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Basic Income from an Ecological Perspective: Measuring and Monitoring Its Environmental Impact

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Master in International Studies

Supervisor:
Dr. Roberto Merrill, PhD
Assistant professor, University of Minho

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SOCIOLOGIA
E POLÍTICAS PÚBLICAS

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This project is dedicated to my nephews and nieces:

Andrew, Kaitlyn, Elise, Baby Marquette, and Baby Bousamra

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-Will

Resumo:

O rendimento básico (RB) é uma proposta teórica de política pública socio-económica redistributiva, ainda pouco testada e de elevado grau de variabilidade. A sua natureza flexível implica que pode ser vista como um meio para uma ampla variedade de fins. Apesar dos seus óbvios benefícios potenciais, o RB também pode causar danos. Quando implementado em nações ricas com grandes pegadas ecológicas e materiais, o RB ameaça com potenciais danos adicionais os sistemas ambientais, através do aumento do consumo agregado. Os programas de RB justos devem promover tanto a convergência como a contração do uso de recursos e impactos ambientais, permitindo a expansão do consumo para as necessidades básicas das classes socio-económicas mais vulneráveis, enquanto restringe o consumo das classes mais abastadas. Este processo deve ocorrer dentro e entre nações para promover o bem-estar de toda a vida atual e futura na Terra, sem violar os limites ecológicos do planeta. Entre todas as variações possíveis de RB, uma versão ecológica (RBE) fornece a melhor estratégia para atingir esses objetivos. Os programas de RB projetados especificamente com objetivos ecológicos em mente têm muito mais probabilidade de atingir esses resultados do que aqueles que não o são. Os programas de RB que não promovem resultados ecológicos correm o risco de por em causa as suas justificações. Este projeto explora visões e elementos comuns de programas de RBE numa tentativa de promover o desenvolvimento deste conceito e garantir a sua sustentabilidade a longo prazo. O projeto propõe também uma estratégia para determinar e monitorizar o impacto ambiental dos RBs e discute os desafios desse processo, com o objetivo de viabilizar resultados justos e ecologicamente positivos.

Palavras-chave: rendimento básico, justiça intergeracional, ecologismo, sustentabilidade ambiental, medidas de sustentabilidade

Abstract:

Basic income (BI) is a largely theoretical, mostly untested, highly variable, redistributive socio-economic policy. Its flexible nature implies that it can be constructed as a means to a wide variety of ends. Despite its obvious potential benefits, BI also has the ability to cause harm. If implemented in wealthy nations with heavy ecological and material footprints, BI potentially threatens additional damage to environmental systems by increasing aggregate consumption. Just BI programs should foster convergence and contraction of resource use and environmental impacts, enabling expanded consumption for basic necessities from vulnerable socio-economic classes while constraining consumption of more affluent classes. This process should take place both within and among nations to promote the well-being of all current and future life on Earth without violating the planet's ecological limits. Among all possible variations of BI, an ecological version (EBI) provides the best strategy for accomplishing these goals. Basic income programs specifically designed with ecological goals in mind are much more likely to achieve these outcomes than those that are not. Basico income programs which do not promote ecological outcomes risk undermining their justifications. This project explores visions and common elements of EBI programs in an attempt to further the development of this concept and ensure their long-term sustainability. It proposes a strategy for determining and monitoring the environmental impact of BIs and discusses challenges to this process, with the aim of facilitating just, ecologically favorable outcomes.

Keywords: basic income, intergenerational justice, ecologism, environmental sustainability, sustainability measurements

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Glossary of Acronyms

APFD	Alaska Permanent Fund Dividend
AS	autonomous sphere
BI	basic income
COICOP	Classification of Individual Consumption According to Purpose
EBI	ecological basic income
EF	ecological footprint
MF	material footprint
MIPS	Material Input Per Service
PB	planetary boundaries
RCT	randomized control trial

1.0 Introduction

The world in which this project was begun is significantly different from the one in which it was finished. The outbreak and global spread of the COVID-19 virus has turned the page to a new chapter in the book of global society. It's changed the way people work, study, enjoy their free time, interact socially, and more. It has thrust to the forefront issues and questions less frequently pondered prior to the pandemic and revealed weaknesses in the global socio-economic paradigm. For example, who are 'essential workers'? In situations like the general quarantines experienced all around the globe in the first half of 2020, whose labor can society not survive without? If individuals and families are dependent upon employment to afford their livelihoods, what happens when large sections of the population are unemployed, even on a temporary basis? If well-being is linked to economic health and growth, how should society respond if economic activity is impossible or restricted for extended periods of time? Spain has attempted to answer some of these by offering a minimum income to its most vulnerable citizens.[1] The global pandemic has prompted other questions, not strictly centered around economics. How much is society willing to restrict (voluntarily or by mandate) individual freedom to ensure collective health and wellness? How can ever-expanding human activity allow for the health of the planet and other creatures we share it with? City streets, typically clogged with traffic and clouded with smog, were photographed empty and covered by clear skies. Videos of animals, emboldened by reduced human presence, wandering through cities and reclaiming sections of their natural habitat, were shared on social media.[2] COVID-19 has forced society onto a different path, and not in a gentle manner, but in doing so has increased awareness of alternative options for societal organization. Time is not a luxury we can afford much more of as we ponder these options. Global carbon emissions continue to push Paris Climate Agreement targets further out of reach. A new, more sustainable balance must quickly be struck between well-being and the economy, the natural and human realms, individual freedom and the collective good, and the present and future. Some see basic income as a means to achieve this balance. This may be possible, but not by default. This project explores the global socio-economic paradigm, theories of justice, basic income, and sustainability measurements in attempts to help locate this balance.

[1] Though commonly portrayed as a basic income in popular media, the Spanish scheme is more accurately portrayed as an unconditional minimum income. Citizens whose income fails to meet a minimum threshold have it 'topped up' to ensure it meets a particular standard based on the composition of their household.

[2] Here in Lisbon, residents need look no further than the Tejo, where dolphins have again been spotted swimming.

1.1 Contemporary Socio-Economic Context

A general overview of the current global socio-economic situation seems like an appropriate starting point. Modern society and the economy are deeply intertwined; both are interrelated and interact with one another. They simultaneously explain and are explained by each other. Examining the socio-economic context is vital to achieve any level of understanding of the globalist 21st century world, or to attempt to influence its direction. The contemporary climate situation[3] may be best understood through this lens. This context is necessary to understand the impacts basic income (BI) may have on society, the economy, and the environment.

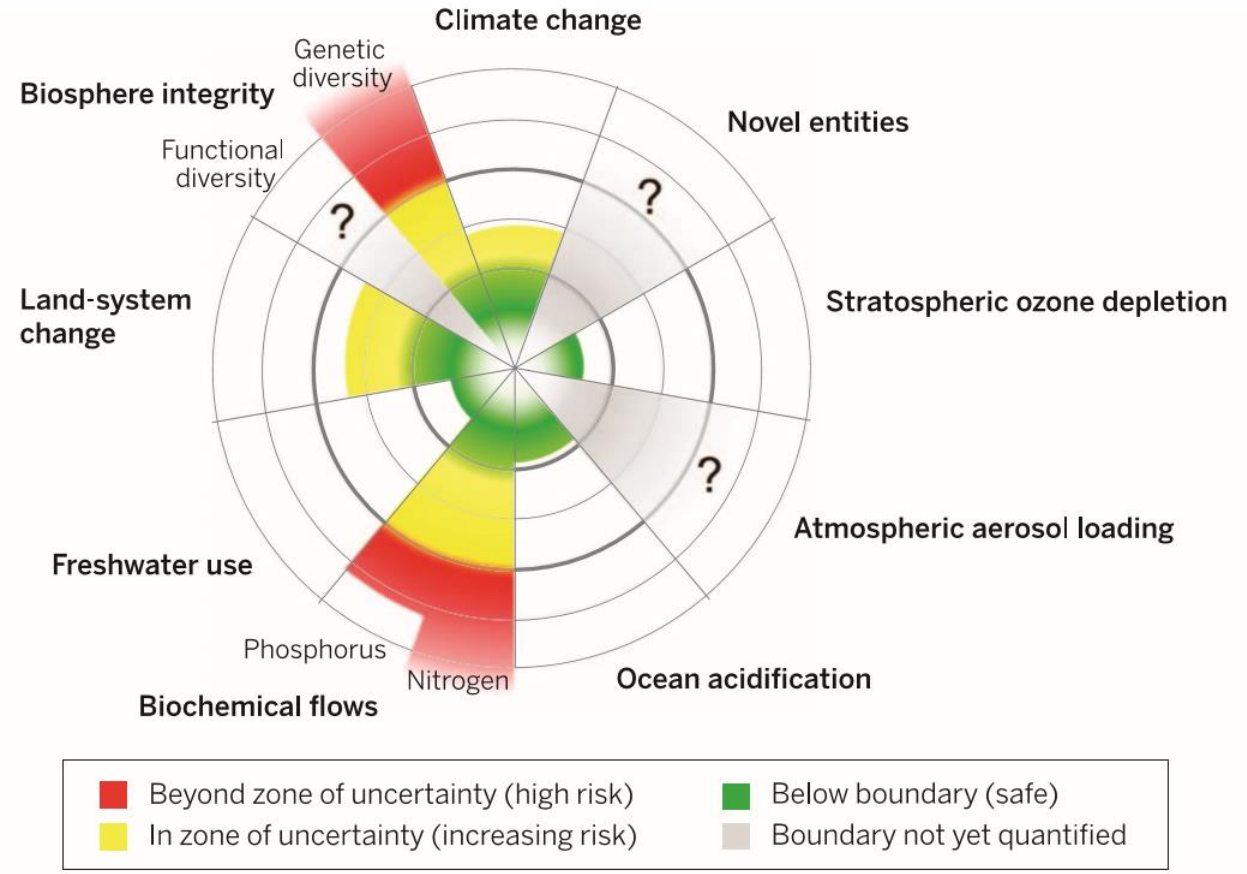
Like any creature, homo sapiens has an innate desire to reproduce, pass along its genes, and sustain itself as a species. An accommodating, relatively stable environment is necessary for life to flourish. As life forms become more complex, they generally require more specific conditions to enable their flourishing (Schulze-Makuch & Bains, 2017, pp. 26-28). Humans represent one of the most complex life forms to have ever inhabited planet Earth, and have been able to thrive or survive in many of its geographical and climatic zones. Modern human civilization emerged during the Holocene, a geological period beginning with the end of the last major ice age. The Holocene is the only time period proven to be able to sustain human civilization in the long term (Steffen, et al., 2015). It may be possible for humans to survive or flourish in conditions other than those enjoyed during the Holocene, but this is uncertain. Humans have a strong self-interest in maintaining Holocene-like conditions in order to sustain civilization.

The Earth is a complex system, made up of various interrelated subsystems which influence and interact with each other. Important work is being done by scientists to understand these systems, though understanding exactly how they interact and what ranges might be identified as safe or stable is challenging. The planetary boundaries (PB) framework presents one of the most comprehensive overviews of the Earth's planetary systems and attempts to locate our current position for nine of its most critical systems (Steffen, et al., 2015). The team finds four of the nine boundaries "at risk": biosphere integrity, climate change, biochemical flows, and land-system change, while regarding stratospheric ozone depletion, ocean acidification, and freshwater use to be within 'safe' limits. The remaining two

[3] I use the term 'climate situation' to refer to the rising global average temperature, greenhouse gas concentrations, shifting weather patterns, etc. In the past, the term 'global warming' may have been used to describe this situation, before it gave way to 'climate change'. Now the term 'climate crisis' seems to be enjoying rising prominence. Acknowledging the potential (but uncertain) severity of shifting climate patterns and their implications, and without denying human activity has affected them, I favor a less alarmist, more neutral term 'climate situation'.

systems, novel entities and atmospheric aerosol loading, have yet to have boundaries identified and quantified (Steffen, et al., 2015). Maintaining these critical systems is vital to preserving the conditions under which human flourishing has accelerated.

Figure 1: The Planetary Boundaries (Steffen, et al., 2015)



The Earth and its systems are dynamic, constantly redefining their own state of balanced equilibrium. There is no denying human activity has affected these systems, though the extent of these effects may not be well known or easily identifiable. One of the main human threats to the Earth systems comes in the form of modern industrial globalist capitalism. The contemporary economic system's continuous extraction of resources for processing and production, largely centered around burning fossil fuels, has instigated the current precarious climate situation. It has also brought tremendous benefits. Developments in science, medicine, and technology, plus increased wealth creation made possible by capitalism have helped enable levels of well-being previously unseen in human history. By many measures, things are better than ever for a larger section of humanity than at any previous time in history (Bregman, 2016). However, more work remains to be done. A large amount of the global population lives

in poverty and/or with unfulfilled basic human needs. Economic development, the traditional method for combatting poverty, carries with it unsustainable levels of adverse environmental impacts, which grow alongside national economies (Fritz & Koch, 2016, p. 44; Sarkodie & Strezov, 2019, p. 868). At a time when both resource use and greenhouse gas emissions are at historic highs (Global Carbon Project, 2020; United Nations Environment Programme, 2019, pp. 42-43), reducing poverty through traditional economic development seemingly ensures planetary boundaries will face additional stress. A world where a significant portion of the global population lives in poverty is clearly unjust, but reducing poverty may mean undermining the very conditions that have enabled human flourishing.

The global nature of both the modern economic and planetery systems mean that impacts of both cannot be isolated within one particular nation or system. Earth's atmosphere and oceans, "the two great fluids" (Steffen, et al., 2015), flow freely and connect all nations. Similarly, international material flows and trade dictate that consumption patterns and demand in one nation will have implications for extraction and processing, along with associated adverse environmental effects, in others (Wiedmann, et al., 2015, p. 6275). Many wealthy nations have shifted their economies away from industry and towards services, which are generally considered to be lighter on material resources and thus the environment (Schandl, et al., 2017, pp. 833-834). This can be misleading however, because after the industry has been relocated, demand for these products typically remains. Importing finished products or component parts for assembly allows nations to reap economic benefits while distancing themselves from negative environmental externalities (Akenji, Bengtsson, Bleischwitz, & Tukker, 2016, p. 4; Al-Mulali, Saboori, & Ozturk, 2015, p. 129; Wiedmann, et al., 2015, p. 6273). The amount of materials and emissions required to enable international exports has reached as much as 40% of global totals in the recent past, and threatens various other Earth systems, such as water and biodiversity (Teubler, Buhl, Lettenmeier, Greiff, & Liedtke, 2018, p. 97; Wiedmann, et al., 2015, p. 6272). Material resources are not distributed equally around the globe; people will always require some, and thus global trade at some level will always exist. Nevertheless, reducing resource use and scaling back international shipping would provide substantial benefits to the planet and the vital balance of its systems.

Unfortunately, evidence shows human impact on the planet is rising and will likely continue to do so in the foreseeable future. The amount of material resources extracted from the Earth has more than tripled in the last half century, and is accelerating (Schandl, et al., 2017, p. 830; United Nations Environment Programme, 2019, pp. 42-43). Increasing demand for material resources is partially a function of global development, rising affluence, increased economic activity, and a growing global

population (Schandl, et al., 2017, pp. 830-831, 833; United Nations Environment Programme, 2019, pp. 40, 56; Wiedmann, et al., 2015, p. 6273). Monitoring and reducing resource use is vital because of the adverse impacts resource extraction, processing, and shipping have on planetary systems, especially biodiversity loss, water use, and carbon emissions (Schandl, et al., 2017, p. 832; United Nations Environment Programme, 2019, p. 68; Wiedmann, et al., 2015, p. 6272). A reduction of or increased efficiency in resource use would likely have residual effects reducing pressure across a number of the PBs.[4] Unfortunately, global resource efficiency has declined this century (Schandl, et al., 2017, p. 834). This reduced efficiency is natural and might be expected as nations develop their economies, undertake construction projects, and expand their infrastructure, all materially intensive processes. Their growing middle classes will continue to demand products and services they can now afford. Though global population growth has slowed, the total number of people on the planet is rising and is projected to continue for some time. Taken together, all of these imply a continued demand for material resources and the accompanying environmental degradation naturally associated with extraction, processing, and shipping.

