Current and Best Practices for Scope3 Emissions Reductions in Higher Education Institutions – Procurement

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Abstract

Given the pressing need to reduce greenhouse gas (GHG) emissions and the limited information available concerning higher education institutions' (HEIs) approach to Scope 3 procurement emissions, this study investigates how HEIs measure and mitigate these emissions while identifying best practices. A review of literature, institutional websites and responses to a self-reporting sustainability performance framework was conducted along with a case study on York University. Results indicate a need to enhance HEIs' awareness of procurement emissions, with only half of the HEIs examined calculating total procurement emissions. While Environmentally Extended Input-Output Analysis (EEIOA) emerges as the primary and recommended method for emissions estimation due to its resource efficiency, it lacks sensitivity to reduction strategies. Notably, HEIs predominately rely on product certifications under sustainable procurement schemes as reduction strategies, overlooking the reduction of consumption. These findings suggest that HEIs' current approach to address procurement emissions often falls within the broader context of sustainability, rather than recognizing them as hotspots of emissions requiring attention for climate change mitigation. A re-evaluation of their approach is needed, given the urgency of the climate crisis. Future studies should address challenges related to data collection, standardization of emissions accounting and awareness of emissions embodied in products and services. Collaborations within HEIs and partnerships with other HEIs and suppliers present promising opportunities to reduce procurement emissions.

Foreword

My area of concentration in the MES program centers on mobilizing environmentally sustainable practices in the private sector. This focus is rooted in the inherent tension between the private sector's pursuit of perpetual growth and the planetary boundaries. My goal is to explore strategies that not only keep private sector activities within these planetary boundaries but also leverage the private sector as a means to drive organizational change toward environmental sustainability.

During the MES program, I broadened my focus to include HEIs as I partook in an internship at York University's Office of Sustainability, researching GHG emissions reduction strategies. Building upon my area of concentration, this research extends from my internship experience, where I concentrated on identifying best practices to address Scope 3 procurement—a challenge linked to planetary boundaries (GHG emissions)—in HEIs. This research has allowed me to delve into the practical dimension of my area of concentration. It has deepened my understanding of environmental sustainability practices within businesses and their implementation.

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List of Abbreviations and Acronyms

AI	Artificial Intelligence
CEDA	Comprehensive Environmental Data Archive
CPG U.S.	Environmental Protection Agency Comprehensive Procurement Guidelines
EPEAT	Electronic Product Environmental Assessment Tool
ESF	State University of New York College of Environmental Science and Forestry
GDP	Gross Domestic Products
GHG	Greenhouse Gases
IT	Informational Technology
LCA	Life Cycle Assessment
LEED	Leadership in Energy and Environmental Design
MC3	Compound Method based on Financial Accounts
MRIO	Multi-Regional Input-Output
PA	Pocess-Based Life Cycle Assessment
SIMAP	Sustainability Indicator Management and Analysis Platform
SPP	Sustainable Public Procurement
TRU	Thompson River University
UC	University of California
UM	University of Michigan
UNEP	United Nations Environment Programme
USEEIO	United States Environmentally-Extended Input-Output Model
VOC	Volatile Organic Compounds

1 Introduction

Scope 3 GHG emissions, which encompass 15 upstream and downstream indirect emission sources in an organization's value chain excluding those related to energy use and purchase, have long been overlooked by organizations in both their accounting and reduction strategies (Kaplan & Ramanna, 2022; Knight & Jackson, 2011; Shrimali, 2022; Walenta, 2021). As they are considered as optional to reporting by the GHG Protocol, the recognized standard for GHG emission accounting in organizations, Scope 3 emissions have been the least measured and reported by both corporations and Canadian higher education institutions among the three scopes of GHG emissions (Schulman et al., 2021; Urban et al., 2022; Walenta, 2021). This is despite several studies demonstrating the significance of Scope 3 emissions, accounting for roughly 70% of total organizational emissions on average (CDP, 2022; Huang et al., 2009). Key challenges in measuring and mitigating Scope 3 emissions include the reporting organization's limited direct control over entities producing such emissions and the intricate nature of supply chains, characterized by numerous suppliers and cascading tiers. Some scholars argue that the origin of the GHG Protocol and scoping (the categorization of GHG emissions and what emissions are mandated for reporting) also contribute to the neglect on Scope 3 emissions (Collard et al., 2016; Walenta, 2021). However, perhaps it is the frequent news headlines on extreme weather events in almost every part of the world, the urgency of decarbonizing supply chains has heightened. More organizations now recognize the significance of Scope 3 emissions and have begun managing their Scope 3 emissions, including those embodied in purchased goods and services, one of the top five categories of Scope 3 emissions in most of the high-impact sectors (Accenture, 2022; CDP, 2022, 2023a; Farsan et al., 2018). The number of companies that reported Scope 3 emissions publicly through the CDP (the former Carbon Disclosure Project) has grown more than double from 2010 to 2021 (Hadziosmanovic et al., 2022). Regulating bodies around the globe, such as the United Kingdom, European Union and the International Sustainability Standards Board (ISSB) plan to phase in mandatory Scope 3 disclosures (Hanawalt, 2023). Large corporations like Walmart and AstraZeneca are committed to reducing their supply chain emissions and some are requesting their suppliers to adhere to science-based emissions targets (SBTs; Smith & López, 2023; Walmart, 2023). Other approaches to reduce procurement emissions include sustainable procurement (i.e., making purchasing decision based on environmental, social and economic considerations) or more specifically, green procurement and low carbon procurement which aim to purchase goods and services with less environmental impacts or lower emissions, respectively. Sustainable procurement is described as "us[ing] capitalism's fundamental principle against itself" by Da Ponte et al. (2020)

While corporations have shown increased efforts to decarbonize supply chains, the same level of emphasis has not been observed in another subgroup of organizations, HEIs, particularly regarding the reduction of procurement-related emissions. In addition to the challenges mentioned, barriers to data accessibility, resources, methodologies, and leadership support have hindered progress in this area for HEIs (Leal Filho et al., 2021; Robinson et al., 2018; Urban et al., 2022). There is also a scarcity of information concerning how HEIs currently address GHG emissions embedded within their procurement processes. Therefore, this research paper aims to investigate the existing approaches employed by HEIs towards procurement emissions and to identify best practices to address these emissions. The review encompasses journal articles, responses to a self-reporting sustainability framework and institutional websites, centering on the accounting and reduction of Scope 3 procurement emissions. A case study of York University was conducted, involving interviews with university staff members.

This paper begins by introducing the origin, significance and implications of Scope 3 emissions and procurement emissions in organizations including HEIs. Next, it outlines HEI's current practices on the accounting of procurement emissions, with a specific focus on calculation practices and methods. This is followed by the identification of best practices that stem from barriers encountered by HEIs in the accounting process and the evaluation of current practices. The discussion of emissions reduction strategies follows the same order described above, but the emphasis is on sustainable procurement. The case study of York University is presented last. It explores current approaches York University employs toward procurement emissions and assesses them based on the best practices identified. The paper concludes by providing potential pathways to address significant challenges York University is experiencing on Scope 3 procurement emissions.

2 Specific Research Questions

My specific research question is two-folded:

1. What are the current practices undertaken by HEIs to account for and reduce Scope 3 emissions associated with procurement?

2. From these current practices and barriers, what are the best practices to account for and reduce Scope 3 emissions associated with procurement?

3 Methods

3.1 Introduction

To investigate current and best practices for reporting and reducing Scope 3 procurement emissions in HEIs, I employed a qualitative approach. This involved conducting literature reviews on the background of Scope 3 procurement emissions in organizations and HEIs, examining HEIs' current practices in managing procurement emissions, and conducting a case study at York University to apply the review's findings. My focus was on the accounting and reduction strategies of general procurement and I provided information on food procurement as an example of procurement in the accounting of emissions.

3.2 Literature Review: Background Information

The objective of this literature review was to gain a comprehensive understanding of the origin, significance, and implications of Scope 3 emissions, with a specific focus on the accounting of Scope 3 emissions and emissions embodied in purchased goods and services in organizations. Additionally, I sought to identify similarities and differences between HEIs and corporations, examining whether HEIs have been adopting practices similar to corporations. The literature search was conducted using Google Scholar, with no specific time range specified for the papers to ensure insights into the historical origins of Scope 3 emissions accounting.

3.3 Literature Review: Accounting of Scope 3 Procurement Emissions

3.3.1 Current Practices

My goal for this literature review was to assess practices regarding the accounting of Scope 3 procurement emissions in HEIs. I conducted searches on Google Scholar for journal articles published between 2011 to 2023, using keywords such as “scope 3 emissions procurement”, “purchasing”, “purchased goods and services”, “higher education institutions” and “food services”. Given that Scope 3 emission are a subset of GHG emissions, I also incorporated search phrases related to “carbon footprint in HEIs”. In addition to Google Scholar, I used websites such as Connected Paper and Research Rabbit to identify relevant clusters and papers.

After generating searches, I screened the papers to ensure their relevance to GHG emissions accounting in HEIs. I categorized the remaining 25 papers based on the extent of procurement emissions considered in the GHG accounting process: (1) no procurement, (2) partial procurement (included less than three types of procurement emissions) and (3) full procurement (included 3 or more types of procurement emissions). Within each category, I analyzed the publication year and identified the primary types of procurement emissions incorporated. For the first two categories, I delved into the reasons for excluding either all or full procurement emissions. In the case of the full procurement category, my focus shifted to the methodologies employed in measuring Scope 3 procurement emissions. I examined various attributes, including accounting guidelines, method types, data collection procedures, measurement scope, and the strengths and weaknesses associated with each accounting method.

Regarding the accounting of emissions on food procurement, I reviewed articles that had been previously screened and flagged for their relevance to food procurement. I focused on a total of five papers where two were not examined in the previous part with their aim on food procurement. My analysis included aspects such as the scope of accounting, data collection and the types of calculation methods utilized.

3.3.2 Best Practices

One approach to identify best practices in accounting for Scope 3 procurement emissions involves comparing different approaches to determine which leads to the greatest emission reduction, while controlling for reduction strategies and how the reduction could be linked back to the accounting approach. However, given the limited progress made by HEIs in reducing procurement emissions, I adopted alternative approaches to discern best practices concerning calculation practices and methods. For calculation practices, I conducted a thorough analysis of variations among HEIs and considered the common challenges they encounter during the accounting process. This assessment aimed to determine the most suitable practice for individual reporting and collective assessments, as emissions are often compared among HEIs. The goal was to pinpoint the practice that could yield the most significant emission reductions. Regarding calculation methods, I evaluated the strengths and weaknesses of the two primary approaches HEIs use to account for procurement emissions along with the consideration of common challenges experienced by HEIs in the process. This analysis aimed to establish which method is more appropriate for HEIs under specific circumstances. I also proposed ideas that HEIs and external stakeholders could explore to enhance emissions accounting in HEIs.

To gain insight into the challenges HEIs face during the accounting process, I consulted the work of Robinson et al. (2018) and the Canadian Association of University Business Officers

(CAUBO; Urban et al., 2022). The former conducted focus group discussions and administered questionnaires with 35 practitioners during the 19th annual Environmental Association of Universities and Colleges conference in 2015. I assumed that participants were based in the UK as they could only select a UK region for their institutions on the questionnaire. The focus of the session was to understand the experience of HEI practitioners on emission accounting and the issues they have encountered. There were also specific questions regarding Scope 3 emissions. The latter conducted a survey with its members on GHG emission accounting practices and reporting (Urban et al., 2022). 56 institutions responded in total where the majority were universities (82%) and it was assumed all respondents were based in Canada.

3.4 Literature Review: Reduction Strategies of Scope 3 Procurement Emissions

The second literature review focused on investigating HEIs’ strategies for reducing emissions embedded in procurement. As previous research determined that HEIs rely on sustainable procurement (SP) to address procurement emissions, I conducted a literature search using keywords such as "sustainable procurement", "green public procurement". I also used keywords relating to the direct reduction of procurement emissions such as "low-carbon procurement" to verify previous findings. This search aimed to uncover the drivers, barriers, and effectiveness of reducing procurement emissions in HEIs along with sustainable procurement (SP) practices. Although sustainable procurement encompasses all three pillars of sustainability, my focus here is primarily on the environmental aspect. I conducted these literature searches on the same search engines as in the previous section of the literature review.

3.4.1 Current Practices

For an in-depth understanding of current practices for the reduction of procurement emissions, I turned to the Sustainability Tracking, Assessment & Rating System (STARS) administered by AASHE. This framework allows HEIs to self-assess their sustainability performance in various aspects, including SP. AASHE reviews the submissions for accuracy and provides ratings. I selected four universities for analysis: State University of New York College of Environmental Science and Forestry, Yale University, University of Michigan, and Thompson River University. These universities were chosen for their high overall ratings, recommendations from sustainability professionals regarding SP policies, their locations, and that they were included in the previous literature review's accounting section. I analyzed their responses in relation to SP and other policies aimed at reducing procurement emissions, supplementing this with information from their respective websites.

3.4.2 Best Practices

To identify best practices for reducing procurement emissions in HEIs, I followed the methodology similar to the accounting practices where I identified best practices theoretically, as empirical data such as the adoption rate of SP in HEIs, was not available. I critically analyzed the differences among practices reviewed and considered the barriers associated with SP and relevant policies. This process aimed to determine which practices are most suitable for HEIs under various circumstances, with the goal of identifying those that could lead to the greatest emissions reduction.

3.5 Case Study: York University

The main purpose of the case study was to provide recommendations for reducing procurement emissions at York University’s procurement emissions based on the findings from the previous sections. I conducted interviews with three staff members from York University, who are members of the sustainability office, procurement office or were responsible for the accounting of York’s Scope 3 emissions. The aim of the interviews was to learn about York’s procurement policies and current effort in the accounting and reduction of procurement-related emissions. The interviews were conducted in accordance with the York University's Faculty of Environmental and Urban Change's research protocol for studies involving human participants. Interviewees were recruited through professional contacts and all interviews were conducted virtually. Interview questions included specific questions relevant to interviewees’ expertise as well as common questions related to interviewees’ opinion on SP. Examples of interview questions included “What challenges does York University face in reducing procurement emissions?" and "What are your views on the use of SP/low-carbon policies to reduce emissions associated with procurement?". I also referred to York’s website for supplemental information.

After the interviews, I assessed York’s current policies by comparing them with the approaches taken by other HEIs in accounting for and reducing procurement emissions, as well as the best practices identified. I identified barriers in York University's case and provided recommendations to address these challenges.

4 Background Information

4.1 Scope 3 Emissions in Organizations– The Significance, Origin, Implications and Current Issues

4.1.1 The Three Scopes of Emissions

The GHG Protocol is an internationally recognized standard for GHG emission accounting in organizations (Walenta, 2021). Developed by the World Resources Institute (WRI, a global non-profit research organization) and World Business Council for Sustainable Development (WBCSD, a coalition of 170 international corporations) along with other stakeholders, including corporations, it categorizes GHG emissions into three scopes (Figure 1Figure 1. Scope 1, 2 and 3 GHG emissions according to the GHG Protocol (WRI et al., 2011). Scope 1 emissions are those directly produced by an organization, originating from sources it owns or controls (WRI & WBCSD, 2004). Scope 2 and 3 emissions are both indirect emissions. Scope 2 emissions are those associated with purchasing electricity, steam, heat or cooling. Scope 3 emissions encompass all other indirect emissions, stemming from both upstream and downstream activities of an organization. They are further divided into 15 categories, such as category 1: purchased goods and services although not all categories apply to all organizations (WRI et al., 2011). Another way to conceptualize Scope 3 emissions is that they present the Scope 1 and 2 emissions of other organizations that interact with the current organization reporting its emissions (WRI et al., 2011). The GHG Protocol only requires Scope 1 and 2 to be disclosed for protocol compliant, reporting Scope 3 is optional.

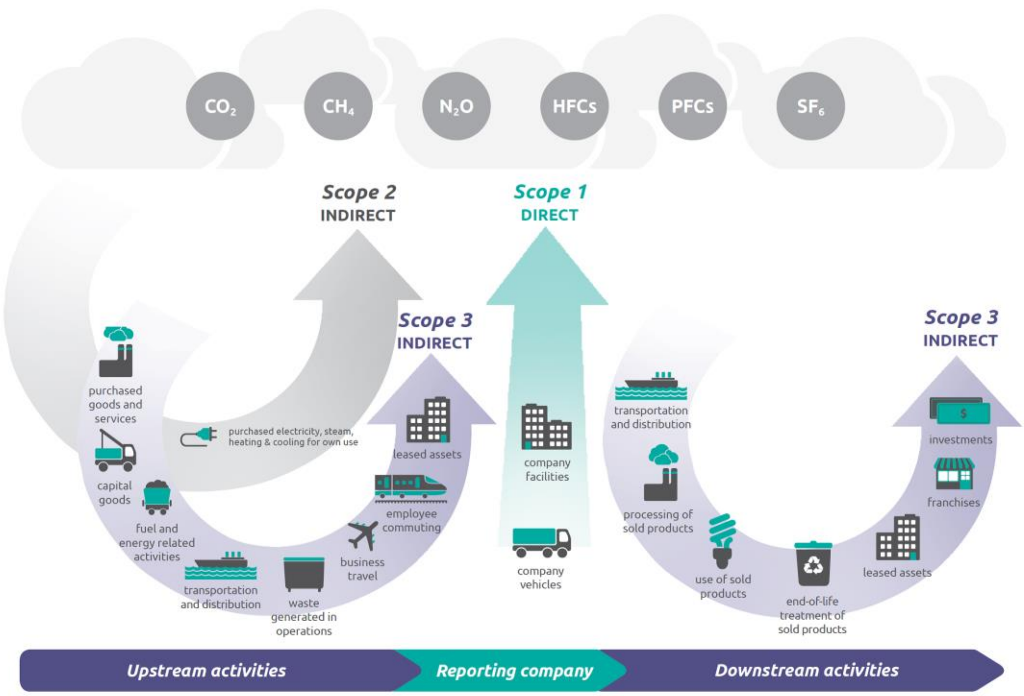

Figure 1. Scope 1, 2 and 3 GHG emissions according to the GHG Protocol (WRI et al., 2011)

4.1.2 Significance of Scope 3 Emissions

While compliance with the GHG Protocol does not mandate the disclosure of Scope 3 emissions, these emissions typically constitute the largest share of an organization's total emissions (CDP, 2022, 2023a; Huang et al., 2009). A CDP's analysis based on a literature review and companies' emissions responses revealed that on average 75% of total GHG emissions fall under Scope 3 emissions accounts regardless of the sectors (CDP, 2022). This is consistent with an earlier study performed by Huang et al. (2009) which estimated that Scope 3 emissions take up around 70% to 80% of total emissions in most businesses. A more recent analysis performed by CDP based on its questionnaire responses even suggested that upstream

Scope 3 emissions (supply chain emissions) are on average 11.4 times (92%) greater than operational emissions, potentially reflecting improved emissions accounting by suppliers (CDP, 2023a). Among the 15 categories of Scope 3 emissions, “ purchased goods and services” (Category 1) ranks among the top five categories by total Scope 3 emissions in 12 out of 15 high-impact sectors classified by the CDP (CDP, 2022). This category also significantly contributes to global GHG emissions, with approximately 40% stemming from purchases made by companies and the use of products sold to consumers.

4.1.3 The Origin of GHG Emissions Accounting

GHG emissions accounting began at the national level in 1995, driven by countries with binding targets under the Kyoto Protocol (Green, 2010). These nations were required by the Framework Convention on Climate Change to report their annual GHG emissions in certain sectors, following guidelines from the Intergovernmental Panel on Climate Change (IPCC). During this period, government-led efforts in emissions measurement predominately focused on national and project levels (Green, 2010).

Corporate GHG emissions accounting, on the other hand, began slightly later around 1997 (Green, 2010; Walenta, 2021). However, interest in this area surged in the private sector during the early to mid-1990s when firms started voluntary reporting on some environmental metrics (Berry & Rondinelli, 1998; Green, 2010; Walenta, 2021). Factors contributing to this interest included the Kyoto Protocol, the emergence of the “triple bottom line” concept, increased stakeholder demand for social and environmental disclosures by stakeholders.

