. The volume of runoff that does not return to the natural ecosystem is measured by the runoff coefficient. The UniverCity OCP sets a target of "maintaining pre-development stormwater runoff rates, volumes and seasonal variations to maintain existing downstream hydrologic patterns". Runoff coefficient tables show that an undeveloped area would typically have a runoff coefficient of 10% to 30% depending on soil composition and vegetative cover. Downstream watercourse monitoring reports by environmental consultants AECOM provide evidence that UniverCity is not meeting its target given that the average runoff coefficient at monitoring station MA2 for 2013 was 60% (AECOM, 2014). This means that 60% of rainfall was not returned to the natural ecosystem. Peak flows measure the flow of stormwater discharges in l/s/ha. In this area, UniverCity performs well. The range of acceptable peak flows is between 2 and 4 l/s/ha, and UniverCity monitoring stations are showing a 2013 average of 2.3 l/s/ha.

Transportation Systems

Composite Score: 66%

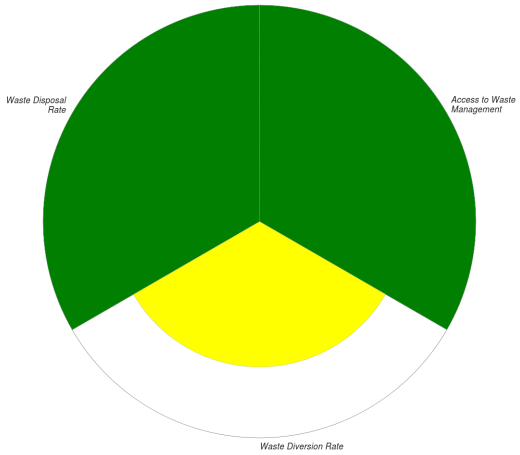


Transportation systems enable neighbourhood residents to meet their needs by accessing shops, services, and workplaces elsewhere in the city, and enable the movement of goods. Public transportation is a community asset, which produces benefits to health, emissions output and social cohesion. The transportation stock measures the effectiveness of transit policies that encourage a shift to transit and active modes such as walking and cycling through two indicators: access to transit and the modal split. Access to transit is measured by the third party transit index Transit Score, produced by Walk Score, which assigns a numerical transit connectivity score to neighbourhoods and unique addresses. This score considers transit options within a 5-minute (400 m) radius. UniverCity's Transit Score is 54/100. This is qualified by Walk Score as: good transit, many public transportation options. Transit Score does not take into account localized initiatives to reduce car dependency such as car sharing, or the Community Transit Pass instituted by the SFU Community Trust (now cancelled) or the proposed Gondola project. If the Gondola were constructed and adopted into the public transportation system, this would reflect positively on UniverCity's Transit Score in future assessments.

Modal split is measured by the proportion of residents in DA 3695 who use a motor vehicle to get to work, using NHS 2011 data. 47% of UniverCity's working population aged 15 and over use a motor vehicle to commute to work, more than 20% less than the municipal rate. This is evidence that UniverCity residents are more likely to use alternative modes of transportation to get to work than their Burnaby counterparts, however, a widely agreed upon sustainable target for model split would bring more clarity to this indicator and strengthen the assessment overall.

Materials and Waste

Composite Score: 89%



The materials in our homes and businesses are important physical assets, and when they are discarded as waste, they become liabilities that need to be managed. This stock measures access to waste management services, and the rate at which waste is disposed as a good proxy for the amount of materials flowing through the community, net of those that are being recycled or otherwise diverted from the waste stream.

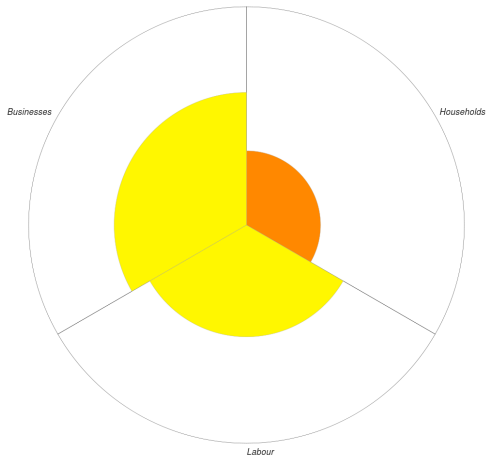
Waste collection data was not available at the neighbourhood scale; City of Burnaby waste collection data is used as a proxy. Burnaby's waste collection rates are measured against the sustainability objectives outlined by the Metro Vancouver regional

government. Metro Vancouver has identified a target of 70% waste diversion by 2020 for all collected residential and business materials, as well as a reduction in waste disposal per capita by 10% from 2010 levels.

In 2013, Burnaby just barely hit Metro Vancouver's waste disposal target. However, 10% isn't a significant reduction in waste disposal to begin with. This example illustrates the importance of international standards for measures of sustainable development. As stated in the dataset limitations section, waste collection data is not available at the neighbourhood scale, so we cannot know how much or how little UniverCity residents are contributing to the achievement of Metro Vancouver's stated goals.

2.3.3. Economic Capital

Composite Score: 49%



According to this assessment, UniverCity's economic capital is not thriving. The age distribution of neighbourhood residents and high proportion of students is a neighbourhood asset in terms of human capital and labour vitality; however, it is a liability in terms of earnings and unemployment at the neighbourhood scale. This in turn

has negative impacts on businesses because few residents have significant disposable income.

Table 5 Economic Capital Stocks

Stock	Score	Strengths	Weaknesses
Labour	51%	Labour force vitality	Unemployment, Dependency on safety net
Households	34%		Living Wage
Businesses	61%	Local ownership	Bankruptcies

Dataset Limitations

The scale of data availability is an issue for economic indicators of neighbourhood sustainability. The dependency on the safety net indicator is measured only at the municipal scale, as are new business incorporations. Ideally, this information would be calculated using Dissemination Area codes – which are closer to the neighbourhood scale.

Another interesting indicator for measurement of the labour market at the neighbourhood scale would be the job vacancy rate, which gives an idea of jobs available from the perspective of employers. Unfortunately this data is only produced at the provincial scale, and is thus not useful for neighbourhood sustainability analysis.

Finally, an important indicator: net tax base or debt-service ratio – would assess the net financial capital relating to a neighbourhood. In other words, it would assess whether the gross taxes paid on income and property for a neighbourhood are proportionate to the cost of providing infrastructure and services to the neighbourhood. This indicator was not included in our report because the information on asset management and operating costs was not available at the neighbourhood scale.

Conclusions

Besides the challenge of data availability, there is some criticism of the relevance of measuring Economic Capital at the neighbourhood scale. Our economies are more interconnected and interdependent than ever. People often work outside of their

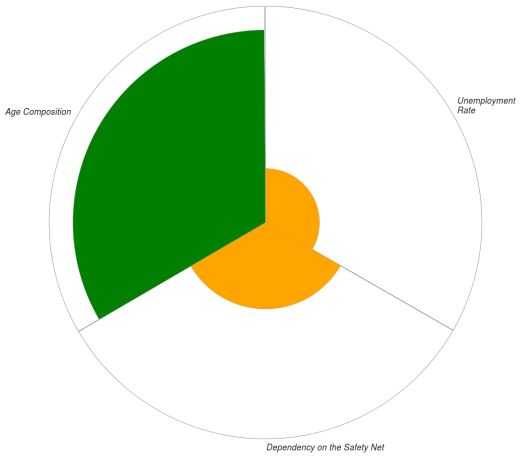
neighbourhood boundaries, work from home or work online. There is an extremely high level of education in the UniverCity neighbourhood, while the jobs available there are mostly service positions paying below a living wage.

There is also some tension between the principles of economic development and the principles of community economic development. According to community economic development principles, prioritizing local, independent business should circulate money in the community and increase economic stability because firms will be more rooted in the community. However, the higher than median number of bankruptcies at UniverCity and anecdotal accounts from the SFU Community Trust suggest that independent, local businesses have a harder time surviving in a community of only 3,500 residents and a large commuter population.

More research is needed to develop the economic capital indicators of the SCORE Tool. Recommendations for future versions of the assessment tool include a) in-depth assessment of community economic development indicators for neighbourhoods and b) identification of the appropriate scale for analysis of traditional economic indicators relative to community needs.

Labour

Composite Score: 51%



A community's labour force is one of its greatest assets. It is by the input of labour that added value is being created for the local economy.

The unemployment rate is the most widely cited indicator of the labour market. The proportion of neighbourhood residents who are unemployed, meaning of working age and looking for a job, is indicative of the economic vitality of the community. Expert practitioners state 0.5%-3% as an ideal unemployment range. The NHS allows us to extract the unemployment rate for DA 3695 and gives us a value of 6%. While this is not unique to UniverCity (the provincial unemployment rate is 5.9%; federal is 7%), it is above what international norms would recommend for economic vitality. Further research is required to investigate factors in unemployment rate at UniverCity, but it could be explained by a larger than average proportion of new entrants (such as graduating students) and re-entrants (such as former homemakers) living in the community, as well as by economic conditions in the region.

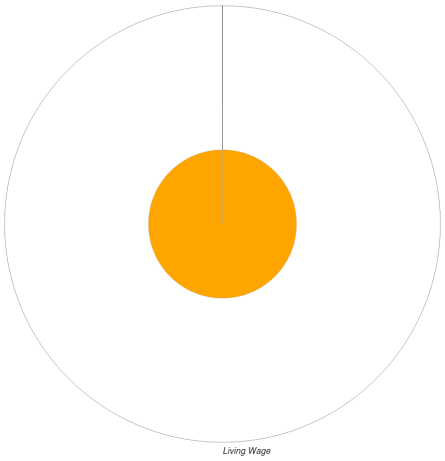
The composition of the labour force is an indicator of the earning capacity of a neighbourhood. This indicator, validated at the Telos, the Brabant Centre for Sustainable Development in the Netherlands, directed by John Davegos, suggests that UniverCity has a very high earning capacity as a neighbourhood, due to the quantity of young people available to work in the community.

Dependency on the safety net is an important indicator of economic capital because a high proportion of neighbourhood residents receiving income assistance or employment insurance could have implications for both the economic vitality of the neighbourhood and the labour market. Given that there is no widely agreed upon target for dependency on the safety net, relative norms were devised to assess the proportion of citizens receiving income assistance or employment insurance. These were calculated by extracting the proportion of residents receiving some form of social assistance from each of the municipalities in Metro Vancouver, and identifying median and interquartile values for that range. Since data for dependency on the safety net is only available at the city scale, unfortunately we cannot know to what extent UniverCity residents contribute to the municipal numbers overall.

As a basis for comparison, Langley City in the Vancouver region represents the bottom of the range, with 5.8% of the population receiving Basic Income Assistance and/or Employment Insurance, and West Vancouver at the top of the range with 1.2% of the population receiving some form of social assistance. Burnaby reported 3.6% of the population receiving some form of social assistance in 2012.

Households

Composite Score: 34%



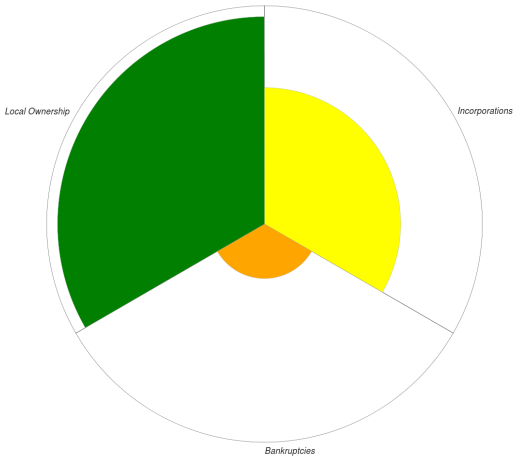
The amount of income available to households is an important asset for equality within a community. Two traditional indicators for measuring income equality are the median household income and income distribution. The Living Wage indicator is a concise indicator that combines these two indicators while giving us a definitive target for achievement.

A Living Wage is defined as a wage that is high enough to maintain a normal standard of living. Since we want every working member of a neighbourhood to be earning enough to maintain a normal standard of living, a target of 100% is used to measure this metric. The living wage in Metro Vancouver is calculated in 2014 at $20.10 hourly or an annual salary of $41,808. As a proxy we have measured the proportion of

neighbourhood residents who are earning a $40,000 annual salary or higher. This method of calculation gives us a value of 34%. Since there are a high proportion of students living at UniverCity who are using student loans or parent's money to live while in school, this reflects negatively on declared income and brings down the Living Wage and Shelter-to-Income Ratio (STIR) indicators. UniverCity's unique community demographic makes them an outlier in this respect. More research is needed to develop thresholds for student neighbourhoods.

Businesses

Composite Score: 61%



Income is generated in all kinds of businesses and organizations: small, large, social, owned by local entrepreneurs, part of multinationals, etc. A neighbourhood's business stock is therefore an important community asset, which furthers its economic capital. UniverCity's business stock is measured in three ways: through new incorporations, bankruptcies and local ownership.

New business incorporations indicate innovation in firms and job creation for the local economy. The annual number of incorporations, which is available at the municipal scale, has been framed as a rate per capita. Relative norms for the number of

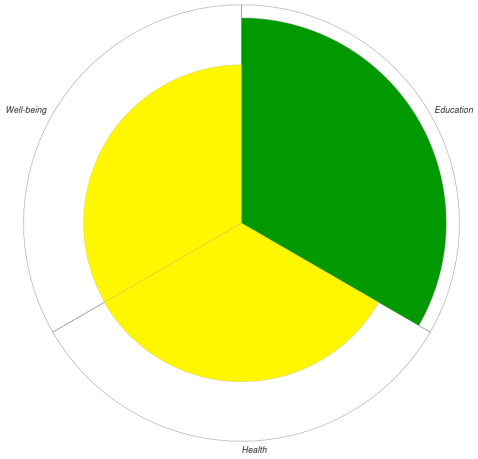
incorporations per capita were calculated by extracting values from all of the municipalities in Metro Vancouver, and identifying median and interquartile values for that range. Burnaby scores in the moderate/average range relative to the Metro Vancouver data set. This indicates that there is a healthy amount of new business creation and innovation in the municipality, with room for improvement.

The number of bankruptcies in a neighbourhood is an indicator of economic stability. This information is available from the Office of the Superintendent of Bankruptcies at the Forward Sortation Area scale. The data collected tells us that there are a high proportion of bankruptcies in UniverCity's Forward Sortation Area – V5A - relative to the rest of British Columbia. Once again, relative norms were established by analyzing the number of bankruptcies (5 year average) for all Forward Sortation Areas in British Columbia. The high number of bankruptcies in the V5A area provides evidence to back up qualitative reports of high merchant turnover rates for the commercial properties in the UniverCity neighbourhood development. However, it should taken into account that the V5A Forward Sortation Area is larger than the development area boundary, which degrades our data quality.

UniverCity's stated sustainability goals prioritize opportunities for community economic development by encouraging commercial leases to local, independent businesses. Since opening its commercial rental properties, 95% of businesses were considered to be local and independent. A target of 100% local, independent businesses is used to evaluate achievement of this indicator.

2.3.4. Human Capital

Composite Score: 79%



UniverCity is a highly educated and healthy community with substantial Human Capital by quantitative measures. In addition, Gross National Happiness (GNH) Index survey measures of perception of health and well-being are included in this stock. UniverCity residents score higher than the GNH Index sample population in all categories of health and-well-being. New Urbanist design principles aim to increase Human Capital through walkable neighbourhoods and planning public spaces for people. Many of these design principles have been incorporated into the Development Guidelines and Regulations at UniverCity, perhaps contributing to the high score in this capital.

Table 6 Human Capital Stocks

Stock	Score	Strengths	Weaknesses
Education	94%	Educational attainment	
Health	73%	Health demographics, perceptions of environment	Time balance
Well-being	73%	Life satisfaction, mental and material well-being	

Dataset Limitations

Community health demographic indicators are measured at the municipal scale based on data produced by BC Stats. Health data is not available at a neighbourhood scale, because at that scale the sample size is not large enough to be statistically valid. Educational statistics are made available by the NHS at the DA scale. The remaining subjective indicators of health and well-being are measured through the GNH Index Survey within UniverCity itself.

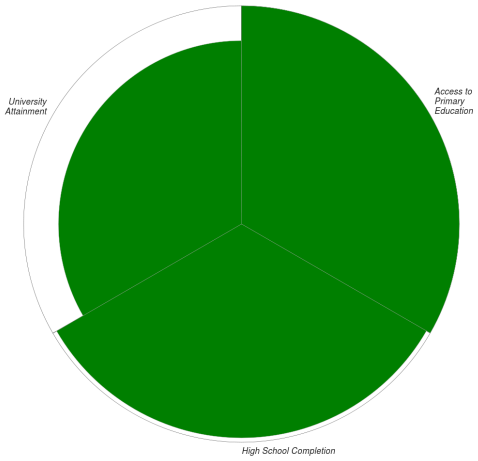
Conclusions

It would be useful to gather data on health practices at the neighbourhood scale in order to analyze how urban design and environment might be affecting health in a localized way. The Fraser Health Authority has acknowledged this gap in public health knowledge resources and is attempting to address this with their My Health, My Community survey, piloted in 2014. The results of their survey will likely be made public in 2015. Future adaptations of the SCORE Tool may consider integrating the My Health, My Community survey – even in place of the GNH Index survey, as there are substantial overlaps between the two.

It is interesting to note that the majority of UniverCity residents are not earning a Living Wage, but the GNH Index survey shows that they see themselves as healthy and financially secure. The lowest score of perception of personal health is in the area of time balance – though this is still similar to the GNH Index survey population.

Education

Composite Score: 94%

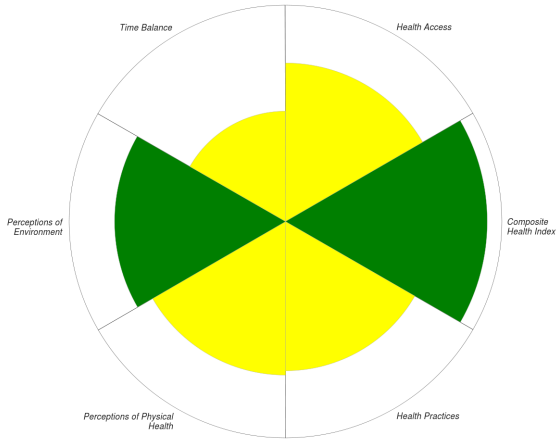


Educational assets in a neighbourhood include both the physical public amenities of schools and centres of lifelong learning as well as the intellectual capacity of the neighbourhood, represented by the educational attainment of neighbourhood residents.

Three measures of educational assets at the neighbourhood scale are: access to primary education, high-school completion and post-secondary attainment. UniverCity has an exceptionally high stock of education – with almost 100% high school completion and substantially higher levels of university attainment than the British Columbia average. This is likely related to the fact that some 36% of neighbourhood residents are affiliated with Simon Fraser University. A target of 100% is used for access to primary education and high school completion, while a benchmark of 23% (the provincial average) is used to assess levels of university attainment.

Health

Composite Score: 73%



Health is both the absence of disease and pain and a general feeling of wellness. Environmental quality and human-nature connectivity are also positively correlated to personal health. Healthy citizens can be conceptualized as community assets because they contribute to their local economies and communities through paid and unpaid labour, skills and knowledge contributions. This report addresses both community health demographics and residents' own personal assessment of health.

Health Access is calculated based on the rate of physicians per capita in Burnaby.

The Composite Health Index gives a score based on life expectancy and weighed causes of death (disease, suicide, homicide) and offers rankings of all municipalities of British Columbia.

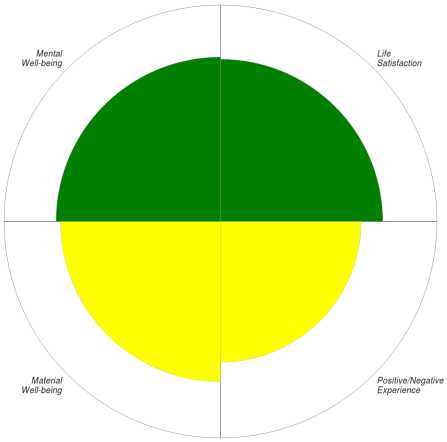
The health practices indicator offers a measure of lifestyle practices that affect health such as smoking, exposure to second hand smoke, being physically active, healthy eating, and having regular health check ups. Burnaby has a high composite health index in relation to the rest of BC, but a lower than average rate of physicians per

capita. In terms of health practices, Burnaby residents do well on not smoking (3% smoke) and having contact with an MD (81%), while only 45% admit to eating 5+ servings of fruit and vegetables per day, and 44% of the population admit to being overweight or obese.

Subjective measures of health are the result of UniverCity residents own personal assessment of health using the Gross National Happiness (GNH) Index survey scores on perceptions of physical health, the environment, and time balance. UniverCity residents score higher than the GNH Index average population in all three categories of health, with a much higher score in the area of perceptions of environment (+12 points).