This should not be read as an argument against development. No one deserves to live in poverty and people will naturally seek to improve their conditions. Nation states typically (though not always) act in the interest of their citizens, and can be expected to continue to pursue economic growth in attempts to improve their prospects.[5] The likely result will be additional stress on a precarious environmental situation. Though standards of living need improvement in many nations around the world, current global levels of production and consumption are already placing pressure on planetary boundaries (Schandl, et al., 2017, pp. 834-835). Consumption patterns in nations with advanced economies already exceed sustainable levels, and cannot be reproduced globally (Hirvilammi, Laakso, Lettenmeier, & Lähteenoja, 2013, pp. 149-150). Though technological solutions, resource productivity, renewable energy, increased energy efficiency, and more circular economic systems all have roles to play and should be pursued, these alone (or combined) do not represent a 'silver bullet' solution to the current environmental situation

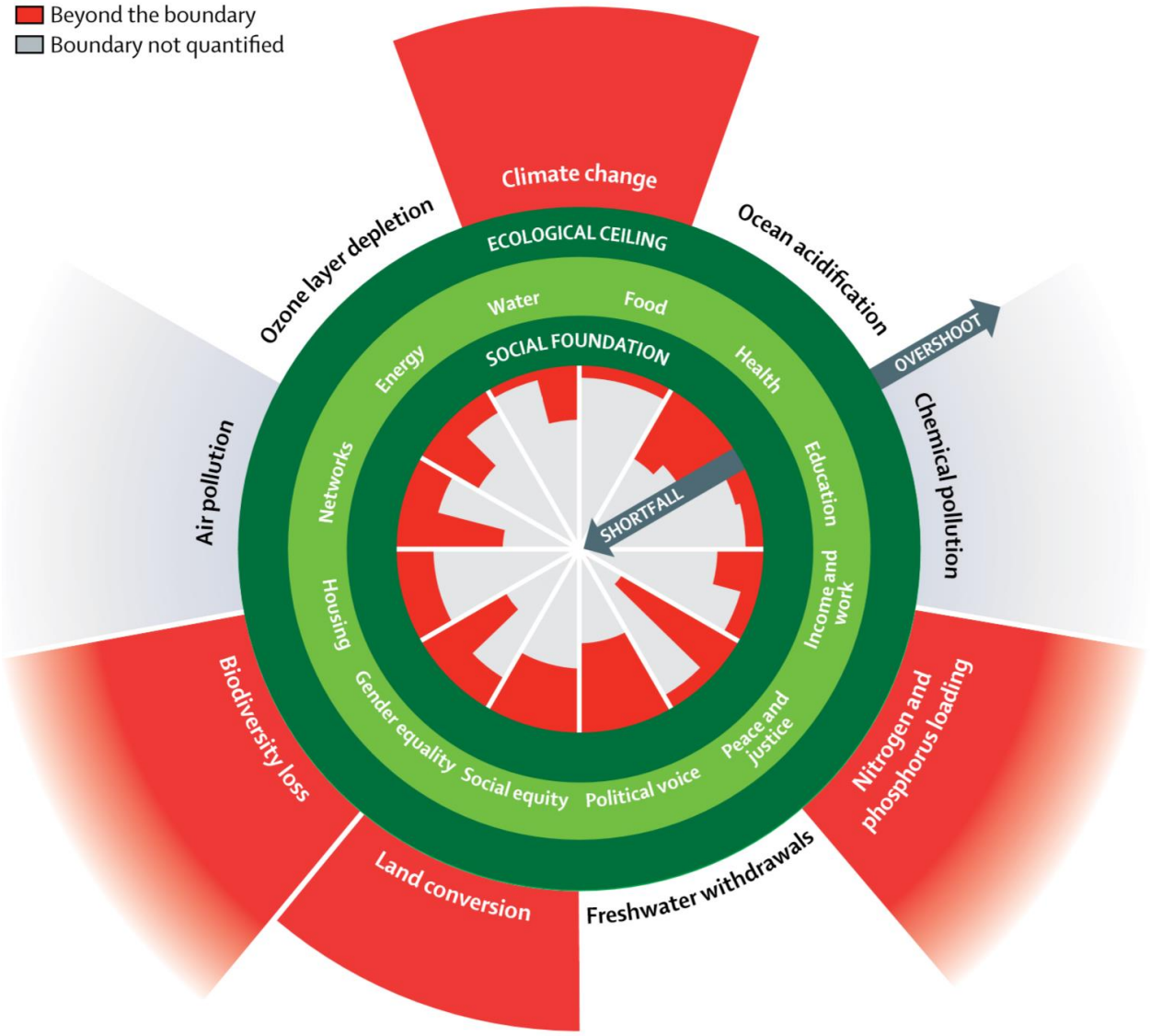
[4] The 'rebound effect' is a danger in this situation. Greater efficiency can lead to higher levels of supply and reduced prices, which in turn might increase demand and consumption overall. This effect might emerge for a single product or spill over and affect other types of consumption. For example, cheaper gasoline may mean more trips by car and an increase in the total amount of fuel consumed. Or, savings at the fuel pump may enable the purchase of additional goods or services which may not have otherwise been made. These effects can occur on the global scale, as in this example with meat (Boulanger, 2009, p. 7), which can have implications for taxes targeting consumption.

[5] Despite the popularity of the 'economic growth as a means to provide well-being' strategy, its efficiency is questionable (Fanning & O'Neill, 2019, p. 818).

(Fitzpatrick, 2009, p. 2). Scholars have recognized growth of developed economies runs counter to environmental sustainability (Christensen, 2012, p. 4; Martínez-Alier, 2012, p. 64), with some even questioning the morality of such growth (Andersson, 2009, p. 3; Peeters, Dirix, & Sterckx, 2013, p. 62). The necessity of absolute reductions in resource use and contraction from more developed nations to allow for growth in the developing world is commonly recognized (Akenji, Bengtsson, Bleischwitz, & Tukker, 2016; Andersson, 2009; Martínez-Alier, 2012; Schachtschneider, 2012; Schachtschneider, 2014; Schandl, et al., 2017, pp. 834-836; United Nations Environment Programme, 2019, pp. 5, 99, 111, 128). The question remains: "how can global society drastically reduce its material throughput and emissions to stay within ecosystem boundaries while securing well-being for all, and within a timeframe that avoids irreversible ecological harm?" (Akenji, Bengtsson, Bleischwitz, & Tukker, 2016, p. 2).

An excellent visual representation of this challenge is provided by Kate Raworth's "Doughnut", which combines the planetary boundaries with an inner ring of social development (2017). The goal of the Doughnut is to move humanity out of the central hole, where social rights and basic needs are lacking, and into the 'doughnut'. This should be done without extending the Earth's planetary systems beyond their capacity, keeping them inside the outer perimeter of the 'doughnut'. Enhancing well-being of people existing in the present without jeopardizing the potential well-being of the future should be one of the primary aims of human society in the 21st century (Wiedmann, Lenzen, Keyßer, & Steinberger, 2020, p. 3).

Figure 2: Kate Raworth's 'Doughnut' (Raworth, 2017)



2.0 Basic Income: The Protean Policy

Proteus is an ancient Greek water god able to change form at will. The English word 'protean', meaning variable, adaptable, or versatile, is derived from this deity's name. Basic income (BI) is a protean socio-economic policy defined as *a periodic, unconditional payment delivered in cash to all individual members of a particular community*. Entire books have been devoted to the concept (Birnbaum, 2012; Merrill, Bizarro, Marcelo, & Pinto, 2019; Murray, 2016; Standing, 2017; Van Parijs, 1995; Van Parijs & Vanderborght, 2017; World Bank, 2020), and an examination of BI with this level of detail is obviously not possible here. A brief discussion of some of BI's relevant characteristics is necessary, however. This section explores basic income's protean and universal nature, and the challenges this presents for testing and monitoring.

2.1 Variable by Definition

Basic income's definition reflects the protean nature of this policy. In one sense, the definition is quite strict, listing numerous criteria which separate BI from other cash transfer policies. The 'unconditional' aspect of the definition is binary; policies either have attached conditions or not. The 'cash' aspect also appears to be binary, unless one considers the possibility that a BI might be paid in some form of local currency. Other criteria are much more open, and can be fulfilled in diverse ways. The 'periodic' aspect of the definition could be fulfilled by annual, biannual, quarterly, monthly, weekly, or another regularly scheduled payment. The 'community' aspect is also broad. A basic income could be implemented nationally, provincially, by state, or at another larger or smaller administrative level. Additional questions can be raised about what constitutes 'members'. Citizens would almost certainly qualify, but what about permanent residents, young children, or other groups?[6] These questions lead to others. Should all members (newborn children, working-age adults, the elderly, etc.) be paid the same amount? What amount(s) shall each member receive? All of these questions must be answered by a particular community before a BI can be implemented. Different communities will undoubtedly have different answers to these questions, and if widely implemented, a great deal of variation can be expected among various policies (Torry, 2018, p. 12). This is natural; different contexts require different approaches. A large number of democracies can be found around the world, each one with its own unique features. Most modern nation-states feature welfare policies and tax codes, but no two appear identical. BI is no different. Basic income's

[6] While a line must be drawn somewhere in order to define a community, overly specific definitions may undermine solidarity and support for these programs.

variable, open-ended nature essentially ensures that it will take on a different form in each context where it is employed.

Basic income's protean nature may help explain the diverse support for the policy.[7] Visions of what this policy can and should do vary, and sometimes conflict. One of BI's most common defenses comes from proponents claiming it will promote justice, freedom, opportunity, and security while reducing inequality (Birnbaum, 2012; Fitzpatrick, 1999; Van Parijs & Vanderborght, 2017). It's been portrayed as a tool for development (Lacey, 2017; Perkiö, 2014; Standing, 2017). It could be used as a method for enhancing democratic citizenry (Pateman, 2004). It's seen as a means to promote gender equality (Lacey, 2017; Pateman, 2004). Some have argued for BI's potential to empower women, while acknowledging the risk of it reinforcing gender roles in specific situations (Miller, Yamamori, & Zelleke, 2019). Others have argued BI would restrict women's options and reinforce gender roles (Robeyns, 2001). Proponents view BI as a way to reform modern welfare states, though there is disagreement whether this reform should complement existing programs (Perkiö, 2014; Schachtschneider, 2012; Van Parijs & Vanderborght, 2017), or replace them (Murray, 2016). Some envision it as a means to provide income and security for workers displaced by automation and technology in shifting modern economies (Standing, 2017; Yang, 2018). It's been characterized as a means to stimulate and maintain consumer economies (Yang, 2018). Others see BI as a way to sever the connection between employment and income, encouraging a shift to a post-productivist economic system (Andersson, 2009; Schachtschneider, 2012; Schachtschneider, 2014; Boulanger, 2009; Pinto, 2019b). Basic income's malleable nature raises support from various corners for differing reasons, which complicates the debate surrounding its purpose (World Bank, 2020, pp. 18, 57), implies potential for conflict, and raises questions about the purpose of basic income programs.

Though all basic income programs may share some common effects, it seems likely that these too will be widely varied, due to the different goals competing interests have for the policy and its protean nature. How can a BI be designed to accomplish the goals of any community choosing to implement it? A long list of variables which may influence the effects of a BI program have been mentioned, such as: the design, (including the amount, duration,[8] source and method of funding, and frequency and method of payment) cultural values/behaviors, social norms, institutional factors, its relationship with other social

[7] Bell and Morse suggest the flexible nature of sustainability could be responsible for the visibility and popularity of this concept (2009, p. 12). The same argument might be made for basic income.

[8] Many proponents would likely reject the concept of a temporary BI.

programs, method and timing of implementation, and the program's justifications and stated goals (Birnbaum, 2012, p. 136; Boulanger, 2009, p. 2, footnote; Goldsmith, 2012, pp. 59, 60; Hoynes & Rothstein, 2019, pp. 11, 22; MacNeill & Vibert, 2019, p. 7; Van Parijs & Vanderborght, 2017, pp. 22-23; World Bank, 2020, pp. 38-43, 107-108, 139, 143). This list is not exhaustive and certainly could be expanded. Various elements will carry different weight, depending on the context. Ranking these in order of importance seems futile, but the design and its composite elements would rank at or near the top in any case. As such, careful consideration should be given to a BI's design and its goals should remain prominent in its architects' minds. Even the most thoughtfully designed BI may eventually prove itself insufficient, or at least in need of adjustment. The goals of any BI policy may shift over time. Negative, undesirable, or unforeseen effects may also appear. These could become apparent quickly, but may only manifest themselves after an extended period of time. Either way, they should be corrected as they arise. A basic income is not a machine to be set in motion and forgotten about; it must be monitored, oiled, tuned up, and repaired as necessary over time.

2.2 The Trouble with Testing

The universal nature of basic income presents acute challenges for monitoring and testing. While some suggest policies should be subject to testing to demonstrate their worthiness, particularly from the standpoint of sustainability (Holland A. , 1999, p. 46), others argue this attitude is too strict and not typical procedure for social policy (Widerquist, 2018, p. 143). Regardless, experiments testing BI may not be possible. One might argue that a BI has never actually been implemented or tested, using strict definitions of the terms 'basic income' and 'experiment'. Among past experiments frequently cited in the BI debate, many can be criticized as falling short of a pure basic income (World Bank, 2020, p. 101). Recalling BI's definition as a periodic, unconditional payment delivered in cash to all individual members of a particular community, we can see how experiments can easily fall short of this particular standard in various ways. While not technically conditional, the specific targeting criteria often employed by experimental programs limits their scope and undermines the relevance of comparisons to more extensive (theoretical) programs. Though some level of targeting will likely be necessary to ensure a BI is reaching those most in need,[9] some may argue that overly specific targeting stigmatizes intended recipients, therefore possibly discouraging participation, and violates the universal, communal spirit of the BI proposal (Van Parijs &

[9] It's perhaps unrealistic to expect a BI to apply to every single member of a community (children, the elderly, citizens, residents, or otherwise) from birth until death. Some specific targets or restrictions will likely aid BI's efficiency, effectiveness, feasibility, and popularity.

Vanderborght, 2017, p. 110). By specifically targeting individuals and families with incomes below certain thresholds (World Bank, 2020, p. 237), the community created by Ontario's cancelled experiment may not be as comprehensive as many BI advocates envision. Similarly, in selecting a random sample of unemployed citizens from across the country to participate (Kangas, Jauhiainen, Simanainen, & Ylikännö, 2019, p. 8), the recently completed experiment in Finland created a specific, disparate community with limited relevance to contexts of wider scale. Other experiments may not be considered true BIs due to structural design, such as those conducted in the United States in the late 1960-70s. These are correctly identified as negative income tax experiments and differ by definition from a pure basic income (Hoynes & Rothstein, 2019, p. 19; Van Parijs & Vanderborght, 2017, pp. 140-144; Widerquist, 2005; World Bank, 2020, p. 24). Strictly speaking, many popularly characterized 'basic income experiments' are actually testing unconditional cash transfers or another related policy.

Long-term, wide-scale programs and policies often discussed in relation to basic income also frequently fall short of being pure experiments, which ideally incorporate separate test and control groups. The Alaska Permanent Fund Dividend (APFD) payments are available to nearly all residents of the state (excluding persons serving sentences related to felony convictions) and are paid out annually, fulfilling the definitional requirement (State of Alaska, 2020). It may not be viewed through an experimental lens however, due to its lack of distinct control and experimental groups, an issue the program run in Otjivero-Omitara, Namibia shares (Perkiö, 2014, p. 5). Two of the most extensive national programs, from Iran and Mongolia, also lack control groups to compare results against.[10] Most, if not all of the past and ongoing programs and experiments are susceptible to such criticisms. Though these standards may be overly demanding, it's possible to argue a genuine basic income experiment has never been conducted by using strict definitions of these concepts.

Any properly designed experiment testing a pure form of basic income faces numerous practical challenges, which diminish its effectiveness, and certain elements of the program would remain untestable. A randomized control trial (RCT) is a type of experimental testing which attempts to control for other variables by randomly allocating members in a representative sample into test and control populations. In theory, the only significant difference between these two populations as a whole is the experimental variable. Supporters of BI advocate for the use of RCTs, but acknowledge their limitations in testing this policy (Standing, 2012, pp. 138-140; Widerquist, 2018, pp. 37-42). Consider the inherent

[10] For more characterization, detail, and comparisons of various BI programs, trials, and various other related programs, see (World Bank, 2020, pp. 237-260).

contradiction of employing this technique to test BI. By definition, RCTs randomly separate members of a distinct community, while a BI is paid out to all members of a community. If a BI is paid out to all members of a community, using this as an experimental variable is impossible. If the community is separated for experimentation, the policy being tested ceases to be a BI. It's possible to institute a basic income, or employ a randomized control trial, but not both simultaneously.

Karl Widerquist suggests a less restrictive understanding of the term 'experiment' to include other methods of scientific study. He encourages the use of RCTs to isolate individual effects combined with "saturation studies" to determine broader community effects (Widerquist, 2018, pp. 22-24). In this context, saturation studies use a similar procedure as RCTs, but test entire communities against one another rather than individuals (Widerquist, 2018, p. 22). The saturation technique has been used in programs including Mincome in Dauphin, Canada, GiveDirectly in Kenya, and the experiments in Namibia and Madhya Pradesh, India (Hoynes & Rothstein, 2019, p. 19; Miller, Yamamori, & Zelleke, 2019, pp. 146-147; Van Parijs & Vanderborght, 2017, p. 141; Widerquist, 2018, p. 25). This strategy can be useful, but risks clouding results by potentially introducing variables which cannot be controlled for between the two communities. For example, imagine a saturation study being run to determine BI's effects on employment between two remote towns 50km apart. During the study, the main employer in one of the towns goes out of business and lays off all of its workers. This type of event cannot be controlled for, would have a huge effect on employment, and effectively nullifies the results of the study. This situation is unlikely, but possible, and exemplifies one of countless variables that complicate the direct comparison of two different communities, no matter how many similarities they share. Though comparing entire communities is possible and potentially useful, this method is imperfect because it cannot always account for variables between the two which can taint the results of any study.

Another challenge to basic income experimentation is determining long-term effects. Like any social policy, it may take years for people to become accustomed to it and adjust their behavior accordingly. The decision by Ontario's government to cancel its experiment prematurely justifies people's hesitation to take such programs for granted. Only after recipients feel assured and secure with their BIs, long-term effects may begin to emerge and its impact on individual behavior and society at large can be assessed, as has been the case in Alaska (Goldsmith, 2012, pp. 50-52; World Bank, 2020, p. 107). Effects on both individuals and society may change over time (Standing, 2012, p. 138). For example, many recipients may initially use a portion of their BI to help pay down existing debt, behavior observed in participants in the programs in Madhya Pradesh and Otjivero-Omitara (Perkiö, 2014, pp. 6, 8). Over time,

spending patterns may shift as people free themselves from this burden and begin to use their income in other ways. The full extent of such effects may take a significant period of time to manifest, perhaps longer than the duration of an experiment. Even if an experiment were designed to test a BI that fulfills a strict definition of the concept, participants may behave differently simply because they know they are involved in a temporary experiment (Van Parijs & Vanderborght, 2017, pp. 139-140). If participants know the duration of the study, the amount they're to be paid, and trust each payment will arrive as scheduled, they can easily calculate how much they can expect to be paid and when the last payment will arrive. This knowledge might lead participants of such an experiment to act differently from members of a community receiving a BI in perpetuity. Besides individual behavior, larger effects such as those on wages or labor market participation, will take time to develop (Van Parijs & Vanderborght, 2017, p. 143). It's possible these effects would take years to unfold, and again would likely differ depending on the community, socio-cultural norms and values, and other factors. A long-term study would be the most effective method to tease out such effects, though this presents its own set of challenges.

