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Improving the sustainability of the Western Norway University of Applied Sciences:

A translation of the SDGs for higher education institutions and carbon footprint assessment of the Sogndal Campus

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With contributions of Victoria Slaymark

Master Thesis in Climate Change Management

Department of Environmental Sciences, Faculty of Engineering and Science

WESTERN NORWAY UNIVERSITY OF APPLIED SCIENCES

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I confirm that the work is self-prepared and that references/source references to all sources used in the work are provided, cf. Regulation relating to academic studies and examinations at the Western Norway University of Applied Sciences (HVL), § 10.

Western Norway University of Applied Sciences

Improving the sustainability of the Western Norway University of Applied Sciences:

A translation of the SDGs for higher education institutions and carbon footprint assessment of the Sogndal Campus

Master thesis in Climate Change Management

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This thesis is a part of the master's program in Climate Change Management (Planlegging for klimaendringer) at the Department of Environmental Sciences, Faculty of Engineering and Science at the Western Norway University of Applied Sciences. The author(s) is responsible for the methods used, the results that are presented and the conclusions in the thesis.

Western Norway University of Applied Sciences

Preface

Acknowledgements

I would like to thank all the teachers and fellow students at the Faculty of Engineering and Science and the administration staff in Sogndal, who assisted me in writing this thesis.

My special thanks go to Valeria Jana Schwanitz for providing valuable guidance and investing a great amount of time and effort in supervising my work, and to Carlo Aall for offering crucial advice. Furthermore, I would like to specifically thank Nina Leivdal Tandle and Svein Tore Sviggum for providing the necessary data to calculate the carbon footprint of HVL-Sogndal.

Statement of contributions

This thesis was written in partial cooperation with Victoria Slaymark. Victoria Slaymark and I initially collaborated on researching the current state of the sustainable development discourse and developing the sustainability assessment framework for higher education institutions. We then focused on different aspects of sustainability at higher education institutions. My own focus was on the assessment of the greenhouse gas emissions of the Sogndal campus of the Western Norway University of Applied Sciences.

In this thesis, part B (Background), part C (Overview of HVL and the Sogndal campus) and part D (Development of SDG-framework for higher education institutions) were written together with Victoria Slaymark and are therefore similar to her thesis. The other parts were written solely by myself.

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Abstract

PURPOSE: The purpose of this thesis is twofold: (i) develop an initial draft of a sustainability assessment framework for higher education institutions (HEIs) based on the United Nations Sustainable Development Goals (SDGs) and (ii) contribute to the assessment of the current sustainability performance of the Sogndal campus of the Western Norway University of Applied Sciences (HVL) by analysing the carbon footprint of HVL-Sogndal.

STRUCTURE: The thesis will therefore be structured in five parts. Part A is the Introduction, part B describes the background for this thesis and part C provides an overview over HVL and the Sogndal campus. Part D will then present and discuss the developed SDG-based sustainability assessment framework for HEIs. The last part (part E), which is the main focus of the thesis, will present the assessment of the carbon footprint of HVL-Sogndal.

METHODOLOGY: The SDG-based framework was developed by linking and translating the relevant targets and indicators of the SDGs to each of the four functional areas of a higher education institution: Education, Research, Operations and Administration, and Community Outreach. Inspiration for the translation was taken from (TAHL ET AL., 2017). The carbon footprint of HVL was calculated for scope 1, 2 and 3 emissions. This includes emissions from energy consumption, purchases, waste management, business travels and commuting. The Scope 3 Evaluator tool was used for the calculations.

RESULTS: The resulting SDG-based sustainability assessment framework provides targets and indicators for all 17 SDGs for each of the four core functional areas, respectively. The carbon footprint assessment shows that the highest contributing emission sources are commuting, purchases and business trips. Energy related emissions only account for a maximum of 4% of the total emissions.

LIMITATIONS: The SDG-based sustainability assessment framework is an initial draft, as the subjectivity of the authors could not be excluded completely. Ideally, this framework would be further developed with the participation of a large group of persons, thereby including different approaches and viewpoints. The carbon footprint of HVL-Sogndal is limited due to the limited quality of the input data and the methodology of the Scope 3 Evaluator. Further research should especially focus on increasing the accuracy of the commuting category as this is likely to be the largest contributor, and it is also the category with the highest uncertainty.

CONCLUSION: This thesis provides a first attempt of a sustainability assessment framework for higher education institutions that is based on the SDGs. While there are other assessment frameworks for higher education institutions, these do not relate specifically to the SDGs. The SDGs are currently the most holistic framework to assess sustainability. Hence, other frameworks should link to the SDGs. The carbon footprint provides a first assessment of the emissions of HVL-Sogndal that includes all emission sources. The assessment can be used to develop a climate action plan for HVL-Sogndal.

Zusammenfassung

ZWECK: Diese Arbeit verfolgt zwei Ziele: (i) die Entwicklung eines konzeptionellen Bewertungsrahmens für die Nachhaltigkeit von Hochschuleinrichtungen, auf der Grundlage der von den Vereinten Nationen entwickelten Nachhaltigkeitsziele (SDG), und (ii) einen Beitrag zur Bewertung der Nachhaltigkeit des Sogndal-Campus der Vestlandet Hochschule (HVL) zu leisten, indem eine Analyse des CO2-Fußabdrucks des Campus durchgeführt wird.

GLIEDERUNG: Diese Arbeit ist in fünf Abschnitte unterteilt. Abschnitt A beinhaltet die Einleitung, Abschnitt B beschreibt den Hintergrund der Arbeit und Abschnitt C liefert ein Überblick über die Vestlandet Hochschule und den Sogndal-Campus. Abschnitt D präsentiert und diskutiert die Methoden und Ergebnisse der Entwicklung des Bewertungsrahmens für die Nachhaltigkeit von Hochschuleinrichtungen. Abschnitt E befasst sich mit der Analyse des CO2-Fußabdrucks des Sogndal-Campus. Dieser Abschnitt ist der Hauptteil der Arbeit.

METHODEN: Der auf den Nachhaltigkeitszielen aufbauende Bewertungsrahmen wurde entwickelt indem die relevanten Teilziele und Indikatoren den vier Aufgabenbereichen von Hochschuleinrichtungen zugeordnet und z.T. an diese angepasst wurden. Die vier Aufgabenbereiche von Hochschuleinrichtungen sind: Bildung, Forschung, Betrieb und Verwaltung, und Öffentlichkeitsarbeit. Inspiration für einen solchen Bewertungsrahmen lieferten Tahl et al. (2017). Der CO2-Fußabdruck wurde für die Scope 1, 2 und 3 Emissionen berechnet und beinhaltet die Emissionen des Sogndal-Campus aus Energieverbrauch, Einkauf, Abfallverwertung, Dienstreisen und Pendelverkehr. Die Berechnungen wurden mithilfe des Scope 3 Evaluator Tools durchgeführt.