Well-being

Composite Score: 73%



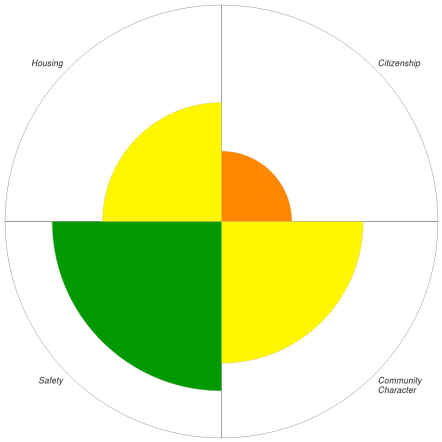
Personal well-being includes the full range of factors that influence what we value in living, reaching beyond its material side.

Satisfaction with life, material possession, and perceptions of mental health are indicative of community well-being. Measured by the GNH Index survey, UniverCity residents score in the 65-76% satisfaction range for each of the dimensions of well-

being. Interestingly, residents report a high degree of personal financial security, even given the low proportion of residents earning a Living Wage.

2.3.5. Social Capital

Composite Score: 58%



The SCORE Tool measures Social Capital as a combination of citizenship, housing affordability, safety and community character. UniverCity scores adequately overall, but lacks a culture of engagement amongst its residents, as measured by low scores in voter participation and social cohesion indicators; this is reinforced through anecdotal accounts. UniverCity is a safe neighbourhood for cyclists and pedestrians, with notably few traffic accidents. There were however, a substantial number of burglaries and auto crime accounts in 2013.

Table 7 Social Capital Stocks

Stock	Score	Strengths	Weaknesses
Citizenship	33%		Voter participation, Confidence in gov't
Community Character	66%	Social support	Social Cohesion
Safety	78%	Few traffic accidents, Few robberies	B&Es
Housing	55%	Housing conditions, Core housing need	STIR, Resident turnover

Dataset Limitations

Housing data is mostly available at the neighbourhood scale, made available by the Canadian Mortgage and Housing Corporation (CMHC). However, targets and thresholds are not identified by the CMHC. More research is needed to develop these thresholds and improve the accuracy of this assessment.

The parameter for voter participation is a little bigger than the UniverCity neighbourhood. Voting Districts are designed around voting stations. UniverCity falls within the City of Burnaby's Voting District 4.

Similarly, the Burnaby RCMP do not recognize 'neighbourhood' boundaries. Burnaby is policed by four community districts. UniverCity falls into District 2, which encompasses Burnaby Mountain, Lougheed and Burnaby Heights. A preferable unit of analysis for neighbourhood crime would probably be more localized and aggregate a) crimes against person and b) crimes against property. While the data can be aggregated at a smaller scale, at the time of writing of this report, the Burnaby RCMP did not have the resources necessary to do so.

Finally, we would have liked to include some measures of hazard and risk assessment in this report, however, no index is available to provide comparable ratings in this complex field of study. The City of Burnaby also expressed concerns about reporting on this key area of safety without a validated methodology.

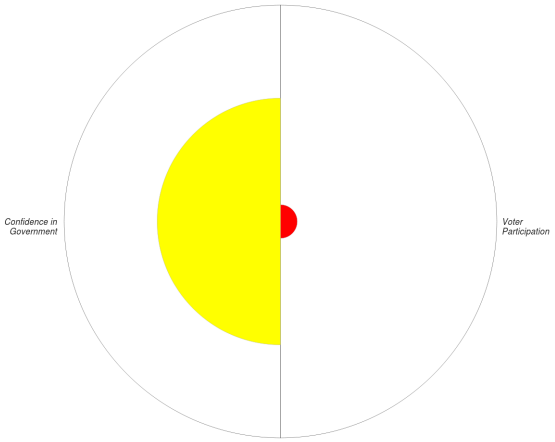
Conclusions

The study shows a lack of social cohesion and engagement at UniverCity, correlated with extremely high resident turnover rate (relative to provincial norms). This is balanced by the quality of the place, where there are few traffic accidents, and good housing conditions.

These results suggest several opportunities to engage residents about citizenship, safety and social cohesion. For example, voter participation rates in UniverCity are very low - demonstrating this information graphically to could be a useful tool for mobilizing change leading up to the fall 2014 municipal election.

Citizenship

Composite Score: 33%



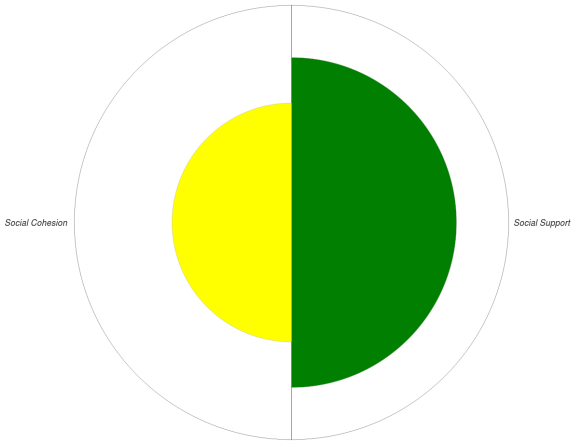
Citizenship refers to the level of political engagement of neighbourhood residents. Trust in institutions can be measured in confidence in government. An engaged and trusting citizenship is linked to democracy and is thus an asset of social capital. A high voter turnout is preferable to a low turnout because it means that the government will likely reflect the interests of a larger share of the population.

UniverCity residents scored extremely low in voter participation compared to municipal voter turnouts across BC. The lowest municipal voter participation rate in the province was 14%, while UniverCity residents achieved only 19%.

The confidence in government indicator, measured by the GNH Index survey, offsets the results of the voter participation indicator that may reflect aspects other than social cohesion. UniverCity residents rated their confidence in government as a 57/100 - 6 points higher than the average GNH Index score. The low score of UniverCity's citizenship stock may be described by the large number of young people living in the neighbourhood (53% of population is 15-29), high resident turnover (29% movers), or the fact that Burnaby's mayor, Derek Corrigan, has been re-elected every municipal election since 2002.

Community Character

Composite Score: 66%

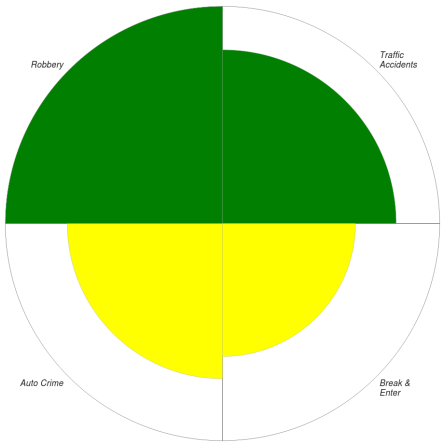


Community character encompasses social support, community vitality and participation. Social solidarity between citizens and the opportunity for citizens to build networks between each other are important for the advancement of social capital. Community character is measured using GNH Index survey.

UniverCity residents scored 76/100 in social support using the GNH Index survey, which addresses loneliness and support from friends and family. Social cohesion, which addresses trust in neighbours, sense of personal safety and volunteering receives a lower score of 55/100.

Safety

Composite Score: 78%



A sense of personal and community safety is essential to a high quality of life. When citizens feel safe from harm against person and property, and have access to support systems that encourage safety, it contributes to a neighbourhood's social capital. Communities should be protected from crime as well as danger from traffic accidents, natural disasters, etc. Streets should also be safe to drive, and safe for pedestrians and cyclists.

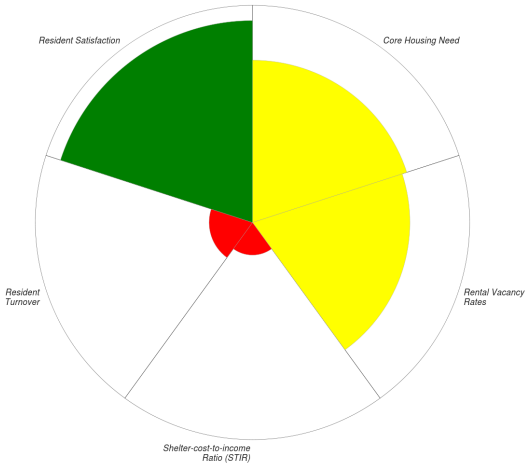
Street safety is measured in traffic accidents, as a rate of causalities per 1000 residents. According to the ICBC Crashes at Intersections database, UniverCity has experienced 1 crash per year (5 year average) within neighbourhood boundaries. Thresholds for safe neighbourhoods are not clearly defined by ICBC at this time and more research is needed to develop thresholds and improve accuracy of this

assessment. However, using a target of 0 crash causalities per 1000 residents, we can confidently say that a rate of 0.32 is a good score for this indicator.

Measures of neighbourhood crime including break & enter, auto crime and robbery are measured by the Burnaby RCMP, who also establish relative norms for the intensity of crime. The Burnaby RCMP could not provide aggregated data at the neighbourhood scale at the time of assessment, so their geographic area 'District 2' is used as a proxy. Robbery is different from break & enter (burglary), when a person is robbed in his/her immediate presence. The values and thresholds used in this report are extracted from Community Policing Reports for District 2, published bi-monthly by the Burnaby RCMP. District 2 sees very few auto crimes and robberies, but a moderate number of business and residential break & enters.

Housing

Composite Score: 78%



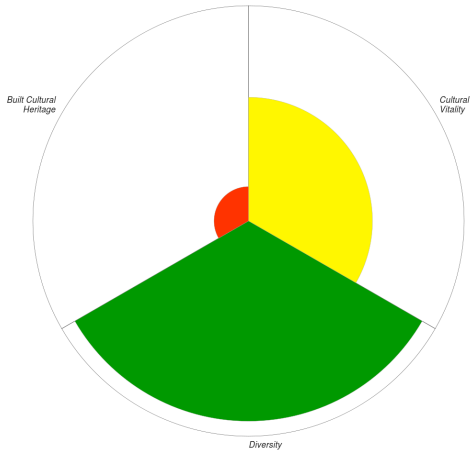
Safe and comfortable housing is fundamental to our sense of well-being. Adequate access to housing for every citizen in a neighbourhood is necessary to produce Social Capital.

Housing suitability is not a major issue at UniverCity, resulting in a core housing need in line with the national average. Similarly, UniverCity maintains a healthy rental vacancy rate in line with the Ministry of Finance benchmark. However, an analysis of the shelter-to-income-ratio (STIR) of DA 3695 tells us that 58% of residents are spending 30% or more of their income on shelter costs. This result may be explained by the number of students collecting loans to pay for living costs, as loans may not be included in the income calculation. The STIR thus may not be an accurate indicator of housing affordability for communities with a high student population.

Resident turnover thresholds were established using the same methodology, and we found that UniverCity experiences a high level of resident turnover (29%) compared to the rest of Metro Vancouver (median 12%). Nonetheless, UniverCity's own resident satisfaction survey found that 95% of residents would recommend living in UniverCity to a friend. The large student population at UniverCity may be attributed to the unusual disconnect between these two statistics.

2.3.6. Cultural Capital

Composite Score: 58%



UniverCity is a new neighbourhood built on previously undeveloped land. As such, this is not a site with rich culture and heritage. The neighbourhood is also relatively isolated - situated on top of Burnaby Mountain, it does not connect at its parameter to a broader community. That context suggests that UniverCity would score low in the area of Cultural Capital. The results of this assessment, however, highlight the success of UniverCity's investments in culture, such as public art projects, and serve as a baseline for analyzing resident engagement and satisfaction with arts and culture opportunities.

Table 8 Cultural Capital Stocks

Stock	Score	Strengths	Weaknesses
Cultural Vitality	58%		Cultural access, Public programming
Diversity	93%	Ethnic diversity	
Built Cultural Heritage	16%	Investment in public art	Registered heritage sites

Dataset Limitations

Culture is certainly not restricted by neighbourhood boundaries, and governments that invest in cultural celebrations draw citizens from across neighbourhoods. Similarly, prominent cultural institutions generally serve whole cities or regions. Therefore, evaluating cultural capital at a neighbourhood scale must focus on a subset of local heritage, access to culture, and resident engagement with neighbourhood arts, culture and recreational opportunities.

Measurement of public programming relies on participation at public City facilities, which may not be an accurate representation for UniverCity given that many residents may instead access university facilities.

Conclusions

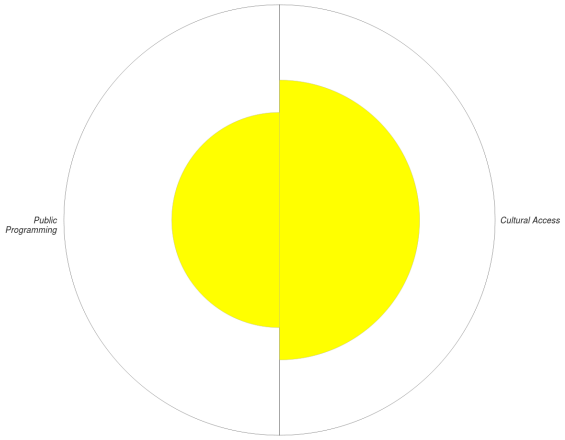
Celebrating diversity, catering cultural programs to community needs and embracing public art are all means to enhance Cultural Capital in a community. In trying to measure culture, the research team would have liked to embrace a wider definition of culture that includes “community culture” and identity. Identity is a concept closely tied to placemaking at the neighbourhood scale. Some measure of placemaking should be developed to help fill this gap in neighbourhood sustainability assessment.

Cultural Capital could also be measured in the capacity and quality of public cultural knowledge sector, e.g. the number of cultural institutions in city and/or the number of employees employed in the cultural heritage sector, however, more research is needed to develop targets and benchmarks for these variables.

Natural cultural heritage is an important subset of Cultural Capital, not measured in this assessment. Natural heritage inventories (such as interpretive plaques) or celebrations should also be considered cultural assets. Unfortunately, there are no well-established targets or benchmarks for these key areas of cultural sustainability, nor are they easily measured.

Cultural Vitality

Composite Score: 58%



Cultural vitality is present when art is encouraged and celebrated and when a community acknowledges traditions and celebrations. Cultural vitality is an asset of Cultural Capital since it contributes to a sense of place and identify within a neighbourhood. We have selected two measures of cultural vitality: perceptions of cultural access and participation in public programming. In an effort to produce a tool that is comparable across neighbourhoods, only participation in public (City of Burnaby) programs is considered. Residents of UniverCity do have further access to SFU cultural

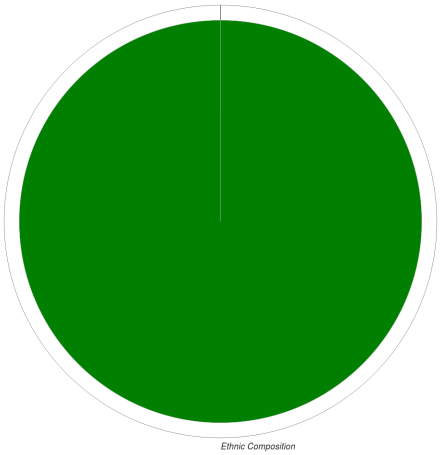
and recreation facilities through the Community Card program. While this is not reflected in public programming indicator, resident perceptions of cultural access to all facilities should be captured in the cultural access indicator.

Cultural access is a subjective well-being indicator taken from the GNH Index survey. This is the only indicator of happiness in which UniverCity residents did not score higher than the average GNH Index score (-2 points).

Public programming is concerned with participation rates in municipal parks, recreation and cultural programs at the neighbourhood community centre. The overall participation rate in programs was 60% in 2013. Using a target of 85% participation, there is room for growth in Parks, Recreation and Cultural Services offerings on Burnaby Mountain. More research is needed to identify why participation rates are low: it could be that residents either do not know about available programs, the programs are not meeting the needs of residents, competing programs (e.g. through the university) are more accessible, or residents do not feel they have enough time or money to participate.

Diversity

Composite Score: 93%

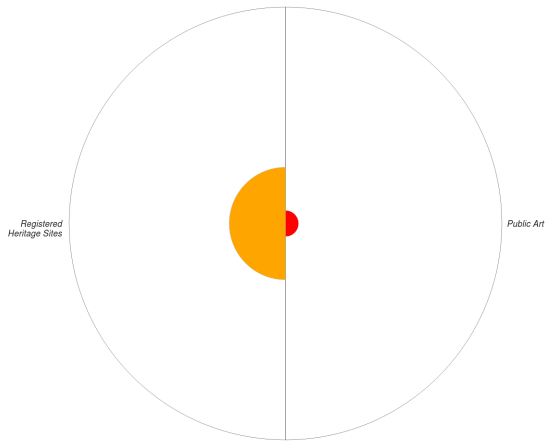


Diversity is thought to be a community asset when diversity of culture and tradition is practiced and celebrated. SFU Community Trust considers diversity to be one of four critical elements to the long-term community character and composition of the neighbourhood.

The ethnic diversity indicator analyzes whether UniverCity's resident population is representative of the municipal ethnic composition. The NHS gives us detailed information about ethnicity at the DA scale. It turns out that the ethnic composition of UniverCity residents is 93% consistent with the ethnic composition of Burnaby, with slightly higher Asian residents, and slightly less residents of Caribbean and Africa descent.

Built Cultural Heritage

Composite Score: 16%



Built cultural heritage is the number of monuments, groups of iconic buildings, and the preservation of heritage sites in a neighbourhood. Built cultural heritage must also be maintained as a contribution to Cultural Capital. As a new community with no pre-existing cultural heritage or archeological sites, SFU Community Trust had no requirement to preserve cultural heritage in the development of UniverCity. It is, so to speak, a clean slate. However, just as it is important to avoid 'food deserts' at the

neighbourhood scale, 'cultural deserts' are similarly unwanted – it is for this reason that an indicator for registered heritage sites remains in the tool.

The registered heritage sites indicator is measured through the Burnaby Heritage Registrar, which identifies 14 unique historic neighbourhoods in Burnaby. Relative norms for the number of registered heritage sites in each historic neighbourhood were established based on the parameters provided by the registrar. UniverCity's historic neighbourhood (Lochdale/Burnaby Mountain) includes substantially fewer heritage sites than other Burnaby neighbourhoods.

Public art is an important feature of placemaking and indicative of a commitment to cultivating arts and culture within a neighbourhood. With all new Phase 2, 3 and 4 developments, SFU Community Trust charges $1 per sq ft of buildable area to its development partners for investment in public art. While the total amount spent on art previous to 2013 is quite low, as Phases 2, 3 and 4 of the neighbourhood reach build out this indicator will increase substantially.

Chapter 3.

Comparative Analysis

3.1. Scope

In the last two years, SFU Community Trust has piloted two unique sustainability assessment systems to measure sustainability at UniverCity: the Dutch Foundation for Sustainable Area Development assessment tool (FSA Tool), and the Sustainable Communities Rating Tool (SCORE Tool). This chapter will conduct a comparative analysis of these two assessment systems in order to learn from this unique Canadian application of new and different neighbourhood sustainability assessment (NSA) tools. The purpose of comparative analysis is to learn about the latest developments in the emerging field of neighbourhood sustainability assessment with a view to:

- determining if different assessment systems produce similar results; and
- developing a strategic understanding of when and how to use different tools.

Therefore, the comparative analysis will entail both an outcomes evaluation and process evaluation.

Sustainable urbanization is now widely recognized as integral to achieving global sustainability goals, and a multitude of sustainability plans, policies and programs have been developed in attempt to translate sustainable development aspirations into implementable actions locally (Briassoulis, 2001; Clos, 2014; Haapio, 2012; Joss, 2012; Moore & Rees, 2013; Roseland, 2013; Shen et al., 2011). Accompanying these developments, there have been increasing calls for indicators, standards and frameworks to evaluate the success of these plans, policies and programs. While these evaluation frameworks share a common goal of capturing and measuring various urban sustainability dimensions, they differ significantly in terms of conceptual definitions,

methodological approaches and modes of operation (Joss, Tomozeiu, & Cowley, 2011). Several recent studies have compared various NSA Tools based on their structure, methodologies of application and their performance (Orova & Reith, 2013; Sharifi & Murayama, 2014a; Sharifi & Murayama, 2014b). However, these studies have mainly focused on comparison of the predominent 'spin off' building assessment tools. There are no comparative case studies written about the two NSA tools selected for this evaluation: the FSA Tool and SCORE Tool. Analyzing multiple cases is necessary to increase the breadth of analysis, verify the findings, and produce findings that are not merely the result of idiosyncrasies of the research setting and are transferable to other cases or generalizable to theory (Cavaye, 1996; Sharifi & Murayama, 2013).

The outcomes evaluation is concerned with comparing the assessment results of the FSA Tool and SCORE Tool. The objective of this exercise is to either provide some triangulation of the assessment results or highlight ambiguities in the data. The process evaluation is concerned with the methodology and application of each of the tools. In order to frame the process evaluation, each of the assessment systems is measured against a framework for analysis developed by Sharifi and Murayama in “A critical review of seven neighborhood sustainability assessment systems” (Sharifi & Murayama, 2013), which was designed to:

- evaluate to which degree NSA tools are able to incorporate different elements of sustainability;
- identify the differences, commonalities, strengths, weaknesses, successes, and failures of NSA tools through cross-comparison of them;
- to understand various problems and challenges the NSA tools are grappling with; and
- to discuss some solutions to these problems and challenges, and refinements needed to enhance the efficiency of NSA tools (Sharifi & Murayama, 2013).

The framework includes seven characteristics of NSA tools: sustainability coverage, inclusion of prerequisites, adaptation to locality, scoring and weighting, participation, presentation of results, and applicability. The framework for analysis allows us to determine the degree of compliance of the selected tools with the principles of sustainable development (Sharifi & Murayama, 2013).