Funding experiments represents another hurdle for testing basic income, particularly in longer terms. Experiments with large numbers of participants over extended periods of time can be expected to return the most accurate and relevant results, but also come with significant costs. For cash-strapped governments, it may not be feasible to fund long-term studies from within. Nations with lower average income levels and costs of living provide more attractive targets for long-term studies, particularly if funded from external sources (World Bank, 2020, p. 175). The GiveDirectly program in Kenya, as well as the Indian and Namibian cases provide examples, though questions might be raised about the broad applicability of findings in these cases in relation to other, often vastly different contexts. Personal income taxes are often mentioned as a potential source of funding for BI programs (Howard, Pinto, & Schachtschneider, 2019, pp. 120-121; Hoynes & Rothstein, 2019, pp. 10-11; Van Parijs & Vanderborght, 2017, p. 134; World Bank, 2020, pp. 167-170). People most in need would be net beneficiaries of such a design, but the majority would be net contributors.[11] Experimental ethics calls for participation in experiments to be voluntary and the likelihood of attracting volunteers to fulfill the role of net contributors is slim (Van Parijs & Vanderborght, 2017, pp. 140, 142; Widerquist, 2018, p. 41). Additional community and societal effects (such as those on the larger labor market, wages, etc.) might only become apparent in large experiments of wide scope and long duration. Any experiments that do not incorporate

[11] This would seem to depend on tax rates in different brackets. If a BI program was to be funded solely through income taxes, it seems inevitable the majority of the population would have to be contributors, though it may be theoretically possible for a highly-taxed wealthy minority to support the majority.

funding into their construction will not be able to measure the full extent of behavioral and societal effects (Hoynes & Rothstein, 2019, p. 11; Van Parijs & Vanderborght, 2017, p. 140; Widerquist, 2018, pp. 41-42). Those incorporating funding potentially blur the line between experiment and actual policy. It seems reasonable to question whether basic income's full effects are possible to observe without actually implementing the policy.

Basic income is an extremely dynamic socio-economic policy. Its flexibility has attracted support from diverse sources, which have differing visions for what BI can and should do. Considering its protean nature, it seems possible to construct a BI as a means to a wide variety of ends. Basic income's universal nature presents a substantial challenge to experiments testing the policy to inform prudent designs or monitor its effects, and doing so may be practically impossible. Only by expanding conceptions of what may be considered scientific inquiry and examining related policies can results be interpreted and possibly applied to BI.

3.0 Basic Income, Justice, and the Future

Basic income is commonly argued for as a means to achieve justice. If one accepts Barry's assertion "sustainability is at least a necessary condition of justice" (1999, p. 106), BI programs have a clear obligation to enable sustainable societies (naturally including the environmental aspect). Those that do not risk undermining their justifications. Specifying the obligations of the present to the future is not straightforward, but dependence on principles of intergenerational justice and sustainability can help BI ensure justice in both the present and future. This section connects the liberal-egalitarian justice cited by proponents of basic income to intergenerational justice through John Rawls' savings principle (Rawls, 1999, pp. 251-258). As such, basic income has an obligation to preserve a space for future generations to define and pursue their own conceptions of fulfillment. As a just policy, BI should alleviate, rather than aggravate, the threat of increased consumerism from societies already living beyond planetary boundaries. It argues that principles of strong sustainability and ecologism should be used to guide basic income, and offer the best chance for this policy to achieve sustainability.

3.1 Relating Inter-Generational and Liberal-Egalitarian Justice

What responsibilities or obligations, if any, does the present have to the future? Addressing this question is vital from a sustainability perspective, but is far from straightforward. The uncertain nature of the future complicates any attempts at pinpointing obligations, and determining whether they have been fulfilled. Many additional questions might be raised when pondering this issue, and Benton outlines merely a few:

> How many future generations are we to be concerned with—or does the concept require sustainability into the indefinite future? How do we know what the needs of future generations will be? How can we weigh the demands for justice of those who live today against the hypothetical demands of people who do not yet exist? Given current advances in genetic knowledge and engineering, how do we know what future generations will be like? Given the profound cultural changes which have occurred in most societies even within the last generation, how do we know what future generations will want? In terms of available natural resources, how can we know whether it will matter to future generations that we use up finite supplies. [sic] It may be that future technologies may make future generations independent of resources which are currently indispensable, or that we destroy things which have no utility for us. (Future technologies may render essential features of the natural world which to us seem quite useless.) (1999, p. 212)

Many of these questions are unanswerable (Beckerman, 1999, p. 71). For those that are, answers will vary among differing philosophies and for individuals. Like basic income, any possible answers will depend upon values (Barry, 1999, p. 105). Broad consensus on these may only be possible in a very general sense,

if at all. Even if answers are subjective, or appear difficult to arrive at, some attempt at addressing them must be made to construct a just, sustainable future.

Rather than getting too caught up in these difficult, but important questions, perhaps side-stepping a few of them is preferable. To start, the concept of a generation is a human construct. Only with the benefit of hindsight can general boundaries between them be established, and various generations identified and characterized. There are no set dates when one generation finishes and another begins; each one bleeds into the next gradually, one day at a time (Wissenburg, 1999, p. 197). This fact carries implications when considering well-being in the future. Even today, there is no universally accepted conception or definition of well-being. Different nations, cultures, societies and even individuals can all possess their own unique interpretation of this concept, though certain core elements may be universally agreed upon. These various conceptions of well-being are not static, and they can shift temporally, just as they do spatially. Though they may appear identical from one day to the next, like generations, conceptions of well-being can transform gradually, one day at a time, along with society. Because of this, "…the further into the future we look the less confidence we can have about the preferences that people will have" (Barry, 1999, p. 99). As such, aiming to ensure a specific outcome for a particular point in the distant future becomes impossible, and we may better serve future generations by factoring their opportunities into daily activities and decision-making in the present (Holland A. , 1999, pp. 67-68). The most important role the present can play in preserving justice for the future is to not reduce their opportunities,[12] thus maximizing their ability to define and pursue well-being on their own terms (Barry, 1999, pp. 104-106; Norton, 1999, p. 120). This strategy can accommodate various conceptualizations of well-being. For example, it allows for a capabilities (Nussbaum, 1995) or functionings (Sen, 1992) approach, but doesn't preclude alternative (perhaps as-yet-unconceptualized) approaches. Intergenerational justice calls for the present to allow future generations to define well-being for themselves, without restricting their opportunities through contemporary actions and lifestyles.

How do such conceptions of intergenerational justice relate with basic income and its philosophical justifications? John Rawls' brand of liberal-egalitarian justice is often cited by BI's proponents (Birnbaum, 2012, pp. 41-63; Van Parijs, 1995; Van Parijs & Vanderborght, 2017, pp. 109-113), and the policy's relationship with and general obligations to the future may be identified by examining this philosophy. Rawls holds that various generations, spread over time, "are not subordinate to one another any more than individuals are and no generation has stronger claims than any other" (1999, p.

[12] For consideration of the difference between opportunities and options, see (Norton, 1999, pp. 130-137).

257). He addresses justice between generations primarily through what he labels 'the savings principle', which requires each generation to "preserve the gains of culture and civilization, and maintain intact those just institutions that have been established, but it must also put aside in each period of time a suitable amount of real capital accumulation" (1999, p. 252). Though Rawls offers general examples, he admits identifying a specific amount of capital to preserve for the future is likely impossible, and different generations will be able to contribute varying amounts. The flow of time ensures that benefits can only be passed on to future generations, but he claims that all generations benefit by adhering to his savings principle, except those preceding its adoption (Rawls, 1999, pp. 251-258). Nothing in this small section of Rawls' theory relevant to the future appears to contradict ideals of intergenerational justice. Both might be used together to outline basic income's duty to the future, and to identify ways it might breach justice and undermine its own justifications.

Using these templates rooted in justice, and understanding the problematic nature of defining human well-being, how might we more concretely describe basic income's duties to the future? How would one ensure that future opportunities are preserved by the present? Like Benton's questions mentioned previously, answering these may be paralyzingly complex, subjective, and ultimately impossible. In order to keep open as many opportunities for the future as possible, perhaps a simpler approach is best. In this case, less may be more, particularly in terms of impact on the planet. In a world where the population, affluence, material use, and footprints are rising, making efforts to control some of these may be most appreciated by future generations. Though we may not be able to identify their needs or how they might choose to fulfill them, future generations will presumably need to occupy some space on which to do so. As such, preserving the planet and its systems in a Holocene-like state, conditions which have proven capable of promoting human flourishing, seems to be the minimum the present can do to ensure justice for the future. A healthy ecosystem has been portrayed as a prerequisite for enabling human capabilities (Holland B. , 2008, pp. 323-325), though this argument could be extended to incorporate functionings or another approach. Governments, the market, and autonomous activity also might be jeopardized without a sufficiently healthy environment to serve as a foundation, as are institutions, well-being, peace, justice, society and much more. If environmental damage is serious enough, these may become impossible to sustain. The PBs, updated and adjusted as scientific knowledge in this area progresses, can serve as a guide to preserve environmental health. Policies and actions which threaten PBs restrict the opportunities of future generations, privileging certain generations over others and violating the savings principle. One example of a restriction on future opportunity would be rendering

traditional homelands uninhabitable, due to shifting climates or rising sea levels.[13] Others are the extinction of particular plant or animal species, or the exhaustion of a nonrenewable resource. Future generations might find value in certain resources which present generations may be unable to conceptualize. More extreme, though still possible examples are the collapse of society as currently constructed, the development of some type of climate apartheid system, or even human extinction. Rawls would surely consider each of these situations unjust, and we should as well. Even if the most extreme possibilities never come to pass, disruption of planetary systems, a shifting climate, or resource scarcity might lead to conflict, which presents a threat to well-being, the establishment and maintenance of Rawls' 'just institutions', and thus justice itself. These unjust scenarios are precisely the type basic income programs should seek to avoid, yet they risk enabling them in a very specific way.

3.2 Basic Income's Threat to Justice and the Future

Jan Otto Andersson notes: "[t]he quest for real freedom could easily lead to an even heavier ecological footprint" (2009, p. 3). One of the most likely threats basic income could pose to the environment and justice comes from wealthy nations with high levels of material use and carbon emissions. A BI might attract migrants, increasing the overall population and thus environmental impact in nations already exhibiting unsustainable footprints (Andersson, 2009, p. 6). For this threat to manifest, a relatively liberal immigration policy is necessary and migrants must adopt lifestyles at least near national footprint averages, which must be larger than in their nation of origin. While these factors all may align, and are worth considering, they perhaps overlook a more likely risk from recipients of BI through increased consumption. As a policy featuring redistributive cash transfers, BI's natural aim is to give more to those who have the least. As a larger percentage of the population finds itself with more disposable income, it seems likely that aggregate levels of consumption will rise (Buch-Hansen & Koch, 2019, p. 269; MacNeill & Vibert, 2019, p. 5). In a study of 18 Finnish citizens receiving the minimum income, all but one displayed consumption patterns beyond estimates of what might be considered sustainable, often by a factor of two or three (Hirvilammi, Laakso, Lettenmeier, & Lähteenoja, 2013, pp. 143-144; Lettenmeier, Lähteenojab, Hirvilammi, & Laakso, 2014, p. 684). Similarly, a study of Spanish households found that only those earning less than 500 Euros per month exhibited patterns of consumption within sustainable estimates, and even then only barely (López, Arce, Morenate, & Zafrilla, 2017, p. 520). If the least well-off citizens of wealthy nations already exhibit unsustainable lifestyles, additional income is likely to aggravate

[13] Acknowledging the climate and sea levels have not been and are not static, human activity contributing to instability in these systems could surely be considered unjust.

this situation, particularly considering the generally hefty nature of consumption to meet basic needs (López, Arce, Morenate, & Zafrilla, 2017, pp. 523-524). It's easy to envision ways even spending on basic needs might further threaten the environment. A BI could enable more occasional purchase of meat or imported fruit, with the associated costs of raising, processing, and shipping. It could encourage upgrades in housing or the purchase of additional appliances, both potentially leading to increased energy costs to heat/cool or run, depending on their energy efficiency and the source of power. Some may decide to purchase a vehicle, which also has environmental implications depending on its source of fuel or how electricity is created to charge it. It might enable individuals or families to afford more frequent flights for vacations or to visit distant relatives. None of these purchases, activities, or behaviors are inherently immoral or unjust in and of themselves. Everyone has the right to enjoy some occasional luxuries, adequate housing, etc., not just those who enjoy a certain level of affluence. It would clearly be unjust to leave people impoverished, and this highlights the necessity of development and more equitable consumption patterns, both within and between nations, if sustainable societies are to be constructed and the entire world is to fit inside Raworth's Doughnut. In a world where little room is available for the expansion of lifestyles, emissions, and footprints, additional space must be found to ensure a just, sustainable future for all.

If basic income (rightfully) increases consumption and footprints from the most vulnerable sectors of society, better enabling them to fulfill their basic needs, it should also pair this with reductions from more secure sectors. In the context of wealthier nations, BI should facilitate reductions in overall resource use and environmental impact. Doing so will aid more impoverished sections of communities (and even entire nations) and can advance justice, both now and in the future. Many proponents envision BI as a route to a post-productivist society (Andersson, 2009; Pinto, 2019b; Pinto, 2020; Schachtschneider, 2012; Schachtschneider, 2014; Van Parijs, 2009; Van Parijs & Vanderborght, 2017, pp. 27-28). Though it *might* encourage people to turn away from employment, live more simply, and reduce consumption, this is uncertain (Boulanger, 2009, p. 3; Fitzpatrick, 2009, p. 2). Rising levels of income typically lead to expansions in material consumption, lifestyles, housing, transportation, and the associated environmental costs (Buhl, Liedtke, Teubler, Bienge, & Schmidt, 2018, p. 9; Buhl, Liedtke, Teubler, & Bienge, 2019, pp. 78, 81; Hirschnitz-Garbers, Tan, Gradmann, & Srebotnjak, 2016, pp. 19-20; Hirvilammi, Laakso, Lettenmeier, & Lähteenoja, 2013, p. 149; Ivanova, et al., 2016, pp. 532-533; López, Arce, Morenate, & Zafrilla, 2017, pp. 522-525; Pothen & Tovar Reaños, 2018, pp. 240-241; Uddin, Salahuddin, Alam, & Gow, 2017, p. 172; United Nations Environment Programme, 2019, p. 52; Wiedmann, Lenzen, Keyßer, & Steinberger, 2020, p. 3). This also is uncertain. Depending on the amount paid, impact on labor markets,

and a variety of other factors, BI may reduce per capita income. Even if net income does increase, and brings consumer expenditure with it, a heavier environmental burden may not follow. All consumption is not equally impactful, and rising incomes may enable the purchase of more expensive, higher quality, less impactful goods and/or services (Buhl, Liedtke, Teubler, & Bienge, 2019, p. 76; Howard, Pinto, & Schachtschneider, 2019, p. 118; Pothen & Tovar Reaños, 2018, p. 241). Some evidence suggests that once basic needs are fulfilled, subsequent consumption tends to be less materially intensive (López, Arce, Morenate, & Zafrilla, 2017, p. 523), though this still implies growing footprints. Regardless, reducing overall environmental impact via BI incidentally seems unlikely, at least in a consistent way. Incorporating environmental goals, like constraining consumption, into the construction of a basic income program increases the likelihood of achieving them and is consistent with intergenerational and liberal-egalitarian justice.

Objections to any type of restrictions in the present can be expected, even if they are put in place to preserve opportunity for the future.[14] Freedom and its potential limitations are some of the most problematic aspects of any conversation about intergenerational justice. Freedom is valuable and enhancing it is preferable to restricting it. That said, freedom also clearly has limits. We cannot drive wherever we wish at 200km/hr. The right to swing our fists ends where another's nose begins. Each society must identify their own balance between individual freedoms, the rights of others, and the collective good. Any position in this arena is naturally subjective, and might be disputed by individuals with differing philosophies and values. The current climate situation and intergenerational justice necessitate the establishment of some type of limits for the health of the planet and the preservation of future opportunities. Though any limits would undoubtedly restrict freedom, so too might a lack of them, particularly if this lack further compromised Earth systems, thus hindering individuals from exercising personal freedoms (Peeters, Dirix, & Sterckx, 2013, p. 65; Pinto, 2019a, pp. 4-5). As Norton notes: "[d]eciding what the current generation owes to future generations thereby becomes a matter of determining which set of current options our generation can exercise without unfairly blocking options that should be held open to present future opportunities" (1999, p. 136). Such limits will likely affect society on all levels, from individuals to corporations and nation states (Pinto, 2019a, p. 4). Carbon emissions and resource use are two examples where increased restrictions will likely better preserve future opportunities, though more could certainly be identified. This process of determining limits will be

[14] The resistance some people have towards wearing masks during the ongoing pandemic provides an example of this.

profoundly difficult and contentious. Opposition from entrenched interests within the current economic system (which demands constant growth) will surely resist any limits, which naturally imply obstacles to expansion. Determining an optimal balance of exercised options between the present and future to determine the maximum total amount of freedom is extraordinarily difficult, at least (Pinto, 2019a, pp. 9-10). Nevertheless, it seems the present will have to accept some additional limits to ensure well-being in the future. The socio-economic status quo is clearly insufficient to maintain the health of Earth systems, as indicated by the state of the planetary boundaries framework.

Locating an optimal position that fulfills all the requirements we have identified represents an acute challenge. Additional, rightful development must occur to ensure people all around the world have their basic needs fulfilled. Unfortunately, doing so will place additional stress on PBs already under duress. To allow for this, more affluent societies must reduce their environmental impacts, which almost certainly implies a reduction in consumption and likely a contraction of economic activity. A dramatic restructuring of society and its workings will likely cause some level of turbulence and conflict, and may pose a threat to well-being. A basic income might provide a measure of security and insulation, especially for the most vulnerable, as society redefines itself and settles into a more sustainable template. This is far from guaranteed and will not likely happen by accident consistently. Only with careful planning and monitoring, a balance might be struck between affluent and impoverished, both within and among nations on Earth. Any such balance must also enable a maximum amount of freedom and well-being in the present without jeopardizing well-being and opportunity in the future. Failure in any of these regards could be considered unjust. Basic income should facilitate, rather than hamper this process, lest it undermine its own justifications.

Raworth's Doughnut may be used as a model, and the planetary boundaries as a measuring stick, to ensure basic income's compatibility with the environment and intergenerational justice. If justice requires sustainability, this may be the best guide to ensure Rawls' savings principle is fulfilled without further threatening planetary systems. The type of capital perhaps most relevant to discussions of environmental sustainability is the natural variety. Natural capital can be defined as any element of the Earth or its systems which can be used for human benefit, whether economic, social, health, or another. Plant and animal species, natural resources, fresh water, and even entire ecosystems are just a few examples of natural capital.[15] Environmental sustainability takes two approaches in regards to natural

[15] Numerous scholars have noted that proponents of strong sustainability are often reluctant to associate natural systems with capital, arguing this reduces the natural world to a mere economic commodity to be harvested,

capital: weak and strong. Weak sustainability, the prominent form encountered in modern economic thinking, accepts the conversion of natural capital into other forms of capital, while strong sustainability seeks to preserve a non-declining level of natural capital overall (Bell & Morse, 2009, pp. 13-14; Holland A. , 1999, p. 51; Jacobs, 1999, p. 32; Neefjes, 1999, p. 252). The weak and strong positions have been characterized as "mutually exclusive rather than as two ends of a spectrum" (Bell & Morse, 2009, p. 13). Unless an alternate position can be identified, basic income must choose between them to ensure environmental sustainability.