ERGEBNISSE: Der resultierende SDG-basierte Bewertungsrahmen liefert Teilziele und Indikatoren für alle 17 Nachhaltigkeitsziele in jedem der vier Aufgabenbereiche von Hochschuleinrichtungen. Der CO2-Fußabdruck zeigt, dass Pendelverkehr, Einkauf, und Dienstreisen die größten Emissionsquellen sind. Die Emissionen aus Energieverbrauch belaufen sich hingegen nur auf 4% der Gesamtemissionen.

BESCHRÄNKUNGEN: Bei dem Bewertungsrahmen für Nachhaltigkeit an Hochschuleinrichtungen handelt es sich um ein erstes Konzept, da die Subjektivität der Autoren nicht ausgeschlossen werden konnte. Idealerweise sollte dieser Bewertungsrahmen in einer partizipativen Weise entwickelt werden, die mehrere Personen miteinbezieht und somit verschiedene Ansichtsweisen und Ideen berücksichtigt. Der CO2-Fußabdruck von HVL-Sogndal ist in zweierlei Hinsicht limitiert. Zum einen durch die mangelhafte Qualität der verwendeten Daten und zum anderen durch die eher simplen Berechnungsmethoden des Scope 3 Evaluator Tools. Weiterführende Untersuchungen sollten sich hauptsächlich auf die Emissionen aus Pendelverkehr konzentrieren, da diese Kategorie einerseits höchstwahrscheinlich die meisten Emissionen verursacht und zugleich die ungenaueste Kategorie ist.

SCHLUSSFOLGERUNG: Diese Arbeit liefert ein erstes Konzept für einen, auf den Nachhaltigkeitszielen basierenden, Bewertungsrahmen für Nachhaltigkeit an Hochschuleinrichtungen. Es existieren zwar bereits mehrere solcher Bewertungsrahmen für Nachhaltigkeit an Hochschuleinrichtungen, jedoch bezieht sich keiner dieser Bewertungsrahmen speziell auf die Nachhaltigkeitsziele der Vereinten Nationen. Die Nachhaltigkeitsziele sind momentan das allumfassendste Konzept zur Bewertung von Nachhaltigkeit. Aus diesem Grunde sollten sich andere Bewertungsrahmen auf die Nachhaltigkeitsziele beziehen. Der hier vorgestellte CO2-Fußabdruck ist die erste Analyse der Treibhausgasemissionen des Sogndal Campus, die alle Emissionsquellen berücksichtigt. Die Ergebnisse können zur Entwicklung eines Klimakonzepts für HVL-Sogndal verwendet werden.

Sammendrag på norsk

FORMÅL: Formålet med denne avhandlingen er todelt: (i) utarbeide et innledende utkast til en ramme for evaluering av bærekraft for høyere utdanningsinstitusjoner (HEIs) basert på FNs bærekraftige utviklingsmål (SDG) og (ii) bidra til en vurdering av dagens bærekraftig ytelse av Sogndal-campuset ved Høgskulen på Vestlandet (HVL) ved å analysere drivhusgassutslippene til HVL-Sogndal.

STRUKTUR: Avhandlingen vil derfor bli strukturert i fem deler. Etter introduksjonen (del A) og bakgrunnen (del B) vil det bli gitt en oversikt over HVL og Sogndal campus av HVL (del C). Del D vil videre presentere den utviklede SDG-baserte ramme for evaluering av bærekraft for HEIs. Den siste delen (del E), som er avhandlingen sitt hovedfokus, vil presentere vurderingen av HVL-Sogndals drivhusgassutslipp.

METODOLOGI: Den SDG-baserte rammen ble utviklet ved å knytte og oversette relevante mål og indikatorer på SDGene til hvert av de fire funksjonelle områdene i en høyere utdanningsinstitusjon: Utdanning, Forskning, Organisasjon og Administrasjon, og Involvering av samfunnet. Inspirasjon til oversettelsen ble tatt fra (TAHL ET AL., 2017). Drivhusgassutslipp av HVL ble beregnet for scope 1, 2 og 3-utslipp. Dette inkluderer utslipp fra energiforbruk, kjøp, avfallshåndtering, forretningsreiser og pendling. Scope 3 Evaluator-tool ble brukt i beregningene.

RESULTATER: Det resulterende SDG-baserte rammen gir delmål og indikatorer for alle 17 SDGs for hvert av de fire kjernevirkningsområdene. Drivhusgassutslippevalueringen viser at de største kildene til utslipp er pendling, innkjøp og forretningsreiser. Energirelaterte utslipp utgjør kun maksimalt 4% av de totale utslippene.

BEGRENSNINGER: Den SDG-baserte rammen er et utgangspunkt, da subjektivitet til forfatterne ikke kunne utelukkes helt. Ideelt sett vil dette rammeverket bli videreutviklet med deltakelse fra en større gruppe med personer, og dermed inkludere flere ulike tilnærminger og synspunkter. Drivhusgassutslipp av HVL-Sogndal er begrenset på grunn av den begrensede kvaliteten på datainput og metoden til verktøyet brukt i kalkuleringene. Ytterligere forskning bør spesielt fokusere på å øke nøyaktigheten av pendlingskategorien da dette sannsynligvis er den største bidragsyteren, og fordi denne kategorien er den med høyest usikkerhet.

KONKLUSJON: Denne oppgaven gir et første forsøk på en ramme for evaluering av bærekraft for høyere utdanningsinstitusjoner som er basert på SDGs. Selv om det finnes andre vurderingsrammeverk for høyere utdanningsinstitusjoner, gjelder de ikke spesielt SDGs. SDGs er for tiden det mest holistiske tilnærmingen for å vurdere bærekraft. Derfor bør andre rammeverk koble til SDGs. Kartleggingen av drivhusgassene gir en første vurdering av utslippene til HVL-Sogndal som inkluderer alle utslippskilder. Vurderingen kan brukes til å utvikle en handlingsplan for redusering av klimautslipp ved HVL-Sogndal.

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List of Abbreviations

AASHE	Association for the Advancement of Sustainability in Higher Education
ACTS	Australian Campuses Towards Sustainability
BDBe	Bundesverband der deutschen Bioethanolwirtschaft e.V. (Federal Association of the German Bioethanol Industry)
BI	Handelshøyskulen (Norwegian Business School
CBS	Copenhagen Business School
CO2-eq	Carbon Dioxide Equivalents
COPERNICUS	Co-operation Programme in Europe for Research on Nature and Industry through Coordinated University Studies
DESD	Decade of Education for Sustainable Development
EAUC	Environmental Association for Universities and Colleges
EE-IO	Environment Extended Input-Output (models/ databases)
EMAS	European Eco-Management and Audit Scheme
ESD	Education for Sustainable Development
FHS	Fakultet for helse- og sosialfag (Faculty of Health and Social Sciences)
FIN	Fakultet for ingeniør- og naturvitskap (Faculty of Engineering and Science)
FLKI	Fakultet for lærarutdanning, kultur og idrett (Faculty of Education, Arts and Sports)
FØS	Fakultet for økonomi- og samfunnsvitskap (Faculty on Business Administration and Social Sciences)
GHG	Greenhouse Gas
GRI	Global Reporting Initiative
GWP	Global Warming Potential
HEIs	Higher education institutions
HESD	Higher Education and Research for Sustainable Development
HiB	Høgskulen i Bergen (Bergen University College
HiH	Høgskolen i Hedmark (Hedmark University College)
HiSF	Høgskulen i Sogn og Fjordane (Sogn og Fjordane Universit College)
HNE Eberswalde	Hochschule für Nachhaltige Entwicklung Eberswalde (Eberswalde University for Sustainable Development)
HSH	Høgskulen Stord/Haugesund (Stord/ Haugesund University College)
HVL	Høgskulen på Vestlandet (Western Norway University of Applied Sciences)
IAU	International Association of Universities
ICSU	International Council for Science
IO	Input-Output (model/ database)
ISCN	International Sustainable Campus Network
ISIC	International Standard Industrial Classification
ISO	International Organisation for Standardisation
ISSC	International Social Science Council
KCL	King's College London
LCA	Life Cycle Analysis
LiFE	Learning in Future Environments
MDGs	Millennium Development Goals
NDC	Nationally Determined Contributions