The conclusions and recommendations section of this chapter will summarize the research findings and make specific recommendations for future adaptations of the SCORE Tool, based on these findings.

3.2. Review of selected NSA tools

The two NSA tools selected for comparative analysis are the Foundation for Sustainable Area Development Assessment Tool (FSA Tool), and the Sustainable Communities Rating Tool (SCORE Tool). These two NSA tools are selected because of their recent application in a community setting to a single study site: UniverCity on Burnaby Mountain, in BC, Canada. The two tools also share a similar objective: to refine a uniform measuring system, which makes it possible to compare sustainability of one neighbourhood to another. They are both developed by non-profit research bodies and intended for use by academics, professional planning consultants, land developers and local government authorities.

An in-depth explanation of the SCORE Tool is available in section 2.1. The FSA Tool is a compact assessment tool for assessing and comparing the sustainability of leading eco-neighbourhoods. In one day, case study teams gather data and process results into a proxy diagram, then ask supervising partners to comment and enhance this information. It is based on the BREEAM framework for area development, LEED ND and the Estidama frameworks. The FSA Tool has been applied in 10 eco-neighbourhoods around the world, one of which was UniverCity in September 2013.

Both tools take a multi-criteria approach to sustainability assessment of neighbourhoods. While sustainability assessment tools can measure performance at all stages of the development or decision-making process, from project initiation, planning, design to construction and operation (monitoring) (Kellett et al., 2009), both the FSA Tool and SCORE Tool measure completed neighbourhoods, post-occupancy.

NSA tools are built upon themes, criteria, indicators and thresholds. While the FSA and SCORE tools differ in their organizing sustainability frameworks (themes) and

methods of evaluation, they both offer scores of sustainability outcomes across a number of *criteria* to account for sustainability challenges facing urban communities.

An overview of the two NSA tools is given in Table 9.

Table 9 Overview of FSA Tool and SCORE Tool

NSA Tool	SCORE Tool	FSA Tool
Developer	Centre for Sustainable Community Development, Simon Fraser University	Foundation for Sustainable Area Development
Development Date	V1: April 2014; ongoing	?
Country/Region	Canada	Netherlands
Rating System	Scores from negative to 100%; 4 thresholds for achievement, colour coded as red, orange, yellow, green	Scores from 0 to 100%; 3 thresholds for achievement, colour coded as red, orange, green
Themes	Community Capital Framework: Natural, Physical, Economic, Human, Social and Cultural Capital.	FSA-framework chapters: Synergy, Resources, Spatial development, Socio-economics, Climate
Intended Users	Academics, professional planning consultants, land developers, local government authorities.	Case study teams include neighbourhood residents and community stakeholders: planners, developers, local government authorities + academic partners
Methodology	Primarily quantitative, based on readily available statistical data and/or geospatial data coupled with statistically valid survey.	Primarily qualitative, based on reports, stakeholder interviews and available geospatial data.
Scoring	Indicators are answered in a variety of formats, such as percentages, index scores, spatial units of measurement, etc. Targets and thresholds are uniquely identified for each indicator, in order to valuate the indicator's performance. Scores for each indicator are translated into percentages.	Some criteria are determined through a process of qualitative research involving interviews and consensus. Others have a more formal system of measurement, such as spatial analysis, or (building on LEED ND methodology) achieving points for core requirements. Scores are translated to percentages for easy interpretation and communication. Scores appear to be rounded up or down in the presentation of UniverCity's assessment results.

Limitations	Data availability at the neighbourhood scale is a major limitation of the SCORE Tool. In some cases where data was unavailable at the neighbourhood scale, a wider area was used as a proxy for study area performance. Furthermore, in the absence of clearly defined targets for sustainability assessment globally, the SCORE Tool methodology for scoring indicators should be considered under development.	Data quality and availability is a substantial limitation to compact assessment tools. Since data is gathered in one day, the analysis is not very in-depth. In cases where no data was found within the given time frame of data collection, scoring was estimated based on anecdotal accounts from developers, residents and other stakeholders. This compromises the legitimacy of the FSA Tool as a decision support system in planning practice.

3.3. Outcomes Evaluation

Evaluation of neighbourhood sustainability assessment systems can be divided into two broad categories: outcomes evaluation and process evaluation (Ellis, Gunton, & Rutherford, 2010). Outcomes evaluation compares the numerical results of the selected NSA tools and gives us a sense of whether the tools are confirming each other's conclusions about the post-occupancy sustainability of UniverCity as a neighbourhood. Stark differences in the results may highlight weaknesses or ambiguities in assessment methods. Similarities between the results strengthen the assessments – both in terms of outcomes and methods.

3.3.1. Methods

In order to compare the outcomes of the NSA tools applied at UniverCity, it was necessary to design a common framework for use as a basis for comparison. Since NSA tools are built upon themes, criteria, indicators and thresholds, it was also necessary to choose a common scale of reporting for pairwise analysis. In their 2014 work, "Viability of using global standards for neighbourhood sustainability assessment: insights from a comparative case study", authors Sharifi and Murayama suggest a list of important criteria related to sustainable neighbourhood development. The authors' list of criteria was anticipated to be comprehensive - based on a wide array of literature (Meter, Urban

Ecology Coalition, and Crossroads Resource Center 1999; IBEC 2007; Choguill 2008; Carmona 2009; BRE 2011; USGBC 2011; GBCA 2012; Sharifi and Murayama 2013a), including three well-known NSA tools: LEED-ND (US), BREEAM Communities (UK) and CASBEE-UD (Japan) (Sharifi & Murayama, 2014b). However, every assessment system is implicit to a particular theoretical construct (O'Connell, 2014), meaning that, the organization of themes, criteria, indicators and thresholds is often determined by the developer of the tool, and generally reflects a practice of building assessment, environmental assessment, or community development. The Sharifi and Murayama list of common criteria intends to synthesize various assessment systems, representing the perspectives of non-governmental organizations, professional organizations and government agencies.

Since both the SCORE Tool and FSA Tool use a framework of themes, criteria, indicators, and thresholds to account for sustainability challenges facing urban communities, they can undergo pairwise comparative analysis at the criteria scale against Sharifi and Murayama's core list of NSA criteria. Criteria are defined as parameters used to evaluate the contribution of a project to meet the required objective. Each criterion is, in turn, comprised of one or more indicators which are variables that are used to make specific measurements (Munier, 2011). While it might be more accurate to conduct a comparative analysis of the assessment results at the more granular, indicator scale, this study is limited by published data available for pairwise analysis. The FSA Tool does not publish their results at the indicator scale, and thus this study could not conduct further pairwise analysis at the indicator scale.

In addition to Sharifi and Murayama's core list of criteria, criteria that are included in either one or both of the selected NSA tools are incorporated into our master list of criteria. Therefore, all related criteria are included, and can be considered for comparison (Sharifi & Murayama, 2014b). The master list is shown in Table 10; it includes 55 core criteria, and 7 additional criteria, totaling 62 possible criteria for pairwise comparative analysis.

Data for the analysis (scores at the criteria scale) comes from the results reporting sections of both the SCORE Tool and FSA Tool UniverCity assessments.

Table 10 Criteria for Sustainable Neighbourhood Development

Environmental		**Economic**	
En1	Heat Island	Ec1	Employment
En2	Soil	Ec2	Investment
En3	Location	Ec3	Use of local resources
En4	Ecological survey	Ec4	Local food production
En5	Ecological networks		
En6	Earth's atmosphere	**Social**	
En7	Greenfield protection	S1	Education
En8	Floodplain avoidance	S2	Health
En9	Water bodies	S3	Equity
En10	Biodiversity	S4	Diversity
En11	Energy efficiency	S5	Affordable housing
En12	Solar orientation	S6	Security
En13	Water efficiency	S7	Heritage
En14	Materials (origin, reuse, recycle)	S8	Culture
En15	Waste management	S9	Identity and distinctiveness
En16	Transport assessment	S10	Active frontages
En17	Public transportation	S11	Civic spaces
En18	Car clubs and car sharing	S12	Universal design
En19	Bicycle network and infrastructure		
En20	Woonerfs	**Institutional**	
En21	Parking requirements	I1	Outreach and involvement
En22	Pedestrian network and infrastructure	I2	Transparency
En23	Housing-job proximity	I3	Local institutions
En24	Density	I4	Monitoring
En25	Connectivity	I5	Innovation
En26	Green buildings		
En27	Expandable infrastructure	**Additional Criteria from Tools**	
En28	Green infrastructure	SCORE1	Businesses
En29	Flexible and multifunctional spaces	SCORE2	Well-being
En30	Mixed-Use	SCORE3	Community Character
En31	Disaster management and prevention	FSA1	Long-term Profit
En32	Improving the wind environment	FSA2	Program
En33	Nuisance (noise, odor, light, etc.)	FSA3	Experience and Esthetic
En34	Access to amenities	FSA4	Management

The goal of the outcomes evaluation is to determine whether the results of the two selected NSA tools are similar or different. In order to do this, our definition of similar and different must be defined:

- Similar +/- 10%
- Somewhat similar +/- 10 - 20%
- Different +/- 20% - 30%
- Very different +/- > 30%

3.3.2. Results

The two selected NSA tools present a score for each criterion, described as a percentage. In Table 11, the SCORE results and the FSA results are compared side-by-side against the refined list of criteria for sustainable neighbourhood development. Where no criteria existed to match the core list, the cell is left empty. The difference between the assessment results of each criterion is also noted.

Table 11 Side-by-side Comparison of SCORE Results and FSA Results

Criteria	Description	SCORE	FSA	Difference
En1	Heat Island	-	67%	-
En2	Soil	67%	36%	31%
En3	Location	-	83%	-
En4	Ecological survey	-	-	-
En5	Ecological networks	84%	-	-
En6	Earth's atmosphere	85%	59%	26%
En7	Greenfield protection	67%	40%	27%
En8	Floodplain avoidance	93%	59%	34%
En9	Water bodies	98%	-	-
En10	Biodiversity	84%	-	-
En11	Energy efficiency	-	100%	-
En12	Solar orientation	-	-	-
En13	Water efficiency	-	46%	-
En14	Materials (origin, reuse, recycle)	89%	53%	36%
En15	Waste management	89%	-	-
En16	Transport assessment	66%	89%	-23%
En17	Public transportation	66%	-	-

En18	Car clubs and car sharing	-	-	-
En19	Bicycle network and infrastructure	-	-	-
En20	Woonerfs	-	-	-
En21	Parking requirements	-	-	-
En22	Pedestrian network and infrastructure	93%	-	-
En23	Housing-job proximity	-	-	-
En24	Density	93%	-	-
En25	Connectivity	93%	89%	4%
En26	Green buildings	83%	-	-
En27	Expandable infrastructure	-	100%	-
En28	Green infrastructure	88%	33%	55%
En29	Flexible and multifunctional spaces	83%	100%	-17%
En30	Mixed-Use	93%	-	-
En31	Disaster management and prevention	-	-	-
En32	Improving the wind environment	-	59%	-
En33	Nuisance (noise, odour, light, etc.)	-	30%	-
En34	Access to amenities	93%	-	-
Ec1	Employment	51%	60%	-9%
Ec2	Investment	-	-	-
Ec3	Use of local resources	-	-	-
Ec4	Local food production	67%	0%	67%
S1	Education	94%	-	-
S2	Health	73%	-	-
S3	Equity	34%	-	-
S4	Diversity	93%	70%	23%
S5	Affordable housing	55%	70%	-15%
S6	Security	78%	83%	-5%
S7	Heritage	16%	62%	-46%
S8	Culture	64%	-	-
S9	Identity and distinctiveness	-	-	-
S10	Active frontages	-	-	-
S11	Civic spaces	-	-	-
S12	Universal design	-	-	-
I1	Outreach and involvement	33%	70%	-37%
I2	Transparency	-	-	-
I3	Local institutions	-	80%	-

I4	Monitoring	-	-	-
I5	Innovation	-	-	-
SCORE1	Businesses	61%	67%	-6%
SCORE2	Well-being	73%	-	-
SCORE3	Community Character	66%	-	-
FSA1	Longterm Profit	-	100%	-
FSA2	Program	-	68%	-
FSA3	Experience and Esthetic	-	81%	-
FSA4	Management	-	61%	-

Against a possible 62 important criteria for sustainable neighbourhood development, the SCORE and FSA Tools only held 17 (27%) criteria in common. Therefore, our analysis of whether the results of the two selected NSA tools are similar or different looks exclusively at these 17 criteria. The 17 criteria are summarized in Table 12. The fact that both tools have relatively few criteria in common also suggests that they are missing many of the core elements of sustainability; this is addressed separately as part of the sustainability coverage discussion in section 3.4.2.

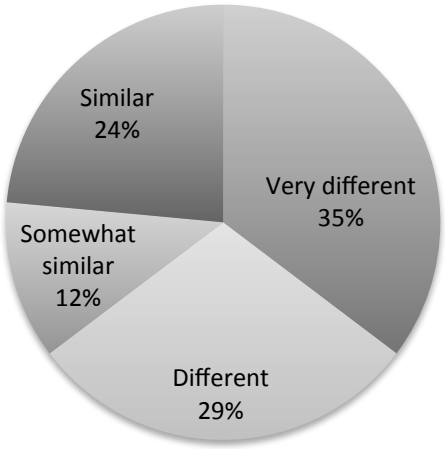
Table 12 SCORE and FSA Tool Common Criteria

Criteria	Description	SCORE	FSA	Dif.	Result
En2	Soil	67%	36%	31%	Very different
En6	Earth's atmosphere	85%	59%	26%	Different
En7	Greenfield protection	67%	40%	27%	Different
En8	Floodplain avoidance	93%	59%	34%	Very different
En14	Materials (origin, reuse, recycle)	89%	53%	36%	Very different
En16	Transport assessment	66%	89%	-23%	Different
En25	Connectivity	93%	89%	4%	Similar
En28	Green infrastructure	88%	33%	55%	Very different
En29	Flexible and multifunctional spaces	83%	100%	-17%	Somewhat similar
Ec1	Employment	51%	60%	-9%	Similar
Ec4	Local food production	67%	0%	67%	Very different
S4	Diversity	93%	70%	23%	Different
S5	Affordable housing	55%	70%	-15%	Somewhat similar
S6	Security	78%	83%	-5%	Similar
S7	Heritage	16%	62%	-46%	Very different
I1	Outreach and involvement	33%	70%	-37%	Different

SCORE1	Businesses	61%	67%	-6%	Similar

Of the 17 common criteria, 4 (24%) criteria were similar, 2 (12%) criteria were somewhat similar, 5 (29%) criteria were different, and 6 (35%) criteria were very different. These results are illustrated in Figure 13.

Figure 13 Similarity/Difference of Common Criteria



Overall more criteria are different or very different than are similar or somewhat similar: 11 (65%) > 6 (35%). This analysis suggests three findings:

1. Given that the SCORE and FSA tools only hold 17 (27%) criteria in common, they are not directly comparable at the criteria scale.
2. Where the tools are comparable, only 2 (12% of common criteria; 3% overall) criteria demonstrated similar results.
3. The results of SCORE and FSA assessments, therefore, do not support each other.

3.3.3. Discussion

As stated in the introductory paragraph, stark differences in the results may highlight weaknesses or ambiguities in assessment methods. The outcomes evaluation surfaced 6 (35% of common indicators; 10% overall) criteria with very different results. These are stated for reference in Table 13. The discussion section of the outcomes

evaluation will focus on these stark differences in order to learn from this unique Canadian application of assessment tools to the same study site.

Table 13 Criteria with Very Different Results

Criteria	Description	SCORE	FSA	Dif.	Result
EEn2	Soil	67%	36%	31%	Very different
En8	Floodplain avoidance	93%	59%	34%	Very different
En14	Materials (origin, reuse, recycle)	89%	53%	36%	Very different
En28	Green infrastructure	88%	33%	55%	Very different
Ec4	Local food production	67%	0%	67%	Very different
S7	Heritage	16%	62%	-46%	Very different

A detailed review of the common criteria with very different results makes three findings:

1. Differences in indicators or components that make up the criteria for sustainable neighbourhood development result in stark differences at the criteria scale. This suggests that sustainability assessment tools are only comparable at their most granular level: at the level of indicators.
2. There is also some confusion about what is an indicator and what is considered criteria. For example, En2 Soil – for the SCORE Tool encompasses an indicator on local food production, which is why the SCORE Tool reports the same results for Ec4. Meanwhile, the FSA Tool has separate criteria for En2 and Ec4.
3. Once again, we note that the evaluation component of sustainability is often implicit to particular theoretical construct (O'Connell, 2014). The organization of themes, criteria, indicators and thresholds is determined by the developer of the tool, and generally reflects a practice of building assessment, environmental assessment, or community development. Comparing tools with differing theoretical foundations proves to be challenging, but not impossible, according to this assessment.

This analysis makes an important observation about our common understanding of criteria for neighbourhood sustainability assessment. Sharifi and Murayama (2014) present one of the most comprehensive lists of criteria for sustainable neighbourhood development, and yet only 17 (27%) common criteria are found between the SCORE Tool and FSA Tool. Results of the outcomes evaluation reveal misconceptions in the definitions of themes, criteria, indicators and thresholds. In sustainability assessment

literature, we are very clear on what an indicator is and what are its parts. However, we are less clear on other scales of sustainability assessment tools, such as criteria and themes. There needs to be a more scientific approach to classification of the components of sustainability assessment systems, so that everyone understands a common architecture and can build off of each others work.

Additionally, what's included in each criteria (what indicators) differs significantly between the selected NSA tools. For example, S7 Heritage – for the SCORE Tool includes indicators on the number registered heritage sites, and amount of public art investments, and for the FSA Tool includes indicators on preservation - and where possible - enhancement of cultural historic values (material and/or immaterial). These differences in how each criterion is comprised result in ambiguities in assessment results that limit the comparability of NSA tools.

In conclusion, this analysis underscores the need for a clearly defined and widely accepted set of indicators including descriptions and metrics, as well as further research and agreement on a methodology and organizing framework for neighbourhood sustainability assessment.

3.3.4. Limitations

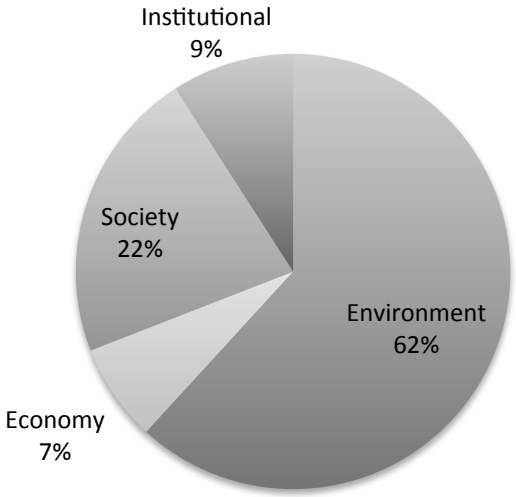
The outcomes evaluation is limited by the list of criteria used for pairwise comparative analysis and also by the availability of detailed data on the FSA Tool. Each of these limitations will be discussed in detail in the following paragraphs.

The list of criteria used for pairwise comparative analysis suggested by Sharifi and Murayama compiles its list of core criteria from three major NSA tools: LEED ND, BREEAM Communities, and CASBEE. However, criticisms of these tools include their bias towards environmental and building performance assessment, and that they do not adequately cover all the components of sustainability (environmental, social, and economic spheres) (Berardi, 2011; Sharifi & Murayama, 2013). This is evidenced by the distribution of Sharifi and Murayama's core criteria list. The core list includes 55 criteria overall, 34 (62%) criteria are concerned with the Environment, 4 (7%) criteria are concerned with the Economy, 12 (22%) criteria are concerned with Society, and 5 (9%)

criteria are concerned with institutional spheres of neighbourhood sustainability. This distribution is noted in Figure 14. Distributional analysis suggests that the framework of common criteria used in the outcomes evaluation does not equally cover all the components of sustainability.

Finally, as previously stated, this study is limited by published data available for pairwise analysis. The FSA Tool does not publish their results at the indicator scale, and thus this study could not conduct further pairwise analysis at the indicator scale.

Figure 14 Sustainability Distribution of Core Indicator List



3.4. Process Evaluation

The process evaluation is concerned with the methodology and application of each of the tools. In order to frame the process evaluation, each of the assessment systems is measured against a framework for analysis developed by Sharifi and Murayama in "A critical review of seven neighborhood sustainability assessment systems" (Sharifi & Murayama, 2013), which was designed to:

- evaluate to which degree NSA tools are able to incorporate different elements of sustainability;
- identify the differences, commonalities, strengths, weaknesses, successes, and failures of NSA tools through cross-comparison of them;

- to understand various problems and challenges the NSA tools are grappling with; and
- to discuss some solutions to these problems and challenges, and refinements needed to enhance the efficiency of NSA tools (Sharifi & Murayama, 2013).

3.4.1. Methods

In a 2013 article "A critical review of seven selected neighborhood sustainability assessment tools", Sharifi and Murayama suggest a framework for analysis of neighbourhood sustainability assessment tools. The framework examines the content of NSA tools, how the tools have been developed, their methodology for measuring the conditions, measures taken to ensure the reliability of assessment results, and their application (Sharifi & Murayama, 2013). This evaluation framework includes seven characteristics of NSA tools, outlined in Table 14.