Weak sustainability is amenable to the conversion of natural capital into various other forms, so long as the total stock of capital is not diminished. It appears to be a strong candidate to fulfill the savings principle and cinch justice for BI. Laws of conservation are not applicable to capital however, which can be created and destroyed. The finite nature of Earth and its resources implies inherent limits to the conversion of natural capital. This is clearly the case for nonrenewable resources and also true for renewable resources if harvested at a rate that exceeds their regenerative capacities. If we accept Rawls' assertion on the equality of each generation's claims, the permanent destruction of any form of natural capital would represent a clear violation of justice, even if it were to be converted to an alternate form. Take for example the often-poached elephant. Though profits from the sale of their tusks may be spent or invested to secure or enhance human well-being, were they to become extinct (particularly through human action, but also through inaction), the inability of future generations to enjoy and benefit from their living, majestic beauty would be a clear infringement upon their claims, and thus a violation of justice. The same argument can be made for maintaining Earth systems. If human (in)activity has a role in destabilizing or undermining them, opportunity and justice for future generations are threatened. We must recognize the Earth's systems and climate are dynamic and constantly shifting. Species naturally interact and compete with one another, sometimes driving one another to extinction. The difference here is humans have the ability to contemplate the implications of their actions and their position among the other inhabitants with which they share the planet. This ability gives people the responsibility to consider the future, shaped by present activity, for the continued flourishing of themselves and other species. Considering weak sustainability's predominant position in our economic system and the effect economic activity has historically had on our planetary systems (Giampietro, 2019, p. 153; Svartzman, Dron, & Espagne, 2019, p. 113), continued reliance on this philosophy with the expectation of different results

processed, sold, and profited from like any other product or service (Barry, 1999, p. 102; Benton, 1999, pp. 220-221; Holland A. , 1999, p. 52; Norton, 1999, p. 130).

seems foolhardy. It appears extremely unlikely weak sustainability will be able to fulfill requirements of intergenerational and Rawlsian justice.

Strong sustainability, which rejects unlimited substitutability of natural capital (Holland A. , 1999, p. 51), appears to have several options to fulfill Rawls' savings principle. Increasing the total amount of natural capital would probably be the most desirable option from an ecological perspective. An admitted hazard of strong sustainability is the risk of ignoring basic human needs, or prioritizing natural systems above them (Beckerman, 1999, p. 87; Neefjes, 1999, p. 252), a possibility this option cannot fully discount. Refusing development, leaving people in poverty, and thus perpetuating human suffering in the name of preserving natural systems also represents an infringement of justice. Unfortunately, the reality of economic and social development almost certainly includes adverse environmental effects, leaving nations to choose between poverty or maintaining natural systems (Akenji, Bengtsson, Bleischwitz, & Tukker, 2016, p. 4). This option is liable to offend either environmental sustainability or justice. Another option might be to leave natural assets undisturbed, and attempt to contribute other forms of capital for future well-being. This strategy seems impossible, since modern society has come to depend on both renewable and nonrenewable resources for shelter and sustenance, a fact unlikely to change any time soon. A third option occupies the space between these. By harvesting renewable resources at a rate equal to or lower than rates of regeneration, levels of natural capital may be maintained or even increased, while still converting these into other forms of capital. This option is not fully possible because human society cannot reject the use of nonrenewable resources and rely on renewable resources alone. Though imperfect, elements of these three approaches combined may offer the best strategy to preserve natural systems. By increasing stocks of natural capital where possible, reducing overall resource use, and replenishing stocks of renewable natural resources, Earth systems and opportunities for the future might be preserved. Full adherence to strong sustainability appears impossible, due to development and consumption patterns developed alongside and incorporated into society. These are being altered gradually, and favoring strong over weak sustainability better guards against unjust transgressions of PBs. Strong sustainability, though not without its own risks, occupies a better position to fulfill Rawls' savings principle and comply with intergenerational justice.

Maintaining natural systems is critical to fulfilling Rawls' savings principle and complying with intergenerational justice. A large number of models have been built to describe the relationship between society, the economy, the environment, governments, institutions, and more, within the context of sustainability (Ali-Toudert & Ji, 2017, pp. 597-599). Though these models may all be applicable to

particular scenarios at certain times, the savings principle and intergenerational justice require one that recognizes the environment's vital role as a foundation. If natural systems are destabilized, economic growth, social development, governance, and maintaining institutions will likely become progressively more difficult and perhaps even impossible. From this perspective, models which equate the environment to other elements of society misrepresent the relationship between them. Ecologism is a biocentric[16] philosophy which seeks to redefine the understanding of the relationship between humans and the natural world. It contends that natural systems and beings have intrinsic value outside of their usefulness to humans (Dobson, 1994, pp. 223-224; Dobson, 2007, p. 15). Adherents of ecologism seek to incorporate this regard toward the natural world into politics, economics, and society in general (Dobson, 1994, pp. 225-232). The respect both ecologism and strong sustainability have for the environment connects these two philosophies. Depending upon them can aid in locating an appropriate space which balances the needs of presently living people and opportunities for future people, securing justice in the present and future. For BI to live up to its justifications and deliver on its promise of justice, it must not contribute to the undermining of planetary systems. By incorporating the principles of strong sustainability and ecologism into the design and monitoring of a basic income, it is in a better position to achieve this goal.[17]

[16] Biocentric, as in centered around the natural world, of which human society is a subsystem. Opposed is the term 'anthropocentric', centered around humans. Most political and economic philosophies, as well as most other ideologies generally, are anthropocentric (Dobson, 1994, p. 223).

[17] For a more thorough examination of environmentalism (associated with weak sustainability) and ecologism (strong sustainability) and their relationship with BI, see (Pinto, 2020).

4.0 Visions of an Ecological Basic Income

An ecological basic income (EBI) is one which is influenced by and delivers results compatible with the philosophy of ecologism. Its goal is to provide an alternative to the contemporary socio-economic paradigm and encourage a societal shift to post-productivism (Andersson, 2009, p. 2; Fitzpatrick, 1999, pp. 184-191; Pinto, 2019b; Pinto, 2020, pp. 4-5; Schachtschneider, 2012, pp. 4-7; Schachtschneider, 2014, pp. 4-5; Van Parijs, 2009). Incorporating elements of ecologism into the design of a social program doesn't ensure the outcome will be compatible with this philosophy. Likewise, programs not specifically designed with ecologism in mind may meet its standards in time, though this seems unlikely. Regardless, an EBI appears to offer the best chance of fulfilling Rawls' savings principle without further aggravating the climate situation, thus risking the well-being, capabilities, and opportunities of living and future beings and securing justice for both the present and future.

The discussion in this section focuses on BI programs employed in wealthy nations, generally characterized by service-based economies and high levels of consumption and environmental impact. These nations have generally enriched themselves through industrial development, incurring high levels of environmental impacts in the process. They bear an oversized responsibility for historical greenhouse gas emissions and represent the greatest risk to long-term global environmental sustainability due to the materially intensive lifestyles citizens of these nations enjoy. Nations transitioning their economies away from a primarily agricultural orientation generally have more work to do to move their populations out of the center of Raworth's Doughnut. Little imagination is necessary to see ways in which regular cash transfers can afford people adequate housing, more plentiful or healthier food, improved health, more time to pursue education, help them find their political voice, and more (Perkiö, 2014). BI has great potential to improve outcomes in these settings, many of which are in the midst of the materially intensive development process. These nations generally possess lower historical greenhouse gas emissions in total, but they too will need to check their growth eventually. For now, the justifiable expansion of their lifestyles underscores the need for contraction from more wealthy nations. Thus, unless otherwise specified, the discussion excludes lower-income and non-industrialized nations. The tightening of proverbial belts potentially risks well-being in these wealthier settings (Fanning & O'Neill, 2019, pp. 818-819; Holland B. , 2008, p. 328), and an EBI could be well-positioned to ensure basic needs in these contexts while encouraging environmental sustainability. Though no singular path exists to deliver an EBI and certain factors may carry more weight than others depending on each unique setting, it seems likely that EBIs will share a number of common elements. Jorge Pinto identifies two direct ways a BI can produce

ecologically friendly outcomes: either through the behavioral or societal effects it promotes, or from its funding (Pinto, 2020, p. 2).[18] The following section explores these two routes, their implications, and challenges to implementing an ecological basic income.

4.1 Effects of an Ecological Basic Income

One way a basic income can be oriented in an ecological direction is through its societal and behavioral effects. These may be broad and diverse, but many of them flow through the possibility of altering the contemporary socio-economic paradigm. The modern welfare state, constructed upon economic growth and income taxes,[19] is incentivized to funnel citizens to the labor market, which naturally limits participation in alternative activities (Fitzpatrick, 1999, p. 180; Pinto, 2019b). By delinking income from employment, a BI (ecologically designed or otherwise) could afford people the opportunity to explore lifestyles unavailable to most in a productivist system designed around full-employment (Andersson, 2009, p. 2; Howard, Pinto, & Schachtschneider, 2019, pp. 117-118; Schachtschneider, 2014, p. 6). Though cash transfers generally seem not to discourage labor participation (World Bank, 2020, pp. 106-107), including results from Finland's recent trial (Kangas, Jauhiainen, Simanainen, & Ylikännö, 2019, p. 12), it seems likely a substantial BI program would allow people to be more selective about what work they accept and how much time they devote to it. A basic income may encourage a more equitable distribution of labor (Birnbaum, 2012, p. 52), and much of the population may find themselves with increased amounts of leisure time. Some speculate this additional freedom would promote activity in what Andre Gorz labeled "the autonomous sphere" (Howard, Pinto, & Schachtschneider, 2019, p. 115; Pinto, 2020, p. 2; Van Parijs, 2009, p. 5). The autonomous sphere (AS) can be defined as all productive goods and services "neither sold on the market nor commissioned by a public authority" (Van Parijs, 2009, p. 2). Other, nearly identical concepts appear in EBI literature. Sometimes they are named, one example being the "Third Sector, i.e. that which is organized around neither the state nor the market" (Fitzpatrick, 1999, p. 191). Other times references are more vague: "the community and the family may play a more important role than they currently do in the provision of goods and services" (Boulanger, 2009, p. 6).[20]

[18] MacNeill and Vibert identify conditions, additions, and compliments, which they argue can be used to improve a BI's environmental impact (2019, pp. 9-11). While this is likely true, I have chosen to leave aside a discussion of these three elements for two different reasons: conditions are counter to the spirit of a basic income while additions and compliments are adjacent to it. A discussion of these and their impact combined with BI is worth having, but this is not the place for that.

[19] This, combined with the fact that the majority of the workforce depends upon wages/salaries for their livelihood.

[20] The confusion and lack of standard terminology for this concept suggest a need for its development, if it's ever to be realized.

The concept of 'the commons', "a class of resources that have been created culturally or naturally" (Barragué, 2008, p. 4), displays considerable overlap with the AS. Natural resources are not part of the AS, but their collection or harvest for communal good would be, as would technological resources such as Wikipedia or open-source software. Any BI program which enables citizens to reduce their participation in the labor market offers an opportunity to promote activity in the AS. As such, this phenomenon may be a standard feature of BI in general, rather than the specific domain of an EBI. Regardless, any basic income program which stimulates autonomous activity may have already taken a significant step towards becoming an ecological basic income.

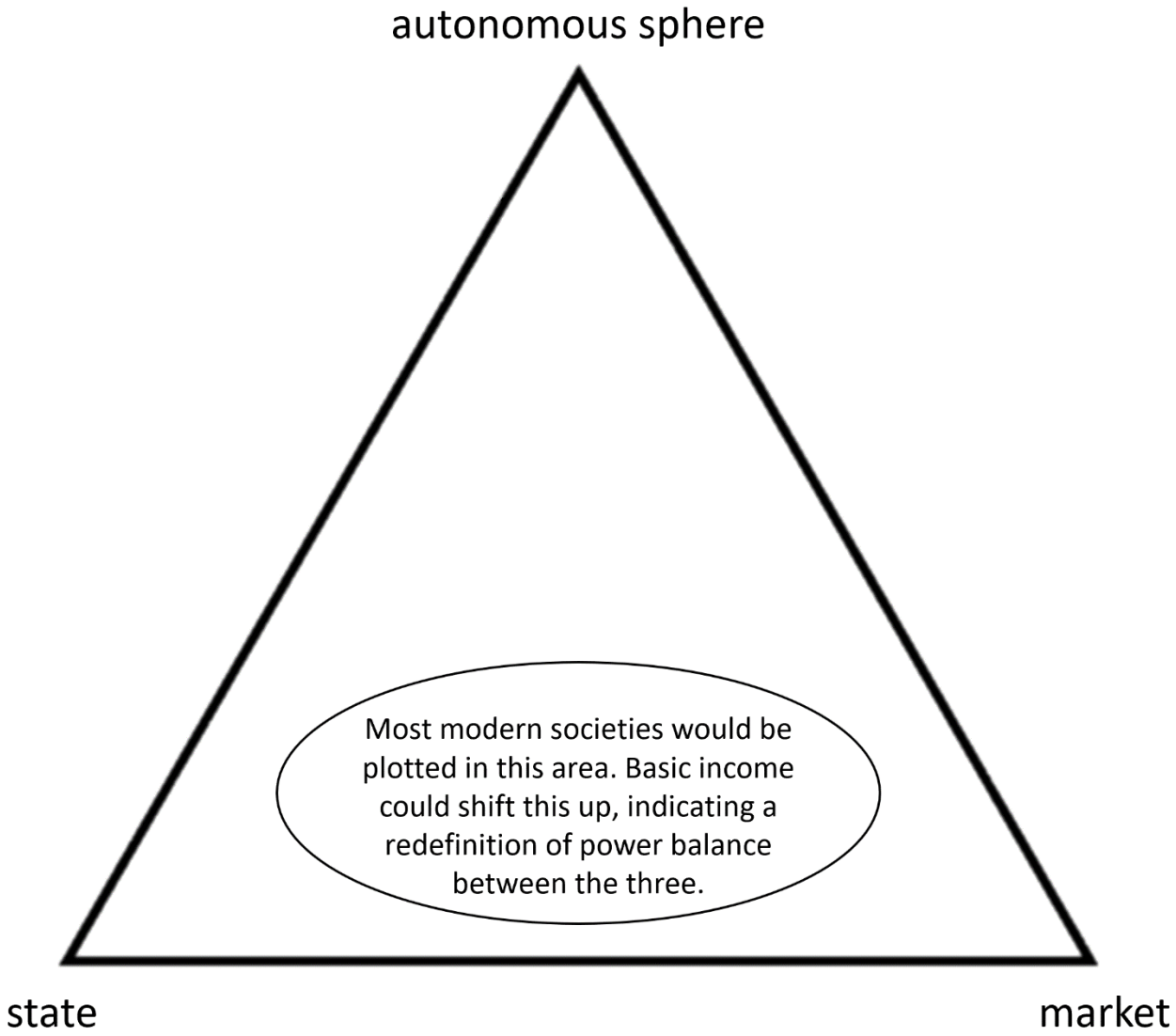
A more robust autonomous sphere would represent a substantial societal shift and could provide a boon for ecological goals in a number of ways. Between state, market, and the AS, activity in the latter may be considered less environmentally intensive (Pinto, forthcoming; Van Parijs, 2009, p. 4). Logically, this appears to be true; the AS possesses no factories or military, and seems to require fewer resources to operate than either of the other two spheres. The development of localized economies, particularly if designed to enhance circularity, sharing, re-use, and exchange, could reduce material resource extraction, production, and global shipping, as well as accompanying environmental effects associated with all of these processes (Birnbaum, 2012, p. 188; Boulanger, 2009, pp. 6-7; Raworth, 2017). The contraction of business and loss of corporate profits would involve a trimming of the workforce and many people would likely find themselves without employment. A BI (particularly one paid at or near subsistence level) would help support workers in a shifting economy as they transition to new employment opportunities, acquire other marketable skills, or possibly reject employment altogether (Birnbaum, 2012, p. 52; Fitzpatrick, 1999, p. 54; Pinto, 2019b; Pinto, 2020, pp. 5-6; Schachtschneider, 2014, p. 4; Standing, 2017; Van Parijs & Vanderborght, 2017, p. 25). The ability to bypass employment to secure one's livelihood could give workers additional leverage if they did choose to enter the labor market, perhaps coercing employers to offer better pay and/or working conditions, particularly for difficult or less desirable jobs (Birnbaum, 2012, p. 52; Pinto, 2020, p. 4; Van Parijs & Vanderborght, 2017, p. 177). Without the fear of costing themselves their livelihoods, workers may find it easier to criticize employers for unethical (or environmentally damaging) behavior (Birnbaum, 2012, p. 179). Regardless of BI's effect on employment, if it were to reduce income inequality, positional status symbols might also lose some of their importance (Howard, Pinto, & Schachtschneider, 2019, p. 118). If these types of positional goods (cars, boats, jet-skis, electronics, even houses, etc.) were to lose their value and consumption decrease, it would likely carry negative consequences for economies, accompanied by positive ones for the environment. Regardless of the strength and scope of its effects, an ecological basic income would involve a redefinition and de-

emphasis of the market sphere, and judging from historical environmental effects of capitalist activity (Giampietro, 2019, p. 153; Svartzman, Dron, & Espagne, 2019, p. 113), we could expect the environmental outcomes of this process to be largely positive.