NHH	Norges Handelshøyskole (Norwegian School of Economics)
NMBU	Norges miljø- og biovitenskapelige universitet (Norwegian University of Life Sciences
NOK	Norwegian Krone
NORAD	Direktoratet for utviklingssamarbeid (Norwegian Agency for Development Cooperation)
NTNU	Norges teknisk-naturvitenskapelige universitet (Norwegian University of Science and Technology)
NVE	Norges vassdrags- og energidirektorat (Norwegian Water Resources and Energy Directorate)
PRME	Principles of Responsible Management Education
RSM	Rotterdam School of Management
SAMAN	Studentsamskipnaden i Vestlandet (Student Welfare Organisation)
SANORD	Southern African-Nordic Center
SAQ	Sustainability Assessment Questionnaire
SD	Sustainable development
SDGs	Sustainable Development Goals
SDSN	United Nation Sustainable Development Solutions Network
SIMAS	Sogn interkommunale miljø- og avfallselskap
SIP	Sharing Information and Progress
SLU	Sveriges lantbruksuniversitet (Swedish University of Agricultural Sciences)
SSB	Statistisk Sentralbyrå (Statistics Norway)
STARS	Sustainability Tracking, Assessment & Rating System
STVL	Studenttinget på Vestlandet (Western Norway Student Council)
TSC	The Sustainability Consortium
TSP	The Shift Project
UHU	Highlands and the Islands University
UiB	Universitetet i Bergen (University of Bergen)
UiO	Universitetet i Oslo (University of Oslo)
UK-DECC	United Kingdom Department of Energy and Climate Change
UK-DEFRA	United Kingdom Department of Environment, Food and Rural Affairs
ULSF	University Leaders for a Sustainable Future
UN	United Nations
UN ECOSOC	United Nations Economic and Social Council
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNFSS	United Nations Forum on Sustainability Standards
UNSD	United Nations Statistical Devision
UoE	University of Edinburgh
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
WBCSD	World Business Council for Sustainable Development
WCED	World Commission on Environment and Development
WIOD	World Input-Output Database
WIR	World Resource Institute

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A: Introduction

Today we are facing numerous challenges that originate from the impact of human activities on the natural environment, such as the overexploitation of natural resources, waste management, climate change and the accumulation of polluting substances in nature. In addition, humankind has to solve social and economic problems of equal importance. Starting with the Brundtland Commission in 1987 (WCED, 1987), the concept of 'sustainable development' (SD) has emerged, acknowledging the fact that all these issues are interlinked and cannot be addressed in isolation. Since then, the United Nations (UN) initiated a number of agendas to promote sustainable development, such as the Agenda 21 and the Millennium Development Goals (MDGs), in an effort to address both the socio-economic and environmental challenges in combination. In 2015, the UN established the latest agenda, the Sustainable Development Goals (SDGs). The SDGs aim to guide us to the "the future we want", which is economically, socially environmentally sustainable (UN, 2012). As of today, the SDGs are the most complete and widely accepted guideline on how to solve these issues.

While the SDGs emphasise the interlinked nature of the goals, they acknowledge that different priority targets can be set in different nations (UN, 2015b). Even on a global level, it is often stated that some goals are of higher priority than others. Especially climate change is often considered one of the major threats to today's society (UN, 2015b; Watt, 2017). Accordingly, SDG 14 'Climate Action' has been referred to as one of the most important SDGs (Guterres, 2017). However, when focusing on SDG 14 to combat climate change, the synergies and feedbacks with the other goals should be considered.

Implementing the SDGs to their full extent will require the innovation of new technology, but even more importantly, a deep and radical transformation of our society across all institutional levels. Throughout history higher education institutions (HEIs) have played a major role in critically reflecting upon societal challenges and in shaping our cultural, political and economic structures, by generating new knowledge and educating new generations. Indeed, HEIs possess the transformative power that is needed: In 2015, ca. 13 million people were employed and ca. 212 million students were enrolled in the global higher education sector (World Bank, 2018). Moreover, millions are indirectly linked to the higher education sector, for instance through cooperation and joint research projects with private companies or government institutions.

Yet, in contrast to the HEIs' potential role in the needed transformation, they are only slowly starting to fully and systematically engage in sustainable development beyond the engagement within single research and/or educational programs. Lozano (2011), for example, showed that sustainability reporting was far more widespread in the private business sector, compared to the higher education sector. Although some institutions have sporadically implemented environmental standards, such as the green certificate 'Miljøfyrtårn' in Norway, HEIs stay very much below their transformative potential, because a radical shift requires the implementation of the SDGs into all core functions, i.e. the streamlining of sustainable development into research, education, operations and administration, and community outreach. HEIs have to become living labs to experiment and apply new ways of engaging in sustainability.

During my two years of studying 'Climate Change Management' and the Sogndal campus of Western Norway University of Applied Sciences (HVL), I realised that HVL is, in that regard, no different from other HEIs: the university engages in and has developed a variety of sustainable development initiatives, but a deep-rooted transformation is missing. For example, HVL is certified with the Norwegian green certificate 'Miljøfyrtårn' which mainly requires a very crude assessment of HVLs greenhouse gas emissions. Additionally, the university has several course programs that also relate to the sustainable development agenda, such as the "Climate Change Management" masters and the "Renewable Energy" bachelor programme. Yet, at HVL there exists no overarching sustainability strategy, integrating and expanding these initiatives, so that the university indeed could serve as a role model and Living Lab.

Developing such an overarching sustainability strategy initially requires an assessment of what has already been done at the institution (Tahl et al., 2017). Ideally, this assessment is done in accordance to a standardised and internationally accepted framework, as this would provide a standardised and transparent methodology that allows for comparison with other HEIs. Yet, currently there is no such widely recognised framework that assesses all of an HEI's functions and includes all aspects of sustainability (Tahl et al., 2017; von Hauff & Nguyen, 2014). Therefore, this thesis includes to research topics:

1. **Developing draft for a SDG-based sustainability assessment framework for HEIs**

While there are a number of sustainability assessment frameworks for HEIs, each of those focuses on different aspects of sustainability (environmental, economic, social) and different functions of an HEI (education, research, operations and administration, community outreach). The SDGs, being a globally accepted framework, have great potential to serve as such a holistic framework for HEIs, if translated accordingly. This initial part of the thesis will therefore provide a proposal for a translated version of the SDGs that is specifically applicable to HEIs.