Content analysis of relevant documents such as assessment results and manuals for each of the selected NSA tools was the main method used for making the comparative analysis. Moreover, interviews were conducted with three members of the FSA assessment UniverCity case-study team, as well as UniverCity Development Director, Dale Mikkelsen, for their input on process evaluation. Interview questions are listed in Appendix C.

Table 14 Process Evaluation Framework for Analysis

Characteristic	Description
Sustainability coverage	What are the major themes included in the NSA tools and how successful are they in assessing neighbourhoods performance in a comprehensive and integrated way?
Inclusion of pre-requisites	Whether there are strategies to assure the achievement of a certain level of performance.
Adaptation to locality	Whether the NSA tools have considered the context-specific needs and priorities in their assessments.
Scoring and weighting	What methods are used by NSA tools to score and weigh different criteria and how rigorous is this process?
Participation	What mechanisms are utilized by the NSA tools to involve different stakeholders during the development and operational stages?
Presentation of results	How do NSA tools report the results of assessment and to what extent are they useful as decision support systems?
Applicability	How practical are the NSA tools and what strategies can be taken to increase their

	applicability?

3.4.2. Results

Results of the process evaluation are organized by the seven characteristics of NSA tools outlined by the framework for analysis. For each characteristic, there is a short description of the characteristic and its importance, an analysis of the SCORE Tool and FSA Tool in reference to this characteristic, and a discussion linking the analysis of both tools.

Sustainability coverage

The sustainability coverage of NSA tools is concerned with the competence of tools in responding to the implications of sustainable development. What are the major themes included in the NSA tools and how successful are they in assessing neighbourhoods' performance in a comprehensive and integrated way? (Sharifi & Murayama, 2013) Since criteria and indicators are the building components of any sustainability framework, this is the main scale of analysis of sustainability coverage.

Both the SCORE Tool and the FSA Tool use a multi-criteria framework for measuring sustainability at the neighbourhood scale. Both tools are built on the assumption that sustainability is a holistic issue, whose complexity demands a multi-criteria measuring system. The SCORE Tool uses a six capital framework to ensure comprehensive sustainability coverage, taking a community development approach. The FSA Tool uses five chapters to address sustainability, but with a focus on synergy and integration between criteria.

In order to evaluate the sustainability coverage of each of the tools, two analyses were conducted. First, sustainability coverage was assessed against the core list of important criteria for sustainable development, suggested by Sharifi and Murayama that was used in the outcomes evaluation. However, in order to correct for the revealed information that the framework of common criteria used in the outcomes evaluation does not equally cover all the components of sustainability, a second analysis is conducted. A second analysis of sustainability coverage compares the two selected NSA tools at the

criteria scale to the International Standards Organization's (ISO) newly released city indicators for service delivery and quality of life: ISO 37120.

Primary Analysis

The primary analysis of sustainability coverage compared the FSA Tool and the SCORE Tool to the core list of criteria for sustainable neighbourhood development used in the outcomes evaluation (Sharifi & Murayama, 2014b). This list includes 55 criteria overall. The list considers four pillars of sustainability: Environmental, Economic, Social and Institutional sustainability (Sharifi & Murayama, 2014b). 34 (62%) criteria are concerned with the Environment, 4 (7%) criteria are concerned with the Economy, 12 (22%) criteria are concerned with Society, and 5 (9%) criteria are concerned with institutional dimensions of neighbourhood sustainability. Evaluated against this set of core criteria, the FSA Tool and SCORE Tool received one point for each criterion they matched. This analysis is shown in Table 15. The purpose of this analysis is not to rate the SCORE Tool and the FSA Tool as 'good' or 'bad', but rather to identify gaps in the current assessment systems, providing detailed recommendations for the SCORE Tool around missing criteria. These gaps help us to identify the differences, commonalities, strengths, weaknesses, successes, and failures of NSA tools through cross-comparison of them.

Table 15 Sustainability Coverage Evaluated against Sharifi and Murayama Criteria

Ref.	Sharifi & Murayama Criteria	SCORE	FSA
En1	Heat Island	0	1
En2	Soil	1	1
En3	Location	0	1
En4	Ecological survey	0	0
En5	Ecological networks	1	0
En6	Earth's atmosphere	1	1
En7	Greenfield protection	1	1
En8	Floodplain avoidance	1	1
En9	Water bodies	1	0
En10	Biodiversity	1	0
En11	Energy efficiency	0	1
En12	Solar orientation	0	0

En13	Water efficiency	0	1
En14	Materials (origin, reuse, recycle)	1	1
En15	Waste management	1	0
En16	Transport assessment	1	1
En17	Public transportation	1	0
En18	Car clubs and car sharing	0	0
En19	Bicycle network and infrastructure	0	0
En20	Woonerfs	0	0
En21	Parking requirements	0	0
En22	Pedestrian network and infrastructure	1	0
En23	Housing-job proximity	0	0
En24	Density	1	0
En25	Connectivity	1	1
En26	Green buildings	1	0
En27	Expandable infrastructure	0	1
En28	Green infrastructure	1	1
En29	Flexible and multifunctional spaces	1	1
En30	Mixed-Use	1	0
En31	Disaster management and prevention	0	0
En32	Improving the wind environment	0	1
En33	Nuisance (noise, odour, light, etc.)	0	1
En34	Access to amenities	1	0
Ec1	Employment	1	1
Ec2	Investment	0	0
Ec3	Use of local resources	0	0
Ec4	Local food production	1	1
S1	Education	1	0
S2	Health	1	0
S3	Equity	1	0
S4	Diversity	1	1
S5	Affordable housing	1	1
S6	Security	1	1
S7	Heritage	1	1
S8	Culture	1	0
S9	Identity and distinctiveness	0	0
S10	Active frontages	0	0

S11	Civic spaces	0	0
S12	Universal design	0	0
I1	Outreach and involvement	1	1
I2	Transparency	0	0
I3	Local institutions	0	1
I4	Monitoring	0	0
I5	Innovation	0	0
Total Points:		30	24
Sustainability Coverage Score:		55%	44%

The overall points achieved, and breakdown of points are shown for each tool below.

The SCORE Tool: 30 points

Sustainability coverage score: 55%

- Environmental: 19/34 points (56%)
- Economic: 2/4 points (50%)
- Social: 8/12 points (67%)
- Institutional: 1/5 points (20%)

Against the Sharifi and Murayama list of important criteria for neighbourhood sustainability assessment, the SCORE Tool is missing the criteria listed in Table 16. Developers of the SCORE Tool may wish to consider inclusion of some of these criteria in future adaptations of the tool.

Table 16: SCORE Tool vs. Sharifi & Murayama: Missing Criteria

Ref.	**Sharifi & Murayama Criteria**
En1	Heat Island
En3	Location
En4	Ecological survey
En11	Energy efficiency
En12	Solar orientation
En13	Water efficiency
En18	Car clubs and car sharing
En19	Bicycle network and infrastructure

En20	Woonerfs
En21	Parking requirements
En23	Housing-job proximity
En27	Expandable infrastructure
En31	Disaster management and prevention
En32	Improving the wind environment
En33	Nuisance (noise, odour, light, etc.)
Ec2	Investment
Ec3	Use of local resources
S9	Identity and distinctiveness
S10	Active frontages
S11	Civic spaces
S12	Universal design
I2	Transparency
I3	Local institutions
I4	Monitoring
I5	Innovation

The FSA Tool: 24 points

Sustainability coverage score: 44%

- Environmental: 16/34 (47%)
- Economic: 2/4 (50%)
- Social: 4/12 (33%)
- Institutional: 2/5 (40%)

Against the Sharifi and Murayama list of important criteria for neighbourhood sustainability assessment, the FSA Tool is missing the criteria listed in Table 17. Developers of the FSA Tool may wish to consider inclusion of some of these criteria in future adaptations of the tool.

Table 17 FSA Tool vs. Sharifi & Murayama: Missing Criteria

Ref.	Sharifi & Murayama Criteria
En1	Heat Island
En2	Soil
En3	Location

En4	Ecological survey
En5	Ecological networks
En9	Water bodies
En10	Biodiversity
En12	Solar orientation
En15	Waste management
En17	Public transportation
En18	Car clubs and car sharing
En19	Bicycle network and infrastructure
En20	Woonerfs
En21	Parking requirements
En22	Pedestrian network and infrastructure
En23	Housing-job proximity
En24	Density
En26	Green buildings
En30	Mixed-Use
En31	Disaster management and prevention
En34	Access to amenities
Ec2	Investment
Ec3	Use of local resources
S1	Education
S2	Health
S3	Equity
S8	Culture
S9	Identity and distinctiveness
S10	Active frontages
S11	Civic spaces
S12	Universal design
I2	Transparency
I4	Monitoring
I5	Innovation

Neither the FSA Tool (44%) nor the SCORE Tool (55%) score highly against the list of important criteria for sustainable development outlined by authors Sharifi and Murayama (2014). However, this analysis is subject to the same limitations of the common framework that are identified in the outcomes evaluation limitations section:

that the framework of common criteria used in the outcomes evaluation does not adequately cover all the components of sustainability.

This analysis is useful for highlighting the strengths and weaknesses between the two tools. The results of the preliminary analysis highlight:

1. The SCORE Tool receives its highest overall score in coverage of social sustainability, while this is the weakest area of the FSA Tool.
2. Both tools score quite poorly in institutional dimensions of neighbourhood sustainability. The FSA achieves a higher score in institutional sustainability by considering local governance institutions, while the SCORE Tool does not. Neither tool identified transparency, monitoring or institutional innovation as important criteria for sustainable neighbourhood development.
3. It is perhaps a helpful distinction that the SCORE Tool is intended to measure sustainability, defined as a state of existence achieved when a neighbourhood scores satisfactorily evaluated against a framework of balanced community capital assets, whereas the FSA Tool is intended to measure sustainable development. This subtle distinction means that the FSA Tool has a bias towards process indicators, while the SCORE Tool uniquely measures outcomes.

Secondary Analysis

In order to strengthen the analysis of sustainability coverage in the two selected neighbourhood sustainability assessment systems, and correct for the revealed information that the framework of common criteria used in the outcomes evaluation does not equally cover all the components of sustainability, a second analysis is conducted. A second analysis of sustainability coverage compares the two selected NSA tools at the criteria scale to the International Standards Organization's (ISO) newly released city indicators for service delivery and quality of life: ISO 37120.

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). ISO 37120 provides a globally standardized set of definitions and methodologies to help enable cities to assess their performance and measure progress over time, and also to draw comparative lessons from other cities locally and globally (ISO, 2014). At the time of research, no standardized indicators for *neighbourhood* sustainability assessment had been

developed. ISO 37120's set of standardized *city* indicators is used in the analysis of sustainability coverage as a proxy for the most widely agreed upon set of urban sustainable development metrics.

The ISO 37120 is different in that it does not distinguish between sustainability criteria and themes – it only lists themes. However, many of the themes match up identically at the criteria scale to each of the selected NSA tools. For this reason, each of the selected NSA tools is evaluated against the set of themes belonging to the ISO 37120. In total, the ISO 37120 contains 17 themes. Evaluated against the ISO 37120 list of themes, the FSA Tool and SCORE Tool received one point for each criterion they matched (a max of 17 points). This analysis is shown in Table 18.

Table 18 Sustainability Coverage Evaluated against ISO Themes

ISO	SCORE	FSA
Economy	1	1
Education	1	0
Energy	0	1
Environment	1	1
Finance	0	0
Fire and Emergency Response	0	0
Governance	1	1
Health	1	0
Recreation	1	0
Safety	1	1
Shelter	1	1
Solid waste	1	1
Telecommunications and Innovation	1	0
Transportation	1	1
Urban planning	1	1
Wastewater	0	0
Water and Sanitation	1	0
Total:	13	10
Sustainability coverage score:	76%	59%

The overall points achieved are shown for each tool below. The sustainability distribution of these points is not analyzed in this case, because the ISO 37120 does not organize its 'themes' in a sustainability framework.

The SCORE Tool: 13 points

Sustainability coverage score: 76%

In this case, the SCORE Tool is missing criteria rated to Energy, Finance, Fire and Emergency Responses, and Wastewater. These are missing criteria, which the developers of the SCORE Tool may wish to consider including in future adaptations of the tool.

The FSA Tool: 10 points

Sustainability coverage score: 59%

The FSA Tool is missing criteria rated to Education, Finance, Fire and Emergency Responses, Healthy, Recreation, Telecommunications and Innovation, Wastewater and Water and Sanitation. These are missing criteria, which the developers of the FSA Tool may wish to consider including in future adaptations of the tool.

In this analysis, the SCORE Tool receives a higher sustainability coverage score (76%) than the FSA Tool (59%). The results of the secondary analysis make some interesting observations about the two selected NSA tools, as well as the ISO 37120 itself:

1. The SCORE Tool loses points due to its omission of energy consumption and water consumption criteria. It is important here to note that these criteria were originally intended to be included as part of the tool, but due to data availability were omitted.
2. The FSA Tool loses points due to its omission of health and education criteria.
3. Neither tool reports on fire and emergency response, finance, recreation or wastewater.
4. There were several criteria belonging to either the SCORE Tool, FSA Tool or both of the selected NSA tools, that were not included in the ISO 37120, these included: soil, water, measures of connectivity and density, equity, heritage and culture. It is particularly interesting that the ISO 37120 does not consider soil or water quality within cities to be relevant for measurement.

Inclusion of pre-requisites

The inclusion of pre-requisites is concerned with whether there are strategies to assure the achievement of a certain level of performance (Sharifi & Murayama, 2013). This characteristic is included in the framework for analysis because the inclusion of criteria in NSA tools does not necessarily mean that a development will comply with them. This has been identified as a major criticism of the LEED ND and other spin-off building assessment tools (Garde, 2009; Sharifi & Murayama, 2013).

In the cases of both the SCORE Tool and the FSA Tool, 100% of indicators and criteria are mandatory. In the pilot assessments this meant that in some cases, even

where data was not available, an answer was required. This led to guestimation in the FSA Tool, according to one member of the climate case-study team. In the SCORE Tool, in some cases where data was unavailable at the neighbourhood scale, a wider area was used as a proxy for study area performance. However, both tools maintain that having a no-exclusion policy for criteria and indicators makes the tools more rigorous and agnostic. It is unique that in both cases 100% of indicators and criteria are mandatory in these frameworks. Many of the well-known NSA tools including LEED-ND, BREEAM Communities, and CASBEE-UD, and the ISO 37120 standardized indicators for sustainable cities and quality of life include both core and supporting indicators.

Adaptation to locality

Adaptation to locality refers to the practice of customization of NSA tools. This characteristic attempts to determine if the tools have considered the context-specific needs and priorities in their assessments (Sharifi & Murayama, 2013). The SCORE Tool and the FSA Tool respond to local context through two unique approaches:

1. Through qualification of results

While the SCORE Tool's criteria and indicators are firm and mandatory, the tool makes a qualitative link to the sustainability priorities of the study site through the presentation of its results. For example, where the living wage indicator in the SCORE Tool yielded a very low result, the presentation of results sought to explain further why the high proportion of students living in the neighbourhood might have negatively impacted this indicator.

The FSA Tool pilot at UniverCity did not have a rigorous methodology to account for adaptation to locality. However, the reporting format does allow for an opportunity to discuss the most important parts of the tool, based on local context. In practice, this means the spider diagrams that the FSA Tool produces are 'agnostic' towards the most pressing local issues, but the analysis of the results responds to local context. This is exemplified in the *Best Practices* section of the assessment results (FSA, 2013).

In conclusion, while both tools use diagrams to quickly explain sustainability assessment scores, they both also find it necessary to tell a story about what these

diagrams mean in the local context. This suggests that while diagrams provide a good summary of information, they are not necessarily accessible as learning tools without some methodological explanation and qualitative analysis.

2. Through scoring of indicators

The SCORE Tool at the outset intended to evaluate the sustainability performance of neighbourhoods against international standards and targets wherever possible. In practice, there are few widely agreed upon targets for neighbourhood sustainability assessment indicators. Instead, the tool uses a method of local benchmarking to regional context to describe the sustainability performance of the UniverCity neighbourhood. Local benchmarking, termed 'relational norms' in the assessment report and described in detail in section 2.2.4, is used for 21% of the indicators for the SCORE Tool. The SCORE Tool also added three unique indicators, with the intent of measuring the express sustainability objectives of UniverCity. These were ethnic composition, investment in public art projects, and resident satisfaction.

The FSA Tool scoring of indicators was predominantly qualitative, wherein case study teams made up of neighbourhood residents, community stakeholders and academic partners brought a high degree of local knowledge to evaluation. In cases where no report or geospatial data was found within the given time frame of data collection, scoring was estimated based on anecdotal accounts from developers, residents and other stakeholders.

The FSA Tool approach to scoring indicators demonstrates a bottom up approach to adapting to local context. However, it also compromises the legitimacy of the FSA Tool as a decision support system in planning practice. The SCORE Tool approach, evaluating performance using relational norms based on local datasets, is a more rigorous method of adapting to local context.

Scoring and weighting

Scoring and weighting refers to the methods that are used by NSA tools to score and weigh different criteria (Sharifi & Murayama 2013). Scoring and weighting of NSA tools is often subjective and implicit to theoretical construct (Garde, 2009; Retzlaff, 2009;

Vakili-Ardebili and Boussabaine, 2007). This has made the practice vulnerable to ambiguity (Kajikawa et al., 2011), impeding the development of widely agreed upon methods of sustainability assessment.

Both the SCORE Tool and the FSA Tool conduct scoring by setting targets and thresholds. The SCORE Tool can interpret values based on any unit of analysis selected by the user. The thresholds, or norms, which the value is scored against, must be framed as the same unit of analysis. For example, if the value is an index which can range from -2 to +2, the thresholds must be points within this range: -2, -1, 0, +1, +2. Indicator ratings are always translated into a score out of 100% when aggregated at the criteria (stock) scale. The FSA Tool also sets targets and thresholds, although more frequently using a type of checklist. For example, the development achieves 5/6 possible points, with thresholds at 0, 1.5, 3, 4,5, 6. The FSA Tool similarly translates the rating into a score out of 100% when aggregated at the criteria scale.

While the SCORE Tool only integrates subjective data gathered through statistically valid surveying, the FSA Tool invites the case-study team to determine qualitative ratings for several indicators for which data is not available. This process is also iterative - preliminary scores are given to supervising partners who are asked to review and enhance the data.

Neither tool uses weighting. This was criticized in the feedback from FSA case-study team members because the tool does not distinguish between any of the criteria as more important than another. The FSA Tool does not deliver a set of priority actions to support decision makers. Therefore a completed action that likely cannot change, like preservation of farmland can receive equal importance to something that surely can change such as the efficiency of water and energy use through the construction of new green buildings and infrastructure.

Participation

Participation is concerned with the level of community involvement in the assessment process. Sharifi and Murayama (2013) outline three main stages in which citizens can engage in the development of NSA tools:

1. At the stage of defining criteria
2. During the weighting of criteria
3. By providing feedback

Neither the SCORE Tool nor the FSA Tool involve community in defining or weighting criteria. They do seek community input in the scoring of indicators.

The SCORE Tool uses the GNH Index survey in order to gather subjective, quantitative data on indicators of health, community cohesion, and well-being. These personal assessments are important indicators of social and human capital at the neighbourhood scale. The combination of subjective and objective indicators in the SCORE Tool results in a more holistic assessment of neighbourhood sustainability and well-being. Invitations to participate in the GNH Index survey were sent to the homes of every neighbourhood resident. The survey was accessed via a link hosted on SFU Community Trust's website. Residents who responded to the survey were a self-selecting sample and results were anonymous.

The FSA Tool uses community involvement to score indicators by engaging residents as participants in the case-study team. This method involves greater participation across the whole tool, but solicits fewer participants overall (2 residents participated in the case-study team) than the SCORE Tool (99 neighbourhood residents responded to the statistically valid GNH Index survey).

Participation, in terms of community involvement in scoring indicators, was wider with the SCORE Tool, and deeper with the FSA Tool. These two approaches to gathering community input are very different, so it is difficult to compare the two. However, it is evident that the FSA case study team approach did not achieve enough input from community stakeholders (only 2 residents participated) to be statistically relevant, whereas the SCORE Tool survey worked surprisingly well in its pilot assessment.

Presentation of Results

The presentation of assessment results is the gateway to learning from monitoring and evaluation practices. How NSA tools report the results of assessment are

directly related to what extent are they useful as decision support systems (Sharifi & Murayama, 2013). A sustainability report should provide a balanced and reasonable representation of the sustainability of the neighbourhood, including both positive and negative contributions (GRI, 2011).

The SCORE Tool assessment results are processed into pie chart diagrams at the stock and capital scales, and summarized in an overview diagram labeled the 'sustainability hexagon'. Each capital receives a composite score, as does each stock. At the capital level, diagrams are accompanied by summary table of stocks and indicators that highlight strengths and weaknesses of the neighbourhood in qualitative terms, helping to tell a more granular story about the results. At the stock level, a short explanation of targets and thresholds is given for each of the indicators.