The expansion of the autonomous sphere would have implications beyond just the market. If the balance of power between AS and market were to shift, it would imply a change in position and power of both spheres relative to the state. An EBI could have positive impacts in this regard as well. If workers were freed from dependency on employment for subsistence and participation in the labor market was reduced, the impetus to pursue full employment would wither, and governments could afford to adopt more ambivalent attitudes towards economic growth (Andersson, 2009, p. 2). The result would likely be a contraction of economic activity, a more acceptable situation if people's basic needs were satisfied. Such economic contractions have historically seen a reduction in growth of material use and emissions (Schandl, et al., 2017, pp. 830-832, 835; United Nations Environment Programme, 2019, p. 52; Wu, et al., 2019, p. 832), and could help prevent transgressions of planetary boundaries. Another benefit to the environment could come via the government and additional time citizens have outside employment. With more time to consider political issues, citizens in democracies might cast more informed votes, generally hold governments more accountable, and take a more active role in government. The effects of increased citizen participation in the democratic process could include greater effectiveness, broader perceptions of legitimacy, and more trust in governments (Van Reybrouck, 2016), and might stretch from local to national levels and potentially beyond. Assuming significant numbers of citizens are interested in creating a more sustainable society, increased citizen participation in government could promote this type of outcome. Part of this may include more rigorous environmental protection/regulation for all three spheres. Though the effects may be variable, depending on a wide range of factors including context and amount, increased participation in the autonomous sphere would empower citizens and could carry considerable ecological benefits as well.

Figure 3: Relationship Between State, Market, and Autonomous Sphere

Adapted visually by the author from description by (Van Parijs, 2009, pp. 2-3).



One could argue the process of restructuring the relationship between state, market, and autonomous sphere is already underway, or is perpetually shifting. Van Parijs presents a bipolar vision of industrial society, each one plotted somewhere between market and state, before suggesting that post-industrial society should be depicted more accurately as triangular (2009, p. 2). In reality, one could likely find evidence of activity in the AS in nearly any historical or contemporary society.[21] The balance between

[21] In fact, the existence of the AS long predates the conceptualization of both the market and state. It would have been a primary feature of early human societies, though it's unlikely any of their members would have recognized it as such.

these three zones will be different according to each place and time. In many contemporary societies, citizens have their say in government in the voting booth, and consumers often have many choices over which products, if any, to buy in the market. Consumers are not synonymous with citizens and questions might be raised as to the effectiveness of individual voters' influence over government, which emphasizes the need for a restructuring of the power balance between the three zones. This redefinition could be encouraged by the establishment of any form of BI which strengthens the AS. An ecological basic income offers the best chance of delivering an environmentally sustainable balance between the three sectors, and an expansion of the autonomous sphere is a critical step towards this.

4.2 Funding an Ecological Basic Income

A second method of establishing an ecological basic income is through its funding, and this could potentially be achieved in a number of different ways. Resource dividends[22] are one of the most commonly mentioned methods for funding a BI (Howard, Pinto, & Schachtschneider, 2019, pp. 113-114; Van Parijs & Vanderborght, 2017, pp. 151-152; World Bank, 2020, pp. 52-55). The Alaska Permanent Fund, primarily financed through the sale of state-held oil reserves, is perhaps the most prominent example of such a scheme. If the proceeds from such a dividend were invested in renewable energy or green infrastructure, they may provide an added ecological bonus. Placing additional taxes on targeted resources (carbon, fossil fuels, or other nonrenewable resources) could artificially inflate their market prices and cull demand, a positive outcome from an ecological perspective. Direct taxes on sources of pollution or resources, at the point of extraction, consumption, or both, are other frequently mentioned sources of funding which could transform a BI into an EBI (Boulanger, 2009, p. 3; Busilacchi, 2008; Schachtschneider, 2012, p. 1; Schachtschneider, 2014, pp. 1-2; Van Parijs & Vanderborght, 2017, pp. 150-151, 154-158; World Bank, 2020, pp. 172-174). A value-added tax (VAT) or other consumption taxes would be included in this category and could be expected to reduce consumption (Fitzpatrick, 1999, p. 194; Howard, Pinto, & Schachtschneider, 2019, pp. 121-122). This option might offer an especially attractive balance between discouraging consumption while still preserving freedom for consumers. Another alternative could be to remove energy subsidies for fossil fuels, for both consumers and producers, thus allowing the market to reflect the true cost of energy production (World Bank, 2020, pp. 148, 159-162). This would perhaps encourage more judicious energy usage in all sectors. The resulting price increases for

[22] Resource dividends operate as follows: publicly held material resources (or carbon emission allowances) are sold by the state to private enterprises to fuel economic activity. The state invests these profits and the returns are paid out to citizens periodically.

all of these measures would almost certainly be passed down to the consumer, meaning redistribution (via an EBI) of the returns/profits/taxes would be necessary to prevent them from being regressive (Andersson, 2009, pp. 4-5; Fitzpatrick, 1999, p. 194; Howard, Pinto, & Schachtschneider, 2019, pp. 113-114). Inspired by economists such as Herman Daly and James Robertson, caps on or taxes targeting income or wealth are often mentioned as a means to fund an EBI, or at least as a complimentary policy (Andersson, 2009, p. 3; Fitzpatrick, 1999, pp. 192-193; Howard, Pinto, & Schachtschneider, 2019, pp. 124-125). Considering the world's wealthiest citizens are disproportionally responsible for carbon emissions, resource use, and environmental impact (Oxfam, 2015, p. 4; United Nations Environment Programme, 2019, p. 52; Wiedmann, Lenzen, Keyßer, & Steinberger, 2020, p. 3), any type of constraint on this class might be expected to return positive environmental results. Though funding represents one of the primary challenges to the establishment of a basic income, particularly in wealthy settings, it is also one of the primary methods available to orient it in an ecological direction.

4.3 Challenges to Establishing an Ecological Basic Income

Challenges to and doubts surrounding the establishment of an ecological basic income are plentiful. This subsection offers a brief review of some of the primary issues facing any EBI. It is not exhaustive and primarily addresses challenges surrounding core elements of an EBI mentioned in the previous sections. Challenges surrounding the establishment of a BI in general, such as political feasibility, are not mentioned and exist in addition to the issues briefly detailed here.

Since experience with extensive, long-term basic income programs (and not only the ecological variety) is short, nearly everything surrounding such a policy's establishment and effects is theoretical. It's easy to speculate ways in which a BI might influence individual and societal behaviors. Such speculation may be based on relevant historical evidence (such as the North American negative income tax experiments or APFD), econometric models, surveys inquiring about individuals' situational behavior, or theory. It's possible to question the applicability of each of these to BI and/or reality. As mentioned previously, experiments testing BI directly are practically impossible and testing cash transfers, negative income taxes, or other similar programs provides an imperfect comparison. The formulas which comprise econometric models may only provide rough approximations of vastly more complicated real world situations (Van Parijs & Vanderborght, 2017, pp. 144-147). Surveys, such as those cited by Howard, Pinto, and Schachtschneider (2019, p. 118), may accurately reflect actual individual behaviors, or they may simply reflect what respondents *think* they would or should do, situationally. Basic income's actual effects on employment, labor participation, and consumption (status-based or otherwise) are almost entirely

theoretical. Like any theory or hypothesis, it's impossible to determine for certain without putting them to the test.

A substantial basic income, at least near subsistence level, provides the greatest likelihood for employees to restrict their participation in the labor market, and possibly to reject it outright. This might boost participation in the AS and encourage environmentally sustainable habits. Even a substantial BI cannot guarantee this, and may in fact do the opposite (Calder, 2009, p. 5; Fitzpatrick, 1999, pp. 189-190; Fitzpatrick, 2009, p. 2; Pinto, 2019b). Even if it were to promote autonomous activity, the increase may resemble a trickle more than a flood. Power and control, once consolidated, are not readily ceded. Any attempts to erode the power of either the market or state can count on stiff resistance from both. This outcome, sought by an ecological basic income, might be dismissed as more utopian dream than tangible goal.

Virtually any funding method which might nudge a basic income towards becoming an ecological basic income can also be scrutinized. Resource dividends may be one of the most just means for redistributing revenue from natural resources among citizens, assuming they all have an equal claim to the Earth's bounty (Van Parijs & Vanderborght, 2017, pp. 149-152). Resource dividends do not guarantee reasonable use (as opposed to abuse) of natural resources, and the exhaustion of any resource used to fund a dividend would be unjust. Any EBI program financed through resource dividends should ensure payments are drawn from mature, well-established funds. Failure to do so forces programs to rely on the proceeds of resource sales directly, instead of returns on the investment of these proceeds. Fluctuations in market prices can quickly undermine immature funds, as demonstrated by the short-lived Mongolian program (2010-2012) financed through copper sales (World Bank, 2020, pp. 55-56). While dependence on investment returns makes a BI program more economically sustainable, it does not ensure environmental sustainability. Sustainable investments would be necessary for any program labelled an EBI. Ascertaining sustainability (detailed in section 5) is a challenging process, particularly from an environmental perspective, and complicates efforts to fund an ecological version of a basic income through resource dividends.

Though taxes may seem like an ideal method to simultaneously preserve freedom, steer consumption in a more sustainable direction, and raise funds for progressive redistribution, they also carry a specific risk. Funding an EBI through consumption (and thus resource use and pollution) sets up an existential crisis for any such program (Andersson, 2009, p. 3; Mulvale, 2019, p. 41; Perkiö, 2014, p. 10). An optimal position between failure (high levels of resource extraction or pollution) and success (lack of

funds) for an EBI may be particularly difficult to locate (Boulanger, 2009, p. 3; Calder, 2009, p. 5; Howard, Pinto, & Schachtschneider, 2019, p. 122; Pinto, 2020, p. 7). The same problem exists if an EBI were to be linked to economic activity (Fitzpatrick, 1999, p. 191). Any variety of taxes, if placed too high, risks discouraging economic activity (Howard, Pinto, & Schachtschneider, 2019, p. 115). While this contraction may bring positive outcomes from an ecological perspective, the current socio-economic paradigm is not well-equipped to handle such a situation,[23] and might threaten livelihoods and well-being (Fanning & O'Neill, 2019, pp. 818-819). Though a BI could help provide a measure of security, the global nature of modern economies implies effects might be felt far beyond the borders of any single nation. Imagine if a significant economy, such as Germany, were to adopt a BI and experience a decrease in consumption and (planned or incidental) economic contraction. The effects would certainly be felt throughout the European Union, but national economies around the globe might suffer, companies driven out of business, and individual employment lost, thus threatening well-being. Depending on the details of a specific basic income program's construction, levels of income, resource extraction, pollution, or general economic activity necessary for adequate funding all might threaten the accomplishment of ecological goals, particularly in wealthier settings.

Taxes specifically targeting the wealthiest sectors of society are another obvious option for funding an ecological basic income, due to the disproportionately large footprints displayed by this social class. Collecting them is far from straightforward, however. Buch-Hansen & Koch briefly consider some of the issues surrounding wealth taxes (2019). They remind us that before any such taxes can be levied, wealth must be defined, targets identified, and numerous questions answered. For example, will all citizens' wealth be targeted? Will there be a threshold, above which taxes might take effect? For non-monetary forms, valuation will be necessary. This process is challenging in itself, particularly if recurring taxes necessitate recurring reassessment. Wealth taxes are likely to invite corruption or capital flight to international tax havens. Increasing international cooperation is critical to combating capital flight, documenting wealth, and ensuring states/institutions receive what is owed to them. An additional obstacle is the social and political connections the wealthiest citizens of any nation typically enjoy, and their natural resistance towards any attempts to erode their wealth or power. Though these citizens may not be shaping policy directly, they are often able to exercise some type of influence over those that are, making these reforms less likely (Buch-Hansen & Koch, 2019, pp. 266-269). Even if increased global cooperation were to facilitate wealth taxation, it's unclear what effect it might have on consumption. The

[23] As evidenced by the ongoing pandemic

wealthiest citizens generally have the most resilient consumption habits (Pothen & Tovar Reaños, 2018, p. 242), so any redistribution of their wealth might simply serve to increase aggregate consumption for society as a whole (Koch & Fritz, 2014, p. 683). Though funding is typically mentioned as a means to enable an EBI, each method carries its own drawbacks and/or challenges. Resolving funding issues is essential for the establishment of any basic income, but seems especially complicated from an ecological perspective.

To say establishing an ecological basic income is challenging would be an understatement. An EBI offers the best chance to promote well-being, preserve opportunity, and protect planetary systems both now and in the future. Its central goal should be to help realize the vision set out in Raworth's Doughnut. An EBI may work in various ways on multiple levels towards this end. One of these would be the convergence and contraction of resource use and the associated environmental effects. This should take place on multiple levels, both among and within nations. Since the world's wealthiest nations disproportionally consume the Earth's resources, they have a duty to contract their use to allow for expansion in nations which are less well off. Individuals with the largest footprints bear the greatest responsibility for contracting their personal resource use to lower national averages. Individuals share responsibility for this necessary contraction and convergence with governmental, corporate, and other sectors of society. The goal of contraction and convergence is not to create a situation where all individuals and nations have a uniform footprint. Some inequality will always be present in any type of socio-economic system, but levels of disparity characterized by the current regime can be considered neither just nor sustainable. An EBI should facilitate the goal of contraction and convergence to aid in bringing as much of human society as possible inside the Doughnut. Consideration of the totality of the current climate situation underscores the necessity for swift, decisive action. Failure to do so threatens well-being and opportunities for the future. Basic income should demonstrate itself an enabler of environmental goals, rather than an obstacle for them. Programs that do not may solve some problems today while creating others for tomorrow by risking further threat to the PBs. Some may be willing to accept this situation, but it would be difficult to describe it as just, according to Rawls' saving principle and notions of intergenerational justice.

5.0 Measuring Environmental Sustainability

Like basic income, sustainability in general is a highly variable, diverse concept. This versatility may contribute to its popularity (Bell & Morse, 2009, p. 12). As is often the case, consensus on definitions can be lacking, and sustainability is no exception (Barry, 1999, p. 101; Bell & Morse, 2009, p. 10; Meijering, Tobi, & Kern, 2018, p. 39). In general, it refers to the continuing long-term feasibility of systems, and has economic, institutional, environmental, and other dimensions. It is a prerequisite for the long-term success and/or existence of nation-states, organizations, institutions, corporations, businesses, and any other social, political, or economic group. These groups may not exhibit sustainable habits or behavior for each and every aspect of the concept at all times. An extended time scale may be necessary, but all unsustainable entities will eventually wither, decay, collapse, erode, and disappear. As human society expands, potentially threatening the very foundation it was built upon, environmental sustainability represents one of its most acute challenges to date. If not adequately addressed, society as it's been developed may no longer be possible on a wide scale. The uncertainty of the exact positions (or safe ranges) of the planetary boundaries, and the consequences if and when they are transgressed make the exercise of the precautionary principle prudent. Disregarding the PBs subjects humanity to the risk of famine, mass migration of climate refugees, conflict, war, societal collapse, and mass extinction, perhaps including our own species. These risks are not inevitable, but undeniably possible, and the uncertainty surrounding them again highlights the importance of the precautionary principle. Environmental sustainability is critical to mitigating these risks and enabling the flourishing of the Earth, the life it contains, and all its encompassing systems. So how exactly might one determine whether a specific system is environmentally sustainable? The following section briefly explores the process of and challenges to monitoring environmental sustainability in general, including: defining systems, identifying objects of sustainability, selecting indicators, determining time scales and reference conditions, and participants in the process.

5.1 Critical Components of Sustainability Measurements

Attempts to measure environmental sustainability are fraught with challenges, difficulties, and subjective decisions from start to finish. A system must be defined before any attempts at determining its sustainability (environmental or otherwise) can be undertaken, though it may not be possible to draw

hard boundaries around it (Bell & Morse, 2009, p. 15).[24] The number of geographical systems on Earth which could be identified and outlined are nearly limitless. They can range from large (a nation or the entire planet) to small (a small town or section of a forest) with many spaces in between and plenty of opportunities for overlap. Scale matters and has implications for measurements. For example, imagine one intends to measure the air quality of the entire planet. Since the atmosphere is not uniform, a wide range in quality can be observed (think urban industrial metropolis vs. rural woodland). How many different sources of data are needed to form a representative sample? Is it possible to reduce these various data points into a single figure? Can one number accurately represent reality for an entire complex system? Alternatively, suppose one is tasked with monitoring and improving the air quality in a small coastal city, which is surrounded by the ocean and other cities, forming a larger metropolis. One of the upwind neighbor cities is an industrial hub, and the exhaust from their production processes blows directly over to a nearby city, affecting the health of its citizens. One may take as many measurements as are possible, but still lack realistic options to significantly improve the air quality. Any boundary is arbitrary to a degree. Systems overlap, interact with each other, and cannot be isolated from one another (Bell & Morse, 2009, pp. 14-15, 32). When a bird flies from Egypt to Israel, no one asks for its passport. Even our own planetary system receives outside influence in the form of energy from the sun and meteorites which fall from space, among other examples. The spatial definition of a system is necessary for measuring environmental sustainability, but boundaries are abstract human constructs, and no complex system can be entirely isolated from its surroundings.

Once a particular system has been defined, the elements and conditions representing the objects of sustainability can be identified. A vast array of options is available for those concerned with environmental sustainability. They may include: numbers of a particular species, biodiversity levels, concentrations of particulate matter in the air, soil quality, or the percentage of forest coverage in a particular territory, to name just a few. The scale and location of the system will influence which elements are chosen. Returning to the small coastal city example, air quality may be of concern to its citizens, but a lack of ability to influence this particular situation may shift focus to others. Conversely, measurements on larger scales may not concern themselves with a rare species within a very small natural habitat. Maintaining healthy river ecosystems may be vital in Brazil, but useless in Saudi Arabia. Context matters

[24] A parallel might be drawn between defining systems to measure sustainability and defining a 'community' in regards to basic income.

in determining which elements of a system to measure/monitor for sustainability. Objects of sustainability may also shift over time, and should be revisited and possibly revised periodically (Barry, 1999, p. 111).

The use of indicators and indexes is common practice in measuring sustainability, and both have advantages and drawbacks. Indicators describe the state or quality of a system. They are dynamic tools which can be used to set targets, measure progress, inform the public, shape policy, and more (Buhl, Liedtke, Teubler, Bienge, & Schmidt, 2018, p. 2; Saidani, Yannou, Leroy, Cluzel, & Kendell, 2019, pp. 546-547). The use of a single or small number of indicators may not provide enough information to accurately represent the health of dynamic ecosystems. Using a large number of indicators may provide an overwhelming or unclear picture. An assortment of indicators may be amalgamated into an index. Indexes are a useful tool for comparison, but risk oversimplifying a complex situation (Bell & Morse, 2009, p. 26). Ultimately, indexes are only as good as the indicators which comprise them and the quality of data used. Selecting appropriate indicators is an important endeavor (Bell & Morse, 2009, p. 28), but is also highly subjective. Objects of sustainability and context are two of the main factors that should be considered during the selection process. The people making these decisions add an additional layer of variability. Each individual's choice of appropriate indicators is inherently subjective. If the indicators are being chosen by a group, it is highly unlikely that all participants will agree right away. This doesn't mean consensus cannot be reached, but rather time, effort, and compromise will be necessary to arrive there.