Perhaps surprising to some, BP, one of the world's biggest oil and gas companies today was among the first actors in GHG measurement in the private sector (Buchholz, 2021; Green, 2010). BP began developing a carbon reporting protocol in 1997 to support an internal emission trading system. Subsequently, BP, along with Monsanto, General Motors and the WRI embarked on the "Safe Climate, Sound Business" project in 1998. This initiative aimed to create a global GHG emissions accounting tool with a goal to protect "the Earth's climate while expanding global economic prosperity" and advocated for other corporations to join (Cook & British Petroleum, 1998:p.2). This project informed Janet Ranganathan and her WRI colleagues who were already working on corporate environmental reporting to develop a standardized emissions reporting framework for corporations around 1999 (Walenta, 2021). They partnered with the WBCSD who was working on similar causes as the developers of the framework. A range of stakeholders were also involved as Ranganathan wanted the development process to be highly collaborative and the WBCSD strived for high legitimacy to warrant a high adoption rate by companies (Walenta, 2021). The final committee consisted of the WRI, WBCSD and four other groups of stakeholders, including (1) targeted users of the framework (private companies) like BP and Shell, (2) financial accounting professionals like PricewaterhouseCoopers (PwC) who can advise on combining emissions accounting with financial accounting structures, (3) government representatives like United States Environmental Protection Agency (US EPA) officials with prior experience on the acid rain trading program and (4) environmental NGOs like World Wildlife Fund (WWF) and the Pew Center on Climate Change. This committee gathered in 1998, with the WRI and WBCSD as the backbone (forming the Greenhouse Gas Protocol Initiative) and together created what is now the GHG Protocol Corporate Accounting and

Reporting Standard (hereafter Protocol; Green, 2010; Walenta, 2021). Noticeably, almost all committee members were from the Global North and climate scientists only had an indirect influence on the Protocol through the IPCC GHG Inventory Guidelines which some sections of the Protocol were based on (Walenta, 2021)

The first edition of the Protocol was published in 2001 with subsequent updates in 2011 and 2015 (GHG Protocol, n.d.). It accounts for six GHGs addressed by the Kyoto Protocol: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6). An additional GHG, nitrogen trifluoride (NF_3) was added in the 2013 amendment (WRI & WBCSD, 2012). In 2016, 92% of Fortune 500 companies used the Protocol to disclose emissions data (Walenta, 2021).

One of the most fundamental challenges during the development of the Protocol was determining the scope of emission responsibility within organizations, i.e., what emissions a corporation should be accountable for and what should be excluded (Walenta, 2021). This issue was described as the most significant challenge in BP's internal project, prompting the need for collaboration to ensure all emissions are considered and not double counted. In BP's internal project, BP classified emissions sources as direct (owned by the company) or indirect (resulting from the generation of electricity from the local electric grid. Emissions produced by end-users (i.e. from burning fossil fuels) were considered irrelevant despite contributing significantly to global GHG emissions in BP's case. Conversely, government-regulated environmental reporting such as the U.S. Toxic Release Inventory, required firms to report pollutant emissions within factory gates, mainly for ease of information access (Ranganathan 1998, p. 4). In the Protocol committee, private actors advocated for a similar approach as BP where companies would only report GHG emissions emitted from sources under their direct legal ownership (Scope 1 emissions today; Walenta, 2021). Progressive voices argued for a broader approach, encompassing both direct and indirect sources that are significant in magnitude. These indirect sources may include emissions produced by end-users, as in the case of BP and emissions embodied in goods and services, depending on the nature of the reporting organization. Through the use of what WRI staff members described as collaboration techniques that prevented any single viewpoint from dominating, the committee ultimately categorized emissions into three scopes as described, requiring the reporting of the first two scopes. Hence, organizations only have to report emissions produced by entities under their direct control (Scope 1) and from the use of purchased energy (Scope 2), excluding all other emissions produced by entities not under their control (Scope 3).

The GHG Protocol committee established a conceptual standard for categorizing GHG emissions for measurement. It has decided that emissions should be classified under the three scopes system and what each scope entails. Furthermore, it also established a standard of what sources of emissions are considered (key) responsibilities of corporations and what is not by setting Scope 1 and 2 as required for compliance and Scope 3 as optional. Walenta (2021, p.542, 544) describes this decision as “to benefit Protocol users, namely the private sector, by minimizing their responsibility to act on climate change,” resulting in “long-lasting implications for private sector climate action”. These implications include corporations prioritizing the reporting and reduction of Scope 1 and 2 while neglecting Scope 3 emissions. This leads to a more significant increase in Scope 3 emissions than the reduction of Scope 1 and 2 in 22 major

US corporations over a four-year period and a skewed investment ratio (1 .2 to 0.148 investment ratio in dollar terms) on the reduction of Scope 1 and 2 combined compared to Scope 3 (Walenta, 2018, 2021). Responsibility for managing Scope 3 emissions of large corporations is also pushed to less powerful actors in the value chain, often without any financial assistance (Ormond, 2015; Walenta, 2021). The shifting of responsibility through scoping is significant given the rise of corporations in the sharing economy (e.g. Airbnb and Uber) and the globalized economy with extensive outsourcing to non-owned facilities (Walenta, 2021).

The scoping decision made by the Protocol committee can also be viewed as the neoliberal environmental governance perspective, which prioritizes market actors' interests and aims to prevent environmental regulation from obstructing economic development (Collard et al., 2016). Within the boundary of emissions responsibility drawn by the committee, taking responsibility for emissions equates largely to cost-cutting through improving operations and energy efficiency for corporations (Walenta, 2021). Hence, climate actions are justified as they can be a win-win for both the environment and financial performance. Such a conceptualization on its own does not necessarily translate to a problem. Yet, it presents a significant concern in this case because it is under a narrow framing of climate actions that neglects a substantial portion of emissions (Scope 3) and ultimately undermines meaningful climate actions (Walenta, 2021). Neoliberal environmental governance also explains the enthusiasm behind private actors in the development of the Protocol as Green (2010) suggests that taking a proactive approach would allow firms to set the rules and avoid regulations forced by the government. Walenta (2021) this sentiment in the case of the WBCSD, formed by private actors to promote a 'self-regulatory approach' to addressing environmental impacts.

4.1.4 Challenges in Measuring Scope 3 Emissions

In addition to the issues surrounding the origin of Scope 3 emissions, their measurement has been the most problematic and lacking out of the three scopes (Kaplan & Ramanna, 2022; Knight & Jackson, 2011; Shrimali, 2022; Walenta, 2021). This is despite the GHG Protocol Initiative releasing an accounting and reporting standard on Scope 3 emissions in 2011 and the CDP creating a supply-chain corporate reporting platform and awarding companies for Scope 3 disclosure.

Primary barriers include incomplete data, uncertainties in data quality, inconsistent boundaries and methodologies, all compounded by resource constraints (Kaplan & Ramanna, 2022; Knight & Jackson, 2011; Shrimali, 2022). Most of these barriers arise from the two primary challenges inherent in Scope 3 emissions, as discussed earlier. Firstly, Scope 3 emissions originate from entities beyond the direct control of the reporting organization. This challenge is intensified by complex supply chains, involving a multitude of suppliers across various tiers. To illustrate, the US technology giant Apple relies on approximately 200 top-tier suppliers, constituting 98% of its procurement in 2022. These obstacles not only complicate the accounting of Scope 3 emissions, but also their effective mitigation.

The fundamental characteristics of Scope 3 emissions described above already make them challenging to address independently. This difficulty is further amplified by the scoping decision that absolves the reporting organization of responsibility for managing Scope 3 emissions. As a result, dominant sustainability reporting frameworks like the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB) standards do not require companies to report their entire or material Scope 3 emissions for compliance (SASB do not even require Scope 2 disclosure; Klaaßen & Stoll, 2021; Shrimali, 2022). Although valid, these frameworks often cite data uncertainties as the reason Scope 3 emissions remain optional in the reporting.

Consequently, Scope 3 emissions in corporations have been overlooked, underreported or increased, as documented (Schulman et al., 2021; Walenta, 2021). This neglect, along with the omittance of Scope 3 emissions in corporations' net-zero commitments, results in a substantial gap in emissions reduction, as Scope 3 emissions are estimated to be five times the combined Scope 1 and 2 emissions (BSR, 2020; Shrimali, 2022). However, there has been a recent surge in attention toward Scope 3 emission, with several regulating authorities, including the US Securities and Exchange Commission (SEC) and ISSB, (which is evolving the SASB standard) expected to require Scope 3 emissions disclosure (IFRS, 2022).

4.2 Higher Education Institutions and Corporations

HEIs have traditionally been seen as distinct from corporations, primarily serving educational purposes. These institutions vary in financial structure, including public (government-funded), private non-profit, and private for-profit (CMEC, n.d.). Private non-profit institutions reinvest their revenue into the institutions themselves. Public HEIs, like most Canadian universities, operate on a non-profit basis, while private institutions, such as Ivy League universities, also receive government funding through research and aid grants (Harvard

University, n.d.; Robson, 2019). Despite private HEIs outnumbering public ones, the majority of students worldwide attend public HEIs (70%; Williams & Usher, 2022).

Supporters of the distinction between HEIs and corporations argue that these two entities have different origins, goals, ownership, and organizational structures (Engwall, 2008). Engwall (2008) specifically posits that universities aim for reputation as their ultimate goal, while corporations prioritize profit.

In contrast, scholars contend that HEIs have adopted more corporate characteristics since the rise of neoliberal policies in the UK and US in the 1970s (Saunders, 2010; Tight, 2019). These policies reduced government funding for HEIs, prompting them to seek alternative revenue sources, prioritize efficiency, and introduce competitive practices (Giroux et al., 2015). This shift, known as the corporatization of universities, led HEIs to adopt policies associated with neoliberalism and capitalism transforming into "new business models" that mirror corporations who chase after growth (Kleinman et al., 2013; Lyall & Sell, 2006; Saunders, 2010). Bessant et al. (2015) assert that HEIs now strive to achieve specific research performance levels and attract a high volume of high-quality students (within defined parameters) to maximize their income. This shift is even evident in how universities seek private investment, increase tuition fees domestically and abroad, establish overseas campuses, and attract international students who pay higher tuition fees than local students (Smeltzer & Hearn, 2015). The shifts in university paradigm are also evident in their “strategic plans and policy priorities towards increased income generation, innovation, commercial enterprise and business engagement” (Bessant et al., 2015:420). Therefore, there is support in the literature indicating that HEIs increasingly resemble corporations in their behaviour. Additionally, another resemblance between the HEIs and corporations is that both are under increasing stakeholder pressures to address climate change and incorporate sustainable practices (Lozano et al., 2015; Shrimali, 2022).

4.3 Scope 3 Emissions: Higher Education Institutions

HEIs have been involved in addressing climate change in combination with promoting sustainable development (Moon et al., 2018). Universities are engaging in a “dual strategy” where they are committing to net-zero goals and embedding climate change and sustainable development in their curriculum under international pressure (Leal Filho et al., 2021). The Association for the Advancement of Sustainability in Higher Education (AASHE) was established in 2005 to support the sustainability efforts of North American HEIs. However, the reporting of Scope 3 emissions remains a challenge. A 2021 survey reveals that only 42% of Canadian universities measuring emissions include Scope 3, while almost 90% report Scope 1 and 2 emissions (Urban et al., 2022). Challenges in measuring Scope 3 emissions persist across HEIs, with emissions associated with purchased goods and services, transportation, and waste among the most reported categories. The proportion of Scope 3 to total GHG emissions varies across HEIs. For instance, the Scope 3 emissions in Yale University and De Montfort University are the largest in the total emissions where the latter accounts for 75% of total GHG emissions (De Montfort University, n.d.; Yale University, 2021). Procurement emissions account for the largest portion in Yale University, about 48% (Yale University, 2021). Nonetheless, University of California (UC) Berkeley's Scope 3 emissions is much smaller, roughly less than half of its Scope 1 emissions (UC Berkeley, n.d.).

4.4 Scope 3 Emissions: Procurement

The Cambridge Business Dictionary (2023) defines procurement as "the process by which an organization buys the products or services it needs from other organizations". It is an indispensable component in both the private and public sectors and hence, a significant source of global GHG emissions as discussed. Nonetheless, the importance of procurement in an organization goes beyond the buying. It is to purchase in a way that supports the objectives and needs of an organization effectively, while being compliant with requirements (Bull et al., 2011). While HEIs behave more like entities in the private sector as discussed, public HEIs follow the regulatory framework of public procurement, emphasizing transparency (Bull et al., 2011).

Procurement forms the basis of the first two categories of Scope 3 emissions, category (1) purchased goods and services, and category (2) capital goods. These two categories fall under Scope 3 emissions because purchased goods and services originate from companies upstream of the reporting company, hence contributing to emissions. Category 1 includes emissions associated with "all upstream (i.e., cradle-to-gate) emissions from the production of products purchased or acquired by the reporting company in the reporting year. Products include both goods (tangible products) and services (intangible products)." (GHG Protocol & Carbon Trust, 2013). In simpler terms, it includes all emissions generated throughout the lifecycle of procured products until they are sent off for delivery to the reporting company. This category excludes more specific upstream emissions categories, which are reported separately in categories 2 to 8. Examples of category 1 emissions include the extraction of raw materials, the manufacturing, production and processing of products, the energy consumed, and waste disposed by upstream activities and transportation of materials between suppliers. On the other hand, Category 2 specifically includes the upstream emissions of capital goods only. This distinction is based on the types of goods that follow financial accounting procedures. Capital goods are finished products that are used by the reporting company for their operations (e.g., manufacturing, providing service and delivering merchandise). They could be referred to as assets and properties of the reporting companies on financial reports but not all capital goods appear on the reports. Equipment, machinery, buildings and vehicles are examples of capital goods. The GHG Protocol gives flexibility to the reporting company to distinguish between the two according to their financial accounting procedures.

The reduction of GHG emissions associated with procurements typically falls under sustainable procurement (SP) or green or low-carbon procurement (Cheng et al., 2018; Correia et al., 2013). In the 1990s, research in this area initially focused on the private sector. The primary aim was to address environmental issues associated with the supply chain with only a handful of studies targeting social issues (Brammer & Walker, 2011). The discourse focusing specifically on public procurement (as green public procurement (GPP) or sustainable public procurement) began around the early 2000s when the concept of low-carbon procurement appeared around 2010 (Cheng et al., 2018). The emergence of sustainable public procurement can be attributed to the enormous government spending that goes on public procurement, about 15% to 20% of national revenue globally (Adjei-Bamfo et al., 2019). Utilizing such significant buying power as leverage, sustainable public procurement aims to contribute to overall sustainability by making purchasing choices with sustainable, environmental and/or low-carbon considerations. Da Ponte et al. (2020) described it as “us[ing] capitalism’s fundamental principle against itself”. At the HEI level, the Higher Education Funding Council for England states that “A university’s procurement policy is one of its strongest ways of supporting sustainability. English higher education spends over £8 billion a year on non-pay costs, and how that money is spent can have a great social and environmental impact” in its Sustainable Development Strategy (HEFCE, 2009). Lundberg et al. (2016) suggest two underlying mechanisms for GPP: (1) substitution where public actors purchase green instead of brown products through buying from green suppliers and (2) transformation where public actors want to incentivize brown producers to turn into green producers.

5 Results and Discussion

5.1 Current Practices in Accounting HEIs' Scope 3 Procurement Emissions

5.1.1 Full Procurement, Partial Procurement and No Procurement

Roughly half of papers I examined measure the full extent of procurement emissions (12 out of 25, 48%; included three or more categories of purchased goods and services). In contrast, 8 out of 25 papers (32%) measure partial procurement emissions (included less than three categories of purchased goods and services) and 5 out of 25 papers (20%) completely exclude procurement emissions. This distribution suggests that a slight majority of HEIs have not yet realized the full significance of procurement emissions and use a narrow scope to address procurement emissions. But with close to 50% of papers estimating the full procurement emissions, it indicates HEIs are also recognizing the importance of addressing emissions embodied in purchased products and services. It suggests a positive outlook in capturing the full procurement in the accounting of procurement emissions in HEIs. However, it's worth noting that a potential concern is the recent trend among papers that exclude procurement emissions, with all of them published from 2017 to 2022 while all other papers were published from 2011-2023.

Notably, not all authors provided explanations for measuring only partial procurement emissions or none at all. For instance, Letete et al. (2011) who accounted for partial procurement emissions, argued that emissions from procuring products and services (excluding water, paper, and food) are insignificant in the overall emissions. However, the emissions composition of HEIs can vary, and in some cases, emissions from other types of procurement, such as raw materials and chemicals, manufactured products, machinery and computers, and utilities and construction, can surpass those from water, paper, and food procurement, as observed in the University of Oulu and the University of Leeds (Kiehle et al., 2023; Townsend & Barrett, 2015). Ridhosari & Rahman (2020) who excluded the full procurement emissions also suggested that procurement's significance is minimal compared to sources like electricity. While this might hold true for HEIs primarily relying on non-renewable electricity sources, it's less applicable to institutions like the University of Oulu, which purchase renewable electricity and have a higher proportion of procurement emissions compared to electricity (Kiehle et al., 2023). Additionally, Yanez et al. (2019) and Samara et al. (2022) highlighted challenges related to data collection and emissions factor availability as barriers to considering full procurement emissions. Detailed information about data-related challenges is provided in subsequent sections.

Among those that measures partial procurement emissions, the most common types of products and services included are paper, electronics and constructions, with the latter two identified as significant sources of procurement emissions in HEIs by Townsend & Barrett (2015). However, making direct comparisons with other HEIs' footprints is challenging due to variations in how researchers categorize their Scope 3 emissions. Notably, three papers that exclude procurement emissions incorporate emissions from other Scope 3 categories in their carbon footprint calculations (Cano et al., 2023; Cortes, 2022; Samara et al., 2022).

While not the primary focus of this study, it's worth highlighting that only Lambrechts & Van Liedekerke (2014) analyzed the ecological footprint of HEIs. Ecological footprint is a broader measure of the environmental performance compared to the assessment of carbon emissions. It considers the environmental impacts of consumption by measuring the amount of different types of land required to meet our needs. It includes cropland, grazing land, fishing grounds, built-up lands and forest area in addition to just carbon sequestration (emissions). Among all papers examined, only Alvarez et al. (2014) discussed the potential of extending their analysis to include ecological footprints, while others concentrated solely on the carbon footprint.

5.1.2 Full Procurement

Among the papers that accounted for full procurement emissions, the majority followed the GHG Protocol or related guidance like the ISO 14064 standard. However, as expected, there were notable inconsistencies in both the calculation practices and methods.

5.1.2.1 Differences in Calculation Practices

5.1.2.1.1 Variation in GHGs Considered

While the GHG Protocol covers seven main GHGs, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3), these papers displayed no consistency in the GHGs they included. For instance, Alvarez et al. (2014) considered only three GHGs (CO_2, CH_4, N_2O) which are the mostly commonly produced GHGs. This is also observed by Robinson (2021).

5.1.2.1.2 Divergent Organizational and Operational Boundaries

Authors established different organizational (i.e. what facilities are owned by the HEIs) and operational boundaries (i.e. what is considered as sources of emission for procurement) for their calculations, or they failed to clearly define these boundaries in their papers. This ambiguity includes areas like student residences and food services. Some papers included residences and related facilities, as they were owned and supplied by the respective HEI (e.g., UC Berkeley), while others believed the HEI influenced decisions related to residences Doyle (2012) and Ozawa-Meida et al. (2013). Similarly, the inclusion of food services varied depending on whether HEIs operated their own restaurants or contracted out these services (Doyle, 2012). Other HEIs such as the School of Forestry Engineering, Technical University of Madrid contract out their food services and thus did not include procurement emissions embedded in the calculations (Alvarez et al., 2014). Kulkarni (2019) simply did not consider non-academic activities. The absence of relevant campus information, such as staff, faculty, and campus size, hindered comparisons. Valls-Val & Bovea (2021) also observed inconsistent inclusion of emission sources within the same scope.

5.1.2.1.3 Different Calculation Approaches to Specific Goods and Services

Authors made different decisions when calculating emissions associated with specific purchased goods and services. For instance, for significant capital expenditures like construction, Gómez et al. (2016) factored in depreciation values based on building life expectancy. Kiehle et al. (2023) considered purchases exceeding €5000 as subject to depreciation, spreading associated emissions over 5 years. In another instance with similar logic, Kiehle et al. (2023) considered the expected service life for informational technology (IT) equipment and added IT equipment purchased 2 years ago in the calculation of the current reporting year while also considering the depreciation. Information on whether other authors adopted similar approaches was often unavailable.

5.1.2.1.4 Inconsistent Presentation of Results

Most authors only employed the Scope 1-3 distinction and did not use the GHG Protocol's Scope 3 categories (10 out of 12 authors). Instead, they categorized procurement emissions based on their data or the types of items procured, such as raw materials & chemicals and food & drink (Figure 2; Townsend & Barrett, 2015). Consequently, there was minimal differentiation between capital goods and total procurement. Only Namovich & Ostrander (2022) and Sangwan et al. (2018) clearly distinguished capital goods from purchased goods and services. In addition, it is worth noting that some authors such as Townsend & Barrett (2015) presented the emission estimates by the responsible department.