The FSA Tool assessment results are processed into a spider diagram. This diagram articulates sustainability issues within the development. The assessment diagram is complemented by bar graphs that demonstrate scores in each criteria of the framework. The assessment results can be complemented with an 'ambition-score' - a key aspect in defining how to improve the development's sustainability performance (FSA, 2013). A qualitative explanation of best practices within the community with specific examples of sustainability initiatives is presented along with the findings.

Both tools are drawn to the spider-like presentation format because of the ease of comparability. When assessments are conducted in several neighbourhoods, the results can be superimposed to quickly demonstrate strengths and weaknesses. However, both tools found it necessary in their presentation format to tell a story about their results: to give background on the development, and to highlight strengths and weaknesses, or in the case of the FSA Tool, best practices and recommendations. This finding resonates with anecdotal feedback on the tools that the diagrams alone do not help users to define priorities, and thus they must be accompanied by some qualifying statements.

Applicability: Potential for Use in Decision Support

Applicability of NSA tools is concerned with their usefulness as decision support systems. In order for NSA tools to be useful decision support systems they must present reliable and comparable results, contextualize the results, and make it clear where to improve. SFU Community Trust Director of Development, Dale Mikkelsen, was interviewed to provide input on the applicability of the FSA and SCORE tool results.

When research funding was granted for the SCORE Tool pilot at UniverCity, part of the goal was to prove a reliable and comparable neighbourhood sustainability assessment system. Dale Mikkelsen had concerns about the compact assessment of the FSA Tool (one day delivery), as well as subjectivity in scoring practices. Dale did not consider the results of the FSA Tool rigorous enough to support planning decisions at UniverCity. However, UniverCity saw the benefit of an NSA tool such as the FSA Tool, with a broad coverage of sustainability issues facing urban communities, that is, not simply focused on environmental assessment, but which takes a holistic community development approach.

Following their commitment to research and education, SFU Community Trust participated in the pilot SCORE Tool assessment in order to support development of a reliable and comparable neighbourhood sustainability assessment system. Dale Mikkelsen's response to the completed assessment was that the SCORE Tool has a lot of potential, and that it is the best NSA tool he has seen in terms of taking a systems perspective to evaluate sustainable community development. However, he did not like the integration of local benchmarks, or relational norms, in order to account for sustainability assessment. Ultimately, Mikkelsen felt that the SCORE Tool was only comparable to itself, because it does not rely on internationally recognized targets for neighbourhood sustainability assessment.

The reliability and comparability of assessment results is directly linked to the data available at the neighbourhood scale to answer meaningful criteria and indicators of sustainable neighbourhood development. Ultimately, the compact assessment methodology of the FSA Tool produced unreliable results caused by guestimation in instances of limited data availability. The SCORE Tool assessment results - based on

primarily quantitative, readily available statistical data and/or geospatial data coupled with statistically valid survey - are more rigorous, however, the tool will require further refinement and repeated applications in order to build a case for comparability.

Chapter 4. Findings

4.1. Scope

This chapter summarizes the findings of Chapter 2: SCORE Tool UniverCity Assessment and Chapter 3: Comparative Analysis, and sets the stage for Chapter 5: Conclusions and Next Steps.

4.2. Chapter 2 Findings

Chapter 2 piloted a new neighbourhood sustainability assessment (NSA) tool, the Sustainable Communities Rating (SCORE) Tool, under development at the Centre for Sustainable Community Development (CSCD) at Simon Fraser University (SFU), in the UniverCity neighbourhood, of Burnaby, BC, Canada. The objectives of the pilot assessment were to:

- prove the concept for the SCORE Tool to measure sustainability outcomes against a six capital framework;
- refine an indicator set that is broadly comparable across neighbourhoods;
- define to what extent it is possible and useful to measure sustainability outcomes at a neighbourhood scale; and
- determine whether there are substantial gaps between what we want to measure, and what data is available.

This section will discuss how the SCORE Tool worked in its inaugural application and comment on the fulfillment of pilot objectives. The SCORE Tool pilot assessment at UniverCity was highly exploratory. Findings are organized in terms of strengths and weaknesses of the pilot assessment. For each category of findings, I give the pilot assessment a rating of excellent, good, satisfactory or poor. Improvements should be sought in each category regardless of rating, as this is a pilot assessment. This rating

system will simply help to prioritize research for future adaptations of the tool. Based on this analysis, a list of specific recommendations for future researchers working on the SCORE Tool are included as Appendix B.

4.2.1. Strengths

Data Availability

The pilot assessment began, perhaps a bit naively, without a clear sense of whether data would be available at the neighbourhood scale. For the purpose of the UniverCity assessment, neighbourhood boundaries were ideally defined by the UniverCity development area boundary (see Figure 4). As it turned out, the 2011 National Housing Survey (NHS) was available by Dissemination Area (DA), and DA 3695 proved to be a good proxy for the UniverCity development area boundary (see Figure 5). Data collected by the NHS, as well as Gross National Happiness Index survey data, and all data provided by the SFU Community Trust was available at the neighbourhood scale. The full list of indicators, with their scale of data availability is noted in Table 19. In total, 51 (77%) indicators were answered at the neighbourhood scale. 7 (11%) indicators were answered at the city scale: these primarily consisted of health and economic statistics, and city services such as waste collection. In the pilot assessment we learned from the Fraser Health Authority that health data, specifically, is not statistically valid and thus not reported at the neighbourhood scale. 7 (11%) indicators were available at scales in between the neighbourhood and city scale: these included voting districts, police community districts, and historic neighbourhood districts. 1 (2%) indicator was answered at a scale larger than city, which was the Air Quality Health Index. Overall, given that 77% of indicators were answered at the neighbourhood scale, I would rate the data availability in the pilot assessment as 'excellent'. Nonetheless, more research is needed in order to determine whether data at varying scales (see Figure 8) is a reliable or valid way of representing performance of a neighbourhood.

Table 19 Scale of Data Availability

Stock	Indicator	Scale
1. Natural Capital		
1.1 Air	1.1.1 Air quality	Larger than City
1.2 Soil	1.2.1 Contaminated sites	Neighbourhood
	1.2.2 Farmland preserved	Neighbourhood
	1.2.3 Growing Space	Neighbourhood
1.3 Water	1.3.1 Water availability	Neighbourhood
	1.3.2 Surface water quality	Neighbourhood
1.4 Biodiversity	1.4.1 Habitat preservation	Neighbourhood
	1.4.2 Native plant preservation	Neighbourhood
	1.4.3 Tree canopy cover	Neighbourhood
2. Physical Capital		
2.1 Land Use	2.1.1 Floodplain avoidance	Neighbourhood
	2.1.2 Mix of use	Neighbourhood
	2.1.3 Compact development	Neighbourhood
	2.1.4 Population density	Neighbourhood
2.2 Built Environment	2.2.1 Access to public space	Neighbourhood
	2.2.2 Quantity of residential building stock	Neighbourhood
	2.2.3 Quality of residential building stock	Neighbourhood
	2.2.4 Green residential building stock	Neighbourhood
2.3 Infrastructure	2.3.1 Access to energy	Neighbourhood
	2.3.2 Access to clean potable water	Neighbourhood
	2.3.3 Access to safe sanitation	Neighbourhood
	2.3.4 Access to reliable communications	Neighbourhood
	2.3.5 Stormwater management: volume of runoff	Neighbourhood
	2.3.6 Stormwater management: peak flows	Neighbourhood
2.4 Transportation Systems	2.4.1 Access to transit	Neighbourhood
	2.4.2 Modal split	Neighbourhood
2.5 Materials and Waste	2.5.1 Access to waste management systems	Neighbourhood
	2.5.2 Waste diversion rate	City
	2.5.3 Waste disposal rate	City
3. Economic Capital		
3.1 Labour	3.1.1 Unemployment rate	Neighbourhood
	3.1.2 Dependency on the safety net	City
	3.1.3 Age composition of the labour force	Neighbourhood

3.2 Households	3.2.1 Living wage	Neighbourhood
3.3 Business	3.3.1 Incorporations	Between
	3.3.2 Bankruptcies	City
	3.3.3 Local ownership	Neighbourhood
4. Human Capital		
4.1 Education	4.1.1 Access to primary education	Neighbourhood
	4.1.2 High school completion	Neighbourhood
	4.1.3 University attainment	Neighbourhood
4.2 Health	4.2.1 Access to GP	City
	4.2.2 Composite Health Index	City
	4.2.3 Health practices	City
	4.2.4 Perceptions of physical health	Neighbourhood
	4.2.5 Perceptions of environment	Neighbourhood
	4.2.6 Time balance	Neighbourhood
4.3 Well-being	4.3.1 Life satisfaction	Neighbourhood
	4.3.2 Positive-negative experience	Neighbourhood
	4.3.3 Material well-being	Neighbourhood
	4.3.4 Mental well-being	Neighbourhood
5. Social Capital		
5.1 Citizenship	5.1.1 Voter participation	Between
	5.1.2 Confidence in government	Neighbourhood
5.2 Community Cohesion	5.2.1 Social support	Neighbourhood
	5.2.2 Social cohesion	Neighbourhood
5.3 Safety	5.3.1 Traffic accidents	Neighbourhood
	5.3.2 Break & Enter	Between
	5.3.3 Auto crime	Between
	5.3.4 Robbery	Between
5.5 Housing	5.4.1 Core housing need	Neighbourhood
	5.4.2 Rental vacancy rates	Between
	5.4.3 Shelter-cost-to-income ratio	Neighbourhood
	5.4.4 Resident turnover	Neighbourhood
	5.4.5 Resident satisfaction	Neighbourhood
6. Cultural Capital		
6.1 Cultural Vitality	6.1.1 Cultural access	Neighbourhood
	6.1.2 Public Programing	Neighbourhood

6.2 Diversity	6.2.1 Ethnic diversity	Neighbourhood
6.3 Built Cultural Heritage	6.3.1 Public art	Neighbourhood
	6.3.2 Registered heritage sites	Between

Data Quality

The SCORE Tool gathers primarily quantitative, readily available, statistical and/or geospatial data coupled with statistically valid survey information such as the Gross National Happiness (GNH) Index. In order for the assessment to be effective and useful, quality data must be collected. ISO 9000 defines quality data as the degree to which a set of characteristics of data fulfills requirements. Characteristics of quality data may be, for example, completeness, validity, accuracy, consistency, availability and timeliness. In order for data to fulfill the requirements of the SCORE Tool, it must be characterized as valid, timely, and comparable.

Validity

In order to be considered valid, data is ideally collected by a government or central agency. The SCORE Tool uses data from various levels of government: federal (Environment Canada), provincial (Ministry of Human Development and Social Innovation), and municipal (City of Burnaby Planning Department), as well as agencies such as CMHC, ICBC and Census Canada. The SCORE Tool also incorporates Walk Score data, which has recently been validated as a global estimate of neighbourhood walkability (Carr, Dunsiger & Marcus, 2010). Finally, the GNH Index survey, which collected prime data from neighbourhood residents, reached a statistically relevant sample size. Overall I would rate the data reliability in the pilot assessment as ‘excellent’.

Timeliness

Data collected from various levels of government generally used 2013 as a reference year. Census data was gathered from the most recent National Housing Survey: 2011. The GNH Index survey data reflects resident opinions in the summer of 2014. In a few cases, 2012 data or earlier (i.e. 2009 for the indicator ‘Incorporations’) was used: mostly in the economic indicators. Further research is needed to enhance

economic indicators and find more reliable and more recent data for this section. Overall I would rate the timeliness of the data in the pilot assessment as 'excellent'.

Comparable

Since the majority of quantitative data was collected from primarily quantitative, readily available, statistical and/or geospatial datasets, with implementation of the same GNH Index survey, this tool is broadly comparable across neighbourhoods in BC. It should be noted that the indicators of the stocks: Water, Biodiversity, and Infrastructure (Stormwater Management) were answered with privately contracted environmental monitoring reports that would not exist in neighbourhoods other than UniverCity. As it stands, 56 (85%) indicators are directly comparable to another neighbourhood in BC. 10 (15%) indicators would likely need some reframing in order to be comparable. Some basic GIS analysis and permission to access aggregated hydro data are needed in order to answer the remaining indicators. Overall I would rate the data comparability in the pilot assessment as 'excellent'.

Survey

The GNH Index survey was developed by the Happiness Alliance, a spin-off of the non-profit organization Sustainable Seattle, based in Seattle, WA. The GNH Index survey method takes a non-monetary multidimensional approach that measures satisfaction and advancements across various life domains (Happiness Alliance, 2014). It was incorporated into the SCORE Tool in order to quantify subjective personal assessments of indicators of social, human and cultural capital. This subjective survey data is intended to compliment the objective data that can reasonably be gathered about ecosystem health, community services and green building performance. The SCORE Tool assessment set a target 2% response rate for the opt-in, self-selecting survey, based on the target set by the Fraser Health Authority *My Community My Health* survey. The number of responses necessary to reach statistical relevance for the UniverCity community was 68. The GNH Index survey was answered by 99 members of the UniverCity community. The success of the survey suggests that a 'happiness' survey is a good hook to engage residents in the assessment process. The prize of a $100 gift certificate to a neighbourhood grocery store was likely enticing as well. Laura Musikanski

of Happiness Alliance was easy to work with, and their analysts provided the aggregated and anonymized results upon request in a timely and effective manner. The one drawback of the survey was that we had to have residents consent to two different ethics approval forms, because of the lateral nature of the information sharing agreement. However, we only had 2 people drop out of the survey, resulting in an extremely low attrition rate of 2%. Overall I would rate the success of the survey in the pilot assessment as 'excellent'.

Partnership development

The SCORE Tool is eventually intended to be part of a suite of consulting tools for measuring the effects of sustainability plans, policies and programs. In order to achieve this standard, the SCORE Tool must undergo peer- and expert- review of: the indicator set, the scoring of indicators (including chosen targets and thresholds), and further development of its user experience (UX) interface. The pilot was successful in partnership development in two ways: first, by developing institutional partners and a network of contacts who might help with data collection in future assessments (if in BC) and second, by identifying institutional partners who are interested enough in the SCORE Tool to potentially collaborate, suggesting a possible angle on future funding. The Fraser Health Authority was notably interested in the project, as were UniverCity parcel developer Polygon Homes. The SFU Community Trust has also expressed continued interest in developing the SCORE Tool. While we were unable to access aggregated energy use data from Fortis and Hydro BC in the pilot assessment, we did manage to make contact with the appropriate personnel at these agencies and lay the foundation for this data collection in future assessments. Overall, I would rate the success of partnership development in the pilot assessment as 'excellent'.

4.2.2. Weaknesses

Scoring Indicators

Sustainability indicators are comprised of two components – the concept (description) and metrics (how performance for the indicator is measured) (Kellett et al., 2009). The SCORE Tool scores indicators against a scale that contains four colour-

coded thresholds: green, gold, orange, and red. Scoring indicators is a challenge in sustainability assessment because we do not have a widely agreed upon set of targets and thresholds against which to evaluate neighbourhood performance. The pilot assessment of the SCORE Tool at UniverCity sought to develop a methodology and a framework for scoring indicators, but the solutions proposed should still be considered under development. Four suggested methods of determining thresholds are outlined in the section 2.2.4. Among these, the relational norms method of determining thresholds for scoring indicators (Method 4) makes a scientific argument for establishing thresholds, as well as makes the tool adaptable to local context. However, for each of the indicators, the target should be based on a clearly defined international standard for sustainable urbanization. While the method of establishing relational norms is innovative and rigorous, overall I would rate the data scoring in the pilot assessment as 'poor'.

Access to Data

The biggest weakness of the UniverCity assessment as it stands is the omission of energy and water use data, and consequently a measure of GHG emissions. Privacy and technological concerns limit access to data at the building scale. In order for the SCORE Tool to deliver a more comprehensive assessment of sustainability outcomes at the neighbourhood scale, we need data sharing agreements, especially to get energy data from BC Hydro and Fortis. Also, the Net Tax Base/Debt-Service Ratio indicator was removed due to data unavailability.

Access to data at the appropriate scale was also a challenge. For many indicators including Bankruptcies, Incorporations, Dependency on the Safety Net, as well as Waste and Materials and Safety indicators, larger areas than the neighbourhood cannot represent performance of a neighbourhood in a reliable or valid way. Overall I would rate the access to data in the pilot assessment as 'satisfactory'.

Gaps

In addition to missing indicators of energy consumption, water use data and debt-service ratio due to data availability, several gaps were identified in the pilot assessment that might be considered for future adaptations of the tool. These include, some measure of placemaking, and the capacity and quality of public cultural knowledge

sector. The economic capital indicators should also be reviewed for their scale of analysis and compared against broad based research on community economic development indicators for neighbourhoods.

Presentation of Results

One major finding of the pilot assessment is that the assessment results, translated into diagrams at various scales: stock, capital, overview, are not easy for users to interpret. Primarily, the flow of the different levels and their nestedness is not easy understood. Before any future assessments take place, the SCORE Tool should undergo a user experience/design review. Informational graphics would also help to teach users about the tool. In addition, the diagrams are not self-explanatory. A qualitative discussion of each stock is needed to accompany the diagrams. Overall I would rate the presentation of results in the pilot assessment as 'satisfactory'.

4.3. Chapter 3 Findings

Chapter 3 conducted a comparative analysis of the FSA Tool with the SCORE Tool in order to learn from this unique Canadian application of new and different neighbourhood sustainability assessment (NSA) tools in the UniverCity neighbourhood in Burnaby, BC, Canada. The comparative analysis was divided into two broad categories: an outcomes evaluation and a process evaluation. The goal of the outcomes evaluation was to either provide some triangulation of the assessment results or highlight ambiguities in the data. The goal of the process evaluation was to discuss each of the tools in detail with respect to their methodology and application to learn from different approaches to sustainability assessment. Research findings are organized in terms of the outcomes evaluation and process evaluation in the following pages.

4.3.1. Outcomes Evaluation

In order to compare the outcomes of the NSA tools applied at UniverCity, it was necessary to design a common framework for use as a basis for comparison. Since NSA tools are built upon themes, criteria, indicators and thresholds, it was also necessary to

choose a common scale of reporting for pairwise analysis. The FSA Tool and the SCORE Tool results were compared at the criteria scale to a list of core criteria for neighbourhood sustainability assessment suggested by Sharifi and Murayama in the paper: “Viability of using global standards for neighbourhood sustainability assessment: insights from a comparative case study” (Sharifi & Murayama, 2014b). At the criteria scale, both the FSA Tool and the SCORE Tool present their results as a percentage, and so it is possible to compare the outcomes of the two tools at this scale to determine if their results support each other.

Comparing the two selected NSA tools against a common framework, the results of the pairwise analysis showed:

1. The SCORE and FSA Tools only hold 17/62 (27%) criteria in common, thus they are not directly comparable at the criteria scale. The analysis suggests that it may be more appropriate to compare the two tools at the indicator scale, but indicator level data was not available for the FSA Tool.
2. Of those 17 criteria in common, the results were more different 11 (65%) > 6 (35%) than similar.
3. Only 2 (12% of common criteria; 3% overall) criteria demonstrated very similar results (+/-10%). The results of SCORE and FSA assessments, therefore, do not support each other.

From this analysis we learned that the results of the FSA Tool and the SCORE Tool assessments at UniverCity do not support each other, so we cannot confirm the assessment results for either tool using this analysis. However, as stated in the introductory paragraph, stark differences in the assessment results may highlight weaknesses or ambiguities in assessment methods. The outcomes evaluation makes an important observation about our common understanding of criteria for neighbourhood sustainability assessment. That is, that there is a lack of understanding about the definitions and components of themes, criteria, indicators and thresholds. In sustainability assessment literature, indicators have been the primary focus of research and development. We are fairly clear on what an indicator is, and what are its components. However, there has been less emphasis on how to organize and aggregate indicators within multi-criteria frameworks (under criteria, themes, etc.) for sustainability assessment. Also, the outcomes evaluation revealed that the organization of themes, criteria, indicators and thresholds is determined by the developer of the tool, and

generally reflects a practice of building assessment, environmental assessment, or community development. Comparing tools with differing theoretical foundations proves to be challenging, because the arrangement of sustainability indicators even within common criteria tends to differ. Consequently, this analysis finds that assessment tools may only directly be comparable for outcomes evaluation at their most granular level: the indicator scale.

In conclusion, this analysis underscores the need for a clearly defined methodology and organizing framework for applying sustainability indicators in neighbourhood sustainability assessment. With consensus on standardized reporting strategies for neighbourhood sustainability assessment, multi-criteria frameworks can be used to conduct in-depth evaluations on the success of policies, regulations and programs in achieving sustainability. These NSA tools will help us to translate our sustainable development aspirations into achievable actions by supporting evidence-based policy making, and also by promoting social learning and knowledge exchange.

4.3.2. Process Evaluation

The process evaluation of the FSA Tool and SCORE Tool assessments at UniverCity is intended to expose the methodologies and applications of both tools in order to learn how to improve upon the SCORE Tool in future assessments. The results of the process evaluation are organized by the 'seven characteristics of NSA tools', a framework suggested by Sharifi and Murayama in an earlier paper "A critical review of seven selected neighborhood sustainability assessment tools" (Sharifi & Murayama, 2013). The seven characteristics of NSA tools are: sustainability coverage, inclusion of pre-requisites, adaptation to locality, scoring and weighting, participation, presentation of results, and applicability.