2. **Assessing HVL-Sogndal's carbon footprint as part of an initial sustainability assessment**

This second part of the thesis aims to contribute to the development of a sustainability strategy for HVL by providing a carbon footprint assessment of HVL-Sogndal that is more detailed than the assessment done for the Miljøfyrtårn certification. While a complete sustainability assessment includes considerably more than just the carbon footprint assessment, a comprehensive sustainability assessment was beyond the scope of this thesis. The carbon footprint was chosen for two reasons. The first is the fact that combating climate change is often considered one of the more pressing issues associated with the SDGs. The second is the fact that HVL declared to take responsibility in limiting the global temperature rise by becoming climate neutral (KRUSE, 2017), which requires the assessment of HVL's greenhouse gas emissions.

B: Background

1. The concept of sustainable development

1.1. The Brundtland Commision's definition of sustainable development

The SD discourse has a long history[1]. Throughout most of this history, only the term 'sustainability' existed, which refers almost exclusively to environmental issues. The term 'sustainable development' encompasses environmental, social and economic issues and was only introduced by the Brundtland Commission in their report 'Our Common Future' in 1987 (DU PISANI, 2006; LAFFERTY & LANGHELLE, 1999). Today, within the SD discourse the terms 'sustainability' and 'sustainable development' are mostly used interchangeably. For this thesis, the terms 'sustainability' and 'sustainable development' will also be used interchangeably, since today the necessary societal actions and policy implications are the same (HOLDEN, LINNERUD, BANISTER, SCHWANITZ, & WIERLING, 2018).

Today the definition provided by the Brundtland Commission is the most widely accepted and operationalised definition, stating:

> *"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:*
>
> - *the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and*
> - *the idea of limitations imposed by the state of technology and social organisation on the environment's ability to meet present and future needs.[2]"* (WCED, 1987, CHAPTER 2)

[1] Historical authors discussing sustainability: (JEVONS, 1865; KAPP, 1950; MALTHUS, 1798; MARSH, 1864; MILL, 1848; VON CARLOWITZ, 1732; WALLACE, 1898)

[2] The Brundtland report also describes this second concept as 'carrying capacity' (WCED, 1987)

The two key concepts of the Brundtland report point out the three main aspects of SD. The first key concept refers to the social and economic aspects and the second key concept refers to the environmental aspect. It is especially interesting that the first concept is given 'overriding priority'. The report acknowledges that a certain degree of economic growth is necessary to reach a certain living standard in a society. In the developing countries, this economic growth should therefore be the first priority.

The Brundtland report was in response to a call by the UN General Assembly to formulate a *"global agenda for change"* (WCED, 1987, P. 6), and aimed to address the most pressing issues of the time. Leading up to the call by the UN General Assembly, there was a growing discourse on environmental and socio-economic challenges (DU PISANI, 2006). A few examples are Rachel Carson's 'Silent spring' (CARSON, 1962), the Club of Rome's 'Limits to Growth' (MEADOWS, 1972) and the 'Declaration on the Human Environment' by the UN (UN, 1972). Rachel Carson's Book is considered to be *"the catalyst for the rise in large scale public environmental campaigns"* (UNESCO, 2014, P. 140). The Club of Rome states that our momentary trend of growth (of population and consumption) cannot be sustained. Lastly, the UN acknowledged the environmental crisis by drafting their 'Declaration on the Human Environment' at the Stockholm Conference, which stated that:

> *"A point has been reached in history when we must shape our actions throughout the world with a more prudent care for their environmental consequences."* (UN, 1972, p. 3)

The Brundtland report emphasises the importance of *"cutting across the divides of national sovereignty, of limited strategies for economic gain, and of separate disciplines of science"* to achieve SD (WCED, 1987, SEC. CHAIRMAN'S FORWARD). The importance of such a transdisciplinary approach is further emphasised in the outcome document of the UN conference on sustainable development from 2012, which stresses that it is important to *"Enhance integration of the three dimensions of sustainable development in a holistic and cross-sectoral manner at all levels"* (UN, 2012, P. 29).

1.2. Discussion of the Brundtland Definition

LÉLÉ (1991) argued that the concept of SD will become the *"developmental paradigm of the 1990s"* (LÉLÉ, 1991, P. 607). Today we know that the idea would not only be the paradigm of the 1990s, as predicted by LÉLÉ, but that it would become even more important in the following two decades. LÉLÉ (1991) also argues that the reason for the broad acceptance of the concept is its vague definition. This vagueness allows people with different opinions and different agendas to find common ground, which is an attribute that can be especially valuable in the political discourse. To illustrate this, he states:

"In short, SD is a "metafix" that will unite everybody from the profit-minded industrialist and risk-minimizing subsistence farmer to the equity-seeking social worker, the pollution-concerned or wildlife-loving First Worlder, the growth-maximizing policy maker, the goal-oriented bureaucrat, and therefore, the vote-counting politician." (Lélé, 1991, p. 60)

HOPWOOD, MELLOR & O'BRIEN (2005) and ROBINSON (2004) further support this by arguing that the vagueness allows for the definition to develop alongside society as society faces new challenges, instead of staying stagnant.

Contrary to this, others believe the vagueness to be the definition's weakness. ROBÈRT, EVERARD, JOHNSTON, & SANTILLO (2007) argue that the vagueness of the definition exposes the term to be exploited as a tool for 'greenwashing'. They claim that:

"As a result, there are many constituencies which perceive the term 'sustainable development' as a vehicle to perpetuate many and varied corporate and institutional interests whilst giving the impression of adherence to, and observance of, environmentally-sound principles." (ROBÈRT ET AL., 2007, P. 60)

Others have criticised it as reducing our potential for progress and thereby hindering us to meet the demands of the growing population (DU PISANI, 2006). It was further criticised that, although the definition endorses the idea that environmental, social and economic issues are all connected, it still separates these issues into the socio-economic aspect and the environmental aspect. Therefore the interlinkages between the social and environmental, and the economic and environmental aspects are not emphasised. As a result, cross-sectoral thinking is not promoted (SCOTT, 2015).

The controversy over the definition's vagueness has led to a large number of different interpretations of the Brundtland definition, many of which are difficult to compare and often contradictory (BOLIS, MORIOKA, & SZNELWAR, 2014). According to ROBÈRT ET AL. (2007) there have been ca. 300 interpretations at the time they published their article.

1.3. The United Nations sustainable development agendas

The Brundtland Report emphasised the need to establish global SD goals to guide society how to become more sustainable. However, it does not provide such guidance. Below, we present the efforts of the UN to establish such goals.