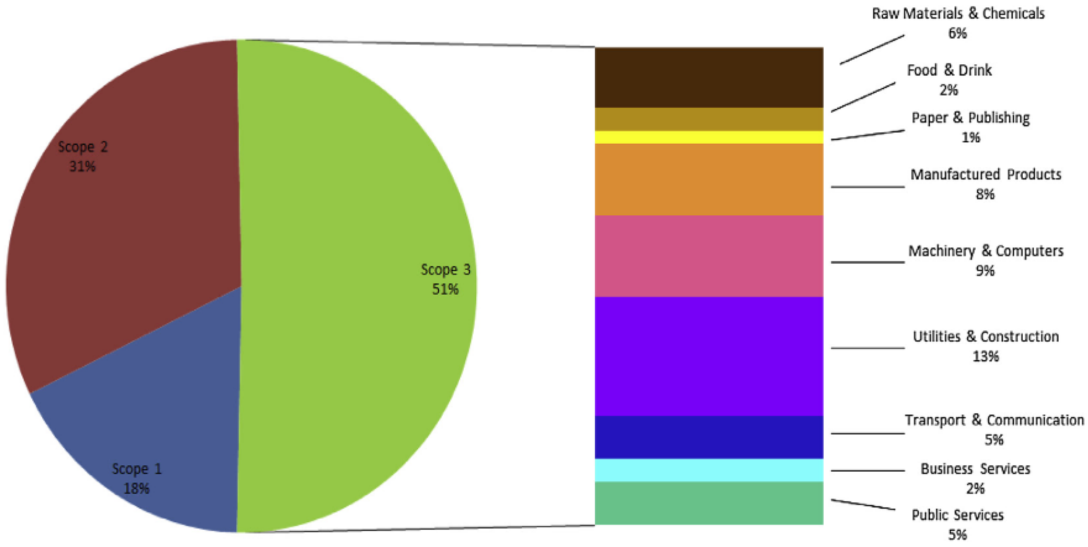

Figure 2. The Scope 3 categories utilized by the University of Leeds (Townsend & Barrett, 2015).

5.1.2.2 Similarities and Differences in the Calculation Method

Authors generally employ Equation 1 as the basis for estimating emissions, consisting of two components: activity data and emission factors. Activity data assumes various forms, including spend-based, unit-based, or mass-based data. Emission factors generally considered the cradle-to-gate emission (from raw material extraction to the manufacturers' gate), typically derived from either EEIOA or process-based Life Cycle Assessment (LCA), also known as PA. Three calculation methods are used: EEIOA, process-based LCA, and hybrid LCA, with EEIOA being the predominant approach for Scope 3 procurement emissions. It should be noted that many authors use a hybrid approach combining EEIOA and process-based LCA to calculate the total GHG emissions and use EEIOA specifically for Scope 3 procurement emissions.

$$\sum \textbf{Activity Data of Purchased Good or Service} \times \textbf{Emission Factor of Purchased Good or Service}$$

(Equation 1; GHG Protocol & Carbon Trust, 2013)

5.1.2.2.1 Environmentally Extended Input Output Analysis (EEIOA)

EEIOA is a top-down form of life cycle analysis (LCA) that estimates average GHG emissions produced per output in an economy by each sector or product category, considering interdependencies between sectors (GHG Protocol & Carbon Trust, 2013). It is based on economic input-output models which are matrices that document and aggregate input and output transactions between each sector in monetary terms, that is the supply chains between sectors in an economy (Namovich & Ostrander, 2022). In a simplified sense, one can identify that the agricultural sector requires $x worth of input from the manufacturing sector and $y worth of input from the electronic sector to produce $10 worth of output (products or services). EEIOA models integrate environmental data with economic input-output models to estimate environmental impacts such as GHG emissions associated with each dollar of output or revenue for each sector. The GHG Protocol considers this approach as the spend-based method where the amount spent on purchased goods and services by product types is multiplied by EEIOA emission factors to obtain emission estimates (GHG Protocol & Carbon Trust, 2013).

Authors primarily use EEIOA emission factors with procurement expenditure data as activity data. The expenditure data include the materials group, types of goods/services being purchased and the purchaser (Townsend & Barrett, 2015) or just aggregated into accounts (Namovich & Ostrander, 2022). More details are discussed in the food procurement section. Authors usually source expenditure data from the procurement department. Data processing involves adjusting emission factors for scale economy and converting expenditures to dollar values, similar to EEIOA values (Doyle, 2012).

Matching expenditure categories to EEIOA sectors can be tedious due to the lack of detail or aggregated descriptions (Alvarez et al., 2014; Doyle, 2012; Herth & Blok, 2022; Ozawa-Meida et al., 2013). However, the process of matching expenditure categories to emission factors only needs to be performed once unless there have been changes in the categorization of expenditure or emission factors. Some researchers took additional measures in the matching process. For instance, Doyle (2012) used the average of emissions factors for sectors if the expense applies to more than one economic sector. To make the estimate more accurate, Doyle (2012) analyzed the top 10 emitting expenditure categories and uses local emissions factors if they are based in the local region. Similarly, Gómez et al. (2016) used more detailed emission factors (less aggregated) for countries that trade heavily where the HEI is located.

EEIOA use varies among authors, which García-Alaminos et al. (2022) categorized into three groups. The first group of authors use emission factors generated from third party EEIO models instead of running the models themselves. They source EEIOA data from governmental agency such as the United States Environmentally-Extended Input-Output Model (USEEIO) developed by the US EPA (Namovich & Ostrander, 2022) and the Compound Method based on Financial Accounts (MC3) model supported by the Spanish government (Alvarez et al., 2014), by organizations such as the Comprehensive Environmental Data Archive (CEDA) (Doyle, 2012) or the literature (Herth & Blok, 2022; Ozawa-Meida et al., 2013). The second group run EEIOA models but only considers national input-output tables which do not capture indirect emissions overseas and do not do additional steps to try to capture these emissions (Townsend & Barrett, 2015). The last group of authors use Multi-Regional Input-Output (MRIO) analysis which considered trade with other regions or countries in the input-output tables (Alvarez et al., 2014; García-Alaminos et al., 2022; Gómez et al., 2016).

The weaknesses and strengths of using EEIOA models to estimate GHG emissions are well documented in the literature (Alvarez et al., 2014; Doyle, 2012; Namovich & Ostrander, 2022; Townsend & Barrett, 2015) and the guidance for calculating Scope 3 Emissions published by GHG Protocol & Carbon Trust (2013). Weaknesses of EEIOA stem from the use of aggregated data and its reliance on spend-based data. The oversimplification fails to capture the variations in emissions intensity among different companies within the sector as the average is used for emission factors. It assumes that all products with the same price produce the same emissions, which lacks specificity and accuracy. In addition, with price being the only determinant, it assumes that products produce more emissions if they are more expensive. While this might hold true in some cases, it disregards the possibility of more efficient and environmentally friendly production processes that may result in lower emissions despite higher costs. The data used in EEIOA, sourced from third parties and input-output tables faces constraints such as time lag and differences between producer and purchaser prices. EEIOA models also have a limitation in that they are typically restricted to specific geographic regions and the availability varies depending on the region in question. The availability of multi-regional tables which considered trade is not guaranteed. Although not reported in the literature, the various levels of processing also present as a source of uncertainty and incomparability to emissions estimate conducted with EEIOA data.

Conversely, the strengths of EEIOA models stem from the use of data that covers the entire economy and is produced by a third party (Alvarez et al., 2014; Doyle, 2012; GHG Protocol & Carbon Trust, 2013; Townsend & Barrett, 2015). As EEIOA data is comprehensive and considers the entire economy, it removes the requirement to draw boundary for the lifecycle of products (Varma et al., 2015). All emission sources are accounted for in an economy. There is also tremendous time and cost savings in using EEIOA models compared to using a process-based LCA as the former is easier to use (GHG Protocol & Carbon Trust, 2013).

5.1.2.2.2 Process Analysis

Process analysis (PA) or process-based LCA is a bottom-up approach involving detailed analysis of specific products or services. According to the ISO 14040 LCA standard, it consists of four phases: (1) Goal and Scope, where the intended use, goal and background information such as functional unit, product system, system boundary and methodology is defined, (2) Inventory Analysis, where as much input and data as possible about the product/services is collected, (3) Impact Assessment, where the inventory data is converted into environmental impacts, i.e. GHG emissions in this case, (4) Interpretation, an ongoing process in the whole analysis to discuss results from stage 2 and 3 (ISO, 2006). Authors use unit-based or mass-based data as activity data and emission factors from literature, organizations, databases, or LCA models performed by themselves. Kulkarni (2019) and Sangwan et al. (2018) are the only authors who use data from process-based LCA to estimate HEI emissions. The former uses emissions factors obtained from literature LCA whereas the latter uses emission factors from the Ecoinvent database.

Unlike an EEIOA, process analysis is more specific and detailed. Conversely, it is much more time consuming, costly and labour intensive because of the size of data required to perform the analysis, particularly when it is performed on more than one product/service which is the case to calculate Scope 3 emissions for an entire HEI (GHG Protocol & Carbon Trust, 2013). Practitioners are required to obtain emission factors for each type of goods and services they include in their calculation when estimating procurement emissions. Hence, it is challenging to perform process analysis for large-scale analyses and why it is not used as frequently as EEIOA for Scope 3 emissions in HEIs. LCA databases help by providing the emission factors for products and reducing the data requirement. Nonetheless, the factors provided by databases may not match the items accurately and precisely. Other weaknesses of process analysis include the truncation error and the lack of comparability as there is inconsistency in the definition of system boundary and use of data among analyses.

The GHG Protocol considers this approach as the average-data or supplier-specific method depending on the type of emission factors that is used in the estimate (GHG Protocol & Carbon Trust, 2013). If the LCA was performed using industry-average data (for specific products and services) from the literature, government statistics and LCA databases, the emission factors obtained would reflect the industry average instead of being specific to the supplier. Hence, it is called the average-data method. This is the case for all the papers that used a process-based LCA for their emission estimates. If the LCA was performed using supplier-specific data and produces supplier specific emission factors, it is considered as the supplier-specific method. Both methods use unit-based or weight-based data of purchased goods and services.

5.1.2.2.3 Hybrid Life Cycle Analysis

Hybrid LCA combines elements of EEIOA and process-based LCA, offering advantages of both approaches. It's commonly used to calculate HEI emissions, with EEIOA applied to Scope 3 procurement emissions and process-based LCA for Scopes 1 and 2, or for specific categories contributing significantly to total emissions (Doyle, 2012; García-Alaminos et al., 2022; Gómez et al., 2016; Ozawa-Meida et al., 2013; Townsend & Barrett, 2015). Kiehle et al. (2023), however, utilized this approach to calculate Scope 3 procurement emissions. They used EEIOA for general procurement including laboratory equipment, furniture and office supplies and PA with specific emission factors from the literature and even manufacturers for categories such as IT equipment, printing paper, printed books and restaurant services.

This approach is a hybrid of what the GHG Protocol considers as the average-data and spend-based method, the two described earlier (GHG Protocol & Carbon Trust, 2013). It allows flexibility by using different calculation methods for various procurement categories, ensuring more specific methods are used for categories with substantial emissions.

5.1.3 Food Procurement

Food procurement is often approached similarly to full procurement, but differences emerge when examining the details. Authors defined different scopes for food procurement according to the data source and calculation method. Townsend & Barrett (2015) and Namovich & Ostrander (2022) did not provide a clear description of what is included as food procurement since their studies focused on the carbon footprint of the entire HEI. Hence, they used expenditure and purchasing data, respectively, as their data source. Particularly, Namovich & Ostrander (2022) specified that they used purchasing data from two different levels, purchase orders and purchases made on P-card, charge cards for university faculties and staff. They followed the product type of expenses to determine what is considered as food procurement. In contrast, although Kiehle et al. (2023) also performed a carbon footprint of the entire HEI, they clearly illustrated that they only included the emissions of food sold on campus from restaurant services which included food production and basic preparation as their scope for food procurement. They obtained both unit-based and weight-based data, whichever was available from restaurant providers. On the other hand, Grekin & Benson (2022) and Sherry & Tivona (2022) focused particularly on the emissions of food procurement. The former collected food purchasing data from several sources which allowed authors to calculate food procurement emissions associated with dining halls and regular use (e.g. snacks or soda for break room). They used data where both weight and spend data were available as they wanted to compare the difference in emissions among the two. The latter only used food purchasing data from the main cafeteria and used weight-based data. It is worth noting that Sherry & Tivona (2022) used data from a summer term only to extrapolate results for the whole school year.

The selection of calculation method depends on the data type and vice versa. Authors who used emission factors obtained through EEIOA collected spend-based data. Authors who used emission factors obtained from process based LCA from the literature and life cycle inventory databases collected weight-based or unit-based data. As described in full procurement, authors performed their emission estimates differently even when the same method was used, particularly when using EEIOA data. Townsend & Barrett (2015) used only EEIOA to estimate their food procurement emissions while Grekin & Benson (2022) and Namovich & Ostrander (2022) used both because they wanted to compare the results among the methods. Townsend & Barrett (2015) categorized the HEI's expenditure data by product group as demonstrated in Figure 2. They further separated the product group of food & drink into 8 material groups such as meat, fish & fruit & vegetables and bread & baked products. Each material group was matched to the closest economic sector out of 123 sectors for their emission factors obtained from a two-region EEIOA. In contrast, Namovich & Ostrander (2022) used the default categorization of the purchasing accounts because of the lack of description for each account. They matched the accounts to all the relevant sectors and used the highest and lowest sector emission factors to generate a range of emissions for the estimation. In addition, they had a data analyst at the dining service to assign a single sector emission factor to the spending data. Alternatively, Grekin & Benson (2022) was the only one who did not match the sectors to spending data manually. They developed a categorization tool using Python script to categorize food spending into groups with a corresponding emission factor from EEIOA. The matching was verified using previously hand-categorized data.

Authors who used emissions factors from LCA estimated their food procurement emissions in largely similar fashion with some minor differences. Kiehle et al. (2023) used weight-based and unit-based activity data according to the availability and emission factors from the literature for their estimate. For both types of activity data, they sorted food items into groups. For instance, they distinguished between meals with meat and without meat when using unit-based data. In contrast, Sherry & Tivona (2022) used only weight-based data. They organized data by food products and only grouped some individual food products together such as different types of milk. Grekin & Benson (2022) also used weight-based data and the categorization tools when using emission factors from LCA. Additionally, although these three papers used emission factors from process-based LCA for their emission estimate, there is no overlap in the databases which they obtained emission factors. The first two authors preferred databases or calculations tools that are specific to the geographic region of their universities. Conversely, the latter used emission factors from different papers as they wanted to compare the effect of different calculation methods. They used one that is region-specific (Heller & Keoleian, 2015; Heller et al., 2018)and one that is a global meta-analysis that consider differences in growing practices (Poore & Nemecek, 2018)It is also important to note that Sherry & Tivona (2022) used a LCA software (SimaPro) while Grekin used Sustainability Indicator Management and Analysis Platform (SIMAP), a tool specific to calculating HEIs' emissions, for their estimates.

5.2 Best Practices in Accounting HEIs' Scope 3 Procurement Emissions

5.2.1 Common Challenges in Measuring HEIs' Scope 3 Procurement Emissions

Common issues faced by HEIs, as reported by Robinson et al. (2018) and Urban et al. (2022) can be attributed to three factors: (1) data accessibility, (2) resources limitations (3) methodological challenges. Firstly, HEIs struggle with finding quality and reliable data to estimate emissions. Specifically, practitioners stated that "Scope 3 calculation for procurement is very difficult to calculate as we purchase from tier 1, 2 and 3 suppliers. We don't always know where products are manufactured" (Robinson et al., 2018:4440). Secondly, HEIs face resources constraint in the calculation of Scope 3 emissions. CAUBO participants identified budget and/or staff constraints as challenges in measuring Scope 3 emissions (Urban et al., 2022). Similarly, respondents of Robinson et al. (2018)'s work identified emphasized the impact of staff resources, time constraints, and budget limitations on the quality of HEIs' carbon footprint calculations. The difficulty in acquiring data could be a contributing factor to this resource shortage. The other potential reason is related to the third factor, methodological challenges. Respondents highlighted the lack of details and clarity in the (data collection) guidance, particularly for less accessible and reliable data which make the accounting process resource intensive and difficult. There is also insufficient understanding of the measurement process among practitioners and inconsistencies in methodologies.

Moreover, the research conducted by Robinson et al. (2018) shed light on another issue concerning Scope 3 reporting in Higher Education Institutions (HEIs). Inconsistent reporting practices among HEIs hinder the accurate disclosure of Scope 3 emissions. Some HEIs, reporting fewer emission sources and consequently lower emissions, may appear as better performers compared to those diligently reporting a broader range of sources, resulting in higher emissions. This disparity discourages HEIs from reporting their Scope 3 emissions to avoid potential reputational damage. It also deters HEIs from setting performance-based reduction targets for Scope 3 emissions to avoid unfair representation, as noted by respondents. Thus, it underscores the pressing need for a standardized and comprehensive reporting framework for HEIs.

5.2.2 Best Practices: Calculation Practices

5.2.2.1 Variation in GHGs Considered

The impact of considering different numbers of GHGs on an individual HEI level is based on the significance of the omitted GHG. If the omitted GHG contributes substantially to total emissions, its exclusion would result in inaccurate reporting with significant discrepancies (Robinson et al., 2018). Conversely, if it has been established, through prior screening, that the omitted GHGs are inconsequential to total Scope 3 procurement emissions and including them would demand considerable resources (e.g. greater than that required for GHGs that are main sources of emissions), it is logical to exclude such GHGs. However, this omission should be explicitly and clearly stated. The number of GHGs considered should also remain consistent over the years, unless the omitted GHG is being incorporated into the estimation. Plans should be in place to account for all GHGs if conditions allow since each of them contributes to climate change.

On a collective level, the number of GHGs accounted by HEI should be standardized, even if it may intensify the resource intensive (Robinson et al., 2018). Inconsistency in the number of GHGs measured would make the comparison between HEI's procurement emissions inaccurate. This is true for other types of differences among calculation practices discussed.

5.2.2.2 Divergent Organizational and Operational Boundaries

At an individual level, the organizational boundary of the HEI's carbon footprint should be clearly described when presented. Entities located on HEI campuses but not owned by the HEIs (and therefore not captured in the footprint, e.g. food outlets) should be explicitly listed. Presenting this information through a map to highlight the entities not included in the calculations would enable easy visualization. As discussed, the boundary should remain consistent and strive to encompass more entities over time. HEIs should also explore whether they can influence these emission sources or consider partnerships with these entities for emissions reduction. Similarly, HEIs should do the same for their operational boundaries. Purchased products and services omitted from the operational boundary (if any) should be highlighted and accompanied by an explanation. This approach will prevent the omission of significant sources of procurement emissions in the measurement process.

On a collective level, the calculation boundary should be standardized to allow for comparisons among HEIs. This is supported by many scholars such as Herth & Blok (2022), Ozawa-Meida et al. (2013) Robinson et al. (2018) and Valls-Val & Bovea (2021). As discussed, HEIs compete with each other, particularly under the influence of neoliberalism. Establishing a standardized framework for HEIs to report their emission would incentivize HEIs to report and actively work towards emissions reduction. It would also address the discrepancy in reporting and methodologies as discussed. Thus, standardized methodologies for HEIs may facilitate understanding among practitioners and streamline data collection, especially if HEIs share common suppliers and collect the same type of data under a standardized calculation boundary. It would also eliminate issues such as HEIs categorizing different emissions under different scopes of emissions (Valls-Val & Bovea, 2021).

Nonetheless, there should be a discussion about whether entities not owned by HEIs, such as food services, should be included. For instance, various models of food service operations exist in HEIs. Some HEIs have private vendors operating on their campuses, while others, like Stanford, have their own dining services (Grekin & Benson, 2022) or a mix of two. Since it's natural to expect HEIs with their own food services to have higher emissions and those with private vendors to have lower emissions (as emissions produced from food procurement are not included), a comparison between the two may not be appropriate. Hence, it should be debated whether a cutoff based solely on ownership is adequate for HEIs. At the same time, HEIs and the audience should understand that the calculation boundary may not be entirely equitable or universal, given the variety of operational structures in HEIs. Moreover, HEIs that contract out food services may require more resources to obtain data from vendors compared to HEIs that have their own dining services, and such data may not even be available.

One potential idea to address the diverse operational models in HEIs while developing a standardized reporting framework is to categorize these models into distinct grades. By identifying the key differences in the operational models of HEIs and selecting a few of the most common but distinct ones as prototypes, each HEI can be assigned to its respective grade based on its similarities to the prototypes. As a result, HEIs would be compared only with others that share a similar operational model, enabling a more meaningful and equitable benchmarking process.

5.2.2.3 Different Calculation Approaches to Specific Goods and Services

HEIs used different approaches when calculating specific types of procurement. For instance, Kiehle et al. (2023) categorized procurement spendings over €5000 as an investment and allocated the initial cost over five years when calculating its emissions. First of all, it is worth questioning why Kiehle et al. (2023) allocated the emissions due to depreciation when estimating procurement emissions. Procurement emissions refer to the cradle to gate emissions produced and whether the investment made for procurement depreciate, it would not affect these emissions. If the allocation aims to prevent distortion of total emissions, Herth & Blok (2022) questioned whether this allocation of emissions fully reflect HEIs' current emission performance and provide urgency for immediate actions. Additionally, Herth & Blok (2022) and Ozawa-Meida et al. (2013) express concerns about large investment spending, notably in construction or capital goods, like energy-saving retrofits, distorting the annual carbon footprint (if not spread out over years), despite potential future energy savings reducing scope 1 and 2 emissions. This distortion poses complexity in setting reduction targets for procurement emissions and could render them meaningless and irrelevant (Robinson et al., 2018). It is also worth scrutinizing that if a HEI has large investment and capital spending every year, whether reporting the emission by the year instead of spreading them, distorts the annual carbon footprint or simply reflecting the true performance. Furthermore, when HEIs allocate large investment spending over time, determining the appropriate cutoff amount, time period, and allocation rate is crucial.