The analysis conducted an in-depth look at sustainability coverage of both tools, by examining the inclusion of criteria against the list of important criteria for NSA tools used for the outcomes evaluation, as well as the International Organization for Standardization's (ISO) new standardized indicators for sustainable cities and quality of life: ISO 37120. Against the Sharifi and Murayama list of criteria neither the FSA Tool

(44%) nor the SCORE Tool (55%) score highly. However, this analysis is subject to the same limitations of the common framework that are identified in the outcomes evaluation limitations section: that the framework of common criteria used in the outcomes evaluation does not adequately cover all the components of sustainability. In a second analysis against the ISO 37120 themes, both the SCORE Tool (76%) and FSA Tool (59%) do better. In both cases, the SCORE Tool achieves a higher sustainability coverage score than the FSA Tool. This is mainly due to the FSA Tool's omission of health, education and other socio-economic criteria. However, this analysis of sustainability coverage made several observations about the strengths and weaknesses of the SCORE Tool, which are useful for future adaptations of the tool. These are:

1. Strong coverage of social sustainability. Comprehensiveness of tool is a unique angle for funding and future applications.
2. Poor coverage of institutional dimensions of neighbourhood sustainability e.g. civic institutions, transparency, monitoring, institutional innovation, etc.
3. The SCORE Tool needs to find a way to include energy and water consumption measures (information sharing agreements). A measure of job/housing connectivity or distance to workplace is also included in other frameworks that is notably missing from the SCORE Tool.
4. The SCORE Tool might consider reporting on the ISO 37120 themes: fire and emergency response, finance, recreation, and wastewater.
5. Interestingly, the ISO 37120 does not cover soil or water quality within cities. Possibly consider omitting from the SCORE Tool.

Overall, there is a lot of value delivered by the SCORE Tool in terms of sustainability coverage owing to its multi-criteria organizing framework and theoretical foundation in sustainable community development. The SCORE Tool is also notably more comprehensive than the ISO 37120, for example, the ISO 37120 does not include criteria for measures of connectivity and density, equity, heritage, community cohesion and culture. The sustainability coverage of the SCORE Tool scores fairly well (76%) against the ISO 37120, and could be improved significantly if the above recommendations are considered, especially building out the institutional sustainability criteria, and addressing the resource efficiency/use indicators.

Other innovations surfaced by the process evaluation respond to the inclusion of pre-requisites, adaptation to locality, scoring and weighting, participation, presentation of results, and applicability:

1. Both tools include all indicators as pre-requisites, this ensures that the results are comparable across neighbourhoods and adds a degree of rigour to the assessment methodology. While no omissions were permitted in the UniverCity assessments, some indicators were custom added. This may be allowable in future assessments to increase adaptation to locality.
2. Scoring must be defensible and pegged to globally standardized targets. The *relative norms* method outlined in section 2.2.4 may be a good starting point for this work. Using relative norms for valuation of sustainability indicators also helps to place the assessment in local context.
3. Both tools tell a story about their results as a complement to the diagrams, with an emphasis on local priorities. The diagrams by themselves are not easily interpreted, and do not help decision makers to prioritize actions.
4. The GNH Index survey was a successful engagement technique, considering the technocratic or top-down bias of the SCORE Tool. It is recommended that some sort of a happiness survey be included in future assessments.

Chapter 5.

Conclusions and Next Steps

Over half of the world's population currently lives in cities and that number is predicted to increase to 70% by 2050 (EIU, 2012). With 60% of their area still to be built before 2030, the role of cities in proactively guiding sustainable global resource use is more important than ever (Roseland, 2013). In this age of urbanization, sustainability assessment tools are used to evaluate the success of our plans, policies and regulations for achieving sustainability in practice. These tools can help us to translate our sustainable development aspirations into achievable actions for the urban context by supporting evidence-based policy making, and also by promoting social learning and knowledge exchange (Joss, 2012; ISO, 2014).

One assumption of this paper is that the neighbourhood is a useful scale of analysis for sustainability assessment. In the last five years, there has been a resurgence of interest in sustainability frameworks at the neighbourhood or community scale, with some 36 new frameworks developed in that period (Joss et al., 2011). At the same time, neighbourhood-scale planning has become a focus of Canadian efforts nationally, with the Federation of Canadian Municipalities focusing Green Municipal Fund resources at that scale and many municipalities finding it a useful scale at which to plan, deliver programs, and engage with citizens (FCM, 2013). The intersection of these two trends is the application of tools that assess how sustainable neighbourhoods are or are expected to be.

5.1. Scope

This paper conducts and discusses the pilot of a neighbourhood sustainability assessment (NSA) tool – the Sustainable Communities Rating Tool (SCORE Tool) -

under development at the Centre for Sustainable Community Development (CSCD) at Simon Fraser University in the UniverCity neighbourhood development in Burnaby, BC, Canada. The pilot assessment was funded by SFU Community Trust and MITACS, and was conducted between June and November 2014. The objectives of the pilot assessment were to:

- prove the concept for the SCORE Tool to measure sustainability outcomes against a six capital framework;
- refine an indicator set that is broadly comparable across neighbourhoods;
- define to what extent it is possible and useful to measure sustainability outcomes at a neighbourhood scale; and
- determine whether there are substantial gaps between what we want to measure, and what data is available.

Chapter 1 of this paper introduced sustainable community development, sustainability assessment principles, popular NSA tools, and introduced the study site, UniverCity. Chapter 2 provides an in-depth explanation of the SCORE Tool, the UniverCity assessment methodology and results. Chapter 3 performed a comparative analysis of two neighbourhood sustainability assessment systems applied in the UniverCity community. The two assessment systems subjected to comparative analysis were the SCORE Tool and the Dutch Foundation for Sustainable Area Development's FSA Tool, which was piloted at UniverCity in September 2013. Chapter 4 presented the findings of Chapter 2 and Chapter 3. Chapter 2 findings discussed how the SCORE Tool assessment worked in its inaugural application. Chapter 3 findings summarized how we can improve upon the SCORE Tool in future assessments, based on the outcomes of the comparative analysis. The final chapter of this paper, Chapter 5, presents the major conclusions of the work and will suggest some potential implications of this research for connecting neighbourhood sustainability assessment to achieving broader municipal, national, and global sustainability goals.

5.2. Conclusions

The pilot assessment of the SCORE Tool in the UniverCity neighbourhood was by and large a success. The SCORE Tool delivered a set of 66 meaningful indicators for

neighbourhood sustainability assessment, organized in a multi-criteria assessment framework, based on a six capital model for sustainable community development. The presentation of results delivers a series of diagrams for easy interpretation and communication, accompanied by a qualitative description of the strengths, weaknesses, and limitations of the assessment.

The pilot was intended as an initial proof of concept for the SCORE Tool, to determine if quality data could be gathered on a meaningful set of sustainability indicators at the neighbourhood scale, and determine whether there are substantial gaps between what we want to measure, and what data is available. As a result, 77% of indicators were answered with neighbourhood scale data. In some cases where data was unavailable at the neighbourhood scale, a wider area was used as a proxy for study area performance (see Figure 8). In general, the lack of consistent data availability at the neighbourhood scale is a fundamental challenge in advancing this work. Researchers will need to determine whether to delve further at the neighbourhood scale to fill this gap or to work at the city or regional scales where data consistency and availability is less of a concern. In terms of gathering quality data, 85% of indicators were gathered from valid government databases or third party organizations such as Walk Score. These indicators are broadly comparable across BC, and so there is a strong case for the comparability of the SCORE Tool between neighbourhoods.

The pilot assessment also revealed some strengths and weaknesses of the tool. Strengths included the integration of the Gross National Happiness Index (GNH) survey and foundations laid for partnership development on further adaptations of the tool. The GNH Index survey posed to neighbourhood residents quantified qualitative personal assessments of indicators of social, human and cultural capital. The indicators answered by the GNH Index survey provide an important contribution to SCORE Tool by integrating measures of resident quality of life. This practice reflects a growing awareness that tools for evaluating progress must look beyond economic indicators or environmental targets to a more integrative and holistic approach to sustainability, one which also optimizes for happiness and well-being (Costanza, 2014).

In terms of partnership development, the pilot assessment has been moderately successful in gaining the attention of land developers, planning consultants, and the government agency Fraser Health Authority. With the value components of the tool clearly defined through this assessment, it is likely time to begin a partnership development campaign to raise money to develop the next iteration of the SCORE Tool and perform the next assessments.

The pilot assessment has also surfaced areas for improvement. In terms of the sustainability coverage of the SCORE Tool, a few adjustments should be made. The SCORE Tool must find a way to include energy consumption data via information sharing agreements with BC Hydro and Fortis. Also, there are missing measures of housing/job connectivity, financial sustainability, and further consideration of the institutional sphere of sustainability.

One weakness of the pilot assessment is that the SCORE Tool currently lacks a transparent and rigorous method of scoring indicators. Each indicator's target should be based on a clearly defined international standard for sustainability assessment. This may be possible by adapting the recently published ISO 37120 to the neighbourhood context. Furthermore, the SCORE Tool must adopt a peer-reviewed methodology for defining thresholds. The pilot assessment of the SCORE Tool at UniverCity sought to develop a methodology and a framework for scoring indicators – explained in detail in section 2.2.4 - but the solutions proposed should still be considered under development. A formal peer review of all criteria and indicators, targets and thresholds, should take place

Finally, one major finding of the comparative evaluation is that there is a gap in sustainability assessment literature that deals with how to organize sustainability indicators into multi-criteria frameworks. There are unclear definitions and uses of the terms themes and criteria in NSA literature and practice. Further research is needed to develop a common criteria and organizational framework, so as to make sustainability assessment practices and their certified developments broadly comparable across the globe.

5.3. Next Steps

In order for the SCORE Tool to play a role in helping to achieve global sustainability goals, this pilot assessment should be considered to be Phase 1 in a multi-phase project. The number of phases and timeline are subject to the dynamism of the group working on this project and resources to support it, but suggested next steps for the development of the SCORE Tool are:

1. Convene a council of experts to review criteria and indicators.
2. Further refine the list of indicators and adapt a peer-reviewed methodology for defining thresholds.
3. Attempt to adapt the ISO 37120 indicator set to the neighbourhood scale.
4. Develop information sharing partnerships with BC Hydro and Fortis, and other service providers as necessary.
5. Find a municipal partner, willing to provide GIS support, to perform multiple assessments using the SCORE Tool within the same municipality, so as to build a case for comparability.
6. Refine the diagrams and user experience of the online tool.
7. Streamline delivery of assessments through automated data collection.
8. Enhance the reporting structure at the indicator scale to be more transparent and interpretive.

As the building blocks of cities, neighbourhoods can drive change at multiple scales by relating the outcomes of neighbourhood sustainability assessment to municipal, national, and global sustainability goals. Multi-criteria frameworks are really good at translating those goals, and evaluating the complexities of sustainability in a holistic and integrative way. The SCORE Tool's capitals approach is a valuable framework for sustainability assessment because it embodies community development principles and reflects trends towards evaluative practice, which considers community well-being alongside equity, economic vitality and sound environmental management.

This paper hopes to emphasize that applying an evaluative approach to sustainability planning is key to sustainable urbanization. If we can manage to further develop the indicators of the SCORE Tool and their associated targets and thresholds,

then we can relate the results of this tool to broader municipal, and global sustainability targets, effectively connecting impact with policy intent.

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Appendix A.

Indicators

Natural Capital

Air

Indicator	1.1.1	**Air Quality**
Natural		Air
Color code		green

Indicator description
Air Quality is calculated using the 2013 average Air Quality Health Index (AQHI) developed by Environment Canada and Health Canada.

Unit	index
Scale	Metro Vancouver NE Quadrant
Data Source	Air Quality Modeling Applications Section (AQMAS), Meteorological Services of Canada, Environment Canada, 2013
Value	1.8
Calculation Method	Produced by Meteorological Services of Canada

Target	0
Target Source	Environment Canada
Threshold Calculation Method	Method 2
Norm Red	> 10
Norm Orange	6 - 10
Norm Gold	3 - 6
Norm Green	< 3

Soil

Indicator	1.2.1	**Contaminated Sites**
Natural		Soil
Color code		green

Indicator description
Proportion of neighbourhood area registered as a contaminated site in the BC contaminated sites registry.

Unit	percentage
Scale	UniverCity development area boundary
Data Source	The Site Registry, British Columbia, 2014
Value	0%

Target	0%
Target Source	N/A
Threshold Calculation Method	Method 1
Norm Red	> 75%
Norm Orange	50% - 75%
Norm Gold	25% - 50%
Norm Green	< 25%

Indicator	1.2.2	**Farmland Preserved**
Natural		Soil
Color code		green

Indicator description
Proportion of existing agricultural land preserved.

Unit	percentage
Scale	UniverCity development area boundary
Data Source	Agricultural Land Reserve, 2014
Value	100%

Target	100%
Target Source	Kellett et al., 2009
Threshold Calculation Method	Method 1
Norm Red	< 25%
Norm Orange	25% - 50%
Norm Gold	50% - 75%
Norm Green	> 75%

Indicator	1.2.3	**Growing space**
Natural		Soil
Color code		red

Indicator description
Area (m2) of dedicated growing space per dwelling unit (DU).

Unit	m2
Scale	UniverCity development area boundary
Data Source	SFU Community Trust, 2014
Value	0 m2
Calculation Method	0/DU = 0

Target	LEED ND recommends 6.5m2 of growing space per DU for projects in the density range of UniverCity.
Target Source	(LEED-ND in Kellett et al., 2009)
Threshold Calculation Method	Method 2
Norm Red	< 2.16 m2
Norm Orange	2.16 - 4.33 m2
Norm Gold	4.33 - 6.5 m2
Norm Green	> 6.5 m2

Water

Indicator	1.3.1	**Water availability**
Natural		Water
Color code		green

Indicator description
The proportion of days in a year that base flows downstream of UniverCity were equal to 0, meaning that the stream ran dry. A base flow should be consistently conveyed to the creek each year.

Unit	percentage
Scale	UniverCity East Highlands Neighbourhood (Phase 1) - MA2 monitoring station
Data Source	AECOM AMC Report UniverCity Stormwater April 2014
Value	0%
Calculation Method	At UniverCity Phase 1 monitoring station MA2 there were 0/365 days in 2013 where base flow = 0. As a reference, Nancy Hill, P. Eng. at AECOM confirmed that at SFU monitoring station MA1 there were 28 days in 2013 where base flow = 0.

Target	0% of days where base flow = 0
Target Source	Expert opinion, Nancy Hill, P. Eng. at AECOM
Threshold Calculation Method	Method 3
Norm Red	> 75%
Norm Orange	50% - 75%
Norm Gold	25% - 50%
Norm Green	< 25%

Indicator	1.3.2	**Surface water quality**
Natural		Water
Color code		green

Indicator description
Proportion of non-compliance events (when any pollutant exceeds water quality guidelines) for storm event water samples. Stream water should be within water quality guidelines to protect aquatic life and ecosystem health.

Unit	percentage
Scale	UniverCity East Highlands Neighbourhood (Phase 1) - MA2 monitoring station
Data Source	R.U. Kistritz Consultants Ltd., AMC Interim Monitoring Report 22 & 23, 2013-2014
Value	4%
Calculation Method	Storm water samples were taken with the auto sampler at MA2 on August 30, 2013, November 1-2, 2013, and January 09, 2014. At monitoring station MA2, there were a total of 12 exceedances (non-compliance events) recorded during storm events for the reporting period, out of total of 314 water quality samples: 12/314 = 4%.

Target	0% exceedances/total samples
Target Source	Expert opinion, Ron Kistritz, R.U. Kistritz Consultants Ltd.
Threshold Calculation Method	Method 3
Norm Red	> 75%
Norm Orange	50% - 75%
Norm Gold	25% - 50%

Norm Green	< 25%

Biodiversity

Indicator	1.4.1	**Habitat preservation**
Natural		Biodiversity
Color code		green

Indicator description
Proportion of developed area that has been preserved, and/or restored, and/or enhanced, and/or created.

Unit	percentage
Scale	UniverCity East Highlands Neighbourhood (Phase 1)
Data Source	Girling, C. L., 2010
Value	20%
Calculation Method	See Girling, C. L., 2010

Target	20%
Target Source	Kellett,et al., 2009
Threshold Calculation Method	Method 2
Norm Red	< 5%
Norm Orange	5% - 10%
Norm Gold	10% - 15%
Norm Green	> 15%

Indicator	1.4.2	**Native plant preservation**
Natural		Biodiversity
Color code		gold

Indicator description
Proportion of developed area that has been preserved, and/or restored, and/or enhanced, and/or created.

Unit	percentage
Scale	UniverCity East Highlands Neighbourhood (Phase 1)
Data Source	Girling, C. L., 2010
Value	65%
Calculation Method	See Girling, C. L., 2010

Target	100%
Target Source	Girling, C. L., 2010
Threshold Calculation Method	Method 2
Norm Red	< 25%
Norm Orange	25% - 50%
Norm Gold	50% - 75%
Norm Green	> 75%

Indicator	1.4.3	**Tree canopy cover**
Natural		Biodiversity
Color code		green

Indicator description
Proportion of area with tree canopy coverage.

Unit	percentage
Scale	UniverCity East Highlands Neighbourhood (Phase 1)
Data Source	Girling, C. L., 2010
Value	30%
Calculation Method	See Girling, C. L., 2010

Target	40%
Target Source	Kellett et al., 2009
Threshold Calculation Method	Method 2
Norm Red	< 6.66%
Norm Orange	6.66% - 13.33%
Norm Gold	13.33% - 20%
Norm Green	> 20%

Physical Capital

Land Use

Indicator	2.1.1	**Floodplain avoidance**
Physical		Land Use
Color code		green

Indicator description
Proportion of parcels outside of floodplain. In order to protect life and property, promote open space and habitat conservation, and enhance water quality and natural hydrological systems locate development on a site that does not contain any land within the 100-year floodplain.

Unit	percentage
Scale	UniverCity development area boundary
Data Source	SFU Community Trust, 2014
Value	100%
Calculation Method	Geospatial analysis

Target	100%
Target Source	Proportion of 100%
Threshold Calculation Method	Method 1
Norm Red	< 25%
Norm Orange	25% - 50%
Norm Gold	50% - 75%
Norm Green	> 75%

Indicator	2.1.2	**Mix of use**
Physical		Land Use
Color code		green

Indicator description
Mix of use is measured by Walk Score, a publicly available, third party walkability index that assigns a numerical walkability score to any address in the United States, Canada, and Australia.

Unit	score
Scale	UniverCity development area boundary
Data Source	Walk Score, 2014
Value	78
Calculation Method	Walk Score analyzes hundreds of walking routes to nearby amenities. Points are awarded based on the distance to amenities in each category. Amenities within a 5-minute walk (.25 miles) are given maximum points. A decay function is used to give points to more distant amenities, with no points given after a 30-minute walk. Walk Score also measures pedestrian friendliness by analyzing population density and road metrics such as block length and intersection density. Data sources include Google, Education.com, Open Street Map, the U.S. Census, Localeze, and places added by the Walk Score user community.

Target	100
Target Source	Walk Score
Threshold Calculation Method	Method 1
Norm Red	< 25
Norm Orange	25 - 50
Norm Gold	50 - 75
Norm Green	> 75

Indicator	2.1.3	**Compact development**
Physical		Land Use
Color code		green

Indicator description
Compact development is measured using LEED ND calculation points for density/acre, for a total score out of 6. Compact development promotes livability, walkability, and transportation efficiency, including vehicle miles traveled, in turn improving public health encouraging daily physical activity associated with alternative modes of transportation.

Unit	score
Scale	UniverCity development area boundary
Data Source	SFU Community Trust, 2014
Value	5.76
Calculation Method	UniverCity's East Neighbourhood Development at full build-out will be approximately 3,853,022 ft^2 - 94% of which will be residential and 6% will be commercial. The average residential density at 50% completion will be 100 DU/acre and the average non-residential will be 1.125 FAR. Therefore according to LEED ND calculation set forth in Credit 1: Compact Community: (0.94 x 6) + (0.06 x 2) = 5.76/6.

Target	6
Target Source	LEED-ND
Threshold Calculation Method	Method 2
Norm Red	< 1.5
Norm Orange	1.5 - 3
Norm Gold	3 - 4.5
Norm Green	> 4.5

Indicator	2.1.4	**Population density**
Physical		Land Use
Color code		green

Indicator description
Population density is measured in persons/hectare (p/h). As UniverCity is a growing community, this number is expected in increase over time. Moderately high density brings many benefits; high densities may see decrease in these benefits.

Unit	p/h
Scale	DA 3695
Data Source	National Housing Survey, 2011
Value	144
Calculation Method	3118 p / 21.65 h = 144 p/h

Target	150 p/h
Target Source	Kellett et al., 2009
Threshold Calculation Method	Method 2
Norm Red	< 25 p/h
Norm Orange	25 - 50 p/h
Norm Gold	50 - 100 p/h
Norm Green	> 100 p/h

Built Environment

Indicator	2.2.1	**Access to public space**
Physical		Built Environment
Color code		green

Indicator description
Proportion of dwellings within 5 minute (400m) walk of a public open space. Access to public space improves physical and mental health and social capital by providing a variety of open spaces close to work and home to facilitate social networking, civic engagement, physical activity, and time spent outdoors.