In 1992, the UN established the Agenda 21 which stated that SD should be prioritised for international communities. The Agenda 21 consisted of 40 goals, divided into four sections[3] (UNCED, 1992) and was signed by 178 governments. DODDS, SCHNEEBERGER, & ULLAR (2012) state that the

[3] Section 1: Social and Economic Dimensions, Section 2: Conservation and Management of resources for Development, Section 3: Strengthening the Role of Major Groups, Section 4: Means of Implementation

Agenda 21 was most successful in raising the awareness of SD, specifically within NGOs, local authorities, science, international institutional arrangements, and international legal instruments and mechanisms. However, the Agenda 21 was considered incomplete as no indicators were provided to monitor progress towards each goal; only advice on how to achieve the goals was given. Furthermore, the fragmentation of the goals into sectors promoted an isolated approach, contradicting the need for cross-sectoral solutions (DODDS ET AL., 2012).

In 2000, the Millennium Development Goals (MDGs) were established and ended in 2015 (UN, 2015A). The MDGs consisted of eight goals that focussed mainly on poverty reduction in developing countries. The MDGs gave specific goals that were to be achieved within a certain timeframe, by 2015. This is in contrast to the agenda 21 which had not timeframe. Additionally, the MDGs also provided quantitative values e.g. to reduce extreme poverty by 50%. Yet, they lacked the necessary global focus as the MDGs aimed to reduce poverty specifically in developing countries. They also did not place enough importance on other aspects of SD, such as environmental issues, economic development of all, human rights and child welfare (UOE, 2017).

In 2015, the Sustainable Development Goals (SDGs) were established as a part of the Agenda 2030 (UN, 2015B). They are a continuation and an improvement of the MDGs. The SDGs consist of 17 goals, 169 targets and 232 indicators, and aim to guide all nations' agendas and political policies to achieve a sustainable state by 2030. The indicators aim to measure the progress towards achieving each associated target and goal. The 17 SDGs are strongly interlinked as working towards one of the goals impacts the progress towards the others; there are synergies and barriers between the goals (GRIGGS ET AL., 2013; UN, 2015B). By the end of 2015, more than 150 state leaders had adopted the SDGs (UNDP, 2015).
BIERMANN, KANIE & KIM (2017, P. 29) states the SDGs are *"one of the most intriguing new global initiatives in the area of sustainable development […]"*. The SDGs are considered a novel approach to global governance because, at current, they are the most holistic description of SD. The SDGs aim to balance the social, economic and environmental dimensions by including including them in each of the 17 goals. The SDGs are also globally and democratically written as their formulation included 5 million people from 88 countries (THOMSON, 2015). With the necessary translation, they can be applied to levels other than global, i.e. nationally, regionally, locally, personally (BIERMANN ET AL., 2017). Finally, while the MDGs mainly targeted eradicating extreme poverty in developing countries, the SDGs give targets for all countries to work towards SD (UN, 2018).

1.4. Discussing the SDGs

Although the SDGs are considered the most holistic and inclusive approach to guide society, they are still in their infancy. A review of the SDG targets states that *"Out of 169 targets, 49 (29 %) are considered well developed, 91 targets (54 %) could be strengthened by being more specific, and 29 (17 %) require significant work"* (ICSU & ISSC, 2015, p. 6). Similarly, 60% of the SDG indicators are not well defined (Mukherjee, 2018). The indicators are often not viable because they are considered imprecise and there is a lack of required data, tools, or methodologies, to monitor their implementation (Fenton, Gustafsson, Brondizio, Leemans, & Solecki, 2017; Hák, Janoušková, & Moldan, 2016; ICSU & ISSC, 2015).

Given that the SDGs were designed with a global focus, they require an effective translation to tailor the SDGs specifically to the different levels and sectors (Biermann et al., 2017; Fenton et al., 2017). However, the translation is difficult due to the diversity of circumstances and roles in the different levels and sectors. At current, the global SDGs declare that everyone has a responsibility to implement the SDGs. In practice, this may lead stakeholders to leave the responsibility to others as key roles are not clearly defined. The translation would therefore clarify the accountability and responsibility for the stakeholders (Engebretsen, Heggen, & Ottersen, 2017).

Lastly, even though the overarching principle of the SDGs is to *"leave no-one behind"*, the SDGs do not adequately address specific vulnerable groups such as refugees, migrants, non-citizens, foreign workers (El-Zein et al., 2016; UN, 2016). Furthermore certain issues, such as the effect of militarisation, war driven displacement and labour migration on development, are not adequately addressed either (El-Zein et al., 2016).

2. Sustainable development assessment, reporting and monitoring

Coinciding with the increase in the popularity of SD and the development of the different UN-Agendas (Agenda 21, MDGs, Agenda 2030 & SDGs) after the release of the Brundtland report in 1987, there was an increase in the number of sustainability initiatives, such as certifications schemes and standards, networks, organisations and associations (Mebratu, 1998). The initiatives aim to promote SD and attempt to assess actions taken towards sustainability. It is well documented that sustainability assessments and reporting is key to monitor progress towards SD (Singh, Murty, Gupta, & Dikshit, 2009). Assessment and reporting allows transparency, accountability and comparability (Daub, 2007). They can serve as guide for policy making, public communication on sustainability performance (Singh et al., 2009).

Ecolabes are important examples of such initiatives and fig. 1 shows a steady increase in their number since 1987. Ecolabels evolved from small-scale local bottom-up initiatives and they vary considerably in their SD-related guidelines. Some ecolabels aim to assess a single environmental or social impact of a single product. Conversely, others provide a holistic assessment of a company's or an institution's management strategy. The standards also vary in their applied methods and whether they are publically or privately instigated (UNFSS, 2015).

Today, the ecolabels are an integral part of governments' monitoring of the progress towards SD. Governments increasingly rely on certain ecolabels in their sustainability strategies (KOMIVES & JACKSON, 2014; POTTS ET AL., 2014) because many provide very detailed assessment methods for specific sectors. However, the great variety of ecolabels may also hinder comparability, as there is no uniform methodology. Furthermore, the great variety may pose as a barrier for businesses or organisations to engage in SD, as choosing the right ecolabel or framework may seem overwhelming (FIORINI, SCHLEIFER, & TAIMASOVA, 2017).

For these reasons, there is great potential to synergise the ecolabels with the SDGs. The SDGs serve as a broad, universally applicable, and globally accepted overarching framework. But, as previously discussed in chapter 1.4, many indicators are not well defined and the indicators have not been fully translated to other than a global level. Linking the ecolabels to the associated SDG targets and indicators has the potential to provide such translated indicators as the ecolabels often take into account the special circumstances in different sectors and local settings.