One potential method to categorize spending would be to base it on completion status. As large-scale procurements such as constructions occur over time, reporting their emissions based on their completion status would align embodied emissions to be reported more closely with actual embodied emissions produced in a given year instead of an arbitrary number. Hence, if the procurement is fully received and completed within the year, the spending would not be considered as a large spending and there would not be an allocation period. If procurement is fully received and completed within a year, it wouldn't be considered a large spending, and there would be no allocation period. Data required for this determination should already be documented by the financial department. For instance, purchasers at York University follow receiving instructions, including sending the purchase order to accounts payable after procurement receipt (York University, n.d.-a). Nonetheless, it is not sure whether construction projects follow similar approach.

Moreover, the discourse over whether an HEI should allocate large spendings highlights the importance of context when reporting Scope 3 procurement emissions. Regardless of whether HEIs allocate large spendings over time, they should provide the context for the audience’s full understanding. For instance, if unallocated large spendings lead to increased procurement emissions, there should be an accompanying description explaining the reasons for the uptake and the projected carbon savings from the large spending (if applicable).

On a collective level, it is crucial for HEIs to adopt uniform calculation practices when calculating their procurement emissions to enable meaningful and equitable comparisons. Therefore, besides exploring best practices for handling large spendings, research should identify differential decisions made by HEIs during their calculation process that affect result comparability. Standardizing both calculation boundaries and practices among HEIs may entail a transition period for staff to familiarize themselves with the standards. Nevertheless, this standardized approach should reduce the resource burden on staff afterward, as inconsistencies among methodologies are eliminated. It should also facilitate staff training and require less time.

5.2.2.4 Inconsistent Presentation of Results

Both at an individual and collective level, presenting procurement emissions by product groups rather than adhering strictly to GHG Protocol categories, offer benefits. As the GHG Protocol was not specifically tailored for HEIs' emissions reporting, categorizing procurement emissions into product groups allows HEIs to pinpoint emission hotspots with greater granularity, facilitating the development of reduction strategies. Alternatively, distinguishing between purchased goods and services and capital goods and presenting emissions by product groups can provide HEIs with better insight into asset expenditures. This approach may also encourage asset retention and transfer across departments, promoting efficient resource management and preventing procurement emissions. Since distinguishing between purchased goods and services and capital goods is a common financial practice, HEIs may already have this distinction in their financial records, resulting in minimal additional resource requirements.

Additionally, differentiating emissions by department is advantageous as it helps HEIs visualize results and develop reduction strategies by identifying emission hotspots by department. However, it's essential to note that certain departments may inherently produce more emissions due to their nature (Townsend & Barrett, 2015).

5.2.3 Best Practices: Calculation Methods

5.2.3.1 Best Practices: Calculation Method – EEIOA vs PA

EEIOA is the most frequently used method for measuring measure procurement emissions among the papers examined. Although the authors are not necessarily HEI practitioners who are responsible for performing emission estimates, it is easy to understand the rationale from practitioners' perspective as EEIOA's strengths align with common challenges HEIs face. Firstly, EEIOA requires data that is generally more accessible compared to PA. EEIOA uses expenditure data, usually accessible through HEIs' financial or procurement service, while PA relies on mass-based or quantity-based data which may not be collected or readily available (Doyle, 2012). For food procurement, Kiehle et al. (2023) who used PA, had to collect the number of meals sold. This information may not be available for HEIs with complex and diverse food systems (Hoey et al., 2021). Similarly, EEIOA provides easier access to emission factors, as long as there is an EEIO table available for the HEI's region. HEIs don't need to source individual emission factors for each product and service, as PA would require unless they seek enhanced specificity. Alternatively, HEIs wishing to use PA could obtain emission factors from LCA databases, which might be more convenient than searching for individual factors in the literature.

Secondly, EEIOA requires fewer resources for emission estimation. While data processing, such as interpreting spending categories and matching them with EEIOA emission factors, is still necessary and can be tedious, it is less resource-intensive than PA, which demands detailed data for each considered product and service (Kiehle et al., 2023; Thurston & Eckelman, 2011). The process of matching spending categories to sector emission factors only needs to be done once for EEIOA, unless there are changes to the spending categories or the sectors. Government-provided EEIOAs are also regularly updated. In contrast, emission factors used in PA, obtained from the literature, may not receive regular updates.

However, one major weakness of EEIOA should be noted. It cannot distinguish between low-carbon practices among sectors. Therefore, its results may not reflect emission reduction strategies. Even if an HEI begins procuring from low-carbon vendors compared to its industry peers, its procurement emissions (controlling for quantity purchased) will not decrease unless the cost of those products decreases. This insensitivity to reduction strategies makes EEIOA less effective for incentivizing emission reductions through procurement. This idea contrasts with Kiehle et al. (2023) who suggests that one of EEIOA's strengths is that it can be used to monitor the reduction of emissions of an HEIs as its calculation can be easily repeated annually.

Additionally, it is worth noting that in its previous edition, SIMAP, a HEI emissions calculation tool developed by the University of New Hampshire, provided users with options to distinguish between organic and local food products by utilizing emission factors from Heller & Keoleian (2015). However, it remains unclear whether users have the same capability in the current edition of SIMAP, as it now employs food emission factors from Poore & Nemecek (2018). Furthermore, it is uncertain whether emission factors for low-carbon practices are available for other types of procurement beyond food.

In contrast, PA offers specificity and sensitivity as major strengths, allowing researchers to select emission factors that closely resemble their conditions or even use factors directly from suppliers (if available). This flexibility enables results that reflect emissions reductions when purchasing from low-carbon vendors, facilitating performance tracking and incentivizing emission reduction. However, it's essential to note that data specificity does not necessarily mean data accuracy (GHG Protocol & Carbon Trust, 2013). Industry-average data, as used in PA and EEIOA, could be more accurate and of higher quality for a specific product than data collected from a vendor, which involves allocating emissions and introduces uncertainties. Additionally, despite the strengths of PA, its weaknesses, including being resource-intensive and relying on hard-to-access data, can pose challenges for HEIs lacking necessary resources. PA's lack of comparability among HEIs due to different system boundaries further compounds the challenge. Although standardization may reduce variability to some extent, differences will persist due to the unique nature of each HEI.

Moreover, while comparing EEIOA and PA methods, it's essential to recognize that some evidence suggests both methods identify the same emission hotspots, with PA estimates generally lower than EEIOA. Grekin & Benson (2022) compared food procurement emissions using four EEIOA and five PA methods and found that both consistently identified emission hotspots, although there were discrepancies in the estimates. PA methods generally resulted in lower emissions, with the largest difference being an EEIOA estimate twice the size of a PA estimate. PA estimates also showed higher variability, ranging from nearly double the lowest to the highest values, whereas EEIOA estimates had around 30% variability between the extremes. Namovich & Ostrander (2022) however, found the PA estimate to be three times higher than the EEIOA estimate. However, this divergence might be attributed to the limited food variety considered in their PA comparison, which focused solely on food procured by dining services. Grekin & Benson (2022) considered a wider range of food products, including both dining services and snacks for events. Additionally, it is essential to note that Namovich & Ostrander (2022) compared their EEIOA estimate to the PA estimate conducted by Hoey et al. (2021), which could introduce inconsistencies due to different calculation boundaries.

These findings hold critical implications, suggesting that the method used, either EEIOA or PA, is likely suitable for identifying emission hotspots. Consequently, the choice between EEIOA and PA should consider specific circumstances, with EEIOA being more suitable for most HEIs. This will allow them to identify emission hotspots and develop effective reduction strategies. Further research is necessary to compare emissions under different methods for products and services aimed at reducing emissions. Additionally, this research offers more insight on the differences in magnitude and hotspots and assesses EEIOA's suitability under such conditions. Moreover, variations in emission magnitudes based on selected emission factors remain a recurring challenge, even with standardized calculation boundaries, introducing a degree of uncertainty when comparing HEIs' procurement emissions.

5.2.3.2 Best Practices: Calculation Method – Suggestions for Selecting a Calculation Method

Considering the strengths and weaknesses outlined above, I recommend that HEIs initiate their Scope 3 procurement emissions calculation using EEIOA to gain understanding of their emission sources. EEIOA demands less time and effort due to its data accessibility and simplified steps. Furthermore, it effectively identifies the same emission hotspots as PA. Alternatively, HEIs can enhance their efforts to reduce emissions in specific hotspots by employing hybrid estimate which utilizes PA for emission hotspots. This approach allows for more specific tracking of emissions performance, especially when procuring from low-carbon vendors. This aligns with the GHG Protocol's guidance as it suggests using PA or even more specific methods like the supplier-specific approach for sources contributing significantly to total emissions (GHG Protocol & Carbon Trust, 2013). HEIs can also perform procurement emission estimate using only PA to enhance the specificity of their estimate and compare the estimate produced by the two methods if resources permit. Ultimately, HEIs would get the most specific results when they perform their estimate using supplier-specific data. However, this approach presents tremendous challenge due to resource requirements and data availability, especially for small to medium enterprises. In the following section, I delve into how HEIs can support their vendors in the emission accounting process.

The recommendation for selecting a calculation method regarding food procurement closely resembles that for general procurement. While there may be a preference for using process-based LCAs due to the availability of emission factors for various agricultural practices, it's worth noting that Grekin & Benson's findings (2022) reveal that both process-based LCAs and EEIOA yield identical hotspot identifications. (Grekin & Benson, 2022). Considering this, HEIs have the flexibility to opt for either approach when the goal is to identify hotspots. Notably, Grekin & Benson's study (2022) is more comprehensive than Namovich & Ostrander (2022), as it considers eight emission factors in the comparisons. Nonetheless, further research is required to determine the difference in magnitude between the two methods.

5.2.3.3 Best Practices: Calculation Method – Exploring Opportunities to Improve Emission Accounting in HEIs

Numerous opportunities exist to address recurring challenges in calculating Scope 3 procurement emissions within HEIs and through collaborations with external parties. These challenges relate to issues like data accessibility, reliability, and resource-intensive processes as discussed.

HEIs can address these concerns within their institutions through student internships, further research on emission accounting, and fostering inter-departmental collaboration to streamline data collection. Firstly, two significant opportunities for student internships arise, enabling students to enhance data accessibility and reliability while managing time-consuming calculation processes. The first opportunity involves partnering with vendors and suppliers who have not collected emission data. Students can support them in calculating emissions and converting them into emission factors during their internship. This arrangement is mutually beneficial, as the private sector increasingly focuses on Scope 3 emissions, and students gain practical experience in GHG emissions accounting. HEIs, in turn, benefit from more specific emission factors and higher-quality data, aiding in understanding and addressing procurement emissions effectively. The second opportunity involves having student interns at HEIs' sustainability offices. Students can be assigned the more time-consuming steps in the emission estimate process, though HEI practitioners need to invest effort in recruiting and training these interns.

Secondly, HEIs can support research on standardizing emission accounting practices across institutions. As discussed, standardizing calculation boundaries and practices would eliminate inconsistencies among accounting methodologies, simplifying the process and facilitating effective comparisons between HEIs' carbon footprints. Opportunities also exist to simplify the accounting process and make it more accessible, through promoting the awareness of approaches such as SIMAP and exploring the use of artificial intelligence (AI), machine learning, automation tools like those explored by Grekin & Benson (2022) in emission accounting. Additionally, comparing processes and results from existing emission accounting tools designed specifically for HEIs, such as SIMAP, with traditional methods (as authors have done without tool assistance) could yield valuable insights, allowing for further tool development and validation.

Lastly, HEI departments can contribute to the emission accounting process by collaborating with the Sustainability Office to review and update their data collection methods. For instance, HEIs that have not accounted their procurement emissions can follow Thurston & Eckelman's (2011) recommendation on changing the expenditure categories for procurement records to match the sectors on EEIOA tables. This alignment reduces or eliminates the need to match spending categories with EEIOA sectors. However, it's important to note that overly disaggregated sectors could lead to underutilization of categories, complicating the matching process and the matching process usually only happen once (Namovich & Ostrander, 2022). Alternatively, the procurement office can maintain current spending categories and collaborate with the IT department to add an additional field generated by AI, which selects the corresponding EEIOA sector. Another potential idea, especially for those that have already matched expenditure categories with sectors, is to review matches and rate them based on similarity. Depending on similarity and expenditure category magnitude, HEIs can decide whether adjustments are needed for more precise results. Opportunities also arise in expanding procurement data collection beyond monetary units to mass or quantity-based units, preparing HEIs for hybrid emission estimates for their hotspots. In the case of food procurement, HEIs contracting dining services could include data submission requirements in their contracts to streamline data collection.

Beyond individual HEIs, opportunities lie in EEIOA providers and external organizations. Given the growing emphasis on Scope 3 emissions reduction in public and private sectors (Scott & Scott, 2023) and the use of EEIOA table in Scope 3 emission accounting by the private sector (Salesforce, n.d.), EEIOA providers should explore options where they can differentiate companies with below-average emissions on the table. Such a process could involve certification procedures similar to those used for organic or Fairtrade standards. Data and knowledge sharing among HEIs and other organizations with shared suppliers could also improve emission accounting practices.

5.3 Current Practices for Reducing HEIs' Scope 3 Procurement Emissions

As previously mentioned, calculating procurement emissions involves two key factors: activity data and emission factors (Equation 1). Consequently, there are two approaches to reducing procurement emissions: (1) decreasing the consumption of products and services (thus lowering the activity data), and (2) opting to procure products and services with lower GHG intensity (thereby reducing the emission factors). As previous research determines the focus on SP as a strategy to reduce procurement emissions, I focus primarily on SP and similar procurement schemes such as GPP in this section. I discuss their effectiveness, barriers and drivers in reducing procurement emissions before conducting a comparative analysis of the current approaches employed in HEIs.

5.3.1 Literature Review on Sustainable Procurement – Effectiveness

While SP has been widely recognized to promote sustainability performance in government and private agencies, integrated as one of the targets in the UNSDGs and GPP was mandated in countries such as Japan in the last decade, there is surprisingly limited discussion on the effectiveness of such policy in both theoretical and empirical literature (Cheng et al., 2018; Hamilton, 2022; UNEP, 2017, 2021). Existing literature yields mixed results regarding the environmental performance of Green Public Procurement (Lundberg et al., 2016; Rietbergen & Blok, 2013).

From a theoretical perspective, Lundberg et al. (2016) argue that policymakers often ignore the market response to GPP. When considered, the effectiveness of GPP as an environmental policy is limited due to two major reasons. First, there could be counteracting responses from private actors depending on price elasticity and whether the public sector is a large buyer. For instance, they demonstrated using economic theories that GPP increases the price of green products by increasing the demand by the public sector. Hence the private sector may be crowded out and turn toward brown products with a decrease in price due to the reduced demand. Second, they highlight that the degree of choice embedded in a GPP combined with the potentially low probability of winning the bid and the cost of adopting green technology make it a weak environmental policy. In other words, GPP is an ineffective policy tool, being a mix of market and command and control policy instrument, along with limited coverage. However, it's important to consider the possibility that demand for green products in the private sector remains steady despite price increases, prompting suppliers to respond by increasing their supply of green products and potentially reducing prices. This scenario seems plausible, especially in the context of climate change, where actors from both the public and private sectors are actively addressing GHG emissions within their supply chains (Walmart, 2023; WEF, 2022).

In contrast, Rietbergen & Blok (2013) provide a case study of SP's relative success in the Netherlands. ProRail, a state-owned rail and transportation network company introduced the "CO_2 Performance Ladder 1.0" (CO2PL), a five-level certification system to implement GPP in 2009. This scheme assessed suppliers based on their CO_2 management performance across four aspects and rewarded them with competitive advantages, such as higher fictitious discounts during contract awards. Governmental agencies in addition to ProRail also use this scheme.

Analyzing data from 2009 to 2010 for 110 companies, they observed a 7.8% reduction in total emissions, although the reduction concentrated in a few companies and the industry was in an economic downtime. When adjusted with the above considerations, this program was projected to reduce between 0.8-1.5% CO_2 emissions a year. This case study demonstrates a promising glimpse of GPP but it also calls for more research to examine the long term performance of the CO_2PL program and effectiveness of GPP programs. One of the reasons why there are positive results according to Lundberg et al. (2016) would be that ProRail has a substantial purchasing power with an annual budget of approximately €1.9 billion for procurement. Though, it is unclear how many of the 110 companies were awarded a contract and whether companies that did not end up winning a contract fulfilled the targets they have set for the program or even increased in CO_2PL level. It will be interesting to apply the theories of Lundberg et al. (2016) to analyze the performance of the CO_2PL program for deeper understanding of GPP.

In synthesis, SP's effectiveness hinges on the integration of environmental criteria into procurement processes and contract award mechanisms. Cheng et al. (2018) argue that mandating technical environmental criteria makes the policy function primarily as a command-and-control tool, potentially hindering innovation with limited financial incentives. In contrast, there may be some reduction in procurement emissions if environmental criteria relevant to the embodied emissions are mandated under lowest price award criteria (Cheng et al., 2018). Nevertheless, the extent of this reduction largely depends on producers not already being environmentally conscious, aligning with Lundberg et al.'s argument (2016) regarding the lack of consideration for private actors' responses. Alternatively, instances like the Netherlands exemplify effective SP, where embedded environmental criteria lead to a genuine competitive advantage during the awarding process (e.g. with fictitious discounts). An instance of ineffective SP arises when environmental criteria are incorporated only in the call for tender process, without extending to the award selection phase. Hence, the weighting and award selection criteria is key to an effective SP, yet they are rarely discussed in the literature (Cheng et al., 2018).

5.3.2 Literature Review on Sustainable Procurement – Barriers of Implementation

Scholars have identified a range of barriers when it comes to implementing SP practices in public organizations. Among these, three barriers stand out as the most common and relevant: (1) financial constraints and the perceived cost of sustainable products, and (2) a lack of leadership support and (3) a lack of knowledge in SP (Cheng et al., 2018; Hamilton, 2022; Leal Filho et al., 2021; UNEP, 2017).

Research indicates that while SP considerations are occasionally considered during purchases, the cost of products and services continues to be the predominant factor, according to more than half of EU practitioners (Cheng et al., 2018; Hamilton, 2022; Leal Filho et al., 2021; UNEP, 2017). This tendency becomes more pronounced, particularly during economic downturns (Cheng et al., 2018). Given the common perception that green products are often pricier than conventional alternatives, they are less preferred when procurement practices prioritize the lowest bid concept. Hamilton (2022) attributes the emphasis on prioritizing the lowest price in public procurement to laissez-faire economic principles that have been influential since the 1980s. These principles emphasize attaining lower prices by promoting international market access through free trade and by refraining from considering non-commercial criteria in public procurement. Nonetheless, although Hamilton (2022) suggests that we have now entered a phase where public procurement is driven by competition based on most advantageous tender considering quality, sustainability and innovation, the studies mentioned suggest lowest price is still key in public procurement (Cheng et al., 2018; Hamilton, 2022; Leal Filho et al., 2021; UNEP, 2017). It could also be attributed to what Hamilton (2022) describes as the "lack of a whole-of-government" perspective. The government fails to recognize that procurement awarded based on the lowest price principle actually leads to negative social and environmental externalities, necessitating intervention by other government departments. This, in turn, increases their total expenditure. Conversely, a review performed on GGP specifically by Vejaratnam et al. (2020) drawing from 29 empirical studies, reports that financial constraints are not a major barrier but rather the lack of knowledge and awareness among procurers in GGP.

In addition, the three main barriers of SP could be interconnected. leaders could be insisting on the lowest price approach without adequate knowledge on SP. The absence of leadership support could also link to the lack of knowledge, experience, and awareness of SP within both HEI procurers (Leal Filho et al., 2019) and public procurers (Cheng et al., 2018; Vejaratnam et al., 2020) as they fail to provide training on SP. Adding to the challenge is the unfamiliarity with available SP options and the complexity in determining which product is more sustainable in the expansive sustainable considerations (Leal Filho et al., 2019). Correspondingly, a lack of formal policies (e.g. lack of a sustainable procurement coordinator) and guidelines on SP exacerbates the issue of inadequate SP knowledge. Bureaucratic barriers and decentralized purchasing systems are additional factors hindering HEIs from effectively implementing SP (Leal Filho et al., 2019). Moreover, a lack of motivation arises due to the absence of evaluation and recognition mechanisms for SP implementation (Leal Filho et al., 2019).

5.3.3 Literature Review on Sustainable Procurement – Drivers of Implementation

While beyond the scope of this article, the overemphasis on the lowest price principles and lack of leadership support can be addressed through national policies promoting SP and fostering financial flexibility toward SP in HEIs (Leal Filho et al., 2019).