Unit	percentage
Scale	UniverCity development area boundary
Data Source	SFU Community Trust, 2014
Value	100%
Calculation Method	Geospatial analysis

Target	90%
Target Source	LEED-ND
Threshold Calculation Method	Method 1
Norm Red	< 25%
Norm Orange	25 – 50%
Norm Gold	50 – 100%
Norm Green	> 100%

Indicator	2.2.2	**Quantity of residential building stock**
Physical		Built Environment
Color code		green

Indicator description
Proportion of occupied private dwellings deemed suitable. Housing suitability refers to whether a private household is living in suitable accommodations according to the National Occupancy Standard (NOS); that is, whether the dwelling has enough bedrooms for the size and composition of the household.

Unit	percentage
Scale	DA 3695
Data Source	National Housing Survey, 2011
Value	87.2%
Calculation Method	See Housing Suitability, NHS 2011

Target	100%
Target Source	Proportion of 100%
Threshold Calculation Method	Method 1
Norm Red	< 25%
Norm Orange	25 – 50%
Norm Gold	50 – 100%
Norm Green	> 100%

Indicator	2.2.3	**Quality of residential building stock**
Physical		Built Environment
Color code		green

Indicator description
Proportion of occupied private dwellings with major repairs needed.

Unit	percentage
Scale	DA 3695
Data Source	National Housing Survey, 2011
Value	0%
Calculation Method	See Dwelling Characteristics, NHS 2011

Target	0%
Target Source	Proportion of 100%
Threshold Calculation Method	Method 1
Norm Red	> 75%
Norm Orange	50% - 75%
Norm Gold	25% - 50%
Norm Green	< 25%

Indicator	2.2.4	**Green residential building stock**
Physical		Built Environment
Color code		orange

Indicator description
Proportion of dwelling units built to a LEED certified green building standard or greater.

Unit	percentage
Scale	UniverCity development area boundary
Data Source	SFU Community Trust, 2014
Value	45%
Calculation Method	843 LEED Gold certified or greater DU / 1858 Total max DU = 45%

Target	100%
Target Source	In a future complete community we would envision 100% of buildings built to LEED certified standard or greater. All of UniverCity's Phase 3 & 4 buildings are required to be built to LEED Gold standard or greater.
Threshold Calculation Method	Method 1
Norm Red	< 25%
Norm Orange	25% - 50%
Norm Gold	50% - 75%
Norm Green	> 75%

Infrastructure

Indicator	2.3.1	**Access to energy**
Physical		Infrastructure
Color code		green

Indicator description
Proportion of occupied private dwellings with heating, electricity.

Unit	percentage
Scale	UniverCity development area boundary
Data Source	SFU Community Trust, 2014
Value	100%
Calculation Method	Verify Occupancy Certificate Application Forms

Target	100%
Target Source	Proportion of 100%
Threshold Calculation Method	Method 1
Norm Red	< 25%
Norm Orange	25% - 50%
Norm Gold	50% - 75%
Norm Green	> 75%

Indicator	2.3.2	**Access to clean, potable water**
Physical		Infrastructure
Color code		green

Indicator description
Proportion of occupied private dwellings with (at least 50 lpcd) potable water.

Unit	percentage
Scale	UniverCity development area boundary
Data Source	SFU Community Trust, 2014
Value	100%
Calculation Method	Verify Occupancy Certificate Application Forms

Target	100%
Target Source	Proportion of 100%
Threshold Calculation Method	Method 1
Norm Red	< 25%
Norm Orange	25% - 50%
Norm Gold	50% - 75%
Norm Green	> 75%

Indicator	2.3.3	**Access to safe sanitation**
Physical		Infrastructure
Color code		green

Indicator description
Proportion of occupied private dwellings with reliable access to safe sanitation.

Unit	percentage
Scale	UniverCity development area boundary
Data Source	SFU Community Trust, 2014
Value	100%
Calculation Method	Verify Occupancy Certificate Application Forms

Target	100%
Target Source	Proportion of 100%
Threshold Calculation Method	Method 1
Norm Red	< 25%
Norm Orange	25% - 50%
Norm Gold	50% - 75%
Norm Green	> 75%

Indicator	2.3.4	**Access to reliable communications**
Physical		Infrastructure
Color code		green

Indicator description
Proportion of occupied private dwellings that have access to reliable communications networks.

Unit	percentage
Scale	UniverCity development area boundary
Data Source	SFU Community Trust, 2014
Value	100%
Calculation Method	Verify 2009 Environmental Inventory

Target	100%
Target Source	Proportion of 100%
Threshold Calculation Method	Method 1
Norm Red	< 25%
Norm Orange	25% - 50%
Norm Gold	50% - 75%
Norm Green	> 75%

Indicator	2.3.5	**Stormwater management: volume of runoff**
Physical		Infrastructure
Color code		orange

Indicator description
Percentage of rainfall that becomes runoff (without baseflow), measured using the runoff coefficient. Stormwater management infrastructure should manage volume of runoff so as to decrease the impacts of human development on ecosystem health and hydrology.

Unit	percentage
Scale	UniverCity East Highlands Neighbourhood (Phase 1) - MA2 monitoring station
Data Source	AECOM AMC Report UniverCity Stormwater April 2014
Value	60%
Calculation Method	See AECOM AMC Report UniverCity Stormwater April 2014

Target	0%
Target Source	UniverCity's own Integrated Stormwater Management plan states that it would like the community to perform like a natural forest. The runoff coefficient in a natural forest would be approximately 0. Thresholds describe the typical performance of a neighbourhood typology: Red >0.75: Downtown to roofed area. Orange 0.75 to 0.5: multi-unit residential; 0.5 to 0.3: single family residential; >0.3: parks, cemeteries, unimproved areas
Threshold Calculation Method	Method 2
Norm Red	> 75%
Norm Orange	50% - 75%
Norm Gold	30% - 50%
Norm Green	< 30%

Indicator	2.3.6	**Stormwater management: peak flows**
Physical		Infrastructure
Color code		green

Indicator description
Peak flow detention of stormwater discharges.

Unit	l/s/ha
Scale	UniverCity East Highlands Neighbourhood (Phase 1) - MA2 monitoring station
Data Source	AECOM AMC Report UniverCity Stormwater April 2014
Value	2.3 l/s/ha
Calculation Method	See AECOM AMC Report UniverCity Stormwater April 2014

Target	2 l/s/ha
Target Source	Nancy Hill, P. Eng. at AECOM advised that an average of 2-4 l/s/ha would be considered a good peak flow detention performance and therefore a proxy range for "green achievement". At the high end of the spectrum, almost 20 l/s/ha was observed on SFU property at monitoring station MA1.
Threshold Calculation Method	Method 2
Norm Red	> 14.7 l/s/ha
Norm Orange	9.7 - 14.7 l/s/ha
Norm Gold	4 - 9.7 l/s/ha
Norm Green	< 4 l/s/ha

Transportation Systems

Indicator	2.4.1	**Access to transit**
Physical		Transportation Systems
Color code		gold

Indicator description
Access to transit is measured by Transit Score – made by Walk Score, a publicly available, third party public transportation index that assigns a numerical score to any address in the United States, Canada, and Australia.

Unit	score
Scale	UniverCity development area boundary
Data Source	Walk Score, 2014
Value	54
Calculation Method	Transit Score provides a 0-100 rating indicating how well an address is served by public transportation. Ratings range from "Rider's Paradises" where multiple transit options are available within a 5 minute walk (400m) to areas with limited or no nearby public transportation.

Target	100
Target Source	Proportion of 100
Threshold Calculation Method	Method 1
Norm Red	< 25
Norm Orange	25 - 50
Norm Gold	50 - 75
Norm Green	> 75

Indicator	2.4.2	**Modal split**
Physical		Transportation Systems
Color code		green

Indicator description
Percentage of total employed population aged 15 years and over using non-vehicular forms of transportation to get to work or carpooling. Primary transportation choices should be dominated by active, low-carbon, low-cost modes.

Unit	percentage
Scale	DA 3695
Data Source	National Housing Survey, 2011
Value	47%
Calculation Method	See Mode of Transportation, NHS, 2011

Target	51%
Target Source	Drawing on Metro Vancouver's 20% carbon emission reduction target, we targeted a 20% reduction in vehicular transport from 2011 municipal levels. In 2011, 61% of Burnaby's total employed population were using vehicular forms of transportation to get to work. 61% x 80% = 49% is therefore our target for vehicular transport. Since we are measuring assets, we are interested in *non-vehicular* transport. Thus, 51% becomes our target.
Threshold Calculation Method	Method 2
Norm Red	< 15%
Norm Orange	15% - 30%
Norm Gold	30% - 45%
Norm Green	> 45%

Materials and Waste

Indicator	2.5.1	**Access to waste management systems**
Physical		Materials and Waste
Color code		green

Indicator description
Proportion of occupied private dwellings with access to solid waste removal services.

Unit	percentage
Scale	UniverCity development area boundary
Data Source	SFU Community Trust, 2014
Value	100%
Calculation Method	Verify waste collection routes

Target	100%
Target Source	Proportion of 100%
Threshold Calculation Method	Method 1
Norm Red	< 25%
Norm Orange	25% - 50%
Norm Gold	50% - 75%
Norm Green	> 75%

Indicator	2.5.2	**Waste diversion rate**
Physical		Materials and Waste
Color code		gold

Indicator description
Proportion of waste recycled and diverted from landfill to total waste materials generated in the region.

Unit	percentage
Scale	City of Burnaby
Data Source	City of Burnaby, 2013 Solid Waste and Recycling Annual Report
Value	47%
Calculation Method	Verify waste collection routes

Target	70%
Target Source	Metro Vancouver
Threshold Calculation Method	Method 2
Norm Red	< 15.5%
Norm Orange	15.5% - 35%
Norm Gold	35% - 52.5%
Norm Green	> 52.5%

Indicator	2.5.3	**Waste disposal rate**
Physical		Materials and Waste
Color code		green

Indicator description
Disposed tons/capita. Measure of the total waste produced per person. Influence waste generation per capita reduction.

Unit	tons/capita
Scale	City of Burnaby
Data Source	City of Burnaby, 2013 Solid Waste and Recycling Annual Report
Value	0.17 tons/capita
Calculation Method	Metro Vancouver's Integrated Solid Waste and Resource Management Plan aims to reduce the quantity of waste generated per capita within the region, calculated on a rolling 5 year average, to 90% or less of 2010 volumes by 2020. 90% of 2010 volumes = 0.17 disposed tons/capita. Burnaby hit this target in 2013.

Target	0.17 disposed tons/capita
Target Source	Metro Vancouver, Integrated Solid Waste and Resource Management Plan, 2010.
Threshold Calculation Method	Method 2
Norm Red	> 0.23 tons/capita
Norm Orange	0.21 - 0.23 tons/capita
Norm Gold	0.19 - 0.21 tons/capita
Norm Green	< 0.19 tons/capita

Economic Capital

Labour

Indicator	3.1.1	**Unemployment rate**
Economic		Labour
Color code		orange

Indicator description
The unemployment rate indicator shows the number of unemployed persons expressed as a percentage of the labour force. Unemployment is a difficult experience for many Canadians. In addition to the loss of work and income, unemployment can bring varying hardships for individuals and their families.

Unit	percentage
Scale	DA 3695
Data Source	National Housing Survey, 2011
Value	6%
Calculation Method	See Labour, NHS, 2011.

Target	0.05%
Target Source	Expert opinion, J. M. Davegos, University of Tilburg.
Threshold Calculation Method	Method 2
Norm Red	> 6%
Norm Orange	5 – 6%
Norm Gold	3.5 – 5%
Norm Green	< 3.5%

Indicator	3.1.2	**Dependency on the safety net**
Economic		Labour
Color code		orange

Indicator description
Percentage of population receiving benefits. The proportion of residents not working and receiving benefits for either income assistance or employment insurance has an impact on the economic vitality of a community.

Unit	percentage
Scale	City of Burnaby
Data Source	BC Stats, Community Facts - Burnaby, BC, 2012 (although data is from 2009)
Value	3.6%
Calculation Method	See Percentage of Population by Age Receiving Benefits, 2009

Target	1.2%
Target Source	Relative norms used data for 17 cities and district municipalities in Metro Vancouver. Based on these values, thresholds represent the median and first and third quartiles of the observed numerical data set. Langley City sits at the high end of this range with 5.8% of the population receiving Basic Income Assistance and/or Employment Insurance, while West Vancouver defines the bottom of the range with 1.2% of the population receiving the same benefits.
Threshold Calculation Method	Method 4
Norm Red	> 4.05%
Norm Orange	3.3% - 4.1%
Norm Gold	2.8% - 3.3%
Norm Green	< 2.8%

Indicator	3.1.3	**Age composition of the labour force**
Economic		Labour
Color code		orange

Indicator description
The age composition of the labour force is calculated by the ratio of people aged 15-39:40-64. Neighbourhoods should have an equal distribution of people young and old in the labour force.

Unit	score
Scale	DA 3695
Data Source	National Housing Survey, 2011
Value	7.8
Calculation Method	See Labour, NHS, 2011

Target	10
Target Source	Expert opinion, J. M. Davegos, University of Tilburg.
Threshold Calculation Method	Method 3
Norm Red	< -5
Norm Orange	-5 - 0
Norm Gold	0 - 5
Norm Green	> 5

Households

Indicator	3.2.1	**Age composition of the labour force**
Economic		Households
Color code		orange

Indicator description
Proportion of the population earning a "Living Wage" for the region. The living wage indicator is a proxy for both median household income and income distribution. Each member of the community should be able to live fully and sufficiently.

Unit	percentage
Scale	DA 3695
Data Source	National Housing Survey, 2011
Value	34%
Calculation Method	See Income, NHS, 2011

Target	100%
Target Source	Proportion of 100%
Threshold Calculation Method	Method 1
Norm Red	< 25%
Norm Orange	25% - 50%
Norm Gold	50% - 75%
Norm Green	> 75%

Businesses

Indicator	3.3.1	**Incorporations**
Economic		Businesses
Color code		gold

Indicator description
Number of incorporations per 1000 residents. New business incorporations can be an indicator of innovation, creativity, and economic vitality. Incorporations are counted in municipality of the registered office address.

Unit	rate per 1000 residents
Scale	City of Burnaby
Data Source	BC Stats, Community Facts - Burnaby, BC, 2012
Value	6
Calculation Method	See BC Stats, Community Facts - Burnaby, BC, 2012

Target	16
Target Source	Relative norms used data for 21 cities, district municipalities and villages in Metro Vancouver. Based on these values, thresholds represent the median and first and third quartiles of the observed numerical data set. Based on these values, Vancouver sits at the high end of this range with 16 incorporations per 1000 residents, while Anmore defines the bottom of the range with 2 incorporations per 1000 residents.
Threshold Calculation Method	Method 4
Norm Red	< 4
Norm Orange	4 - 5
Norm Gold	5 - 7
Norm Green	> 7

Indicator	3.3.2	**Bankruptcies**
Economic		Businesses
Color code		orange

Indicator description
Annual number of bankruptcies, 5 year average 2009-2013. Less bankruptcies is better for economic stability and employment.

Unit	number
Scale	Forward Sortation Area V5A
Data Source	The Office of the Superintendent of Bankruptcy (OSB), 2014
Value	2
Calculation Method	Provided by OSB

Target	0
Target Source	Relative norms used data for every Forward Sortation Area in BC. Thresholds were established at the median and interquartile of the observed data set.
Threshold Calculation Method	Method 4
Norm Red	> 2
Norm Orange	1 - 2
Norm Gold	0 - 1
Norm Green	< 0

Indicator	3.3.3	**Local Ownership**
Economic		Businesses
Color code		green

Indicator description
Proportion of merchants considered small, independent, local businesses, 2005-2013. A growing body of evidence suggests that the communities that have a high percentage of locally-owned businesses have greater wealth, higher voter turnout, better health outcomes and more jobs.

Unit	percentage
Scale	UniverCity development area boundary
Data Source	SFU Community Trust, 2014
Value	95%
Calculation Method	36/38 businesses under local ownership = 95%

Target	100%
Target Source	UniverCity's own policy
Threshold Calculation Method	Method 1
Norm Red	< 25%
Norm Orange	25% - 50%
Norm Gold	50% - 75%
Norm Green	> 75%

Human Capital

Education

Indicator	4.1.1	**Access to primary education**
Human		Education
Color code		green

Indicator description
Proportion of neighbourhood children who belong to the attendance area or have a guaranteed spot in the local primary school. Primary education is a basic service to be provided to all residents within a neighbourhood.

Unit	percentage
Scale	University Highlands Elementary School Attendance Area
Data Source	Board of Education School District 41
Value	100%
Calculation Method	Verified with Board of Education School District 41

Target	100%
Target Source	Proportion of 100%
Threshold Calculation Method	Method 1
Norm Red	< 25%
Norm Orange	25% - 50%
Norm Gold	50% - 75%
Norm Green	> 75%

Indicator	4.1.2	**Access to primary education**
Human		Education
Color code		green

Indicator description
Proportion of neighbourhood residents who have completed high school. There is a growing consensus that high-school completion is the prerequisite stepping stone to post- secondary education, now deemed essential to success in the labour market.99 High-school completion contributes to an individual's self-worth and is thus a measurement of human capital.

Unit	percentage
Scale	DA 3695
Data Source	National Household Survey, 2011
Value	98%
Calculation Method	See Education, NHS, 2011

Target	100%
Target Source	Proportion of 100%
Threshold Calculation Method	Method 1
Norm Red	< 25%
Norm Orange	25% - 50%
Norm Gold	50% - 75%
Norm Green	> 75%

Indicator	4.1.3	**University attainment**
Human		Education
Color code		green

Indicator description
Proportion of neighbourhood residents who have completed university certificate or degree. Higher levels of education open the door to new opportunities that can improve one's standard of living.

Unit	percentage
Scale	DA 3695
Data Source	National Household Survey, 2011
Value	51%
Calculation Method	See Education, NHS, 2011

Target	100%
Target Source	The more individuals in a community that have completed a university certificate or degree the better. The proportion of British Columbians overall who have completed a university certificate or degree is 23%. Using the societal average as a benchmark for "green" achievement, UniverCity scores significantly above that threshold with a score of 51%.
Threshold Calculation Method	Method 4
Norm Red	< 8%
Norm Orange	8% - 15.5%
Norm Gold	15.5% - 23%
Norm Green	> 23%

Health

Indicator	4.2.1	**Access to GP**
Human		Health
Color code		gold

Indicator description
Rate of General Practitioners registered with MSP per 100,000 residents. Individuals should have access to health care practitioners within their communities. In this indicator, the rate of general practitioners to municipal population per 100,000 is used as a proxy for access to all health care practitioners including specialists and other practitioners.

Unit	rate per 100,000 residents
Scale	City of Burnaby
Data Source	Burnaby Local Health Authority Profile, 2010
Value	82
Calculation Method	See Burnaby Local Health Authority Profile, 2010

Target	112
Target Source	The rate of General Practitioners registered with MSP per 100,000 residents for all of British Columbia is 112. Using the societal average as a baseline for "green" achievement, Burnaby lies slightly below that threshold with a score of 82.
Threshold Calculation Method	Method 4
Norm Red	< 28
Norm Orange	28 - 56
Norm Gold	56 - 84
Norm Green	> 84

Indicator	4.2.2	**Composite Health Index**
Human		Health
Color code		green

Indicator description
The composite health index is the weighted average of the sub-indices: Life expectancy at birth x Potential years of life lost via natural, accidental, and violent causes. Individuals should live long, healthy and happy lives. The composite health index offers a proxy for instances of chronic disease in a population by capturing the number of death by disease in a resident population.

Unit	index
Scale	City of Burnaby
Data Source	BC Stats, Socio-Economic Indices, Indicators of Health Problems by SD, 2012
Value	-0.8
Calculation Method	See BC Stats, Socio-Economic Indices, Indicators of Health Problems by SD, 2012

Target	-0.97
Target Source	The Composite Health Index gives a score based on life expectancy and weighed causes of death (disease, suicide, homicide) and offers rankings of all municipalities of British Columbia. Relational norms using the median and interquartile points are established using the ranking values as our dataset.
Threshold Calculation Method	Method 4
Norm Red	> 0.55
Norm Orange	0.11 - 0.55
Norm Gold	-0.34 - 0.11
Norm Green	< -0.34

Indicator	4.2.3	**Health practices**
Human		Health
Color code		gold

Indicator description
The health practices index gives us an average proportion of Burnaby resident population who participate in positive health practices including: not smoking, not being exposed to second hand smoke, eating 5+ fruits and/or vegetables per day, being physically active, not being overweight or obese, having contact with a MD in the past year.

Unit	index
Scale	City of Burnaby
Data Source	Burnaby Local Health Authority Profile, 2010
Value	69
Calculation Method	See Burnaby Local Health Authority Profile, 2010

Target	100
Target Source	Since the index corresponds to a proportion of residents, the benchmark is that 100% of Burnaby residents engage in positive health practices.
Threshold Calculation Method	Method 3
Norm Red	< 25
Norm Orange	25 - 50
Norm Gold	50 - 75
Norm Green	> 75

Indicator	4.2.4	**Perceptions of physical health**
Human		Health
Color code		gold

Indicator description
Perceptions of physical health is measured here as an index given by the GNH Index survey answering questions on Physical Health. Individuals should feel they good energy levels, can perform everyday activities, and exercise.