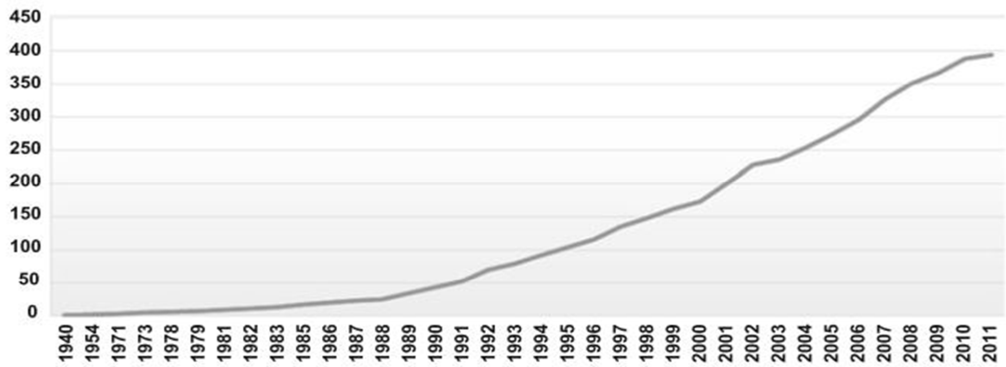

Fig. 1: Number of Ecolabels established each year from 1940-2011; Source: (KOMIVES & JACKSON, 2014)

3. Higher education institutions and sustainable development

3.1. Higher education institutions' role in sustainable development

The important role of higher education institutions (HEIs) regarding SD, specifically environmental protection, was first acknowledged at the Stockholm Conference in 1972 (LOZANO ET AL., 2015). It was stated that the UN should *"[…] take the necessary steps to establish an international programme in environmental education, interdisciplinary in approach, in school and out of school, encompassing all levels of education and directed towards the general public, […]"* (UN, 1972, p. 24). The critical role of

HEIs in SD was most notably furthered in the UN Decade of Education for Sustainable Development (DESD) 2005-2014, which was led by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) (UNESCO, 2005A, 2005B, 2014).

HEIs, such as universities, have the potential to be key actors and leaders to transform society towards SD (ALONSO-ALMEIDA, MARIMON, CASANI, & RODRIGUEZ-POMEDA, 2015; VON HAUFF & NGUYEN, 2014). It is estimated that there are over 20 000 HEIs globally (BERZOSA, BERNALDO, & FERNÁNDEZ-SANCHEZ, 2017). In 2015, ca. 13 million people were employed and ca. 212 million students were enrolled in the global higher education sector (WORLD BANK, 2018). Additionally, the large number of people that are indirectly linked to HEIs, for instance through cooperation with private companies or government institutions, further emphasises the transformative power of HEIs. To *"catalyze and/or accelerate a societal transition toward sustainability"* (STEPHENS, HERNANDEZ, ROMÁN, GRAHAM, & SCHOLZ, 2008, P. 320), HEIs should educate sustainability-literate citizens (JONES ET AL., 2008), and *"lead by example"* (AMARAL, MARTINS, & GOUVEIA, 2015, P. 156).

For HEIs to lead by example and fulfil their transformative power they must be a 'sustainable university'. VELAZQUEZ, MUNGUIA, PLATT, & TADDEI (2006, p. 812) define a sustainable university to be *"a HEI [...] that addresses, involves and promotes, on a regional or a global level, the minimization of negative environmental, economic, social, and health effects generated in the use of their resources in order to fulfil its functions of teaching, research, outreach and partnership, and stewardship in ways to help society make the transition to sustainable life-styles"*. HEIs must incorporate SD into all university functions; meaning that a 'whole system approach' and must be applied (KOESTER, EFLIN, & VANN, 2006). To do this, it is useful to describe HEIs by their core functions (fig. 2), or functional boundaries: education (curricula and competences); research; campus operations and administration; and community outreach. SD must be implemented in all of these core functions to achieve the necessary transformative change in society (CORTESE, 2003; DAGILIŪTĖ, LIOBIKIENĖ, & MINELGAITĖ, 2018; KARATZOGLOU, 2013; LOZANO ET AL., 2015; VAN WEENEN, 2000; VELAZQUEZ ET AL., 2006).

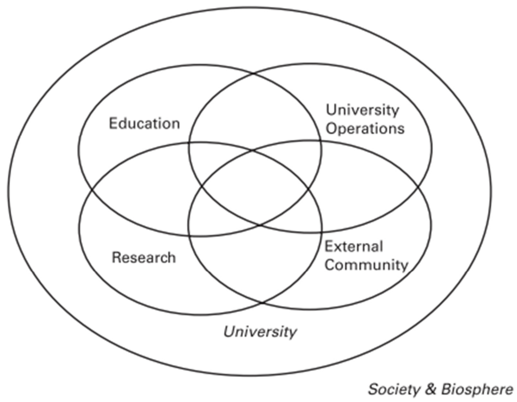

Fig. 2: HEIs' core functions: education, research, operations and administration (university operations) and community outreach (external community); Source: (CORTESE, 2003, FIG. 1)

3.1.1. Higher education institutions' role in education

The primary responsibility of HEIs is to provide students with the necessary knowledge and skills to be able to go on to work in society. Most graduates go on to be professionals, such as entrepreneurs, managers or decision-makers (ALONSO-ALMEIDA ET AL., 2015; VON HAUFF & NGUYEN, 2014), who work to develop, lead, manage, and influence societal development (CORTESE, 2003). GORNITZKA (2018) states *"Graduates are the long-term impact of university on society: on the economy; on civil society; on public society; and on political institutions"*. Therefore, it is vital that HEI graduates have knowledge of SD and the necessary skills and values (such as critical, holistic and transdisciplinary thinking) to tackle the challenges of SD (CORTESE, 2003). The critical role of education in SD is reflected by the DESD (UNESCO, 2005A, 2005B, 2014). The DESD guided various global education programs to emphasise the critical role of education in pursuing SD and has been reviewed by an array of literature[4]. Continuing on from the DESD, UN member states committed to further the efforts (UN, 2012, PARA. 233). The latest reinforcement of the role of education is stated in SDG 4, 'Quality education', in target 4.7, *"By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development [...]"* (UN ECOSOC, 2016, P. 20).

3.1.2. Higher education institutions' role in Research

Secondary to education, HEIs have a responsibility to shape, mediate and create knowledge to help improve society. HEIs must research transition pathways for HEIs and wider society to become more sustainable (WAAS, VERBRUGGEN, & WRIGHT, 2009). As pointed out by ROBÈRT ET AL. (2007), there are over 300 interpretations of the definition of SD (chapter 1.2). This indicates that a large amount of research has been dedicated to the definition of SD in the past. Now research is needed on the implementation and operationalisation of SD and the SDGs, for instance to address the issues associated with the SDGs, as outlined in chapter 1.4. Currently in HEIs, research and education is mostly organised into distinct disciplines, often referred to as 'silos'. HEIs need to develop research and curricula that work across the disciplines in a transdisciplinary manner (BIERMANN ET AL., 2017)

[4] Examples of literature reviewing the DESD: (FILHO, 2014; SINAKOU, BOEVE-DE PAUW, & VAN PETEGEM, 2017; TILBURY, 2009; WALS, 2014)

3.1.3. Higher education institutions' role in operations and administration

To "lead by example", as pointed out by AMARAL, MARTINS & GOUVEIA (2015, p. 156), HEIs must integrate SD into campus operations and administration (SHIEL, LEAL FILHO, DO PAÇO, & BRANDLI, 2016). Sustainable practices within operation and admisitration must, for instance, address the HEI's energy and material consumption, emissions, waste management, and transport strategy. From our perspective as students, HEIs must engage in SD in their operations and administration, not only in education, research or outreach. Otherwise the HEI's efforts are hypocritical and this may lead to a loss of credibility. Our view is supported by GÓMEZ, CADARSO, & MONSALVE (2016).