In contrast, anticipated reputational benefits, identified as a driver of SP within HEIs, can serve as a persuasive tool to encourage senior management to commit to and provide support for SP framework (Leal Filho et al., 2019). Furthermore, offering training, technical guidance, and well-defined policies concerning SP to HEIs procurers and staff can effectively tackle the discussed barriers. This is particularly applicable to the first barrier, as procurers begin to acknowledge the external costs that are disregarded under the lowest price approach and recognize the potential for long-term cost savings through green products and services. These strategies are also linked to another highly relevant driver of SP which is the moral and ethical motivation based on procurers' beliefs and values on SP (Leal Filho et al., 2019; Sönnichsen & Clement, 2020). Nonetheless, the provision of training could be predicated on whether there is leadership support on SP. Conversely, Cheng et al. (2018) highlight that procurers who are confident, experienced and committed to GPP specifically can achieve environmental objectives while balancing efficiency.

Synthesizing from the main barriers discussed, Leal Filho et al., (2019) recommend HEIs to develop formal but flexible SP framework where incentives, evaluations and specificity to the individual HEI are key to the adoption of SP. Other recommendations to strengthen SP policy include having a dedicated SP coordinator, engaging the HEI community on SP and considering SP in the formal planning process (Brammer & Walker, 2011; Leal Filho et al., 2019).

5.3.4 Overall Trend of Sustainable Procurement in HEIs

Table 1 Comparison of SP practices in HEIs

HEIs	State University of New York College of Environmental Science and Forestry (ESF)	Yale University	University of Michigan (UM)	Thompson River University (TRU)	York University
SP/GP policy/guidance	- Has a GP policy: Green Purchasing and Break Free from Plastic Policy	- Does not have a standalone SP/GP policy but there is a sustainable procurement section in its general purchasing policy under the Competition and Supplier Selection. Mentions environmentally preferable purchasing in its definition section but the term is not used anywhere else in the policy - Has a Yale procurement sustainability action plan but only the executive summary is available. It highlights goals but there is no details on how to achieve goals • 2 goals from the procurement related goals in the Yale Sustainability Plan 2025: 1. Materials - "define sustainability criteria for vendor contracts to ensure sustainable consumption" 2. Climate action -"develop a system to report scope 3 emissions from purchased goods and services" - Other procurement related goals in the Yale Sustainability Plan 2025 include: • Develop a strategy for sourcing local goods and services. • Commit to ongoing sustainable professional development for all Procurement staff.	- Does not have a standalone SP/GP policy but there is a guidance/webpage on sustainable purchasing with overlapping information	- Does not have a standalone SP/GP policy but there is a sustainable purchasing guide - Not discussed below but there are sustainable purchasing facts sheets on its website for different types of purchasing including catering, furniture, lawn and garden machinery, IT accessories, events, IV hardware, office products etc.	- Does not have a standalone SP/GP but include sustainability and environmental considerations in the policy and procedure of procurement of goods and services and procurement code of ethics - Included the development of sustainability standards for procurement and capital construction as one of the responsibilities of the president in the newly amended sustainability policy

		• Create progressive sustainability language for requests for proposals and vendor contracts.			
Origin of policy/guidance	1. An extension of a New York State policy (green procurement and agency sustainability program) that requires state agencies to meet the approved green procurement specifications when purchasing 2. The break free from plastic pledge	Yale Sustainability Plan 2025 General purchasing policy	Unknown	Campus Strategic Sustainability Plan - One of the priorities is to "integrate sustainable purchasing throughout campus operations" - "Sustainable procurement policy is a short-term strategies for taking action, including life cycle cost analysis, certified supply chain"	York University Sustainability Strategy 2017 - One of the strategic goals is "York University integrates sustainability into its overall financial plan, integrated resource plans and procurement, and is a responsible investor with respect to sustainability".
Goal of policy/guidance	From the NY State program: - "Reduce or eliminate the health and environmental risks from the use or release of toxic substances; - Minimize the risks of the discharge of pollutants into the environment; - Minimize the volume and toxicity of packaging; - Maximize the use of recycled content and sustainably managed renewable resources; and - Provide other environmental and health benefits"	N/A	• "Serve as an advocate for U-M's sustainability goals • Encourage the development of environmentally friendly practices within our supplier and campus communities • Promote suppliers whose businesses provide environmentally sustainable products or services • Reflect our commitment to be an economic partner to the communities in which we conduct business" "the acquisition of products that: • Are made from recycled, environmentally preferable, or bio-based content. • Offer alternatives to hazardous or toxic chemicals.	"To help staff consider sustainability in the many procurement decisions they make in TMU"	N/A

	Additional by the ESF if there is no products available with the required standards: - Product is made from recycled content - Minimal, recyclable and/or compostable packaging - Product is easily reusable/durable Uses replaceable/refillable parts.		• Use energy- and/or water-efficient manufacturing processes. • Use alternate fuel and/or renewable energy. • Use eco-responsible packaging."		
Relevant components in the policy/guidance	1) Scope of purchasing policy - consumable, durable, electronic equipment and food and beverages 2) Quantitative goals for purchasing according to product category and performance measurement unit -> fig 1, more ambitious with general consumable, less with food and beverage 3) Reason for the policy 4) Product standards • the NY state program • The break free plastic program (including a ban on single use plastic and exemptions) • Food and beverage criteria 5) Procedures and strategies for implementation	Under the sustainable procurement section in General Purchasing Policy: 1. A paragraph to refer readers to the Yale sustainability website (where access is denied probably because of the lack of authority) and the Sustainable Procurement Standards Guidelines for guidance. a. Yale Sustainability Website on green purchasing (accessed through manual search) • how to differentiate recycled/green supplies on purchasing platform • The reuse program - Eli surplus exchange, for product exchange or sale among departments at Yale • Additional resources related to sustainable purchasing such as green event, reducing consumptions b. Sustainable Procurement Standards Guidelines • Include standards by produce types • e.g. copy paper	1) Definition of sustainable purchasing 2) Program objectives (listed below) 3) Importance of using sustainable products 4) Guidance on buying green in the university's online catalog • Depending on the types of catalog, can access sustainable products by selecting the sustainable product category or by suppliers who produce green products (cannot access the actual catalog without authority) 5) Link to a database of internal service providers and university-wide contracts	1) Definition of sustainable purchasing 2) Reasons for this guideline 3) Instruction on using this guide 4) Guidance by purchase amount (guideline for each step listed below) a. $0 - $10,000 Purchase - Buy durable products - Avoid over packaging and plastic packaging - Prioritize local and Canadian vendors - Look for recognized ecolabels with examples given (Fairtrade, BCorp, FSC, EPEAT and Energy Star etc.) - TRU ReUse: online exchange platform across TRU departments	High level inclusion of environmental and sustainable considerations in the following: - Under the policy statement in Procurement of Goods and Services (Policy) - Under guidelines in Procurement of Goods and Services (Procedure) - In Procurement Code of Ethics

• Explained which standard to follow when products with required certifications are not available • Provided examples of alternatives that are not preferred, e.g. single use paper products for single use plastic products 6) Implementation - Green purchasing guide - Include product standards - most commonly used products on ESF campuses that meet NYS greenNY mandates by product categories • hyperlinks attached • Pictures of products, brand, name, unit of purchase included - other commonly purchased products that do not meet NYS spec, but meet other 3rd party spec/ESF environmentally preferred - Reviewed quarterly to ensure products are in stock and hyperlinks are function 7) Party responsible and responsibilities (The Chief of Staff, Executive Operating Officer and Chief Sustainability Officer) Evaluation: quality assurance and control: yearly evaluation, investigation on unmet goals by the purchasing department with the purchaser	(1) CPG (30% postconsumer fiber) OR (2) Ecologo/UL 2771 Standard for Sustainable Paper Products OR (3) Green Seal 07 Standard for Printing and Writing Paper	• Can be search by search terms, types of vendors such as sustainable purchasing • Basic info on the vendor, how to order, purchasing options with hyperlinks 6) Additional ways to help	b. $10,000 - $30,000 - A three steps process 1) Identifying if the purchase is necessarily, in this quantity, in this form (or as a service); a tool to calculate total cost of ownership included 2) Assessing available options for sustainability certification, risks and opportunities; Guiding questions and discussion included 3) Developing specifications for purchase based on sustainability risks and opportunities identified c. Competitive Bids (use anytime, mandatory for purchases $30,000+) 1) Developing specification for the competitive bid on sustainability priority 2) Selecting tools to collect sustainability information from proposals 3) Evaluating the sustainability performance of proposals; setting weighting for sustainability performance or pass/fail, with an example for weighting provided) Specifying sustainability performance into the contract 4) Additional resources on • Sustainability certifications • Steps listed above

				• Tools to support the steps listed above e.g. sample supplier leadership questionnaire, LCA tool • Websites for more resources	

Tone	Relatively strong
	• "As a State agency, SUNY ESF **must abide by State regulations**, follow guidelines and use resources/specifications provided by the NYS Office of General Services when purchasing ongoing consumables and electronic equipment"
	• "The College **shall strive** to meet the following target"
	• "The following single use items **are no longer able** to be purchased with State funding for use on College property or for College events"
	• " Purchasers **must alway**s be in compliance with the College's Break Free From Plastics Pledge"
		Weak in the general purchasing policy
		• "**Please refer** to the Yale Sustainability website for the latest guidance on the University's efforts to monitor and reduce the University's environmental impact"
		• "**Please review** the guidance provided before making purchasing decisions and supplier selections and **consider** the Sustainable Procurement Standards guidelines for buying sustainable products or services"
		
		Determined in the Yale Sustainability Plan 2025
		• "Climate Action: Take **urgent action** to mitigate climate change and proactively adapt to its impacts. Develop system for reporting Scope 3 emissions for materials procured"
			Weak e.g. (the document seems to explain what sustainable procurement is and discussed some actions UM is taking toward sustainable procurement rather than actively
			• "By making small changes to your purchasing approach, your department **can**…"
			  • "Procurement Services **is committed** to supporting sustainable initiatives by leveraging its buying power and supplier partnerships"
				Weak but inviting
				• "This Guide has been created to **help you** consider sustainability in the many procurement decisions you will make in your role on campus. We know that you are busy. Instead of doing more, this Guide will set out a few ways you can do things differently to get more sustainability bang for your buck"
				  • "The Campus Strategic Sustainability Plan provides a framework for each TRU department and business unit to **embed sustainability considerations** into their own operations, including through sustainable procurement"
					Weak, as recommendations even included in the policy statement and as commitments:
					
					Policy:
					• "York University **aspires to high ethical, legal, environmental, managerial and professional standards** in the management of the resources entrusted to it. Within this context, the University's procurement function **shall be performed** in an open, fair and transparent manner where goods and services are procured in a competitive environment and where all transactions yield the optimal benefit to the University in the circumstances."
					• "York University **is committed** to promoting the values

of sustainability and social responsibility. To the degree possible, the University **shall incorporate sustainability standards** into its procurement practices, and give favorable consideration in its evaluation process to those goods and services which reflect this commitment to sustainability or broader social responsibility."

Procedure:

- Goods and services **shall be acquired competitively** from qualified vendors who meet specific requirements and provide the **maximum benefit for funds expended**, subject to ethical, **environmenta**l, and legal considerations.
- The University **shall normally give preference** to vendors of products and services that are **environmentally friendly** and acquisitions that targets poverty reduction.

Code of Ethics:

- **Encourage** suppliers to consider

					sustainability and social responsibility in their product or service offerings
Approach to support actions	Green purchasing guide	Sustainable Procurement Standards Guidelines for guidance, differentiation of sustainability products on online purchasing platform	Differentiation of sustainability product on online purchasing platform	The guidance was developed to support actions	In the process of development, potentially include the following: • Ecolabel guidance • Engagement tools that not only address the acquisition phase but the entire lifecycle
Environmental Criteria/Award Criteria for selecting vendors	• Environmental criteria for product purchasing described above • Award criteria not provided	Not provided	Procurement general policies and procedures • Select supplier using a best value approach • "The lowest price may not always be the best value; Units should consider the total cost of ownership, which includes the purchase price, transportation, handling, inspection, quality, rework, maintenance, disposal and other associated costs. Units should purchase from responsible sources possessing the	Integrated in the guidance, see above	Integrated in the guidelines, see above

			ability to perform successfully under the terms and conditions of the university with consideration given to such matters as supplier integrity, compliance with public policy, record of past performance, and financial and technical resources"		
Sources	(ESF, 2021a)	(Yale University, 2023)	(University of Michigan, 2022)	(TRU, 2021)	(York University, n.d.-c)

Among the HEIs examined in Table 1, three main approaches of how HEIs embed SP practice emerge: (1) a dedicated green purchasing policy (ESF), (2) incorporation into the general purchasing policy (Yale) and (3) guidelines on sustainable purchasing (Yale: purchasing standard, UM: website and TRU: purchasing guide). While ESF mandates SP, Yale's approach is voluntary.

These institutions employ five overlapping strategies to facilitate practical actions on SP. The predominant strategy involves offering standards in the form of certifications, which can either be mandatory (ESF) or voluntary (Yale and TRU). This distinction is reflected in the tone and language used across the documents (Table 1). Table 2 presents a list of certifications frequently mentioned by these HEIs. Additionally, other strategies include providing a product guide (ESF), identifying sustainable products on the purchasing platform (UM and Yale), offering guidelines for sustainable purchasing (TRU), and providing a list of established sustainable vendors (UM).

A notable observation is that HEIs primarily focus on purchasing sustainable products compared to services (only TRU and UM consider services). Furthermore, the focus of guidance predominantly lies in selecting sustainable products rather than specifying criteria for choosing a sustainable vendor (a subject explicitly covered by TRU). Guidance on SP frequently derives from the HEIs' sustainability plans (Yale, albeit still in development, and TRU) or is influenced by state policies or commitments to environmental objectives (ESF). Notably, not all HEIs provide explicit SP goals; where available, these goals may manifest as preferred environmental criteria (ESF and UM) or as broader efforts to enhance overall campus sustainability (UM and

TRU). Some environmental criteria provided contribute to GHG reduction, including using renewable energy sources, energy and water efficient processes, reusable/repairable designs, recycled materials and minimization of packaging.

The components included in the guidance differ among HEIs but most have a definition of SP, reasons to purchase sustainably and how purchasers can do so in the HEIs. Interestingly, guidance on vendor selection for SP is generally absent, except for TRU, which integrates vendor selection advice within its sustainable purchasing guide. On the other hand, UM states that suppliers are selected based on the best value approach. In addition, it is worth noting that two of the HEIs provide an online exchange platform for departments to exchange (or sell) items across the institution (Yale and TRU). Instead of SP, this approach tackles procurement emissions by the first variable in (Equation 1 by reducing the consumption of products.

Table 2. Commonly Adopted Certifications for SP in HEIs

(ESF, 2021a; TRU, 2021; University of Michigan, 2022; Yale University, 2023; York University, n.d.-c)

Certifications
• U.S. Environmental Protection Agency Comprehensive Procurement Guidelines (CPG) • Energy Star • the Forest Stewardship Council • Electronic Product Environmental Assessment Tool (EPEAT) rating • ENERGY STAR rating • Cradle to Cradle • Fairtrade • Green Seal • Ecologo

5.3.5 ESF's Green Purchasing Policy

ESF's green purchasing policy is the only formal and mandated policy among the HEIs examined. This is reflected in the components and overall tone of the policy. This aligns with Leal Filho et al. (2019) findings, indicating a lack of formal SP policies in HEIs. Unlike the other institutions, ESF's policy carries authoritative weight, making it more than just a set of recommendations, potentially enhancing its effectiveness.

ESF’s policy is also the most comprehensive, including components absent in other HEIs. These include a defined scope, quantitative goals with measurement unit, mandatory product standards, implementation strategies, a product guide and a control mechanism detailing the responsible party, duties, and policy evaluation. Including a product guide for frequently purchased items addresses the potential barrier to the lack of familiarity with sustainable products and the inconvenience of referencing the required technical specifications. Thus, making it more convenient and user-friendly for staff to follow the SP standards. In addition, including a control mechanism underscores ESF's commitment to SP, empowering responsible parties to oversee policy execution, monitor progress, and drive continuous improvement—an essential facet suggested by Leal Filho et al. (2019).

Notably, ESF's policy is unique in its origin, deriving from a government program developed by New York State. The requirement for state agencies to procure products meeting specific GreenNY specifications is believed to be a key driver behind ESF's formal SP policy

(NYS, n.d.). The state policy also explains the comprehensiveness and seriousness of ESF's SP policy. It supports the notion proposed by Leal Filho et al. (2019) that national or state-level SP policies act as catalysts for HEI engagement in SP. However, it should be noted that the components in ESF's policy are very similar to the LEED (Leadership in Energy and Environmental Design) v4.1 requirements for purchasing (USGBC, 2020).

Moreover, it is unexpected that the Break Free from Plastic pledge also acts as a critical driver of ESF's policy. Despite being initiated by a student-led network (Post Landfill Action Network) and lacking formal power, the pledge has driven ESF to ban the purchase of commonly used single-use plastics for use on campus and campus events with state funding. Perhaps the reputational benefits associated with the pledge also act as a driver supporting the ban. In addition to the ban, ESF provides additional guidance demonstrating their commitment to reducing single-use waste. They emphasize that the campus community should avoid using these items on campus even when purchased with their funds and provided examples of preferred alternatives such as reusable items and not-preferred alternatives such as single-use paper items to single-use plastic.

5.3.6 TRU's Sustainable Purchasing Guide

TRU provides the second most comprehensive guidelines on SP among all HEIs, following ESF. It provides guidance on sustainable purchasing strategies based on the dollar amounts in its purchasing guide and provides factsheets on ten purchasing categories on its website.

Notably, TRU is the only institution that integrates guidance on supplier selection within its guidelines, with various resources on how to incorporate SP in vendor selection. For instance, it provides detailed instructions on establishing sustainability requirements for request for proposals during the bidding process. Additionally, the guide includes valuable tools such as a sample supplier leadership questionnaire and a Life Cycle Assessment (LCA) tool. Nonetheless, despite the array of resources provided, its effectiveness is debatable due to its status resemblance to a guidebook rather than an enforceable policy. While certain goals are outlined in the guidance, such as to "Purchase computers and/or other electronic products that are EPEAT registered or similar and track compliance," the mechanisms for enforcement, implementation, and accountability are notably absent (TRU, 2021). This lack of clarity extends to TRU's level of commitment to these goals. It remains uncertain whether TRU's staff members will read the purchasing guide and subsequently follow the guidance. Presently, the guide appears tailored to individuals who are already inclined towards sustainable purchasing and seek resources to align their efforts within TRU.

Moreover, the guidance provided, particularly for product procurement under $10,000, appears to be less user-friendly compared to ESF's product guide. Instead of offering a catalog of frequently purchased products that fulfill SP recommendations, TRU presents four key principles for SP. While these principles are easy to comprehend and essential for sustainable procurement, they do not entirely mitigate the time constraints, as staff members must still independently identify products that meet the certification. This disparity makes TRU's guide less convenient compared to ESF's more comprehensive product guide. However, the absence of a comprehensive purchasing guide could be attributed to factors such as insufficient funding, limited resources, or a lack of support from leadership.

Additionally, the purchasing guide features only five certification recommendations, whereas supplementary certifications are suggested on the institution's website based on item categories. While quantity does not necessarily equate to quality, TRU could consider combining the information from its website into the purchasing guide itself or directing guide readers to the website for more information.

5.3.7 Yale and UM Sustainable Procurement Guidance

Alternatively, the guidance provided by Yale and UM are similar to each other. Both provide sustainable products on their online purchasing platforms although Yale has integrated SP in its procurement policy and UM has only provided voluntary guidelines on SP. Regrettably, due to limitations in authority, the accessibility of these purchasing platforms for analysis remains restricted. Regardless, the practice of spotlighting sustainable products or those adhering to specific sustainability standards directly on the online purchasing platform could potentially offer a greater level of convenience for HEI staff compared to ESF's product guide. This streamlined approach eliminates the need for staff to reference external documents throughout the procurement process. However, the efficacy of this method depends on the adoption and utilization rate of the online purchasing platform.

In addition, Yale provides the sustainable procurement standards guideline which is essentially certifications that staff are encouraged to adhere to when conducting purchases. Unlike TRU's purchasing guide, Yale covers more product categories and separates the recommendation by product types. UM's list of sustainable vendor serves similar purposes as Yale's guideline. They both short-list products and vendors that align with their sustainability criteria for easy access. Nonetheless, similar to TRU, the effectiveness of the guidance provided by Yale and UM is also questionable as they are recommendations rather than formal policy.

Lastly, it is noteworthy that despite the study conducted by Thurston & Eckelman (2011) on Yale's procurement emissions took place in 2011, subsequent documents such as the Yale 2016 Sustainability Plan and the 2017 Procurement Action Plan continued to identify the establishment of a procurement emissions tracking system as a goal and the actual tracking started in 2018 (Yale University, 2021). This may indicate the potential time lag and bureaucratic obstacles that HEIs encounter when attempting to translate pilot studies into institutional procedures.