The temporal aspect of measuring sustainability also deserves consideration. Scale and context are both important here as well. Measurements over inappropriate time scales can obscure legitimate trends or worse (Bell & Morse, 2009, pp. 15-16). Cherry-picking points in time could be used to support one conclusion, whereas taking an expanded view could support an opposite conclusion. For example, let's say today was two degrees cooler than yesterday and tomorrow will be two degrees cooler than today. Both of these may be true, but it does not follow that we should prepare for an ice age next week. The average temperature in a particular location this February may be lower than the average temperature in the same location last February. This does not mean the average temperature is dropping for this location (though it may be), and examining multiple years of data for all months of the year can provide a more robust understanding of the situation in context. The time scale on which sustainability is measured depends on the subject of measurements, and different subjects may require different scales (Bell & Morse, 2009, p. 15).

Measuring sustainability involves tracking change over time. Reference points or conditions are necessary to gauge progress. These reference points may be attached to a particular level of quality,

conditions at a certain point in time, or another measure. Identifying appropriate reference points or conditions may be a considerable challenge. Knowledge of or data from a specific system may be lacking. Reference points or conditions poorly chosen can produce misleading results (Bell & Morse, 2009, p. 16). This deception could be accidental or intentional. Governments or other institutions may be tempted to choose reference points that portray themselves as effective (Bell & Morse, 2009, p. 41). Reference points are subjective as well. Participants in the process may have differing conceptions of what a sustainable target may be. Scientific understanding of a system may be insufficient to identify a precise value. Bell and Morse suggest that a "band of equilibrium" allowing for a range of acceptable outcomes may be more appropriate than a single point in many cases (2009, p. 179). Finally, as more thorough data or understanding of a particular system arises, conceptions of what can be considered sustainable may change. Targets and reference conditions may need to be adjusted periodically.

The process of measuring sustainability is intricate and involves considerations of multiple factors, some of which were outlined above. Who should be involved in this process? A broad scope of participants can increase the likelihood of acceptance and legitimacy of the results. Pluralistic perspectives help provide a deeper understanding of a situation (Bell & Morse, 2009, pp. 110, 202). Certainly scientists, experts, and policy makers will play a role. Citizens also have much to contribute, and should be incorporated in all stages of the process. Members of local communities may possess an understanding of local conditions in a way that compliment scientists and experts, who may not be as familiar with conditions on the ground (Bell & Morse, 2009, p. 104; Norton, 1999, p. 142). As the number of participants in this process increases, so too does the opportunity for conflict, on multiple levels. Individuals or groups may have differing conceptions of the meaning of sustainability or which targets should be set (Bell & Morse, 2009, pp. 77, 144-145). For example, local hunters and a birdwatching club may both share a desire to maintain a healthy bird population, but may disagree on the meaning of 'healthy' and its implications for their preferred pastimes. Conflicts between top down and bottom up approaches are an inherent result of multi-layered government bureaucracies. Perhaps increasing citizen participation at all levels can help to mitigate these conflicts.[25] This participation must be genuine, and not simply for show or as a means to legitimate predetermined decisions (Bell & Morse, 2009, pp. 84, 121, 198). Ultimately, including a broad range of participants and incorporating their various visions and perceptions is a challenging

[25] A basic income might facilitate participation by affording more spare time for recipients, some of whom may choose to become involved in this process.

endeavor, but is necessary to build an encompassing model of sustainability (Bell & Morse, 2009, pp. 126-128; Jacobs, 1999, pp. 26-27; Neefjes, 1999, pp. 277-278).

Sustainability and its measurements and monitoring are variable, subjective concepts and processes. Bell and Morse explore several different methods, but caution there is no single, correct, step-by-step method for this dynamic process (2009, pp. 156, 191). Though certain elements will be present regardless of the method (defining the system, choosing indicators, taking reference conditions, etc.), individual attempts should remain sensitive to inherent contextual intricacies to achieve the best results in each case. There will never be a universal, eternal guideline for sustainability, and the process will need to be continued and measurements adapted and adjusted over time (Bell & Morse, 2009, p. 201). This process ideally involves a broad spectrum of interests and conceptions from a representative sample of community members combined with experts and policymakers. The involvement of numerous parties enhances the possibility of conflict between them, but legitimizes the results if these conflicts can be satisfactorily resolved. The process may present a formidable challenge and involve considerable amounts of time and effort. Assessing sustainability may be daunting and fraught with subjectivity, but it is not impossible. Expectations should remain grounded and realistic attitudes held regarding what this process can and cannot do. Perhaps these efforts are best considered investments in the future, rather than impositions on the present.

6.0 Monitoring Basic Income's Ecological Impact

Basic income and sustainability overlap in multiple respects, but the environmental aspect is a primary concern from an ecological perspective. Basic income has the ability to either encourage or threaten environmental sustainability due to its protean nature. If designed as a crutch to maintain the socio-economic status quo built around full employment and exponential growth, BI will likely jeopardize transitions towards more sustainable societies. Unless implementors of a basic income are willing to mortgage the future to pay for the present, an ecologically oriented design seems essential to ensure BI programs live up to their philosophical justifications. Those that do not may be rejected as unjust towards future (and current) inhabitants of the Earth. Conversely, BI programs designed with the environment in mind have a much better chance of achieving sustainable outcomes because of their potential to restructure society and its priorities. A name and blueprint influenced by ecologism are not sufficient to ensure any such program actually complies with the principles of this philosophy. Tangible results are necessary to ensure an EBI meets ecological standards. Continuous assessment should take place to guide programs and confirm they meet such standards. Currently, no previous or existing BI trial or program has explicitly integrated ecological elements into its design or assessment of its impacts (MacNeill & Vibert, 2019, p. 4). How might one go about incorporating these assessments within the framework of a BI?

Though the process of determining sustainability is complicated and fraught with subjectivity, it should be attempted in order to demonstrate and ensure BI's compatibility with justice. Though the process and outcomes will be unique to each particular situation, certain common elements will likely be the focus of monitoring in any context. By determining a BI's impact on time expenditure, lifestyles, and consumer spending patterns, its environmental impact can be estimated and EBIs differentiated from other BI programs (MacNeill & Vibert, 2019, p. 12). Previous studies attempting to gauge the impact of individual lifestyles have already made these elements their focus, and demonstrate consensus on the most environmentally impactful categories: housing, food, and transportation (Buhl, Liedtke, Teubler, Bienge, & Schmidt, 2018, pp. 5-7; Buhl, Liedtke, Teubler, & Bienge, 2019, p. 78; Hirvilammi, Laakso, Lettenmeier, & Lähteenoja, 2013, pp. 144-146; Laakso & Lettenmeier, 2016, p. 188; Lettenmeier, Lähteenojab, Hirvilammi, & Laakso, 2014, p. 683; Lettenmeier, Liedtke, & Rohn, 2014, p. 494; Pothen & Tovar Reaños, 2018, p. 242). As such, these three elements should feature prominently in sustainability measurements. Though these studies are not without limitations, they can provide a template to inform future efforts. As more data is amassed and techniques are refined, the results of these measurements will become ever more accurate and reliable. This section explores measuring environmental

sustainability within the context of basic income and the challenges to this process. It proposes monitoring individual or household habits, behaviors, and consumer purchases, and connecting each of these with their estimated environmental impact. By comparing similar communities to each other, or specific communities with themselves over time, a general conclusion can be drawn about basic income's impact on the environment.

6.1 The Process Proposed

The first step of determining sustainability is identifying and defining the system to be examined. To best ascertain basic income's effects on the environment, communities actually implementing the policy should be studied. By doing so, emergent community effects and the impacts of funding mechanisms (diminished or absent in trials and experiments) can be incorporated in monitoring and assessment. Historical examples are in short supply, but include the national programs in Iran and Mongolia, the APFD, distribution of casino profits among the Cherokee Nation, and the privately funded programs in Kenya, Namibia, and India.[26] These programs most closely resemble a BI based on the definition provided earlier, though many of them fail to fulfill the criteria in some way. Unfortunately, existing data gathered in all of these cases appears insufficient to determine their environmental impact. Since retroactive analysis is limited, focus should shift to future programs. Tailoring measurements for specific programs before they have begun allows focus on the most pertinent data from the very beginning for most thorough measurements and accurate analysis. Saturation studies, comparisons of data from other communities of a similar composition, can be used to gain insight into a program's ecological impact. Comparable communities will need to be identified and data gathered from them to enable comparisons. For programs implemented at the national level, other nations exhibiting similar patterns of consumption, material use, environmental impact, levels of income, economies, population sizes, and geographic location will be the most useful. If implemented regionally within a nation, such as in a particular province, state, or city, comparisons with the most similar entities within that particular nation will likely provide the best opportunity for comparison. The primary difference between communities being compared should be the presence or absence of a basic income. The more characteristically similar the communities are, the better the comparison will be. Monitoring consumption, behavior, and lifestyles, and how they change with the implementation of a basic income

[26] For a more comprehensive, detailed comparison of these and other programs, see (World Bank, 2020, pp. 22-23).

between two or more similar communities via saturation study is the best method to determine any program's overall ecological effect.

Once a system has been identified, indicators can be selected for monitoring and sustainability assessment. Measuring emissions, footprints, and material use are critical to this process and can be done in various ways. One of the most prominent measures is carbon or greenhouse gas emissions. Atmospheric levels of greenhouse gases are certainly a critical factor worth measuring, particularly concerning the stability of global temperatures, sea level, and the implications for human civilization (Steffen, et al., 2018). Atmospheric quality is but one of the planetary boundaries, however. Even if human society were somehow able to eliminate its greenhouse gas emissions entirely, it would not preclude or eliminate stress on other boundaries. Considering other measures, such as ecological footprint (EF), can provide additional context. The EF's methodology attempts to provide a holistic measure of ecological impact by comparing a specific geographic area's estimated capacity to provide resources and absorb waste against its population's resource use and waste generation (Global Footprint Network, 2020). It can be estimated for smaller areas, such as cities, or scaled up to encompass the entire planet. Another useful measure to consider is material footprint (MF), which estimates the total amount of resources consumed by a particular nation or individual. Its methodology accounts for transnational material flows and globalized production processes by attributing materials used for production to the country where they are consumed, rather than extracted from or processed (López, Arce, Morenate, & Zafrilla, 2017, p. 517; Pothen & Tovar Reaños, 2018, p. 237; United Nations Environment Programme, 2019, pp. 51-52; Wiedmann, et al., 2015, p. 6271). Material footprint attempts to account for industrial outsourcing, a phenomenon where environmentally damaging extraction and production processes are relocated to nations where labor is cheaper or laws protecting the environment are less stringent (Wiedmann, et al., 2015, p. 6275). Material footprint can also be used effectively for analyzing resource use at multiple levels, from entire nations down to individuals (Hirvilammi, Laakso, Lettenmeier, & Lähteenoja, 2013, p. 140), though its methodology and accounting can vary depending on the level (Bringezu, 2015, p. 26; Lettenmeier, Liedtke, & Rohn, 2014, p. 491). Each of these indicators paints its own unique picture of human impact on the planet, and combined they may provide a more granular image (Buhl, Liedtke, Teubler, Bienge, & Schmidt, 2018, p. 3). They deserve strong consideration as indicators for sustainability measurements because of the generally holistic nature of their methodologies (particularly EF and MF), which well-reflects the global nature of the modern economy and the interconnected nature of PBs and other Earth systems. They may well be supplemented with other measures, including those more

reflective of specific, local, environmental conditions, or perhaps others which are currently undeveloped. Ultimately, communities should determine for themselves which (if any) of these to select and monitor.

To best determine the environmental impact of an individually-focused socio-economic policy, like basic income, its effects on individual behaviors and habits needs to be determined. If the size of the footprints associated with these behaviors is known, tracking changes in behavioral patterns will enable changes in impact to be estimated as well. The Classification of Individual Consumption According to Purpose (COICOP) and Material Input Per Service unit (MIPS) can be used in tandem to connect individual consumer and behavioral patterns with their environmental impacts. COICOP categorizes consumer goods and services into 15 divisions,[27] before breaking them down into groupings, classes, and finally reaching a total of 338 subclasses (United Nations, 2018). Meanwhile, MIPS estimates the lifetime material and energy input for nearly any product or service (Kotakorpi, Lähteenoja, & Lettenmeier, 2008, p. 7; Ritthof, Rohn, & Liedtke, 2002, p. 9). By connecting the MIPS for each COICOP division, down to subclasses if possible, the general environmental impact of consumer spending can be determined. Since MIPS can be calculated not only for products and services, but also transport, housing, household appliances, tourism, leisure activities, and more (Kotakorpi, Lähteenoja, & Lettenmeier, 2008, p. 41), it can be used to determine the environmental impacts of lifestyles in general. Used together, these two systems can estimate impacts of nearly any product, service, behavior, activity, habit, or hobby.

The scope of the community taking measurements will largely dictate which indicators are most appropriate, and measurements at multiple levels is desirable. At the highest levels (national or supranational), national footprint averages are obvious choices for indicators and can serve as reference conditions as well. Per capita footprint averages are an effective expression of consumption rates for typical citizens and can serve as snapshots for entire nations over given periods of time. National averages are probably the simplest to calculate and can be compared between communities over differing time periods to assess impact. Examining whether behavioral changes and consumption cause footprints to grow or shrink (and by how much) relative to rates in similar communities can help determine whether BI is generally impacting the environment positively or negatively. Examinations at the individual level should supplement macro views, and may be some of the most informative and useful measurements taken for a variety of reasons. Obviously, data gathered from individual citizens is necessary to build community footprint averages for comparison. The individual nature of BI payments underscores the importance of determining their effect on individuals. Focus on individual consumers is rational due to

[27] Food and beverages, clothing and footwear, housing and energy, health, transportation, etc.

the policy's potential to alter patterns of consumption (Howard, Pinto, & Schachtschneider, 2019, p. 118) and the fact that consumption is the strongest indicator of environmental impact (Wiedmann, Lenzen, Keyßer, & Steinberger, 2020, p. 2). Though it will take time for the full effects to be felt, individual consumption and behavioral patterns will begin to shift as soon as payments begin to flow and can provide some of the strongest and earliest indications of a program's effects.

Analysis of individual behavior also allows for the creation of consumer profiles, which can provide numerous benefits. Collecting and analyzing data on individuals can help expose trends and patterns in their behavior and consumption (Buhl, Liedtke, Teubler, Bienge, & Schmidt, 2018, p. 3; Buhl, Liedtke, Teubler, & Bienge, 2019, p. 82) in ways that are not possible by examining national averages, which can easily obscure trends among various sectors of the community. Collecting anonymous socio-economic characteristics on individuals can provide additional opportunities for deeper analysis. Such characteristics might include: sex, age, income, ethnicity, geographic location, level of education, and occupational status (Buhl, Liedtke, Teubler, Bienge, & Schmidt, 2018, pp. 2-3; Buhl, Liedtke, Teubler, & Bienge, 2019, p. 76). Based on this data, profiles of particular types of citizens and consumers may be constructed[28], which could enable the creation of policies targeting specific groups to nudge their behavior in more sustainable directions (Buhl, Liedtke, Teubler, Bienge, & Schmidt, 2018, pp. 3, 5; Buhl, Liedtke, Teubler, & Bienge, 2019, p. 82; Teubler, Buhl, Lettenmeier, Greiff, & Liedtke, 2018, p. 104). One of these nudges might be taxes, carefully targeting highly impactful luxury consumption of the wealthiest groups while leaving basic necessities untouched (Pothen & Tovar Reaños, 2018). If this type of progressive taxation were used to help fund an EBI, it could help preserve freedom and opportunity, while reducing both financial inequality and the most environmentally impactful consumption patterns. The wealthiest citizens in any community generally exhibit the highest rates of consumption and are the most economically secure. Though behavioral changes from this section of society may be the most difficult to induce, they can also have the greatest impact on sustainability. One of the main goals of an EBI should be to encourage a contraction of consumption and environmental impacts from the most affluent members of the community. More sophisticated individual data from various segments of these communities can enable more reliable conclusions to be drawn and allows targeted

[28] For example, households earning over $100,000/year, single parent households, only-child families, professionals between the age of 20-29, etc. These may be broad, or fairly specific. Greater levels of socio-economic data which can be gathered from individuals will provide more opportunities for analysis within various sectors of the community being examined.

corrections/alterations to promote sustainability better made, particularly if combined with continuous assessment.

Once the system has been identified, and scope and indicators chosen, data collection may begin. If not already available, baseline data related to indicators selected by the community must be gathered to serve as reference conditions. This baseline data should be collected *prior* to the implementation of a basic income, and should be detailed enough to allow for thorough analysis (Standing, 2012, pp. 140-141). Though more detail is certainly preferable to less, surveys should not be overly long and complicated so as not to discourage participation. Balancing detail and simplicity for the ease of data collection may be challenging, but this compromise will be a necessary part of this process in any context. The currently favored data collection method is via survey. Recent cash transfer research in Finland (Kangas, Jauhiainen, Simanainen, & Ylikännö, 2019, pp. 9-10) and Barcelona (Laín, Riutort, & Julià, 2019, p. 14) have heavily relied upon surveys. One of the previously mentioned studies in Germany used an online survey (Wuppertal Institut, n.d.) and was able to collect over 60,000 individual responses for analysis in less than 3 years (Buhl, Liedtke, Teubler, & Bienge, 2019, p. 77). Other German studies combined global material flow data with a voluntary German socio-economic statistical survey for their analysis, including over 120,000 (Pothen & Tovar Reaños, 2018, p. 240) and 44,000 households (Teubler, Buhl, Lettenmeier, Greiff, & Liedtke, 2018, p. 98). Three studies in Finland used personal interviews to collect data, but were of a much smaller scope: 18 individuals (Hirvilammi, Laakso, Lettenmeier, & Lähteenoja, 2013, p. 142), 27 households containing a total of 78 members (Kotakorpi, Lähteenoja, & Lettenmeier, 2008, pp. 21-26), and 5 households (Laakso & Lettenmeier, 2016, p. 187). Personal face-to-face interviews would probably be too laborious for gathering data from any community of significant size, and this technique would not likely be viable to form a representative sample in most contexts. Baseline data must also be collected from the control communities (those not implementing a BI) for saturation studies. This should happen simultaneously with data collection from the communities who will be implementing a BI. Failure to collect baseline data from both communities makes comparisons impossible.