3.1.4. HEIs role in Community Outreach

Lastly, HEIs have a role to lead and be key partners in contributing to SD by collaborating with the external community, such as government, industry, and civil organisation, to advance sustainable societal transformation (TRENCHER, BAI, EVANS, MCCORMICK, & YARIME, 2014; TRENCHER, YARIME, & KHARRAZI, 2013; TRENCHER, YARIME, MCCORMICK, DOLL, & KRAINES, 2014). HEIs have a unique position within society to influence the external community as they are institutions that *"are trusted by the public and are seen as neutral actors by other sectors"* (TAHL ET AL., 2017, P. 8). HEIs have a role in local, regional, national, and international communities to carry out activities aimed at building capacity to understand SD and implement new actions towards SD (KARATZOGLOU, 2013; SEDLACEK, 2013; SHIEL ET AL., 2016).

3.1.5. Linking the core functions: HEIs as "Living Labs"

An attempt to operationalise the 'whole system approach' of SD in HEIs is the 'Living Lab' approach. Living Labs provide applied research and teaching opportunities for SD, as Living Labs link research and education to the operations and administration of HEIs (EVANS, JONES, KARVONEN, MILLARD, & WENDLER, 2015). The concept of Living Labs acknowledges that the different functions of a HEI are interlinked and affect each other, and tries to identify synergies between the functional areas. HEIs have been compared to be the size of and function as small cities (TAHL ET AL., 2017) or towns (EVANS ET AL., 2015). Due to this similarity, HEIs offer an ideal platform to design, test, and evaluate the 'real world' performance of theoretical innovative SD theories (ADAMS, MARTIN, & BOOM, 2018; EMANUEL & ADAMS, 2011). EVANS ET AL.(2015, p. 1) highlight that *"Living labs promise to bring researchers, students, external stakeholders […] and university estates and facilities staff together to co-produce knowledge about new sustainability technologies and services in real world settings".* Examples of such approaches are the Edinburgh University Living Lab (GRACZYK PATRYCJA, 2015) and the University of Manchester Living Lab (EVANS ET AL., 2015).

3.2. The Relation of HEIs and the SDGs

The relationship between HEIs and the SDGs can be described as symbiotic (fig. 3). Firstly, HEIs have a role to further the SDGs by engaging with the SDGs in all the HEI's core functions. In this way, the role of HEIs in relation to the SDGs is the same as the HEIs role in SD. Secondly, HEIs benefit from the SDGs, as the SDGs provide a holistic framework to engage in SD, create a common language and methodology to assess sustainability performance, provide new funding streams, and increases the HEIs reputation.

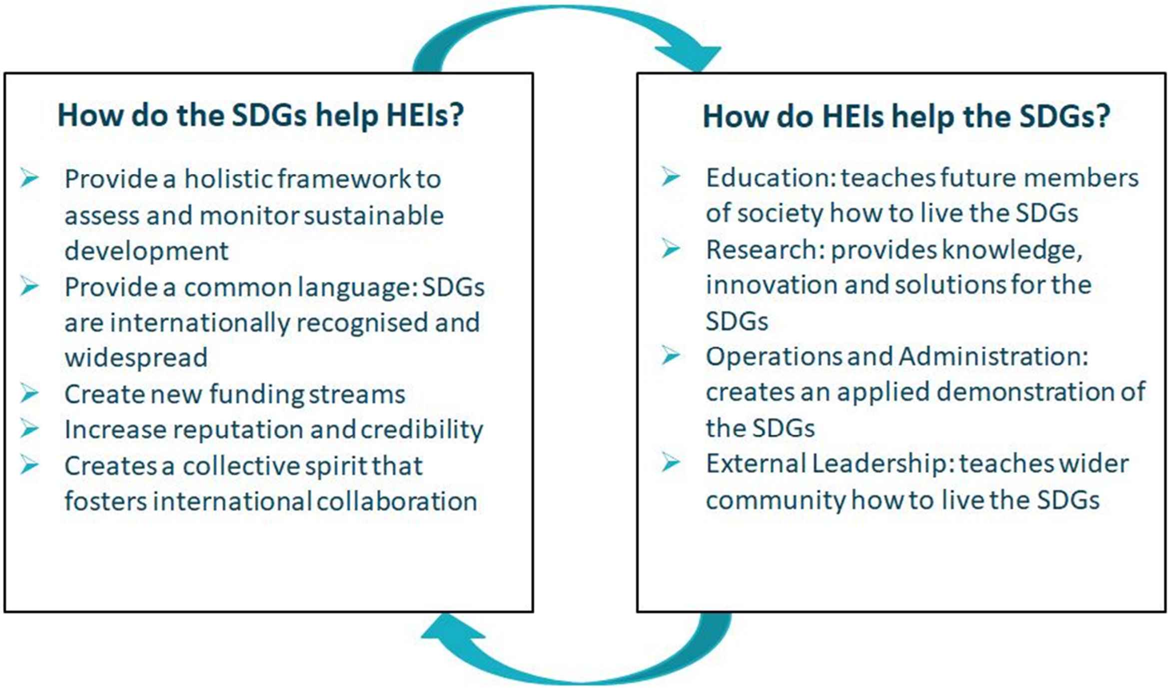

Fig. 3: The symbiotic relationship between the SDGs and HEIs; Adapted from (TAHL ET AL., 2017, FIG. 1)

3.3. Sustainability Networks and associated assessment tools for higher education institutions

Similarly to the development of the numerous ecolabels to assess and certify sustainable practices of businesses (chapter 2), there are a number of initiatives, including charters, declarations, partnerships and networks, that aim to promote, assess and certify sustainable practices at HEIs. Most of these were established after the release of the Brundtland report in 1987.

Sustainability assessment and reporting is also a highly useful tool for HEIs, for the same reasons as the importance of SD assessment and reporting for society. Also in regards to HEIs, the importance of sustainability assessments and reporting is written about extensively in research[5]. It is vital that HEIs follow a standardised assessment framework, as it provides the necessary information to develop systematic implementation strategies and plans. Furthermore, if several HEIs use the same standardised assessment framework, it allows for the sharing of successes, failures and challenges (von Hauff & Nguyen, 2014).

Table 1 provides a summary of a selection of networks, organisations, and their associated assessment frameworks. As this thesis is focused on HVL, only those networks and frameworks that are most relevant for HVL are listed[6]. Except from the ISO[7], the GRI[8], and the SDSN[9], all listed networks and organisations focus specifically on HEIs. While the GRI and ISO focus more on the business sector, the assessment frameworks provided by these organisations are commonly used in HEIs' sustainability assessments. For this reason, they are included in the list. The SDSN is also included as they released one of the first guides on how HEIs can engage in the SDGs (chapter 3.4.2.). PRME[10], which only applies to management related HEIs, is also included as they require their HEI signatories to submit 'Sharing Information on Progress (SIP)' reports where they must specifically document their actions towards fulfilling SDGs. PRME does not provide a guide or framework for HEIs to engage in the SDGs but they have a blog named 'PRiMEtime' (Weybrecht, 2017a, 2017b) which communicates advice how to mainstream SDG into management-related HEIs based on HEI case studies.