5.4 Best Practices for Reducing HEIs' Scope 3 Procurement Emissions

5.4.1 Reduction of Consumption VS Sustainable Procurement

Best practices for reducing Scope 3 procurement emissions should achieve the most significant emission reduction. Considering the two approaches to reduce procurement emissions based on (Equation 1, the reduction of consumption outshines sustainable procurement (reducing emission intensity). While both are equally related and proportional to procurement emissions in the equation, reducing consumption provides more direct results, especially given the current data limitation, notably in differentiating low-carbon practices in sectoral average EEIOA emission factors. Moreover, it is crucial to recognize that lowering emission intensity will not provide visible results to procurement emissions if consumption continues to rise (HEIs' current approach). This can be illustrated by a somewhat similar stimulation performed by Victor (2012) on the relationship on gross domestic products (GDP) and emission intensity to meeting GHG targets. It indicates that a much greater reduction in emission intensity is required if the GDP (measures of consumption) maintains or continues to grow. In contrast, the reduction in procurement emissions would remain obvious from reduction of consumption as long as the emission intensity does not increase. This suggests that the reduction of procurement emissions would be more effective if HEIs prioritize reduction of consumption or at least a more balanced approach.

Moreover, while SP contributes to emission reduction in theory, there are still questions on its effectiveness in reducing procurement emissions as discussed in section 5.3.1. Another issue regarding the use of SP to reduce procurement emissions lies in the multitude of environmentally preferred criteria. Recommended certifications in SP schemes may not exclusively prioritize emission reduction during product manufacturing. For instance, the Green Seal certification for personal care products (like hand soap, commonly used in HEIs) includes standards for Volatile Organic Compounds (VOC), carcinogens, mutagens, reproductive toxins, and biodegradability. However, only VOC has an indirect link to climate change (David & Niculescu, 2021; Green Seal, n.d.). From a climate-conscious standpoint, it remains uncertain whether products lacking carcinogens, mutagens, and reproductive toxins are produced with lower emissions. Similarly, ENERGY STAR products are energy efficient in the use phase, contributing to overall GHG reduction, but not specifically target procurement emissions reduction. This example also highlights the importance and complexity in considering life-cycle environmental impacts of procurement.

Conversely, other certifications like CPG and EPEAT ratings address the product manufacturing phase, directly contributing to the reduction of procurement emissions. CPG-designated products contain recycled or recovered content, potentially resulting in lower GHG emissions compared to raw material production, depending on the material (Gorman et al., 2022; US EPA, 2016). EPEAT-registered products meet criteria involving material selection, supply chain GHG reduction, circular design and longevity (US EPA, 2014). These standards provide support for the effectiveness of SP on the reduction of procurement emissions. Therefore, HEIs should prioritize this type of standard when the goal for SP is to reduce procurement emissions.

While some consumption is necessary to support operation and learning in HEIs, they can consider taking a multi-prong approach and address product and service consumption for procurement emissions reduction, rather than relying solely on SP. Practices that reduce product consumption include online exchange platforms where departments can exchange or sell items within institutions. Further investigation reveals that both ESF and UM have mechanisms to manage surplus items (ESF, 2021b; UM, 2022). However, it is a missed opportunity that surplus programs are not discussed alongside sustainable procurement guidance, given their interconnectedness and the priority of consumption reduction in emissions reduction. Additionally, HEIs located in the same geographic area or belonging to the same network could explore the possibility of implementing second-hand programs for institutional supplies, akin to the exchange programs within individual HEIs. This broader approach would encompass a larger pool of participating HEIs, thereby enhancing the likelihood for purchasers to locate suitable matches for desired products. HEIs can also reduce unnecessary consumption by purchasing durable products, raising awareness to staff and students on resources conservation and using asset management software to avoid redundant purchases as suggested by Namovich & Ostrander (2022).

Furthermore, HEIs should refer to their procurement emissions data when developing a consumption reduction strategy. They need to identify what goods and services can be purchased less while maintaining smooth operations. It is crucial for HEIs to recognize that the reduction of consumption extends beyond consumables and equipment to include other goods and services such as those related to construction activities. Construction activities are the main contributor to some HEI's procurement and Scope 3 emissions, ranging from 13% to 26% of their entire carbon footprints (Larsen et al., 2013; Ozawa-Meida et al., 2013; Thurston & Eckelman, 2011; Townsend & Barrett, 2015). The consumption of other goods and services associated with construction, such as iron, steel, cement, engineering, and architectural services, rank among the top 10 most emissions-intensive expenditure categories and sector in Yale's procurement (Thurston & Eckelman, 2011). If constructions are carried out to expand HEIs, they also create more demand for other types of procurement and further drive procurement emissions up.

The results that construction activities account for a significant part of HEIs' procurement and Scope 3 emissions, raise a larger question on the underlying causes of climate change. The common directive of HEIs, as they undergo corporatization, revolves around the pursuit of growth. This priority in the form of expansion and construction clashes with the climate action agenda—let alone its contribution to climate change. This conflict urges institutions to examine their values, particularly their growth aspirations amid the climate crisis as educational institutions in society. It also challenges HEIs to balance the necessary constructions while minimizing procurement emissions.

5.4.2 Formal Policy VS Voluntary Guidelines

As demonstrated, HEIs utilize formal policies and voluntary guidelines to incorporate SP into their practices. Among these approaches, formal policies naturally outshine voluntary guidelines as they often involve a degree of commitment and accountability mechanisms, particularly when SP is mandated, as seen in ESF's green purchasing policy. Having a formal policy on SP directly tackles one of the barriers to SP implementation, the lack of a formal policy (Leal Filho et al., 2019). Nonetheless, it is critical to recognize that a formal SP policy does not necessarily guarantee effective SP in HEIs. For instance, although Yale includes statements on SP in its General Purchasing Policy, the language employed is weak and they are not mandatory with any commitments stated. The absence of evaluative and accountability mechanisms raises questions on the effectiveness of Yale's formal policy, as the lack of policy commitments/goals/actions plans and the lack of mandatory SP rules/legislation are among the barriers to SP implementation identified by the United Nations Environment Programme (UNEP) Global Review of SP (UNEP, 2017). This is also a common weakness observed among all HEIs' SP program, except ESF. This raises questions about the extent of leadership for SP programs. In contrast, ESF includes implementation strategies, a product guide, targets and evaluative procedures. However, it is uncertain whether the enforcement mechanism outlined is effective enough given the potentially high volume of purchasing records to evaluate annually (NYS et al., 2022). Another HEI, the UC has a separate SP guideline document with a clear focus on SP, along with requirements and targets that complement the SP requirements in the policy on sustainable practices (UC, 2021). By including an action plan or procedural guidance on SP implementation, HEIs demonstrate a strong commitment to SP.

Several other factors are essential for effective SP implementation, even with a formal SP policy. Engagement is critical because procurement involves various parties in a HEI, depending on the procurement structure. A formal SP policy with limited awareness among campus staff does not make it an effective way to reduce procurement emissions. Similarly, having a SP policy with no training on SP does not translate to the SP implementation, especially given that the lack of knowledge about SP is one of the main barriers to its implementation (Cheng et al., 2018; Leal Filho et al., 2019; UNEP, 2017). An evaluative scheme with SP targets and a timeline for regular review also facilitates SP implementation, necessitating a monitoring system to track SP expenses, which is also essential. Examples of SP targets include ESF's identification of SP goals (in percentage) and performance measurement units for product categories. Targets can also provide flexibility, as seen in the case of UC, which identifies both required and preferred levels of dollars spent on GP (UC, 2021). HEIs should also consider developing a recognition scheme to recognize departments with top SP performance, hence using both carrot and stick to motivate SP in HEIs.

In addition, financial restraints and the perceived cost of sustainable products are major barriers to the implementation of SP in HEIs (Cheng et al., 2018; Hamilton, 2022; Leal Filho et al., 2019). Therefore, a formal policy should be accompanied by some mechanisms addressing such barriers. This is particularly relevant to a product guide. If the sustainable options are indeed more costly, there should be a corresponding increase in the budget to support the policy. Otherwise, it sends conflicting signals to staff, who may stick to conventional purchasing. If a budget increase isn't feasible, the products included in the product guide should be in a similar price range as conventional products. However, it's worth noting that New York State, a national leader in green purchasing in the US, states that environmentally preferable products are competitively priced against conventional products and often come with discounts (NYS et al., 2022). Interestingly, the barrier of financial restraints is not discussed in the policy/guidelines examined earlier, even in TRU, which is the only institution that resemble the literature's emphasis on vendor selection in sustainable procurement over product selection.

Alternatively, voluntary guidelines on SP are not necessarily completely ineffective in reducing emissions, as the lack of guidance is also one of the barriers to SP identified in the literature (Leal Filho et al., 2019). Voluntary guidelines serve as education and awareness tools to promote SP, particularly when they include concepts on total cost of ownership and LCA highlighting, the reasons for pursuing SP. Nonetheless, the efficacy of voluntary guidelines is questionable. First, it depends on the relevance of the guideline, whether they address staff's SP-related questions. Secondly, it depends on whether staff will read or follow the guidelines without any sort of mechanism in place to drive motivation. As discussed, these guidelines seem to target staff who are already leaning toward sustainable procurement. Perhaps they can be introduced when there is lack of leader support for formal policy to raise awareness on sustainable procurement. Doing so relates to a key driver of SP, which is the moral and ethical motivation based on procurers' beliefs and values on SP. However, this will also depend on whether there are resources to compile voluntary guidelines on SP and whether there is leadership approval for such guidelines.

5.4.3 Tools to Support Actions in Sustainable Procurement

As stated, HEIs employ five types of tools to facilitate SP actions, including certification recommendations/standards, product guides, identification of sustainable products on purchasing platforms, guidelines on sustainable purchasing, and lists of existing sustainable vendors. To determine which of these tools could yield the most significant reduction in procurement emissions, several factors must be considered.

Firstly, effectiveness of these tools depends on whether the recommended (or mandatory) certifications, products, and vendors directly address cradle-to-gate emissions. Some recommendations may focus on general environmental sustainability aspects, which, while beneficial, might not be directly related to reducing procurement emissions. Therefore, it's crucial to recommend or mandate certifications that specifically target emissions in the manufacturing phase when the goal is emission reduction in procurement.

Second, the extent to which a tool can significantly reduce emissions in HEIs procurement processes is influenced by its effectiveness in addressing emission hotspots in procurement and its rate of adoption. Hence, it is critical that tools are developed according to the analysis of procurement data. Additionally, the adoption rate of these tools depends on the typical purchasing behavior of HEI staff and the user-friendliness of the tools.

Assuming that online purchasing platforms are the primary method for procurement, identifying sustainable products, especially those with low-carbon footprints, on these platforms appears to be the most convenient and proactive choice. It takes a proactive role to promote SP and may raise awareness about SP even among staff who may not have initially been interested. In contrast, ESF's product guide, while comprehensive, plays a more passive role and requires staff to be aware of its existence to benefit from its recommendations (unless there is reminder about the guide on the online platform). A product guide is more valuable for HEIs where staff make frequent purchases outside of a centralized online purchasing system. It addresses the barrier of lack of adequate knowledge in SP, lack of adequate knowledge in sustainable options, as well as the complexity in the expansive environmental preferred criteria. Conversely, providing a list of recommended certifications may not be as useful compared to the online platform identification and the product guide, particularly for frequently purchased products. It adds an extra layer of work for staff who must verify certifications during the purchasing process. Such a list could be more beneficial for products not commonly found on online platforms, for which there are many choices available, or for products where user requirements vary significantly, such as laptops. That way, there is still some guidance for SP outside of the online platform. The effectiveness of a list of sustainable vendors and purchasing guidance also relies on staff awareness and adherence to these recommendations, making them relatively passive tools.

Synthesizing from the above, the essence in selecting strategies to support SP actions in product procurement lies in choosing one that is proactive and matches the frequently used purchasing method for the products targeted. Additionally, these strategies should be closely linked to procurement data to address emissions hotspots effectively, considering both quantity and expenditure, depending on the type of procurement (e.g., product selection or vendor selection).

5.4.4 The origin of Sustainable Procurement in HEIs

As discussed in Section 5.3.5 (ESF's Green Purchasing Policy), SP schemes stemming from state programs or student-led initiatives appear to have a more significant impact compared to those originating from HEI sustainability plans. This finding partly aligns with Leal Filho et al. (2019) that national SP program are key drivers for SP in HEIs. Although it may fall outside the scope of this paper, this underscores the substantial influence of governmental programs, especially those directly linked to funding allocation.

In addition, the ESF case highlights the potential power of student-led initiatives. The single use plastic ban associated with the Break Free from Plastic pledge to the Post Landfill Action Network suggests that not only governmental program but students-led initiatives can be potent drivers of SP in HEIs. While this may be a case-specific observation, such bans can inspire students and grassroots initiatives to continue advocating for climate action from both public and private organizations. The ESF case also supports the effectiveness of pledges as a mobilization tool for climate action, which could warrant further research.

5.4.5 Products vs Suppliers Selection

When comparing SP schemes across the four HEIs, a notable focus on product standards appears, with less emphasis on integrating sustainability criteria into supplier selection. This diverges from the existing literature on SP in HEIs and reveals a research gap regarding sustainable and low-carbon product procurement, including services, in HEIs. It may also indicate that HEIs may not have integrated SP in larger scale purchases that involves the selection of vendors and competitive bidding as discussed in the literature. This could also be a missed opportunity for HEIs as larger scale purchasing is often associated with greater production of GHG emissions. Nonetheless, it should be noted that the product-based standards or guidance can also be used in supplier selection by requiring products that meet such standards. However, the selection of supplier will then be limited by the availability of sustainable certification of products. Embedding languages on sustainability in supplier tenders or contracts would give more flexibility to both HEIs and suppliers establishing the sustainable requirements. But it may also entail more work for HEIs to verify suppliers' responses without a third-party certification as in the case of product standards.

In addition, the focus on product standards instead of supplier selection through contracts and tenders is unexpected. I initially thought that it would be easier to implement SP in contracts as supplier selections typically involve approval by centralized procurement offices. In contrast, implementing SP through product standards was assumed to represent decentralized procurement, where many individual purchasers make purchases that bypass the central procurement office. However, product standards can serve as a tool for both centralized and decentralized procurement, as discussed earlier.

At the same time, it is worth questioning whether SP implementation is more effective in centralized or decentralized procurement. The former seems to be more effective for two reasons. First, procurements routed through centralized offices often involve larger scales and costs, increasing the likelihood that purchased products meet sustainable requirements. Second, suppliers on HEIs' online purchasing platforms are selected through centralized procurement. Embedding sustainability language in contracts with these platform suppliers would ensure that all platform purchases meet sustainability requirements. However, this approach might be less effective in decentralized procurements, where SP implementation relies solely on individual purchasers' values and knowledge of SP, unless other policies mandate SP. HEIs would have limited ability to enforce rules on suppliers in decentralized procurement, affecting the effectiveness of SP implementation. Nevertheless, the approach with sustainable suppliers on online platforms could be ineffective if there is leakage, where purchasers turn to external suppliers because they cannot find suitable products through centralized suppliers or shopping sites.

5.5 Key Takeaways on the Accounting and Reduction of HEIs' Procurement Emissions

5.4.1 Key Takeaways: Current and Best Practices on Calculation Practices

The examination of HEI's carbon footprint reveals that a similar portion of HEIs reporting their full emissions compared to those reporting partial or zero procurement emissions. This suggests a need for HEIs to enhance their procurement emissions accounting, possibly through promoting awareness of procurement emissions or addressing the challenges in the accounting process.

Inconsistencies have been identified in four areas of calculation practices. Variations in the number of greenhouse gases included in the calculations have exposed limitations in the GHG protocol guidance and data constraints. Moreover, differences in organizational and operational boundaries, as well as calculation approaches for specific types of purchased goods and services, have demonstrated the complexity in standardizing calculation practices, developing meaningful comparisons, and setting reduction targets among HEIs. Additionally, although the predominant approach employed to present emissions results does not align with the GHG Protocol categories, it appears to be more effective at highlighting emission hotspots and the visualization of results.

Based on these findings, best practices of Scope 3 procurement emissions calculation in HEIs should prioritize on transparency, clarity and consistency while providing context specific to the reporting HEI, both on an individual and collective level. The differences identified among HEIs' calculation practices, namely in the first three areas (variations in GHGs considered, divergent organizational and operational boundaries and different calculation approaches to specific goods and services), highlight the diverse approaches HEIs employ when accounting their procurement emissions. These differences may stem from various considerations, including values-based choices to lower HEIs’ emissions or practical factors like operational structures and data availability. Therefore, it is crucial for HEIs to be explicit and clear when presenting information related to the boundaries of their procurement emissions, as well as the rationale behind these choices. Furthermore, maintaining a consistent scope when accounting for procurement emissions (unless expanding the scope to include additional sources) is essential for transparency and effective performance tracking. This is particularly important when HEIs report emissions associated with substantial expenditures, which may exhibit considerable variability over time and require explanations. Additionally, the variations identified in HEIs' emissions calculation practices in this study emphasize the importance of establishing a standardized framework for reporting GHG emissions in HEIs. Such a framework would facilitate meaningful comparisons of HEIs' performance in climate actions.

5.4.2 Key Takeaways: Current and Best Practices on Calculation Method

In terms of calculation method, this study demonstrates that most researchers employ the EEIOA method over a process-based LCA or a hybrid of both to calculate procurement emissions in HEIs. Based on the strengths and weaknesses discussed for each calculation method, it is advisable for HEIs to initiate their Scope 3 procurement emissions calculations using the EEIOA method. This approach allows for an initial understanding of emission sources and demands less time and effort compared to the process-based LCA. Importantly, there is some evidence suggesting that EEIOA identifies the same emission hotspots as the process-based LCA (Grekin & Benson, 2022; Namovich & Ostrander, 2022).

As HEIs progress and become ready to take more actions to reduce their procurement emissions, they can transition to hybrid estimates, utilizing the process-based LCA for specific hotspots to achieve more precise results. This approach facilitates accurate tracking of emissions performance, particularly when purchasing from low-carbon vendors and suppliers. It is worth noting that the GHG Protocol also recommends using the process-based LCA or even more specific methods, such as the supplier-specific approach, for sources that significantly contribute to total emissions (GHG Protocol & Carbon Trust, 2013). Alternatively, HEIs can perform procurement emission estimate using only PA to enhance the specificity of their estimate and compare the estimate produced by the two methods if resources permit. Ultimately, HEIs would get the most specific results when they perform their estimate using supplier-specific data. However, it's essential to acknowledge that this approach poses substantial challenges to both HEIs and their suppliers, primarily due to constraints in resources and data availability.

The guidance for choosing a calculation method regarding food procurement closely mirrors that of general procurement. While there may be an inclination to lean towards process-based LCAs due to the accessibility of emission factors for various agricultural practices, it's important to acknowledge Grekin & Benson's (2022) discovery, which demonstrates that both process-based LCAs and EEIOA produce identical hotspot identifications, as previously discussed. In light of this, HEIs have the flexibility to employ either approach when the objective is hotspot identification.

Further research is required to compare the emissions hotspots identified by EEIOA and PA, as well as to assess the emissions magnitudes resulting from these two methods. Currently there is limited evidence suggesting that both methods yield similar hotspot and mixed findings regarding magnitude. Thus, HEIs are advised to remain vigilant regarding new studies comparing results between EEIOA and PA for both general procurement and food procurement emissions. Monitoring these developments in the field will offer valuable insights into whether results align or differ in hotspot identification and magnitude.

5.4.3 Key Takeaways: Current and Best Practices on the Reduction of Procurement Emissions

This study highlights that the HEIs reviewed employ SP as the primary approach to reduce emissions embodied in purchased goods and services, over the reduction of consumption, although there are limited and mixed results on its effectiveness. They integrate SP into their campuses using three different approaches: (1) a green purchasing policy, (2) integration into the general purchasing policy and (3) guidelines on sustainable purchasing. Actions in SP are commonly facilitated with some sort of materials that highlight the more sustainable choices or sustainable certifications that purchasers should look for when making their purchases. Most of these programs and policies lack significant authoritative weight, except for ESF, which has a mandatory green purchasing policy that originates from the local government.

Given these findings, it is recommended that HEIs adopt a more balanced approach in reducing procurement emissions, through both the reduction of consumption and sustainable procurement instead of a sole focus on the latter. The reduction of consumption should go beyond mere equipment and consumables and encompass other goods and services, such as construction, based on the HEI's own data on procurement emissions. However, consumption related to construction prompts broader questions about balancing HEIs' growth aspirations and sustainability. Formal and mandatory SP guidelines with well-defined goals and action plans offer clear advantages over voluntary SP policies. However, the effectiveness of both types depends on factors such as engagement, training, regular review, recognition schemes, and budgetary considerations for successful SP implementations. Voluntary SP guidance also has its own value as educational tools to promote awareness on SP in HEIs that lack leadership support for formal SP policies. In addition, several criteria are vital to the development of tools to support SP actions. These tools should be proactive, targeting the most frequently used purchasing platforms and should address procurement emissions, particularly the hotspots identified through the emission data.