Once respondents' baseline surveys have been received, they must be supplemented periodically with additional data over time in order to allow for comparison. Follow-up efforts should largely replicate questioning from initial baseline surveys to enable accurate comparisons, though certain questions may often be redundant. For example, changing jobs or housing, purchasing new vehicles or appliances, methods of commuting, and the composition of individual households may only change infrequently for many respondents. Nevertheless, these factors can have large impacts on sustainability and should be

monitored and updated. Additionally, time in between surveys must be sufficient to allow for consumption and lifestyle patterns to change and develop. A particular risk for long-term, detailed studies is 'respondent fatigue', where disinterest sets in and participation suffers (Standing, 2012, p. 138; Walker, 2014, p. 138). An adequate period of time in between surveys could help prevent this phenomenon. Standing suggests one survey every six months (2012, p. 142).[29] Measurements and monitoring should be ongoing, to allow for continuous assessment of a program and its impacts. Again, follow-up surveys need to be taken from control communities to enable comparison and assessment.

Technology can be used to enhance data collection in a variety of ways, and can be increasingly relied upon as it becomes further integrated into daily life. Robust sample sizes are most desirable for accurate results, and using a website or smartphone application could provide an ideal medium to facilitate data collection via surveys. Numerous examples can already be found online (Carbon Footprint Ltd, n.d.; Henkel AG & Co., Wuppertal Institut, 2020; The Nature Conservancy, 2020; World Wildlife Fund, n.d.). A healthy amount of detail in lifestyle habits, behaviors, consumption, and anonymous socio-economic data would enable more thorough analysis. Login details for individuals or households might help streamline the data collection process, which might otherwise seem repetitive and discourage participation. A brief reminder at the beginning of follow-up surveys might allow individual profiles to be updated to incorporate shifts in household composition, the purchase of a new home, car, or appliance, changes in employment status, and so on. For example, questions such as: "In the past six months, have you purchased a new appliance?", "Car or other vehicle?", or "Changed dwellings?" might be accompanied by an option to answer 'yes' or 'no'. If the respondent chose 'no', the survey would advance, whereas if they chose 'yes', it would prompt additional questions to add detail. Answers to these additional questions might be incorporated into individual profiles in order to better track lifestyle changes in various socio-economic classes within the community. Another benefit footprint calculators can provide is personalized feedback once surveys are completed, based on individual responses and lifestyles. Completing surveys regularly might increase awareness of one's personal habits and their implications on the planet or dialogue on sustainable lifestyle options for citizens, hopefully accompanied by action.

Another way technology could assist this process involves tracking purchases of goods and services. Knowing how recipients use their BIs is obviously useful, but understanding how it is used in concert with other sources of income is vital as well. For example, certain people may use their BI for

[29] It should be noted his recommendation is for BI pilot schemes.

fundamental needs like food, housing, and bills while using supplemental income for travel and entertainment. Other common patterns may emerge generally or within segments of a society. Understanding the relationship and interaction between various sources of income and their use has implications for sustainability. Just as shifts in one consumption category can carry over to affect others, so too can uses for various sources of income.[30] The regularity of a BI payment or consistency in its amount may affect consumer spending, particularly for citizens whose income is somewhat irregular or erratic. As such, examining as much individual consumer spending as possible will provide the clearest picture of their spending habits. Collecting this type of data via surveys is limited, at best. In wealthy nations (those with the largest footprints, generally), a significant portion of transactions are performed digitally, via card or contactless payment. Banks approve countless transactions daily and update balances nearly instantaneously. Retail stores typically track inventory digitally, scan each item upon purchase, and offer detailed, itemized receipts to customers at the point-of-sale. Connecting this data within a COICOP/MIPS framework and compiling it digitally in a database for analysis is not currently possible, but does not seem far-fetched. If developed, this type of system might provide a rich option for recording and studying consumer expenditure. Removing any identifying personal data would obviously be necessary, but preserving socio-economic information on the purchaser would be vital for thorough analysis. Individuals would have to give consent and if anonymity were not guaranteed, this strategy would have to be discarded and surveys relied upon. Nevertheless, society's ever-expanding digital footprint may be a means to access and gather much more sophisticated consumer data.

Besides individuals, households might also be the target of study. Nearly two-thirds of global carbon emissions and over half of the world's MF have been attributed to household consumption (Ivanova, et al., 2016, p. 528). Another estimate attributes 80% of greenhouse gas emissions for housing and consumer goods combined (Teubler, Buhl, Lettenmeier, Greiff, & Liedtke, 2018, p. 97). Acknowledging the complex variety of factors fueling consumption, and leaving aside discussions over which parties are responsible to which degrees, it's undeniable that a large volume of material and energy flow through household consumption. Analysis of private households provides an opportunity to observe the effects of socio-economic policies generally (López, Arce, Morenate, & Zafrilla, 2017, p. 522), and encourage a shift of behavior patterns to more efficient, sustainable tracks (Buhl, Liedtke, Teubler, Bienge, & Schmidt, 2018, p. 1). A methodology combining COICOP and MIPS would be compatible with household studies, since

[30] Determining uses for various sources of income may be impossible once they reach individual bank accounts. Still, inquiring how individuals with various sources of income mentally account for outgoing consumer expenses might prove worthwhile, if only for assessing individual motivations and attitudes.

they are composed of individuals purchasing products and services, exhibiting behaviors, and participating in activities. Household studies could employ many of the same techniques and offer many of the same benefits as individual studies. Surveys could be used to collect consumption and lifestyle data. Again, socio-economic microdata from surveys could be used to construct profiles of different households and their resource consumption patterns (Buhl, Liedtke, Teubler, Bienge, & Schmidt, 2018, pp. 2-4; Teubler, Buhl, Lettenmeier, Greiff, & Liedtke, 2018, p. 98). Household profiles might consider data such as: net income, number of people, number of children, age profiles, total size of living area, community,[31] and net consumer expenditure (Buhl, Liedtke, Teubler, & Bienge, 2019, p. 76; Pothen & Tovar Reaños, 2018, p. 240). Particular household profiles might tend to exhibit certain (un)sustainable consumption patterns. A decline in one consumption category might be linked with an increase in another, for certain profiles or all of them. This knowledge might be used to encourage more sustainable behavior from households, but requires a certain level of sophisticated data.

Appliances are an important component of households, and can provide another opportunity for technology to facilitate data collection. Since housing is one of the COICOP categories with the heaviest impact, focus on this area is logical. There are many variables involving appliances which carry implications for sustainability. The type, age, model, and energy intensity of various appliances can all affect their energy usage. Specific information regarding each individual appliance might be included in initial surveys directed towards households. Connecting this data with general efficiency information on specific brands and models can be used to create more specific profiles of household energy consumption. These profiles can be used to suggest ways individual households can use energy more efficiently or to analyze patterns for certain socio-economic groups. Just as particular materially intensive luxury goods and services might be the target of taxes, so too might energy intensive luxury appliances. Any such taxes should be progressive, targeting primarily those who can most afford them, and might also be redistributed as part of an ecological basic income.

Collecting data on household appliances and their energy use may seem tedious, overbearing, and borderline impossible. The internet of things can help clear this hurdle by providing detailed information on specific appliances and their usage. As more smart appliances and meters make their way into homes, more sophisticated pictures of household energy use can be drawn. The most affluent households in wealthy nations are generally in the best position to be able to afford new, smart appliances and will be the first to thoroughly integrate this technology into their homes. Since these households

[31] In this case, community refers to the specific geographic area where one resides, like a neighborhood.

typically consume the most energy, this will provide opportunities for energy analysis to encourage more efficient usage from those consuming the most. Naturally, any such information collected from appliances would need to be anonymous, but if the socio-economic data on households where each appliance is used could be maintained, all the better. Even if this was impossible, general geographic data (such as a street, block, or neighborhood) might be connected with socio-economic survey data for these regions to create general energy-use profiles for these areas. Analyzing energy use and promoting efficiency is a process that is underway with or without BI. Still, ascertaining BI's effects on energy consumption and household appliances can shed much light on BI's prospects as a sustainable policy. Understanding its effect on overall household energy consumption, usage for existing household appliances, if it enables the purchase of new appliances (and if so, which types) will be critical to this process. Household energy use, both independent of and in relation to, productive (in the corporate and economic sense) use should be examined in light of its implications for long-term environmental sustainability. As the internet of things develops, data collection regarding appliances will cease to be a problem, but finding adequate time and manpower to analyze the data may be.

Transportation has a very large environmental impact generally, and monitoring should not neglect these behaviors and habits. Surveys should incorporate highly detailed information on how citizens get around, and the ways in which a BI affects these habits. The types of transportation people are utilizing is obviously important; cars have a larger footprint than bicycles. Besides the method, the distance, duration, and frequency with which people are traveling are also quite relevant. Would a BI allow families or individuals to purchase a vehicle? If so, is it a first vehicle, or an addition? New[32] or used? Gasoline or electric? Does a BI increase the frequency or distance with which people travel by airplane? How does it affect usage rates of public transportation? These are just a few of the questions surveys might address. Societal effects, such as participation in the labor market, may have a significant effect on how often and the ways in which citizens travel. If people tend to work less, it may undermine the need for a vehicle and encourage people to utilize public transportation or ridesharing. Alternatively, it may afford some citizens time to drive around the city visiting friends. Since many of these societal effects will not emerge in a trial or pilot, this underscores the necessity of monitoring ongoing programs to best ascertain their effects. A BI will inspire different types of behavioral changes among various sectors of society. Again, socio-economic data can help determine how a BI is affecting various types of citizens, and

[32] The internet of things may enable a rich set of data for analysis from new cars, including distance driven, amount of fuel used, time spent commuting, etc. Of course, privacy concerns must be considered and consent received for data collection in this manner.

can be used to promote sustainable behavior. Higher levels of detail on individual citizens and their habits will enable these efforts. Knowing how a basic income affects the way people move in, around, and out of their community will better allow assessment of its prospects as a sustainable policy

The effectiveness of the measurements and analysis involved with this strategy largely hinges on the detail of data collected. An insufficient level of detail will hinder analysis. Conversely, more detailed data allows for more thorough analysis, but may be challenging to collect and examine. As previously noted, a balance must be struck somewhere between these. Adequate detail is necessary in two areas for proper sustainability measurements as suggested in this method. First, fairly detailed information regarding individuals' consumer purchases, housing, behavior, and time expenditure is necessary to determine if BI is encouraging more sustainable lifestyles. Second, gathering significant detail of individual socio-economic characteristics will enable the creation of profiles for members of the society being examined. These profiles are a critical part of sustainability measurements, determining BI's impact on lifestyles, and societal analysis in general. A better understanding of the relationship between various consumption patterns in various sections of society can help inform policy or detect and combat rebound effects (Buhl, Liedtke, Teubler, Bienge, & Schmidt, 2018, p. 13). Understanding the causes of sustainable habits for certain groups could be used to encourage their spread to others, if possible (Laakso & Lettenmeier, 2016, p. 190). Knowledge of unsustainable habits might enable the establishment of taxes or regulations to discourage them, so long as any such measures weren't regressive. Analysis of the socio-economic profiles can be used to help ensure such taxes are progressive by targeting affluent populations and behaviors. Understanding why and how BI is affecting change for individuals and households at different levels of society is necessary to guide it as a tool for justice, opportunity, and sustainability. Without a sufficient amount of detail in data collection, this type of analysis and evaluation become more difficult or impossible.

It's critical to remember that determining sustainability with any degree of universal, unquestionable certainty is impossible. It's a naturally subjective concept and process. Individual communities will have to define sustainability and determine how to assess it for themselves. As such, there will be variety and peculiarities in specific attempts, though they will likely contain some common, recurring elements. Among these may be a focus on individual time expenditure, behaviors, and consumption generally, with a more specific focus on housing, food, and transportation as elements with the largest impact on the environment. Because the process will be unique to each specific context, it may

only be outlined and described in a very general way. The recommendations provided here represent one possible technique among many others, which may differ incrementally or entirely.

In summary, observing how individuals and socio-economic groups adapt their behavior and lifestyles to a basic income over time will allow for assessment of its ecological impact. The saturation study technique should be used to compare communities implementing BI against those which are not. Baseline data from control and experimental communities ought to be collected prior to the implementation of a BI, and should focus on behavior, time expenditure, lifestyles, and consumption. Linking COICOP, MIPS, consumer purchases, and individual behaviors and lifestyles will enable the impact of individuals, various socio-economic groups, and the community as a whole to be estimated. National or community averages can serve as reference conditions for comparisons with other, similar communities and across time. These averages will come from data on individuals, which if sufficiently sophisticated, will allow for taxes and regulations which may help finance EBIs and encourage more sustainable individual behaviors in a progressive, just manner. The creation of socio-economic consumer/lifestyle profiles can aid in the analysis and guidance of BI programs and enable sustainable transitions. This process should be ongoing to enable continuous assessment to ensure BI continues to encourage sustainable lifestyles. Surveys are likely the best method for data collection, though technology may be used to enhance and supplement in various ways. Surveys of individual citizens are probably the best option, but focus on households may also be worth considering. Options for analysis of this data are plentiful and offer numerous benefits. Community averages, their change over time, and comparisons with other communities will help shed light on the environmental impacts of BI. Comparisons of various consumer/lifestyle profiles of particular socio-economic groups within individual communities can help inform how a BI is impacting different segments of society. This information might be used to battle rebound effects, design progressive tax schemes targeting more affluent social classes and particularly damaging luxury consumption, and help encourage sustainable transitions in general. Individual behavior and feedback attached to surveys may encourage awareness and dialogue of sustainable lifestyle habits among citizens. Though imperfect, this process can be used to help determine the environmental impact of basic income, its potential as a just, sustainable policy, and to promote convergence and contraction for the benefit of current and future inhabitants of the Earth.

6.2 Addressing Challenges and Limitations to the Proposal

Some will certainly question the wisdom of attempting to measure the environmental effects of basic income, or if it is possible at all. Their reservations and criticism may be well justified, particularly

considering the protean nature of basic income, the subjectivity involved in measuring sustainability, and the values-laden judgements surrounding both of these topics. Any proposal involving these elements will be accompanied by a list of challenges and limitations. This subsection attempts to identify and address some of the primary reservations surrounding assessing basic income's environmental impact.

The methodology described in the previous subsection is best employed in communities actually implementing the policy. The saturation study technique is the best option for comparing entire communities, and can be employed on various levels, from small villages up to entire nations. It requires the identification of at least one comparatively similar community of equivalent size and composition, whose primary difference is the implementation of a BI. Locating an equivalent community may prove challenging and, because at least two distinct communities are necessary, saturation studies introduce factors which are impossible to control for and naturally limit comparisons. The lack of true control and test groups mean the results of any measurements will reflect the impact of BI combined with other factors. Since the full effects of a BI will take a significant amount of time to emerge, any study of its impacts will need to take place in the long term to allow for adequate observation and accurate assessment. Long-term studies cannot fully insulate communities from various factors (effects from other policies, economic conditions, etc.) and this will necessarily complicate conclusive assessment of any policy. There will always be some who reject the results due to these inevitable, extraneous factors. The lack of a true control group in this process means that even if BI is found to have a negative impact over a certain time period, it may represent a smaller impact than would have happened otherwise. For example, a particular community may implement a BI, and see its carbon emissions rise 2% overall during the first year of the program. Without a BI, the various socio-economic factors involved may have led to a 5% increase in carbon emissions, though this is impossible to test and determine. To circumvent this limitation, a community might be compared against itself over time, but even this cannot provide a perfect comparison. For example, let's say we are comparing data for all residents of a particular city over a 5-year time span. Over those 5 years, the compositional character of the city will necessarily change. Each of the residents will be 5 years older. Some will have been born while others died. Some will have left for and arrived from other locations. Businesses will have opened and closed, jobs changed, and people retired. The technology utilized by the residents of the city will have changed. Each moment of each day, the community will redefine itself incrementally. The name may be the same, but the communities being compared will be inherently different, however marginally. Though these types of comparisons are imperfect and limited, they offer the best opportunity for accurately determining the environmental impact of basic income.

Since entire communities implementing basic incomes are short in supply, and because comparisons at the community level are flawed, it may be tempting to incorporate sustainability measurements into experiments, trials, or pilot programs. After all, these can incorporate the use of RCTs and better isolate variables to provide a more accurate comparison. Since BI's universal nature is incompatible with the use of RCTS however, testing becomes practically impossible and this method would actually be examining cash transfers. The inability to recreate or simulate structural elements such as taxes, and the limited scope (both temporally and among the community's population) inherent to trials and experiments naturally obscure broad societal effects and diminish the applicability of comparisons to BI. Examining consumer spending, behavioral changes, and lifestyles through this lens could incorporate the use of RCTs and may be informative and useful but is also inherently limited. Various methods of observation and comparison of entire communities (or segments of them) are possible and useful, but none is perfect. This does not imply that comparisons are impossible, just that one must be aware of their limitations. Examining individual consumption patterns, behaviors, and lifestyles, using either an experimental population or the saturation study technique for an entire community, might both be used to help determine BI's prospects as a sustainable policy, but neither can provide infallible certainty.