Unit	index
Scale	UniverCity residents
Data Source	Prime, 2014
Value	71; The GNH Index average score for Physical Health is 65. UniverCity residents score 6 points higher in this life domain than the GNH Index database of over 35K people.
Calculation Method	See GNH Index Methodology

Target	100
Target Source	N/A
Threshold Calculation Method	Method 1
Norm Red	< 25
Norm Orange	25 - 50
Norm Gold	50 - 75
Norm Green	> 75

Indicator	4.2.5	**Perceptions of environment**
Human		Health
Color code		green

Indicator description
Perceptions of environment is measured here as an index given by the GNH Index survey answering questions on Environment. Individuals should feel they have access to nature; have positive reflections on community pollution, conservation and preservation efforts.

Unit	index
Scale	UniverCity residents
Data Source	Prime, 2014
Value	79; The GNH Index average score for Environment is 67. UniverCity residents score 12 points higher in this life domain than the GNH Index database of over 35K people
Calculation Method	See GNH Index Methodology

Target	100
Target Source	Proportion of 100
Threshold Calculation Method	Method 1
Norm Red	< 25
Norm Orange	25 - 50
Norm Gold	50 - 75
Norm Green	> 75

Indicator	4.2.6	**Time balance**
Human		Health
Color code		gold

Indicator description
Time Balance is measured here as an index given by the GNH Index survey answering questions on Time Balance. Individuals should feel they have sufficient time to complete tasks, enjoy leisure time and activities.

Unit	index
Scale	UniverCity residents
Data Source	Prime, 2014
Value	51; The GNH Index average score for Time Balance is 50. UniverCity residents score 1 point higher in this life domain than the GNH Index database of over 35K people.
Calculation Method	See GNH Index Methodology

Target	100
Target Source	Proportion of 100
Threshold Calculation Method	Method 1
Norm Red	< 25
Norm Orange	25 - 50
Norm Gold	50 - 75
Norm Green	> 75

Well-being

Indicator	4.3.1	**Life satisfaction**
Human		Well-being
Color code		green

Indicator description
Life satisfaction is measured here as an index given by the GNH Index survey answering questions on Satisfaction with Life. One's perceived life satisfaction tell us their own personal assessment of well-being.

Unit	index
Scale	UniverCity residents
Data Source	Prime, 2014
Value	75; The GNH Index average score for Satisfaction with Life is 68. UniverCity residents score 7 points higher in this life domain than the GNH Index database of over 35K people.
Calculation Method	See GNH Index Methodology

Target	100
Target Source	Proportion of 100
Threshold Calculation Method	Method 1
Norm Red	< 25
Norm Orange	25 - 50
Norm Gold	50 - 75
Norm Green	> 75

Indicator	4.3.2	**Positive/negative experience**
Human		Well-being
Color code		gold

Indicator description
Positive/negative experience is measured here as an index given by the GNH Index survey answering questions on Positive/Negative Experience. Individuals should feel they have a positive experience in their lives.

Unit	index
Scale	UniverCity residents
Data Source	Prime, 2014
Value	65; The GNH Index average score for Positive/Negative Experience is 63. UniverCity residents score 2 points higher in this life domain than the GNH Index database of over 35K people.
Calculation Method	See GNH Index Methodology

Target	100
Target Source	Proportion of 100
Threshold Calculation Method	Method 1
Norm Red	< 25
Norm Orange	25 - 50
Norm Gold	50 - 75
Norm Green	> 75

Indicator	4.3.3	**Material well-being**
Human		Well-being
Color code		gold

Indicator description
Material well-being is measured here as an index given by the GNH Index survey answering questions on Material Well-Being. Individuals should feel they have personal financial security, and that their basic needs are met.

Unit	index
Scale	UniverCity residents
Data Source	Prime, 2014
Value	74; The GNH Index average score for Material Well-Being is 66. UniverCity residents score 8 points higher in this life domain than the GNH Index database of over 35K people.
Calculation Method	See GNH Index Methodology

Target	100
Target Source	Proportion of 100
Threshold Calculation Method	Method 1
Norm Red	< 25
Norm Orange	25 - 50
Norm Gold	50 - 75
Norm Green	> 75

Indicator	4.3.4	**Mental well-being**
Human		Well-being
Color code		green

Indicator description
Mental well-being is measured here as an index given by the GNH Index survey answering questions on Psychological Well-Being. Individuals should feel optimistic, positive, purposeful, and have a sense of accomplishment. Personal assessment of psychological well-being is an important aspect of mental health and happiness.

Unit	index
Scale	UniverCity residents
Data Source	Prime, 2014
Value	76; The GNH Index average score for Psychological is 70. UniverCity residents score 6 points higher in this life domain than the GNH Index database of over 35K people.
Calculation Method	See GNH Index Methodology

Target	100
Target Source	Proportion of 100
Threshold Calculation Method	Method 1
Norm Red	< 25
Norm Orange	25 - 50
Norm Gold	50 - 75
Norm Green	> 75

Social Capital

Citizenship

Indicator	5.1.1	**Voter participation**
Social		Citizenship
Color code		red

Indicator description
The proportion of voting-age neighbourhood population that cast ballots in 2011 municipal elections.

Unit	percentage
Scale	Voting Division: 4
Data Source	City of Burnaby Elections Office
Value	19%
Calculation Method	Verified with City of Burnaby Elections Office

Target	84%
Target Source	Relative norms have been established based on municipal voter participation rates in the 2011 municipal election, province wide.
Threshold Calculation Method	Method 4
Norm Red	< 30%
Norm Orange	30% - 37%
Norm Gold	37% - 50%
Norm Green	> 50%

Indicator	5.1.2	**Confidence in government**
Social		Citizenship
Color code		orange

Indicator description
Confidence in government, involvement, influence is measured here as an index given by the GNH Index survey answering questions on Governance. Confidence in political institutions is crucial for the stability of societies and for the functioning of democracy. It also shapes people's willingness to cooperate in achieving collective goals and financing public goods. The Confidence in Government indicator offsets the results within the Voter Participation indicator that may be reflecting aspects other than social cohesion.

Unit	index
Scale	UniverCity residents
Data Source	Prime, 2014
Value	57
Calculation Method	See GNH Index Methodology

Target	100
Target Source	Proportion of 100
Threshold Calculation Method	Method 1
Norm Red	< 25
Norm Orange	25 - 50
Norm Gold	50 - 75
Norm Green	> 75

Community Character

Indicator	5.2.1	**Social support**
Social		Community Character
Color code		green

Indicator description
Social support is measured here as an index given by the GNH Index survey answering questions on Social Support. Individuals should feel supported by family and friends, cared for or loved.

Unit	index
Scale	UniverCity residents
Data Source	Prime, 2014
Value	76; The GNH Index average score for Social Support is 71. UniverCity residents score 5 points higher in this life domain than the GNH Index database of over 35K people.
Calculation Method	See GNH Index Methodology

Target	100
Target Source	Proportion of 100
Threshold Calculation Method	Method 1
Norm Red	< 25
Norm Orange	25 - 50
Norm Gold	50 - 75
Norm Green	> 75

Indicator	5.2.2	**Social cohesion**
Social		Community Character
Color code		gold

Indicator description
Social cohesion is measured here as an index given by the GNH Index survey answering questions on Community. Participation in social activities, by bringing people together to work on mutually beneficial things, affects social capital at the neighbourhood scale. Individual's involvement in volunteer time as well as perceptions of safety and trust in strangers are considered measured of community cohesion.

Unit	index
Scale	UniverCity residents
Data Source	Prime, 2014
Value	55; The GNH Index average score for Community is 52. UniverCity residents score 3 points higher in this life domain than the GNH Index database of over 35K people.
Calculation Method	See GNH Index Methodology

Target	100
Target Source	Proportion of 100
Threshold Calculation Method	Method 1
Norm Red	< 25
Norm Orange	25 - 50
Norm Gold	50 - 75

Norm Green	> 75

Safety

Indicator	5.3.1	**Traffic accidents**
Social		Safety
Color code		green

Indicator description
Crash casualty rate, 2013. Casualty crashes: Motor vehicle crashes resulting in an injury or fatality. Streets should be safe to drive, and safe for pedestrians and cyclists.

Unit	rate per 1000 residents
Scale	UniverCity development area boundary
Data Source	ICBC Crashes at Intersections, 2009-2013 5 year average
Value	0.32
Calculation Method	

Target	0
Target Source	The identified thresholds consider 5 casualties per year within neighbourhood boundaries to be a very dangerous number. Working backwards the tool then designates moderately dangerous, and moderately low, and low danger thresholds.
Threshold Calculation Method	Method 3
Norm Red	> 1.2
Norm Orange	0.8 - 1.2
Norm Gold	0.4 - 0.8
Norm Green	< 0.4

Indicator	5.3.2	**Break & Enter**
Social		Safety
Color code		gold

Indicator description
Break & enter occurrences, 2013. Aggregate business and residential. Neighbourhood crime should be low. Crime against property can have a major impact on the well-being of victims and on the wider community. Breakdown in social capital can thus be measured directly by assessing levels of crime.

Unit	number
Scale	District 2
Data Source	Community Policing Reports, Burnaby RCMP, January through December 2013
Value	5
Calculation Method	Counted

Target	0
Target Source	Benchmarks described in this study are an average of identified benchmarks in Burnaby RCMP Community Policing Reports, 2013.
Threshold Calculation Method	Method 4
Norm Red	> 9.75
Norm Orange	6.25 - 9.75
Norm Gold	3.5 - 6.25
Norm Green	< 3.5

Indicator	5.3.3	**Auto crime**
Social		Safety
Color code		gold

Indicator description
Auto crime occurrences.

Unit	number
Scale	District 2
Data Source	Community Policing Reports, Burnaby RCMP, January through December 2013
Value	7
Calculation Method	Counted

Target	0
Target Source	Benchmarks described in this study are an average of identified benchmarks in Burnaby RCMP Community Policing Reports, 2013.
Threshold Calculation Method	Method 4
Norm Red	> 20
Norm Orange	13 - 20
Norm Gold	6 - 13
Norm Green	< 6

Indicator	5.3.4	**Robbery**
Social		Safety
Color code		green

Indicator description
Robbery occurrences.

Unit	number
Scale	District 2
Data Source	Community Policing Reports, Burnaby RCMP, January through December 2013
Value	0
Calculation Method	Counted

Target	0
Target Source	Benchmarks described in this study are an average of identified benchmarks in Burnaby RCMP Community Policing Reports, 2013.
Threshold Calculation Method	Method 4
Norm Red	> 3
Norm Orange	2 - 3
Norm Gold	1 - 2
Norm Green	< 1

Housing

Indicator	5.4.1	**Core housing need**
Social		Housing
Color code		gold

Indicator description
Proportion of neighbourhood population in core housing need. There should be adequate, suitable, and affordable housing available in a community. Households are in core housing need if they live in housing that is inadequate, unsuitable, or unaffordable, and cannot access a suitable, adequate alternative in the local market without spending 30% or more of their before-tax household income.

Unit	percentage
Scale	CT 0243.02
Data Source	CMHC (census-based housing indicators and data, Starts and Completions Survey, Rental Market Survey), Statistics Canada (Census of Canada)
Value	13%
Calculation Method	CMHC calculated

Target	0%
Target Source	The CMHC does not publish a target on this indicator to date. In Canada, in 2006, 12.7% of households surveyed were in core housing need, thus we used this as a benchmark for “green” achievement.
Threshold Calculation Method	Method 4
Norm Red	> 75%
Norm Orange	50% - 75%
Norm Gold	12.7% - 50%
Norm Green	< 12.7%

Indicator	5.4.2	**Rental vacancy rates**
Social		Housing
Color code		gold

Indicator description
The 'rental vacancy rates' indicator shows the percentage of rental apartment units or rental apartment and row/townhouse units in a given region that are vacant and available to rent. Ensure availability of rental housing. Renting has traditionally provided a more affordable housing option than homeownership. As a result, renting is a popular option for young and lower-income households.

Unit	percentage
Scale	University/Lougheed
Data Source	CMHC Rental Market Survey
Value	2.9%
Calculation Method	See CMHC Rental Market Survey

Target	0%
Target Source	The Canadian Ministry of Finance suggests a benchmark of 3% for rental vacancy rates. Low vacancy rates typically mean that households will have greater difficulty finding a place to rent. They may also lead to increases in rents, as more households seek to occupy a smaller pool of rental units.
Threshold Calculation Method	Method 2
Norm Red	< 1%
Norm Orange	1% - 2%
Norm Gold	2% - 3%
Norm Green	> 3%

Indicator	5.4.3	**Shelter-to-income-cost ratio**
Social		Housing
Color code		red

Indicator description
Proportion of owner and tenant households with household total income greater than zero spending 30% or more of household total income on shelter costs. Housing is affordable as a percentage of net income. Households spending more than 30% on shelter-related expenses are deemed unsustainable.

Unit	percentage
Scale	DA 3695
Data Source	National Household Survey, 2011
Value	58%
Calculation Method	See Housing, NHS, 2011

Target	0%
Target Source	Relative norms were established using the STIR values for every Dissemination Area (DA) in Metro Vancouver as our dataset. UniverCity scores in the red range with 58%. As a basis for comparison, Burnaby overall has a STIR of 35%.
Threshold Calculation Method	Method 4
Norm Red	> 39%
Norm Orange	30% - 39%
Norm Gold	22% - 30%
Norm Green	< 22%

Indicator	5.4.4	**Resident turnover**
Social		Housing
Color code		red

Indicator description
Percent of resident movers. Movers: persons who have moved from one residence to another in the past year. Social cohesion and a sense of belonging are increased when there is less turnover in a community. The resident turnover also tell us something about how attractive the neighbourhood is; it can also have an impact on housing prices

Unit	percentage
Scale	DA 3695
Data Source	National Household Survey, 2011
Value	29%
Calculation Method	See Migration, NHS, 2011

Target	0%
Target Source	The National Housing Survey tells us the number of residents who have moved from one residence to another in the past year. Relational norms using the median and interquartile points were established using the % of movers for every Dissemination Area (DA) in Metro Vancouver as our dataset. More research is needed to develop absolute thresholds and improve accuracy.
Threshold Calculation Method	Method 4
Norm Red	> 39%
Norm Orange	30% - 39%
Norm Gold	22% - 30%
Norm Green	< 22%

Indicator	5.4.5	**Resident satisfaction**
Social		Housing
Color code		green

Indicator description
Percentage of neighbourhood population who would recommend UniverCity to friends or family. Individuals should be satisfied with their dwellings and neighbourhoods.

Unit	percentage
Scale	UniverCity development area boundary
Data Source	Mustel Survey, 2012
Value	93%
Calculation Method	See Mustel Survey, 2012

Target	100%
Target Source	UniverCity's own target
Threshold Calculation Method	Method 1
Norm Red	< 25%
Norm Orange	25% - 50%
Norm Gold	50% - 75%
Norm Green	> 75%

Cultural Capital

Cultural Vitality

Indicator	6.1.1	**Cultural access**
Cultural		Cultural Vitality
Color code		gold

Indicator description
Cultural access is measured here as an index given by the GNH Index survey answering questions on Access to Education, Arts and Culture.

Unit	index
Scale	UniverCity residents
Data Source	Prime, 2014
Value	65
Calculation Method	See GNH Index Methodology

Target	100
Target Source	Proportion of 100
Threshold Calculation Method	Method 1
Norm Red	< 25
Norm Orange	25 - 50
Norm Gold	50 - 75
Norm Green	> 75

Indicator	6.1.2	**Public Programming**
Cultural		Cultural Vitality
Color code		gold

Indicator description
Participation rate in Parks, recreation & cultural programming. Public programming is meeting the wants and needs of the neighbourhood population.

Unit	percentage
Scale	University Highlands Elementary School
Data Source	City of Burnaby Parks, Recreation & Cultural Services: 2013 Registration Statistics
Value	60%
Calculation Method	Verified with City of Burnaby Parks, Recreation & Cultural Services

Target	85%
Target Source	Target participation rate is 85%. If more, there is probably a high enough demand to run more programming, and capacity may be an issue.
Threshold Calculation Method	Method 3
Norm Red	< 50%
Norm Orange	50% - 60%
Norm Gold	60% - 70%
Norm Green	> 70%

Diversity

Indicator	6.2.1	**Ethnic Composition**
Cultural		Diversity
Color code		green

Indicator description
Percentage of similarity between neighbourhood and municipal ethnic composition.

Unit	percentage
Scale	DA 3695
Data Source	National Household Survey, Total Ethnic Origin by Continent: DA 3695 vs. CSD 1502, 2011
Value	93%
Calculation Method	The National Household Survey, 2011 describes the Ethnic Composition of Burnaby (CSD 15025) as: North American Aboriginal origins: 2% Other North American origins: 9% European origins: 36% Caribbean origins: 1% African origins: 2% Asian origins: 49% Oceania origins: 1%

Target	100%
Target Source	Proportion of 100%
Threshold Calculation Method	Method 1
Norm Red	< 25%
Norm Orange	25% - 50%
Norm Gold	50% - 75%
Norm Green	> 75%

Built Cultural Heritage

Indicator	6.3.1	**Public Art**
Cultural		Built Cultural Heritage
Color code		red

Indicator description
Investment in public art. $ / ft2of buildable area.

Unit	$ / ft2
Scale	UniverCity development area boundary
Data Source	SFU Community Trust, 2014
Value	0.06
Calculation Method	

Target	$1.00
Target Source	UniverCity have a identified goal of $1 per ft2of building area moving forward. This policy has been effected in negotiations with all Phase 3 developers; moving forward UniverCity will see increases in this indicator towards the $1 target.
Threshold Calculation Method	Method 2
Norm Red	< 0.25 $/ ft2
Norm Orange	0.25 - 0.5 $/ ft2
Norm Gold	0.5 - 0.75 $/ ft2
Norm Green	> 0.75 $/ ft2

Indicator	6.3.2	**Registered Heritage Sites**
Cultural		Built Cultural Heritage
Color code		orange

Indicator description
Number of designated heritage sites identified in Burnaby's Heritage Inventory.

Unit	number
Scale	Lochdale/Burnaby Mountain
Data Source	Burnaby's Heritage - An Inventory of Buildings and Structures
Value	4
Calculation Method	Counted

Target	44
Target Source	Burnaby's Heritage Inventory identifies 14 unique historic neighbourhoods. In each of the neighbourhoods the number of registered heritage sites was counted. Based on these values, thresholds represent the median and first and third quartiles of the observed numerical data set.
Threshold Calculation Method	Method 4
Norm Red	< 4
Norm Orange	4 - 15
Norm Gold	15 - 21
Norm Green	> 21

Appendix B. SCORE Tool Recommendations

Recommendations for future adaptations of the tool are numbered for clarity and ease of addressing these concerns.

1. Scope

    1.1. Streamline delivery

        1.1.1. Automated data gathering

        1.1.2. Secure GIS support from municipalities

        1.1.3. Secure data sharing agreements

        1.1.4. More structured reporting in terms of design and layout

    1.2. Interpretation of results – how can we deliver at a very low cost but still interpret a little

2. Indicator Selection

    2.1. Peer review of indicator selection

        2.1.1. Should identify best in class based on data availability and relevance to neighbourhood sustainability assessment

        2.1.2. Compare indicator list to those selected for international, municipal frameworks (partially met in Chapter 3)

3. Indicator Valuation

    3.1. Peer review of valuation methods

    3.2. Identify widely accepted international standards/targets for each indicator

4. Presentation of Results

    4.1. Construct better informational graphics

    4.2. Change threshold categories from green, gold, orange, red to shades of green

    4.3. Identify the geography of each indicator geographically

    4.4. Present each indicator as a bar graph beside indicator table to visually represent where the value sites in relation to thresholds

    4.5. http://www.ccbalance-ca.cscd.sfu.ca/ website is buggy, some examples include:

        4.5.1. You can't leave weight blank

        4.5.2. You can't add a new unit of measurement, only modify existing ones

        4.5.3. Human capital graph on homepage isn't generating

        4.5.4. Should be able to click on a map to zoom in on completed assessment at most macro level

5. Customization

    5.1. Build rational for addressing customization

        5.1.1. Explore: weighting,

        5.1.2. Omitting indicators,

        5.1.3. Adding indicators

Appendix C. Interview Questions

In order to answer the comparative analysis, interviews were conducted with three members of the FSA assessment UniverCity case-study team, as well as Development Director Dale Mikkelsen, for their input on process evaluation. The interview questions that were used are listed below.

1. Review FSA sustainability framework and framework chapters. Do you feel that the FSA Tool provided a good coverage of sustainability issues?
2. In total the FSA Tool scores 23 criteria within FSA framework chapters, was scoring each one of these criteria mandatory?
3. How did FSA tool consider the specific needs and priorities of UniverCity?
4. How did scoring of the criteria take place?
5. Was there any weighting?
6. What was the level of community involvement in applying the FSA Tool?
7. Do you feel that of the FSA Tool useful as decision support system?