6 Case Study: York University

6.1 Background Information on York University

York University is a public research University located in Toronto, Canada with 59,000 students, two campuses combined of 500 acres and a third in development (York University, 2023b). It is the third largest university in Canada by student enrolment. It has received some global and domestic recognitions on the sustainability front, but they are not truly outstanding. It received an Impact Rankings of 40th in 2023 by the Times Higher Education out of 1590 universities based on its efforts on research, stewardship, outreach and teaching of the United Nation Sustainable Development Goals (SDGs) (Times Higher Education, 2023). It should be noted that the ranking is based on the performance of the top three performing SDGs and SDG 17 Partnerships for Goals. SDG 12: Responsible Consumption and Production is one of York University's top three SDGs that is most directly related to procurement where the remaining are SDG 10 Reduced Inequalities and SDG 11 Sustainable Cities and Communities. York University was also ranked 89th in 2023 by the specific Impact Rankings on climate action, where the top performing Canadian University, University of Victoria ranked 3rd on the list. In addition, York University has been recognized as Canada's top 100 greenest employers for the 11th consecutive years in 2023 by Mediacorp Canada (Mediacorp Canada, 2023). Others on the list include entities in both the private and public sector such as Metrolinx who has been criticized for the lack of transparency and disinterest in public opinion on environmental impacts posed by its projects (Draaisma, 2022; M. Robinson, 2021; Spurr, 2021).

On the other hand, York University's effort on sustainability and climate actions has been underwhelming. While the institution has committed to achieving net-zero emissions by 2040 and a 45% reduction in direct and indirect GHG emissions by 2030 (using 2005 as the baseline year), it falls short in terms of transparency regarding its GHG emissions and a detailed plan to attain these reduction goals (York University, 2023a). York University has not disclosed its annual GHG emissions data, offering only broad strategies for reduction on its website. These strategies encompass carbon emissions reporting, decarbonization via energy management, and building retrofits. A comprehensive climate action plan is still in development. Regarding procurement emissions, York University's sustainability strategy includes the integration of sustainability into procurement, and it has introduced a social procurement policy. However, this policy predominantly addresses the social aspect of sustainability rather than environmental concerns.

York University's procurement system can be categorized into decentralized and centralized procurement (York University, n.d.-c). Purchases under $25k are considered decentralized procurement as they do not go through the central procurement office. These transactions occur through Sm@rtbuy, York University's online marketplace, PCard (the York University purchasing card) or external means. Purchases between $25k and 50k may go through the central procurement office for procedural purposes depending on the type of vendor and purchase order. The cut-off between decentralized and centralized procurement is generally considered to be at $50k where purchases above $50k must go through the central procurement office.

6.2 York University: Current Practices on the Accounting of Scope 3 Procurement Emissions

In 2021, York University began the estimation of its entire greenhouse gas (GHG) emissions, encompassing Scope 1 to 3 emissions. The estimation covered Scope 3 emissions for the years 2016 to 2020, including procurement emissions. The final GHG emission report was submitted in early 2023, however, it has not been made available to the public. Consequently, I had limited access to the official report, only gaining insight into the measurement of procurement emissions from interviews with Interviewee A.

6.2.1 Calculation Practices and Method

York University estimated its full Scope 3 procurement emissions using EEIOA sectoral average emission coefficients obtained from Statistics Canada and its non-salary expenditure data. Statistic Canada derives the emission coefficients from their input-output table, indicating that York employed an EEIOA model built by others (Statistic Canada) in its estimate (Statistics Canada, 2023). It is unclear whether the input-output table is of a multi-regional nature, but it includes domestic industries combined with imports and exports.

York University attempted to consider all seven of the GHG as directed by the GHG Protocol but faced limitations due to the availability of the emission factors. The factors published by Statistic Canada only include carbon dioxide, methane and nitrous oxide (Statistics Canada, 2023). The rest of GHGs were excluded due to insufficient data for emissions allocation among industries.

Scope 3 emissions produced by York University were categorized into 12 distinct categories, with categories 301-303, 307, and 310 directly related to procurement (Table 3).

Categories 301-303 pertain to capital spendings, including the procurement of capital (301), maintenance of capital (302) and the procurement of capital as a service (303). Category 307 reflects solely food procured by York University, excluding food procured by York's vendors and 310 includes all other procurements. Notably, the calculations did not include emissions associated with food procurement from contracted vendors or other downstream Scope 3 emissions (Table 4). This omission occurred because York University faced difficulties in quantifying these categories to the same extent as the upstream categories. In contrast, as all non-salary expenditures were employed in the calculation, the estimate included procurement emissions beyond academic purposes such as auxiliary services (residences) and external research grants. These sources of emissions were categorized based on associated fund numbers with each fund’s contribution to the Scope 3 emissions presented. In terms of calculation practices, York did not allocate large and/or capital spendings over a certain period but rather to the year of the capital expense. This approach resulted in capital spending showing the most variability among categories of procurement emissions.

York University employed Microsoft Access to estimate its procurement emissions. While the matching process between expenditure data and sectoral average emission factors was described as labour intensive, it only needed to be performed once unless changes are made to expense categories or sectors. York’s expenditure categories are very specific and general simultaneously with around 1000 categories used per year. For instance, there is a category for food and beverage disposable supplies and another category for general travel/meals/hospitality. The latter is probably combined into one category as they are all relevant to business travel and hosting guests. The sectors available for emission factors on the other hand are less specific compared to York's expenditure categories (117 sectors; Statistics Canada, 2023). Hence, Interviewee A matched up to 3 sectors to each of the expenditure category, using the average of the sectoral emission factors for the estimate. To ensure precision, two additional graduate students participated in the matching process to arrive at a consensus. The matching process considered the magnitude of each expenditure category, from the category with the highest value to the lowest.

Moreover, considering that York University houses the Ecological Footprint Initiative, a group responsible for producing the annual National Ecological Footprint and Biocapacity Account, the university also undertook the estimation of its ecological footprint. It included goods and services sold on campus by vendors using sampled data.

Table 3. York University's upstream Scope 3 emissions categories (Miller, 2023)

Scope 3 up-stream	301	YorkU capital expenses (fund 700)
	302	YorkU repair and maintenance
	303	YorkU leases of buildings, equipment, software
	304	YorkU air travel
	305	YorkU reimbursed mileage
	306	YorkU other travel expenses
	307	YorkU purchased hospitality including food
	308	Solid waste collected from campus (net of diversion)
	309	YorkU carbon offset purchases (emission offset)
	310	YorkU other goods and services purchased
	311	Commuting to campus by driving
	312	Commuting to campus by transit

Table 4. York University's downstream Scope 3 emissions categories (Miller, 2023)

	Investigated but not included in total	
Scope 3 down-stream	313	Other food and vending purchased on campus
	314	Other retail and other commercial activity on campus
	315	Emissions from York investments including endowments

6.3 Gap from Best Practices and Exploring Future Opportunities

As previously mentioned, York University has not made its GHG emissions report public, limiting my ability to evaluate York University's reporting of Scope 3 procurement emissions against the best practices outlined in section 5.2 of the report.

One notable aspect of York University’s accounting practices is the absence of public publication of their GHG emissions report, despite having completed the work (the draft was presented early last year, and the final version was presented early this year). The report remains accessible only to select members of York University. The exact underlying reason is unknown but studies suggest that social and environmental disclosure and carbon emission disclosure are associated with corporate reputation (Allam & Diyanty, 2020; Cho et al., 2012; Cho et al., 2015). Organizations with a positive reputation want to maintain it and keep the legitimacy that is associated with the reputation from its stakeholders. Thus, potential damages to its reputation could be a factor hindering York University from publishing their GHGs emission. Nonetheless, publishing the GHG inventory could also demonstrate York’s dedication and commitment toward GHG reductions, particularly when the other two universities located in Toronto have only published their partial emissions. Toronto Metropolitan University did not include procurement emissions in its Scope 3 emissions and University of Toronto omitted its entire

Scope 3 emissions (TMU, n.d.; U of T, n.d.). There is a high possibility that York University's emissions will appear to be higher than the two mentioned as they did not publish their full emissions. However, being the pioneer among Toronto universities to publish its entire emission inventory, particularly Scope 3 emissions, during a time of widespread recognition of the importance of Scope 3 reduction in mitigating climate change, could positively influence York's reputation.

In addition, the delay in publishing York's emissions could also result from competing objectives and bureaucratic constraints. There may be other objectives that take precedence over discussions regarding when the GHG inventory should be published or climate actions in general. The bureaucratic governance structure at York University could further exacerbate the delay. It should be noted that these factors are not unique to York University but HEIs in general as they have been mentioned as barriers to SP in HEIs (Leal Filho et al., 2019). Hence, practitioners should be aware of how these factors may affect their plan to reduce procurement emissions.

6.3.1 Number of GHGs Accounted for

On an individual level, it is reasonable for York University to include only the GHGs covered by the emission factors obtained from Statistics Canada considering potential budget and staff constraints. Since even Statistics Canada, a federal agency dedicated for producing data faces constraints in data collection and allocation for HFCs, PFCs, SF_6 and NF_3, it is uncertain whether York University could possibly supplement the emission factors themselves for the missing GHGs even if they have the resources. Alternatively, York University can look for emission factors for the Canadian economy produced by other agencies that include all seven GHGs as directed by the GHG Protocol. Statistic Canada has difficulty allocating the data for fluorinated gases, likely due to their small quantity compared to CO_2, CH_4 and accounting for only around 2% of total GHGs produced in Canada (Environment and Climate Change Canada, 2021). Despite the smaller quantity, fluorinated gases are significantly more potent (140 – 23,900 times) than CO_2 and are generated from industrial processes such as metal and electronics manufacturing and the use of refrigerants (Environment and Climate Change Canada, 2021; EPA, 2009; Statistics Canada, 2023). This signals some level of importance to include fluorinated gases in the accounting of York's procurement emissions, particularly since electronics is one of the most frequently purchased products in volume and the procurement emissions considers the cradle to gate emissions associated with the purchased products and services. In this case, York University could assess major sources of the fluorinated gases in products and services they procure, considering the expenditure and volume. If York University purchases a significant quantity of such products or services, it's worth investigating how to estimate the embedded emissions of fluorinated gases due to their high potency. Even if York University decides not to estimate these emissions, it should be transparent about their omission.

Moreover, the omittance of fluorinated gases in York's emission estimate suggests that other HEIs with limited GHG coverage in their estimate could also face constraints due to the availability of emission factors that cover all seven GHGs. This is overlooked in the best practice section and it exposes a gap between the GHG protocol and the actual data accessible for conducting emission estimates (Robinson et al., 2018). This discrepancy is noteworthy, given that the EEIOA method is already considered to be the most straightforward approach for data collection out of the three discussed. Furthermore, this situation raises another question of how HEIs should approach the missing GHGs when they are not included in the emission factors selected. It calls for an adjustment or clarification within the GHG Protocol itself to address such gaps and provide guidance on handling missing GHGs in the estimation process. It also urges statistical agencies to examine how the emissions of fluorinated gases can be allocated across sectors or if there are alternatives method to estimate the embedded emissions even with the data gap. This is critical as both public and private organizations are turning their attention to Scope 3 emissions in climate change mitigation.

6.3.2 Calculation Boundary

Based on the interview with Interviewee A, it seems that York University presented their operational boundary clearly in the accounting of Scope 3 procurement emissions in a table format. Table 3 and Table 4 demonstrate what is included and excluded in the estimate of procurement emissions. In addition, Interviewee A went over the funds (i.e. organizational boundary) included in the estimate through the interview. However, it is unclear whether the funds were presented clearly in the report. They should be illustrated in the report so that readers can have a clear understanding of the organizational boundary employed for the emission estimate. Notably, the exclusion of food purchased by contracted vendors demonstrates a recurring problem with data accessibility. This is discussed in greater detail in the reduction strategies section.

6.3.3 Calculation of Specific Types of Procurement

As discussed, York University allocated all procurement emissions to the year of the expense, leading to high variability in the emissions associated with capital expenditures. As the report was not accessible, it is unclear whether there were text explaining the variability in the procurement emissions associated with capital spendings and whether the particular investment that led to the increase in procurement emission was highlighted. While there is still debate on what is the best practices to calculate large spendings, the highly variable emissions associated with capital spendings could pose as a challenge for York in developing meaningful targets for procurement emissions as discussed. It may render the targets meaningless if a “high” emission year is selected as the baseline. In contrast, using a “low” emission year as the baseline may render the target too aspirational. Setting separate targets for general procurement and capital procurement may help in some sense in planning the trajectory of emission reduction for general procurement emissions. However, it doesn’t address the issue of the highly variable emissions embodied with capital spending. Perhaps setting the base year as the average emission of a few years would help as well as allocating expenses over a certain time period.

6.3.4 Presentation of Scope 3 Categories

York University categorized capital goods and other procurement in greater details compared to the GHG protocol which only separates capital spendings from general procurement spendings (Table 3). York university had categories for the maintenance of capitals and procurement of capital in a form of service. While this further categorization may provide a detailed view of how each capital category contributes to total procurement emissions and could be useful for developing reduction strategies, combining all other types of procurement besides food into one category may not be as effective for readers in understanding emissions hotspots in terms of types of products or services. This could be mitigated by presenting the hotspots of procurement emissions in Scope 3 upstream categories similar to those shown in Table 3.

6.3.5 Calculation Method

York University's choice of calculating method for Scope 3 procurement emissions aligns with best practices in calculation method discussed, using the EEIOA. However, the use of EEIOA emission factors exposes the lack of specificity in the EEIOA method, with an almost 10:1 ratio between the expenditure categories and the sectoral emission factors. Employing a hybrid method that combines EEIOA sectoral average emission factors and PA emission factors could improve the specificity of the emission estimate. However, that would require some process-based emissions factors and quantity-based activity data which are not collected currently for procurement. Hence, this transition would require supporting policies and cooperation from the procurement team, particularly on the collection of activity-based data and potentially supplier specific emission factors. This is discussed in more detail in the reduction strategies section.

6.4 York University: Current Practices on the Reduction of Scope 3 Procurement Emissions

6.4.1 Reduction of Consumption VS Sustainable Procurement

York University primarily focuses on SP to reduce Scope 3 procurement emissions. SP is embedded in procurement policy, guidelines, and ethical conduct at a high level. Presently, there's no formal approach in place to reduce procurement emissions through consumption reduction (the other variable in (Equation 1)) although York also has an assets transfer program across departments. However, York university is currently developing tools designed to address the entire lifecycle of products, as they are updating their sustainable policy, strategy and net-zero plan.

6.4.2 Formal Policy VS Voluntary Guidelines

York University's current SP policy falls between ESF and Yale in terms of its completeness. While SP is formally integrated into procurement policy, procedures, and the code of ethics, it is recommended rather than mandatory (Table 1). However, York's policy lacks specific targets, action plans, or evaluation mechanisms for SP implementation.

6.4.3 Tools to Support Action in Sustainable Procurement

York University supports SP on two fronts, product and service procurement, and vendor selections. Efforts related to product and service procurement are still in development. To build effective tools, the Sustainability Office is assessing major purchasing categories by expenditure amount (construction) and quantity (computers and paper) and investigating the type of guidance the York community needs for purchasing. In contrast, more progress has been made in integrating SP into vendor selections. This includes incorporating environmental and sustainable objectives in procurement policies, procedure and code of ethics at a high level, as well as environmentally sustainable criteria in vendor contracts.

6.4.3.1 Procurement of Products and Services

York is planning several tools to support SP in product and service purchasing across campus. Firstly, they are working on an ecolabel program that offers recommendations for purchasers, similar to certification standards, one of the five strategies employed among other HEIs. When asked about which environmental objective York will focus on when developing the program and if it will be to lower the embedded emissions, interviewee B indicated that it will probably not go into the technicality of different faucets of environmental objectives, but rather ones that are easy to use by the audience.

Secondly, York University aims to develop tools that do not only emphasize sustainability in the acquisition phase (the procurement phase) but the entire lifecycle of products. This is what interviewee B responded with when asked about whether York University would develop something like a product guide for frequently purchased products (like ESF) to engage purchasers on SP; "We have seen it. We want to do one better basically". This may include prioritizing products that are durable and reusable.

Thirdly, York University is exploring options with vendors on its online purchasing platform Sm@rtbuy, although it is still in the early stages. This could include highlighting sustainable products, but the specifics are uncertain as vendors manage the punch-out website.

Although this falls outside of my research, York University is developing a dashboard tool for their business travels. Business travel falls under one of the 15 Scope 3 emissions categories and is considered a purchased service at York. Nonetheless, I do not include it in my research as it is beyond the first two categories of Scope 3 emissions according to the GHG Protocol. York University is currently opening up data streams for business travel with the goal of calculating total carbon cost associated with business travel to influence business travel decisions.

6.4.3.2 Vendor Selection

York University has made more progress in integrating SP in vendor selections compared to products and services purchasing, through approaches like including environmentally sustainable requirements in contracts with vendors. For instance, they included specific language on the reduction of GHG emissions through the purchase of local and sustainable products in the contract with their new food service provider. Alternatively, the contract for office coffee included high standards in waste reduction and the use of Fairtrade coffee.

Furthermore, criteria or standards included in tenders are often product-specific and can involve ISO standards, ecolabel requirements, and packaging reductions. Sometimes they are added in the form of supplier qualification questions on criteria that are more difficult to quantify by York. An example of the question would be for suppliers to answer how sustainably they are operating. Though, interviewee B also admitted that environmental criteria are usually added for larger tenders but not as often as they want, just as often as they can. Regrettably, the reason for that was not discussed in the interviews but perhaps it is one of the barriers identified in the main challenges section. Moreover, York University is examining the feasibility of mandating environmental standards for certain types of procurement. It is also planning to include sustainability and environmental criteria in all future contracts.

In addition to working with its individual suppliers, York University is also advocating for SP in collaborative purchasing agreements. York University is persuading its collaborative purchasing partners to incorporate sustainable criteria into collaborative purchasing agreements. These agreements leverage the purchasing power of collective entities to negotiate for the best value. Hence, when more of the partners are on board for SP, there is huge potential to achieve SP through this type of agreement.

6.5 Gap from Best Practices and Exploring Future Opportunities

The evaluation of York University's procurement emissions reduction strategies also faced similar challenges in accounting practices as the strategies are mostly still in development. The evaluation is based upon information collected from interviewing Interviewee B and C and York University website which may not have reflected the strategies in full detail.

6.5.1 Reduction of Consumption VS Sustainable Procurement

While York is planning on using a multi-prong approach to address its procurement emissions and developing tools that target the entire lifecycle of products and services instead of solely focusing on sustainable procurement, it is a missed opportunity that York's asset surplus transfer program does not seem to be widely known and well supported. Such a transfer program is something that all other HEIs examined have in place, most commonly offered through a web portal that resembles an online store. In York's case, it is supposed to be available through the Procurement Services website as described through the Surplus Asset Disposal (Procedure), yet it is not found on the website (York University, n.d.-b). When asked about whether York has this kind of product transfer program in place, Interviewee C responded that it is something to be considered, suggesting the absence of knowledge of this program/policy. This is particularly relevant considering York's size, being the third largest university in Canada by student enrolment, suggesting the high probability of products overlap across faculties and potential to reduce procurement emissions through consumption reduction. However, it should be noted this is an under-researched area with minimal empirical support on the effectiveness. Thus, it would be interesting to perform research on the utilization rate and effectiveness of this type of program in HEIs to determine whether York should revitalize this program. As there may not be data available on the effectiveness of product exchange programs, York University could reach out to HEIs examined in this paper on their experience with these programs.

There are other potential opportunities for reducing procurement through reducing consumption besides a product transfer program and buying durable products. They include emphasizing the option to repair when products are damaged to extend product lifespan instead of throwing them into the trash or even recycling them. Other approaches based on behavioural science are explored in subsequent sections.

Moreover, it should be noted that York University currently has several construction projects underway or recently completed, including the new Markham campus that is expected to open in 2024 and the new School of Continuing Education building (York University, n.d.-d, 2023c). Despite these structures being designed to meet green building standards (LEED Gold, Leadership in Energy and Environmental Design), their construction contributes to procurement emissions on their own and generates additional demand. The completion of these projects is imminent, but it is imperative for York University to identify and consider the potential procurement emissions associated with new infrastructure decisions. Reflection on the appropriateness of the institution's priorities, particularly their expansion approach, is also warranted in the context of the current climate crisis.

6.5.2 Formal Policy VS Voluntary Guidelines

York University's SP policy stands out in the HEIs examined as it is one of the few HEIs that has formally integrated SP into its policy somewhat meaningfully, even the integration was done in a high-level. Additionally, although the current SP policy is not mandated, the fact that York University is studying the feasibility of mandatory environmental standards of specific types of procurement demonstrates dedication and commitment in implementing SP than most of the HEIs examined. However, the effectiveness of the current policy is questionable due to the absence of targets, action plans, or evaluation mechanisms. Consequently, York may face the challenges previously identified concerning the lack of supporting mechanisms.

6.5.3 Origin of Sustainable Procurement Policy/Guidance

Like most of the HEIs examined, York's SP policy stems from its Sustainability Strategy 2017 as one of the strategic goals (York University, 2017). The goal relevant to procurement is rather vague, potentially explaining the high-level integration of SP into its procurement policy and the lack of supporting tools for SP implementation. York's case underscores the importance of governmental sustainable procurement requirements and public pledges, as seen in ESF, which maintains stringent standards and a detailed SP policy.