Some may take issue with various footprints or other potential indicators. Each possess their own shortcomings which should be acknowledged. For example, critics observe EF's methodology implies an acceptance of human activity subjugating the entire planet, its resources, and absorptive capacity, and doing so could lead to system collapse (Martínez-Alier, 2012, p. 63). Others may point to the approximate nature of MF and its calculations, which can be extended to MIPS as well. Determining the impact of each individual good or service and monitoring individual or household behavior involves averages, estimates, speculation, and best guesses. No results or figures associated with such a process can be held up as absolute and indisputable. The quality of any study's output is directly related to the quality of the input, and improving the accuracy of collected data and replacing averages and assumptions in MIPS with more concrete numbers will provide truer results (Buhl, Liedtke, Teubler, Bienge, & Schmidt, 2018, pp. 5, 10; Buhl, Liedtke, Teubler, & Bienge, 2019, p. 76). Resource intensities vary between consumption categories, but also for individual products (Buhl, Liedtke, Teubler, Bienge, & Schmidt, 2018, p. 7). For example, all cars are not equally fuel efficient, and increasingly specific classifications within COICOP categorizations could provide additional granularity (Teubler, Buhl, Lettenmeier, Greiff, & Liedtke, 2018, p. 104; Pothen & Tovar Reaños, 2018, p. 241). Considering the COICOP system already has 338 subclasses, some might argue it is too complex for practical use. Measurement systems may be based on COICOP, but need not

replicate it exactly. They might simply draw inspiration from it, and focusing on specific materially intensive categories might simplify the process. The communities making measurements themselves ought to determine which indicators to adopt and how to go about monitoring them. Consulting a variety of factors will help to paint a clearer picture. As time advances, existing indicators will be strengthened and made more accurate, but new ones also will be developed. The incorporation of the best, most accurate, and detailed indicators is an important part of producing accurate sustainability measurements. Ultimately, each community will have to determine the best indicators to consider and how best to balance detail for thorough analysis and simplicity for ease of data collection.

Focus on the individual is natural due to the nature of basic income payments and their ability to inspire behavioral changes. Community effects, as well as changes in interactions between citizens, governments, and the corporate sector should be examined as well. None of these groups acts in isolation and each affect and influence the behavior and workings of one another. Many of the societal changes inspired by a BI will stem from the collective action of individuals. These will take time to manifest and by examining individuals, these shifts may be observed in real time as they develop. Focus on individual consumers should not be portrayed as an attempt to stigmatize or scapegoat them. It's important to recognize individual consumers are not solely responsible for unsustainable levels of consumption; they are influenced by a complex variety of factors, many of which are beyond the scope of individual control. Their ability to make sustainable lifestyle decisions are affected by an array of variables including transportation and energy infrastructures, societal factors, technology, and urban planning; and consumers share responsibility for this situation with governments, corporations, retailers, and even the advertising industry (Akenji, Bengtsson, Bleischwitz, & Tukker, 2016, p. 6; Greene, 2018, p. 7; Hirvilammi, Laakso, Lettenmeier, & Lähteenoja, 2013, p. 150; Lettenmeier, Liedtke, & Rohn, 2014, p. 502; Seyfang, 2005, p. 297; Wiedmann, Lenzen, Keyßer, & Steinberger, 2020, p. 2).[33] Regardless of external (societal, corporate, etc.) influence, studying individual consumer behavior is useful both to determine basic income's larger environmental impact and to encourage sustainable societal reforms. This should be supplemented by study focused on other levels and sectors of society, but individual behavior will likely be one of the first and best indicators of these changes.

Some may question the wisdom of constructing sophisticated consumer profiles as it might risk increasing consumerism, particularly if this data were made publicly available. Advertising and marketing

[33] Household consumption is also often determined by a similar array of societal and other factors, rather than individual decisions (López, Arce, Morenate, & Zafrilla, 2017, p. 526).

agencies might use this data to target specific sectors of society with tempting ads for consumer goods. A considerable portion of (basic) incomes might be spent because of targeted ads.[34] Many advertising and marketing groups likely already possess highly advanced consumer profiles, however. If these groups could be persuaded to share their profiles (however unlikely this may be), they might be used to advance sustainability measurements based around consumption. Some corporations are already tracking the footprints of their products, in order to market to environmentally conscious consumers (Allbirds, 2020). Though this demonstrates a growing societal concern for sustainability, there lies an inherent contradiction between sustainability and the consumption of material goods. Notably, Allbirds has chosen to track and display their shoes' *carbon* footprint, which is useful but less comprehensive than a different measure, like MF. Though the marketization of products' footprints may help consumers make more informed decisions regarding the impact of their consumption, it perhaps inappropriately suggests consumers bear responsibility for sustainability, rather than producers (Akenji, Bengtsson, Bleischwitz, & Tukker, 2016, p. 6). Additionally, it's highly doubtful whether simply 'greening' current rates and patterns of consumption is a feasible long-term path towards sustainability (Seyfang, 2005, pp. 294-298; Wiedmann, Lenzen, Keyßer, & Steinberger, 2020, pp. 3-4). If maintaining planetary systems is a serious goal, reducing overall rates of consumption will almost certainly be necessary. Any action which risks promoting consumerism, such as the creation of sophisticated consumer profiles, ought to be considered carefully.

By collecting socio-economic microdata from individuals and using it to create consumer profiles, consumption patterns among various sectors of society might be identified. This information might be used to create progressive taxes, targeting particularly ecologically damaging habits from the wealthiest citizens. Taxes might be adjusted as consumption patterns respond to price changes over time, and redistribution could ensure their progressivity. This strategy carries the same risk as all other consumption or resource taxes. Either they are too successful and undermine a BI's funding, or they are not successful enough in curtailing excessive consumption and environmental damage. Multiple sources of funding, likely necessary in any BI program paid at a high level in wealthy nations, could help mitigate this risk (Pinto, 2020, p. 8). Consumption taxes might be a useful initial step towards establishing a BI however, and could be transitioned away from over time as necessary. This situation underscores the need for a

[34] Evidence from Alaska shows retailers making efforts to part citizens from their APFD payments, though the dividend's effect on overall consumption is unclear (Goldsmith, 2012, pp. 51-52).

commitment to ecological principles and continuous assessment of BI programs to ensure their compatibility with the natural world.

Collection of accurate, reliable data for analysis from individuals or households presents another significant challenge for monitoring consumer spending. Surveys represent the best option currently available for data collection to help determine the environmental impact of BI. All of the typical challenges involved in survey sampling would apply if this technique were employed. Larger sample sizes are preferable for producing more representative household and individual consumer profiles (Teubler, Buhl, Lettenmeier, Greiff, & Liedtke, 2018, p. 97), but incentivizing participation may be challenging. Coercing participation conflicts with experimental ethics (Babbie, 2011, pp. 64-65) and the unconditional spirit of BI. Those who are inclined to participate and respond might be individuals more attuned with environmental issues, potentially biasing results (Buhl, Liedtke, Teubler, & Bienge, 2019, p. 81). As mentioned previously, respondent fatigue is a particular hazard for lengthy, in-depth surveys, especially if the data collection process were ongoing. Technology could help overcome this by creating login profiles for websites or apps, which can streamline the process and reduce repetitiveness. A best-case scenario would have individuals who completed baseline surveys continue participation and complete multiple follow-up surveys as monitoring continued. It may be unrealistic to expect the same individuals to complete the same survey every six months or even more sporadically. To counter this, data from surveys within a given time range (within a six-month period or the same calendar year?) could be compared to data collected in surveys of a differing time period. A representative sample for each of the various socio-economic groups might be compiled if an adequate number of responses in a particular time frame were received. This might decrease dependence on particular individuals, but would still require a high-level of participation from society in general. Encouraging this level of participation may always be challenging.

Technology may be relied upon to facilitate data collection, particularly on individual consumer purchases, something surveys can only capture very generally. Automatically collecting and compiling consumer purchases at the point of sale (with consent, of course) may be technologically feasible and useful for analysis, but is also likely to alarm many citizens. Clearly, any data would need to remain anonymous, and even if constructing a secure database to house this information were possible, convincing individuals of its security may not be. Considering the general atmosphere and feelings surrounding data protection, breaches, and privacy in general, many individuals may not consent to participating in this method. Another risk involved in this type of data collection technique is the development or expansion of a surveillance state. Many citizens might view this as an infringement on

privacy and undue oversight on individual lives. Though one may argue privacy in the 21st century is dead (or at least on life-support), some individuals will likely cling to whatever shreds they're able to maintain. One limitation specific to an entirely digital monitoring process would be the difficulty in accounting for cash transactions. This might be addressed in a number of ways, though none could be considered ideal. All cash transactions might be compiled within a consumer database, and an average footprint/impact for cash transactions could be estimated. This would erode the effectiveness of individual analysis, however. Another solution would be to have consumers attach an identifying number[35] to each cash transaction. If collecting data on personal consumption is a goal, it's unclear how the contradiction between anonymity and attaching some type of identifying code or digit to each cash purchase might be resolved. Finally, not all stores track inventory digitally (think of buying produce at a farmers' market), and incorporating these transactions into this type of database may not be practical. Self-reporting estimates through good old-fashioned surveys might offer the best remedy for these situations.

Determining whether to monitor individuals or households, or both, and how, also represents a significant challenge. The composition of households has considerable implications for measuring sustainability. Some individuals live alone, and in this case, there is no distinction between individual and household consumption. Households typically consist of more than one person however, and the communal nature of certain types of consumption (electricity, meals, etc.) blurs the lines between individual and household consumption (Buhl, Liedtke, Teubler, & Bienge, 2019, p. 76; Standing, 2012, p. 141). One household member may enjoy a steak while the rest share a vegan meal while all of them sit in an air-conditioned dining room on a hot summer day. Untangling individual from household responsibility may be a futile pursuit, and underscores the subjective, inexact nature of the entire process.

When considering the monitor of energy use, it's useful to recognize that the method of energy generation has a deep impact on sustainability. Individuals and households often have little control over how the energy powering their homes is generated.[36] Energy intensive lifestyles may be more tolerable if powered by sources other than fossil fuels (Peeters, Dirix, & Sterckx, 2013, p. 71). Reducing overall energy

[35] For example, here in Portugal an individual fiscal number (NIF) is often attached to purchases at the point-of-sale for tax accounting purposes. This is built in to the transaction process and might be used as a model for monitoring.

[36] Prospective homeowners may have the ability to consider the method of electricity generation when deciding between purchasing a particular house in one neighborhood or another. Outfitting one's home with solar panels might be another method to take some personal ownership to ensure clean energy production. Considering the energy source of a particular neighborhood reflects a particular level of privilege, however. Certain styles of housing, high rise apartment buildings for example, may not be able to accommodate solar panels for all units. These options, and others, may not be available to large sections of the population.

demand may be desirable in certain settings, if it allows for households which are typically powered by fossil fuels to be incorporated into grids powered by cleaner energy sources. Like material use and consumption, lower socio-economic classes will likely expand their energy consumption if supplied with a BI. This should be acceptable since these groups will likely be using this energy to more adequately fulfill their own basic needs. Besides promoting equity of material use, emissions, and environmental impact, a just basic income will also encourage convergence and contraction of energy use. Finally, it's worth noting that even if household energy usage increases generally with a BI, it may not imply unsustainability overall. If people are spending more time at home and less time in factories and offices (and commuting to these places), household energy use may increase while overall societal energy use decreases.

The debates surrounding the concepts of basic income, intergenerational justice, and sustainability are largely values based. There is no fact, figure, trend, or data point(s) which will indisputably settle these debates. Nevertheless, sustainability measurements should be integrated into the design and calculus of any basic income program. These measurements are being taken anyway, and their sophistication and accuracy will continue to improve and advance. The results will be used to drive society in more sustainable directions. Basic income will either help or hinder this process, and likely has the ability to do both depending on the setting and each individual program's construction. Basic income bolsters its case as a just policy if it can demonstrate compatibility with sustainability (as an EBI), something BI's supporters should welcome. If it cannot (or does not), BI programs should be adjusted to ensure they promote sustainable societies. If such adjustments prove impossible, it would seem difficult to consider these BI programs just, and they may be rejected. Either way, a better future is created, but discerning this is impossible without sustainability measurements. Basic income may play a role in this future, but it must be earned. Demonstrating its compatibility with environmental sustainability will make it more difficult to argue against. If it cannot, it becomes more difficult to argue for. Either way, knowledge which can be applied to the future will be gained. It seems there is little to lose, particularly if technology can increasingly be used to facilitate data collection and analysis.

7.0 Conclusion

Life on Earth is only possible due to the planet's relatively hospitable, stable climate. Though the climate is in a constant state of flux, human activity has contributed to its shifting and destabilization. Though climate science is advancing steadily, a degree of uncertainty surrounds its measurements and forecasts, largely due to the complexity and interconnected nature of component systems and the climate in totality. This uncertainty, combined with the severity of potential consequences for life on a planet with a rapidly shifting climate (in geologic time scales), highlight the necessity of reducing humanity's environmental impact. Analysis of economic, demographic, developmental, and material use trends all imply a continuing increase of human impact on the planet and its critical systems in the foreseeable future. Since humanity has already pushed several planetary boundaries beyond sustainable limits, contraction of material use and environmental effects from more affluent socio-economic classes will be necessary to enable just expansion of footprints from more vulnerable socio-economic classes as they rise out of poverty. A failure to do so seems certain to further degrade natural systems, threatening well-being in the present and future.

Basic income has been proposed as a solution to a great number of challenges, and likely has enough inherent flexibility to respond to many of them. Due to a lack of case studies and the difficulties involved with testing, BI and its effects remain largely theoretical and uncertain. It's been characterized as a step towards post-productivism and a more sustainable future, and may well be, though this is not guaranteed and will not happen by default. If employed in relatively wealthy settings with heavy material and ecological footprints, shifting consumption patterns risk further damaging climate systems and planetary boundaries. It would be difficult to characterize such programs as just based on their philosophical justifications, and ongoing monitoring, direction, and adjustments will all be necessary to ensure they can deliver sustainable outcomes. From an ecological perspective, any basic income program must be sustainable to be considered just. Though measuring, monitoring, and determining sustainability is a complicated, subjective, lengthy process, it should be undertaken to ensure the continued flourishing and well-being of current and future inhabitants of the planet. Achieving consensus on what might be considered 'sustainable', setting targets, and identifying appropriate methods to reach them will likely be profoundly difficult, but is not impossible. They say the journey is more important than the destination, and perhaps this is true for sustainability as well. Considering the current climate situation and how it's trending, accelerating along the road to sustainability may be more important than knowing exactly where to exit. At least we know which road to take, even if it may not always be smooth and well lit. A failure to

undertake rapid, decisive action to accomplish ecological goals would constitute a breach of justice against future generations and can potentially threaten their well-being, however they choose to define it. Just as communities must define and determine sustainability for themselves, so too must future generations define well-being for themselves. Ensuring they have a clean, healthy space in which to do so may be the most the present can do for the future.

Basic income programs may be divided into two categories, those capable of delivering ecologically favorable outcomes, referred to here as ecological basic incomes, and those that are not. No past or present BI program (or its relatives) has incorporated ecological goals into its design or monitoring. By examining individuals' time expenditure, lifestyle habits, and consumption patterns, and the effect a BI has on them, a program's ecological impact can be estimated. Surveys targeting recipients of a BI represent the best existing method for data collection, though they may be supplemented in various ways as technology advances in the future. Community averages can be compared against themselves over time or against averages from other equivalent communities through saturation studies to gain insight on a BI's prospects as a sustainable policy. If detailed personal data can be gathered from surveys, this information might be used to create socio-economic profiles of community members. Analysis of the changes in consumption and behavior among these profiles may reveal trends and can be used to ascertain the effect BI is having on various socio-economic classes within the community. This knowledge may be used to encourage the spread of sustainable behavioral and lifestyle habits, and to design progressive consumption taxes which might help fund an EBI. Basic income programs monitored and guided using this method, which demonstrate the ability to encourage communities to exhibit more sustainable lifestyles, may be considered ecological basic incomes

It's unclear whether an ecological basic income is a viable policy, particularly in relatively wealthy settings. The method proposed in this project may be used to help determine this, though it cannot provide a definitive evaluation due to the subjective nature of sustainability and its measurements. Complicating this evaluation process is the fact that, while communities actually implementing BI are necessary to gauge its effects, tangible case studies are rare. The establishment of a basic income faces an array of challenges, including political feasibility, establishing long-term funding, philosophical justifications, securing public support, and more. Few communities have been able to overcome all of these challenges and implement a basic income. An EBI faces all of these, plus the additional hurdle of demonstrating compatibility with ecological goals, and thus may be that much more difficult to establish. In addition to the effects and funding, which will exert significant influence, accompanying policies may

also be used to nudge a BI in a more ecological direction. Adjacent policies,[37] combined with the lengthy time period necessary to tease out a BI's long-term societal effects, may hinder attempts at determining the ecological impacts of such a policy. An EBI will not be the sole means of transitioning society on to a more sustainable track, but one of a large number of potential policies, interventions, and actions which share this aim. Sustainability analyses may present dilemmas for governments when considering ecological limits and which policies might best enhance their citizens' well-being. Data from Finland indicates providing access to healthcare has a relatively small footprint (Hirvilammi, Laakso, Lettenmeier, & Lähteenoja, 2013, pp. 143-145) and, if broadly true, many governments may choose to focus on medical care. Considering the high impact costs of transportation and housing, these too might be prioritized over a BI. Investment in more comprehensive public transport (Calder, 2009; MacNeill & Vibert, 2019, p. 10; Mulvale, 2019, p. 45) or subsidizing the installation of insulation in private housing to encourage energy efficiency (Tindale & Hewett, 1999, pp. 241-242) may be seen as providing better ecological or well-being returns. It's unclear where an EBI might rank in the hierarchy of governmental budgets as compared with these or other policies. Ultimately, sustainability measurements can inform citizens and their representatives in government, enabling them to make the best possible decisions for their communities. Doing so will ensure EBI programs earn their place in a more sustainable, just future. These measurements need not be created anew; methods currently exist, are being employed, and will continue to grow in accuracy and sophistication over time. Employing sustainability measurements in the context of basic income, and incorporating ecological standards into programs' designs based on the results, appears logical, appropriate, necessary, and just.

As a largely theoretical concept, ecological basic income provides ample opportunities for future research. Investigation into its potential behavioral or societal effects, sources of funding, or relationship with potential adjacent policies all may aid in the development of this concept. Any such research will be necessarily theoretical until communities actually implement a BI. Only then can the policy be more adequately assessed and the prospects of an EBI determined. The apparent necessity of limiting freedom in the present to preserve opportunities and well-being in the future also might provide a rich avenue for future research. Examining the implications of these potential limits, and identifying situations where they may or may not be considered acceptable also could carry significant consequences for sustainability, justice, and the future in general.

[37] For more information on potential policy accompaniments, see (Calder, 2009, pp. 5-8; Howard, Pinto, & Schachtschneider, 2019, pp. 123-126; MacNeill & Vibert, 2019, pp. 9-11; Mulvale, 2019, p. 45).

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