6.5.4 Tools To Support Action in Sustainable Procurement

Only one of the tools currently in development takes a data-oriented approach. However, such a tool addresses business travel and that is out of the scope of this paper. Hence, there are opportunities to enhance data collection for procurement emissions mitigation and incorporated data into tools planning. York University currently relies on spend-based data to estimate its procurement emissions as this is the only one available. The unavailability of quantity-based data restricts York's ability to employ a hybrid method to improve the specificity of its results. Collecting quantity-based or mass-based activity data would be the first step required to transition to a hybrid method for procurement emission estimate. Regrettably, it is unclear what the current challenges are to recording quantity-based data at York University. Without more information, it is difficult to pinpoint how to address these challenges and propose suggestions. Nonetheless, resource constraint may play a role as a barrier. Considering my personal experience on the receiving end in a small-medium enterprise, the quantity received from purchasing is one of the required components when recording any purchase. It could also be retrieved from the purchasing records. Therefore, York can try collecting quantity-based data through either one of the mechanisms in only a small group of products or services as a pilot project. Nonetheless, the data in the receiving end should be more accurate considering potential errors from suppliers.

6.5.4.1 Procurement of Products and Services

There are both weaknesses and strengths in the tools York University is developing to support SP. Firstly, the ecolabel program that York is developing is prone to problems discussed where certifications may not directly tackle the embodied emissions of products and services. However, it may do so indirectly perhaps through ecolabels for zero-waste or products produced from recycled material. As there are expansive topics in the environmentally friendly realm or the sustainability realm, York University should clearly state the order of priorities in SP for effective emissions reduction. For instance, UC define its priority for SP based on its waste reduction priorities which is to "reduce unnecessary purchasing first, then prioritize purchase of surplus or multiple use products, before looking at recyclable, compostable, or otherwise sustainable products" (UC, 2021:6). In addition, York University should select ecolabels with caution as they could be prone to greenwashing as interviewee C suggested. For instance, the Sustainable Forestry Initiative (SFI), North America's largest forest certification system, is currently under investigation by the Canadian Competition Bureau for falsely claiming that the certified practices are sustainable. Environmental groups argues that there is actually no requirements for sustainable logging by the certification or on-site evaluation for sustainable practices (Wei, 2022). Therefore, York University should examine the standards and the entire certification process selecting ecolabels for recommendations.

Secondly, tools that tackle the entire lifecycle of products and prioritize reusable and durable products would address procurement emissions through reducing the consumption of products, something that is currently missing in York's approach. However, it is difficult to assess whether such tools are effective for reducing procurement emissions without more information on the potential tools. On the other hand, it is assumed that multiple tools would be required to address the entire lifecycle beyond the acquisition stage with various stages in a product's lifecycle. It would be interesting to see whether voluntary guidance at every stage of the lifecycle would lead to fatigue toward sustainability and which stage in procurement would be affected the most from such a fatigue, if that is the case.

6.5.4.2 Vendor Selection

Like product and service procurement, environmental requirements in York University's vendor selection approach seem to lack clear priorities. Establishing a hierarchy of priorities would provide a clearer sense to the procurement staff of what they should strike for when looking for vendors instead of accepting any environmental criteria as a win.

Additionally, a list of priorities would serve as guidance for procurement staff when incorporating environmental requirements in tenders and contracts. Currently the standards are product specific, and it is not clear whether there are guidelines for staff to refer to when procurement staff select the type of environmental criteria to include in tenders and contracts. This list of priorities could streamline the process, especially when staff may not be familiar with specific environmental requirements for a certain type of product and services. It can also guarantee a minimum level of requirements embedded for contracts with environmental requirements. Though, the lack of an official guidance of such may provide the flexibility needed in the current stage of SP implementation. In terms of the examples of environmental requirements, it seems that York University could be constrained by the availability of formal environmental standards like ISO standards and ecolabels as they are easier to verify.

6.6 York University's Main Challenges to Reduce Procurement Emissions

York University faces three primary challenges in reducing procurement emissions through SP, as identified by Interviewees. These challenges are relevant to the reduction of procurement emissions as a whole, including the accounting of procurement emissions.

6.6.1 Challenges Related to Data

Firstly, York University faces challenges relating to data and particularly in data accessibility. Interviewee B raised concerns about understanding the data required for SP and emission reduction, the availability of this data, and the complexities of collecting detailed data. Only one vendor currently provides emissions data, limiting York's ability to precisely assess procurement emissions and devise appropriate reduction strategies. This also signifies the difficulty in accessing supplier specific emission factors. The data-related challenge experienced by York mirrors findings from Robinson et al. (2018). One potential reason for this challenge is the complexity in the supply chain where HEIs are the final consumer, purchasing the finished product (Robinson et al., 2018). Another potential reason suggested by Interviewee A is that the current data collection system focuses primarily on financial accountability over other data like quantity that is essential for tracking procurement emissions.

6.6.2 Challenges Related to Awareness and Engagement

Secondly, there's an awareness challenge regarding embodied emissions in procurement, both on the consumer (York University) and supplier sides. Consumers often overlook the emissions associated with the products they buy, with the focus primarily on energy use (Scope 1 and 2 emissions). This supports Leal Filho et al. (2019) with the lack of knowledge being one of the main barriers to SP. Even when the impact of consumption is recognized, habitual behaviors and convenience often take precedence over considering emissions (Aibana et al., 2017). This issue is exacerbated when individuals are spending institutional funds, leading to a principal-agent problem (Soudry, 2007).

A second issue on the consumer's side relates to engaging purchasers to procure sustainably. This problem is more relevant in decentralized procurement as they do not go through the central procurement office for approval and are currently up to the purchaser as long as the procurement falls within the assigned budget and general legal requirements. In addition, there are also questions on how policies and tools can support the numerous types of products and services being purchased by York University.

On the other hand, suppliers also face the problem of lack of awareness in Scope 3 procurement emissions in general, giving rise to limitations in data availability. This is particularly relevant to small-medium enterprises and potential conflicts in the social and environmental faucets when pursuing overall sustainability, as suggested by Interviewee B.

6.6.3 Challenges Related to Financial Considerations

The last challenge is one that is almost always present in environmental discussion, financial considerations. Interviewee C highlighted that prices are still an essential factor in procurement, particularly in those with greater scale and higher expenses. Despite the examples provided above, life-cycle analysis is not often embedded into decision-making in procurement. This also aligns with Leal Filho et al. (2019) with financial constraints being one of the barriers to SP in HEIs.

6.7 Exploring Potential Opportunities

Both common and specific potential opportunities exist to address the three challenges identified in the last section regarding the reduction of procurement emissions at York University. I discuss the common approaches first before elaborating on the specific strategies for each barrier. The opportunities discussed earlier on improving the accounting of procurement emissions overlaps with addressing the challenge related to data and they are not repeated here.

6.7.1 Monitoring and Feedback Mechanisms

Firstly, York University should set up monitoring and feedback mechanisms to accompany procurement emissions reduction policies and tools. As there are uncertainties in the details of procurement emissions, how the York community will respond to such policies and tools and the lack of concrete guidance on the implementation of SP to reduce emissions, having a monitoring and feedback mechanism would allow York University to continue to improve its policies and tools in the reduction of procurement emissions. This could lend more formality to these strategies and signal commitment to procurement emissions reduction (UNEP, 2017). Rieg et al. (2021) provide support to this suggestion as they underscore the value of reflective actions in driving institutional changes in HEIs. The review performed by UNEP on global sustainable public procurement (SPP) may provide insight to York on developing a monitoring system (UNEP, 2017). It identifies three main areas of SPP monitored by government, common tools used to gather data on SPP implementation and the indicators employed to assess SPP outcomes. Moreover, the case study on the City of Ghent in Belgium demonstrates the use of monitoring and feedback mechanisms along with other quality management techniques in implementing SP in decentralized procurement (UNEP, 2017). Techniques that York University can borrow from include setting up clear targets, using management dashboards to measure process and deciding on key performance indicators.

6.7.2 Systems Thinking and Leverage Points

The suggestion of a monitoring and feedback system or a form of adaptive approach is based upon a larger opportunity associated with systems thinking, a discipline that deals with complex problems. Uncertainty, normative bias, and a multitude of legitimate perspectives are some attributes of complex problems and they resemble the case of procurement emissions at York University (Functowicz & Ravetz, 2003:1). Hence, York University can explore the use of systems thinking to approach the reduction of procurement emissions. Systems thinking is also relevant as the reduction of procurement emissions essentially necessitates a shift in values toward considering environmental and social externalities in addition to monetary costs. (e.g. embodied GHG emissions, life-cycle impacts). Meadows (2008) identifies leverage points to effect changes in a system which could inform York's strategies. In addition, Rieg et al. (2021) suggest embedding sustainability in the institutional framework and employing a pluralistic approach to effect systemic changes in HEIs. The inclusion of Professor Martin Bunch, a specialist in complex systems, on York's President's Sustainability Council (an advisory body on sustainability) suggests that York may already be on the right track, but there could be room for further refinement and optimization.

6.7.3 Knowledge Sharing

Knowledge sharing, both within York University and across HEIs and even with the private sector, presents an opportunity. York can enhance the effectiveness of its knowledge-sharing mechanisms, such as the President's Sustainability Council, by evaluating and perhaps removing participation barriers, and ensuring the presence of experts who can address the specific challenges faced by York. The essence lies in how York can leverage its position as a knowledge hub to tackle problems it is experiencing. Outside of York University, it is extremely beneficial to exchange ideas with other HEIs on the reduction of procurement emissions. This applies to all three of the challenges mentioned. For instance, it has been observed that two

Canadian HEIs (University of Victoria and Simon Fraser University) have started using EcoVadis, a sustainability rating platform to access and evaluate suppliers' sustainability performance (Srinivasan, 2023; University of Victoria, n.d.). It would be interesting to learn from their experience with EcoVadis and whether it helps with their data collection. The AASHE community forum is also a good place to connect with sustainability practitioners in other HEIs but the response rate varies depending on the topic. A potential tool library on SP implementation and the reduction of procurement emissions would be considered useful not only for York University but other HEIs as well. Beyond HEIs, there may also be opportunities to leverage the connections the Business School of Schulich has with private actors and to exchange ideas on procurement reduction. It is important to note that the approaches employed by private actors may not function well in York since York is a public organization and consumers of final products. But perhaps it is still worth exploring ideas particularly on the data collection front.

6.7.4 Students Involvement

Two promising opportunities exist for involving students in supporting policies and strategies aimed at reducing procurement emissions, particularly addressing the challenges related to data accessibility and awareness. Firstly, the Schulich School of Business is set to introduce a graduate course on sustainability reporting, which is expected to include Scope 3 emissions as a mandatory component in various disclosure standards, as discussed (Delphi Group, 2022). This presents an intersection where improvements in data accessibility and collection for procurement emissions can be explored.

Secondly, there are opportunities for collaboration, particularly with marketing and psychology students to promote the awareness and engagement of SP, and the reduction of procurement emissions within the York University community. Given that the private sector effectively employs marketing techniques and behavioral science to promote consumerism, York University can experiment with a concept of "reverse marketing" through these students to advocate for reduced consumption and SP. This could take the form of case competitions integrated into marketing and psychology courses. Although there may be questions about the Schulich School of Business's involvement, considering it functions somewhat independently from York University, its growing emphasis on sustainability as a core research area and its alignment with sustainability goals in the private sector could provide motivation for their participation (Schulich School of Business, n.d.).

6.7.5 Vendor and Supplier Data Collection

York University can tackle data related challenges in the vendor and supplier selection process. For instance, UC requires their vendors to follow their guidelines on green spend by including their Sustainable Procurement Policy and Guidelines on contracts and leases (UC, 2021). While that may be too ambitious for York University for now, York University could consider including specific language in data collection requirements when negotiating contracts with vendors and suppliers. This is a viable option, given that Interviewee B mentioned a similar practice for social procurement, and Interviewee C indicated the inclusion of climate-related clauses in vendor contracts. Notably, York might face inconsistent supplier emissions data after expanding its data streams (UN Global Compact Network UK, 2022). Therefore, it is good practice to request suppliers to use a consistent accounting method when reporting their emissions when York first communicates such a need with their suppliers. In addition, the use of an external data collecting platform may help York collect supplier-specific data. As discussed, other HEIs are turning to EcoVadis to help them collect data in their supply chain (Srinivasan, 2023; University of Victoria, n.d.). Another option is the CDP, a global NGO that promotes disclosure in supply chain emission. It is frequently employed by multinational corporations such as Microsoft and Walmart for suppliers' Scope 3 emission (CDP, 2023b; Hettler & Graf-Vlachy, 2023). However, it is worth considering the cost associated with these platforms and the methodology they employ when selecting a platform to support York's data collection process.

6.7.6 Behavioral Science Approaches

Moreover, York University can experiment with the application of behavioural science approaches to promote the engagement of SP and the reduction of procurement emissions, in addition to the conventional route on knowledge dissemination. The following suggestions arises from the five behavioural barriers to sustainable consumption identified by (Table 5; Aibana et al., 2017).

Targeting the Sm@rtbuy platform, which allows for decentralized procurement, is an ideal starting point. One strategy involves making sustainable products and services the most straight-forward choice compared to conventional products and service (Aibana et al., 2017). This could involve prominently featuring sustainable choices at the top of search results. Using physical cues to remind purchasers of the environmental benefits of choosing, providing personalized performance information on sustainable purchasing and allowing individuals to compare their performance with peers are other effective strategies. This approach can also be combined to the vendor selection process. York University can refer to the specific language of how UC incorporated criteria based upon behavioural science into vendor contracts (UC, 2021). However, it's important to note that modifying the Sm@rtbuy platform may be subject to constraints imposed by vendors and existing agreements. Even if these constraints are removed, the effectiveness of this approach depends on the extent to which the Sm@rtbuy platform is utilized, necessitating an investigation into potential barriers to its adoption within the York community. Other approaches to enhance awareness of SP and procurement emissions include developing a recognition system and implementing incentives to motivate SP adoption. Other approaches to facilitate the awareness of SP and procurement emissions include developing a recognition system and using incentives to motivate SP (Leal Filho et al., 2019). These methods also relate to systems thinking as they change the rules of the existing system.

Table 5: Behaviour barriers to sustainable consumption (Aibana et al., 2017)

Behaviour Barriers
1. Many “choices” in consumption are often habitual behaviours
2. Consequences of consumption are often hard to see
3. Sustainable consumption may not seem personally relevant
4. Behaviour is influenced by peers and social groups
5. It can be hard to follow through on sustainable choices

6.7.7 Addressing Financial Constraints

Furthermore, to address the barrier on financial constraints, York University can first focus on cases where economic savings align sustainable options in the long run, fostering confidence and openness toward SP. Supporting research on the simplification of the LCA process, perhaps through the application of machine learning and AI may also help with lowering the cost associated with SP and data related problems. Nonetheless, it's worth noting that sustainable products are not necessarily more costly than conventional alternatives, as discussed.

6.8 Key Takeaways on York University's Case Study

The evaluation of York University's current practices in accounting for procurement emissions is hindered by the unavailability of a publicly released emission report. Consequently, it is challenging to assess York University's reporting of procurement emissions on its transparency, clarity, consistency and the context provided in the report. The absence of a publicly published report also raises questions about the level of transparency in York University's procurement emissions reporting. However, the information that was accessible indicates that York University's reporting of procurement emissions largely aligns with best practices. It clearly defines its operational boundary, something that is lacking in many of the papers reviewed. The university also follows the recommended approach and employs the EEIOA method, the most frequently used approach that is suitable for HEIs initiating their procurement emissions accounting. In contrast, York University would benefit from using more detailed categories to present emissions hotspots and collecting quantity-based activity data in procurement. In addition, the review of York's practices reveals the absence of EEIOA emission factors that capture all 7 GHGs included by the GHG Protocol. This deficiency exposes a limitation in the GHG Protocol's guidance.

In terms of reducing procurement emissions, evaluating York University's current practices is also challenging because the institution is actively developing its emission reduction strategies. Nevertheless, based on their existing strategies and information about those in development, York distinguishes itself by adopting an approach that addresses the entire lifecycle of purchased products and services, as opposed to solely focusing on sustainable procurement. The formal integration of SP into its policy, albeit at a high level, reflects this commitment.

However, despite York's multi-prong approach to reducing procurement emissions, it is crucial to recognize that construction is a form of procurement and a significant contributor to procurement emissions. The institution should reflect on the underlying reasons for construction, considering its potential conflict with sustainability goals. Questions around the necessity of construction and its beneficiaries should be central to this reflection. Additionally, the SP tools that are being developed lack linkages to York's procurement data and a clear hierarchy concerning sustainability topics to prioritize procurement emissions. These weaknesses are observed in both the decentralized purchase of products and services and centralized vendor selection.

Moreover, York University faces three primary challenges in reducing procurement emissions, namely data-related issues, awareness and engagement, and financial considerations. Potential opportunities to address these challenges include:

1. Developing monitoring and feedback mechanisms for emission reduction policies.

2. Applying systems thinking approaches and addressing relevant leverage points
3. Exploring knowledge sharing initiatives within York University and across HEIs.
4. Involving students in the development of supporting policies and strategies
5. Integrating data requirements into vendor and supplier contracts
6. Experimenting with behavioural science approaches.
7. Addressing financial constraints.

From these suggestions, York University should prioritize establishing a regular review mechanism for its procurement emissions reduction policies. This would enable the university to assess the effectiveness of its strategies and make necessary adjustments. It would also allow York to explore the other suggestions as reduction strategies in the future Additionally, expanding data collection streams is essential for enhancing the quality and specificity of York's procurement emissions data, a critical step in developing effective emission reduction strategies.

7 Conclusion

2023 has witnessed an alarming escalation in extreme weather events, underscoring the urgency to reduce GHG emissions across all possible avenues (WMO, 2023). This study conducts a review and evaluation of how HEIs as organizations are addressing Scope 3 procurement emissions, an area that has long been neglected, focusing on the measurement and decarbonization strategies.

This paper reveals that there is a roughly equal number of HEIs reporting their full procurement emissions compared to those reporting partial or zero procurement emissions. This suggests some recognition of the significance of procurement emissions within HEIs, signaling the need for further promotion of awareness in this regard. A closer examination of HEIs' calculation practices uncovers limitations in the GHG Protocol, along with complexities involved in standardizing these practices and establishing meaningful targets. These challenges, particularly the last two, impede the broader adoption of measures to address procurement emissions in HEIs.

Regarding calculation methods, this study finds that most researchers employ the EEIOA method over a process based LCA or a hybrid approach. EEIOA is also most suitable for HEIs who are starting their procurement emissions journey. It is the simplest option, demanding the least time, cost and data requirement, while still identifying emission hotspots comparable to the more complicated process based LCA. Nevertheless, HEIs should be aware that EEIOA’s results may lack sensitivity to emission reduction strategies due to its inability to distinguish between low-carbon practices among sectors.

On the other hand, the review of HEIs and York University's reduction strategies for procurement emissions demonstrates a prevalent reliance on sustainable procurement over the reduction of consumption. This is despite limited discourse and mixed results regarding its effectiveness (Lundberg et al., 2016; Rietbergen & Blok, 2013). It also diverges from established best practices which recommend a more balanced approach that addresses both consumption quantity and product/service emission factors. Moreover, the comparison of HEIs' reduction strategies illustrates the reliance on products certification and potential impacts of formal and mandatory green purchasing policies driven by government directives and student initiatives. A common weakness is exposed—the lack of evaluation and incentive mechanisms in SP programs.

Considering these findings, it is clear that while HEIs have begun addressing procurement emissions, these efforts often fall within the broader umbrella of sustainability, rather than adopting a more urgent perspective towards mitigating the climate crisis. Although the lack of urgency could be due to other reasons, such as the lack of leadership support as discussed, HEIs should re-examine their approach given the pressing climate crisis.

This study acknowledges several limitations, including the narrow scope of procurement examined. HEIs procure various types of products and services which have significantly different characteristics and procedures. Focusing primarily on general procurement and only providing a small section on food procurement assumes uniform behaviour across all procurement categories. Another limitation relates to the case study of York University. Limited access to its GHG emissions report, reduction strategies and procurement data restricts a more comprehensive evaluation of York University's current practices in reducing procurement emissions and developing strategies to address its challenges. Additionally, this study is constrained by the absence of empirical data evaluating SP mechanisms which led to the identification of best practices relied primarily on theoretical considerations.

This study contributes to climate mitigation efforts within HEIs by analyzing current and best practices in accounting and reducing procurement emissions. It provides guidance to HEIs practitioners, highlights common challenges and identifies potential opportunities to explore. Addressing issues related to data accessibility, raising awareness of emissions embodied in products and services, and promoting knowledge sharing and partnerships within HEIs and with external stakeholders are vital steps forward. There is a potential for the application of AI to streamline data collection processes. Moreover, this study demonstrates the challenges and necessity of developing a standardized emissions accounting framework for HEIs. The absence of such has hindered the establishment of meaningful procurement emissions targets. Future research examining the effectiveness of SP schemes in emissions reduction is also essential given their predominant use. These suggestions along with those discussed throughout the paper should drive HEIs towards meeting global emission reduction targets, contributing to the broader global effort to combat climate change.

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