The networks and organisations presented in table 1 vary in the level of commitment required from their member institutions. Some simply aim to provide a platform for knowledge sharing related to sustainability issues (e.g. IAU[11]), while others require their members to sign a declaration, pledging to engage in SD (e.g. ULSF[12], COPERNICUS[13] Alliance, ISCN[14]). A few networks and organisations furthermore require their member institutions to provide regular reports on their sustainability performance (e.g. ISCN, EAUC[15], PRME) and in some cases they also provide tools and frameworks to guide institutions in the process of assessing their sustainability performance (e.g. AASHE[16], ULSF).

[5] E.g. (Alonso-Almeida et al., 2015; Berzosa et al., 2017; Ceulemans et al., 2015)
[6] Additionally, the rootAbility Webpage (rootAbility, 2018) provides a more complete list of sustainability initiatives for HEIs
[7] ISO: International Organisation for Standardisation
[8] GRI: Global Reporting Initiative
[9] SDSN: Sustainable Development Solutions Network
[10] Principles of Responsible Management Education
[11] IAU: Internation Association of Universities
[12] ULSF: University Leaders for a Sustainable Future
[13] COPERNICUS: Co-operation Programme in Europe for Research on Nature and Industry through Coordinated University Studies
[14] ISCN: International Sustainable Campus Network
[15] EAUC: Environmental Association for Universities and Colleges
[16] AASHE: Association for the Advancement of Sustainability in Higher Education

The assessment frameworks provided by the different networks and organisations vary in their focus and methodology (BERZOSA ET AL., 2017). Some frameworks, such as the SAQ[17], use qualitative indicators to show the subjective opinions of how HEI stakeholders believe their institutions' to be performing. Others, such as the STARS[18] and the GRI standards, provide a wide array of quantitative indicators. Specifically, STARS uses complex calculations to attribute credit points to each assessed category and ranks each institution depending on their sustainability performance. The GRI and STARS frameworks are the most detailed, competent and prescriptive (ALONSO-ALMEIDA ET AL., 2015; BERZOSA ET AL., 2017). STARS is specifically designed for HEIs, while the GRI standards are not. The ISO standards are also very extensive, yet they are not publicly accessible. Therefore, the ISO standards will not be further discussed in this thesis.

[17] SAQ: Sustainability Assessment Questionnaire
[18] STARS: Sustainability Tracking, Assessment & Rating System

Table 1: Summary of a selection of networks, organisations, and the associated assessment frameworks; adapted from (Ceulemans et al., 2015b; Hauff & Nguyen, 2014; Lozano, Lukman, Lozano, Huisingh, & Lambrechts, 2011, table 1)

Network/ Organization	Associated Declaration	Declaration/ Network/ Organisation Characteristics	Signing Declaration required?	Assessment framework	Assessment framework characteristics	Regular reporting required?	References
AASHE *Established 2005*	N/A	**Network** - North American Focus - Aims to provide information and guidance for institutions engaging in SD	NO	STARS	**STARS:** - Indicator based standardised assessment including ranking system - Focus areas: (1) Academics, (2) Operations, (3) Planning, Administration, and (4) Engagement - Each focus area rewards a specific amount of credits, used for the sustainability ranking	NO	(AASHE, 2017a, 2017b)
ACTS[19] *Established 2006*	N/A	**Network:** - Australian Focus - collaborated with SDSN Australia/Pacific in developing the guide 'Getting started with the SDGs in universities'	NO	LiFE-Index (in collaboration with EAUC) 'Getting started with the SDGs […]'-guide	**LiFE-Index focus areas:** - (1) Leadership and Governance, (2) Operations and Estate, (3) Partnership and Engagement and (4) Learning, Teaching and research **'Getting started with the SDGs […]'-guide:** - Not an assessment tool, but it provides recommendations for HEIs on how to engage in the SDGs	NO	(ACTS, 2017; EAUC, n.d.; Tahl et al., 2017)
COPERNICUS Alliance *Established 1993*	COPERNICUS Charter *Created 1993*	**Network:** - European Focus **Declaration:** - Environmental sustainability - Knowledge sharing related to environmental issues Multidisciplinarity	YES	NO	N/A	NO	(COPERNICUS Alliance, 2018; CRE, 1994)
EAUC *Established 1996*	SDG-Accord *Created 2017*	**Network:** British focus **Declaration:** Commitment to SDGs	NO	SDG-Accord (In Development) LiFE[20]-Index	**LiFE-Index focus areas:** (1) Leadership and Governance, (2) Operations and Estate, (3) Partnership and Engagement and (4) Learning, Teaching and research	YES, if SDG-Accord is signed	(EAUC, n.d., 2017, 2018a)

[19] ACTS:
[20] LiFE: Learning in Future Environments

GRI *Established 1997*	N/A	**Organisation:** - International organisation providing standards specifically for sustainability reporting frameworks - Runs the SDG-Compass Website, a database linking standards from different institutions to the SDGs	NO	GRI Standards	- extensive standards for social, economic and environmental sustainability - Recently, released a document linking the GRI standards to the SDGs - Standards are designed for private businesses, but can also be applied to higher education institutions	YES, but timeframe can be chosen by reporting institution	(GRI, 2015, 2016, 2018A; GRI, UN GLOBAL COMPACT, & WBCSD, 2015)
IAU *Established 1950*	Kyoto Declaration *Created 1993*	**Network:** - International focus - initial focus on providing global forum for university leaders and providing communication channel to high level political institutions - Runs SDG dashboard **Declaration:** - Knowledge sharing - Environmental education and operations Interdisciplinarity - North-South Disparities - Inter-generational Inequities	NO Declaration only signed by IAU as statement to promote SD within their network	NO	N/A	NO	(IAU, 1993, 2016, 2018)
ISCN Established 2007	Sustainable Campus Charter *Created 2010*	**Network** - International focus **Declaration:** - sustainable operations - sustainable campus planning - 'Living Lab': linking research, education and operations	YES	NO, Refers to STARS, GRI and ISO.	N/A	YES	(ISCN, 2010, 2016, 2018)
ISO *Established 1947*	N/A	**Organisation:** - provides standards for a variety of different economic sectors - standards range from product level to organisation level	N/A	ISO-Standards	**ISO standards related to sustainability:** - ISO 14 000 series on environmental management - ISO 26 000 series on social responsibility	YES, Re-certificati on every 3 years	(ISO, 2018; ISOREADY, 2018)

PRME *Established 2007*	Membership declaration *Created 2007*	**Network:** - Focus on realising the SDGs in management-related HEIs **Declaration:** - 6 principles focused on commitment to and advancement of the SDGs	YES	- SIP - PRiMEtime	**- SIP:** Not an assessment tool, but a guide on how to share Information on progress towards the six principles of the declaration **- PRiMEtime:** Not an assessment tool, but a blog providing advice on how to implement the 6 principles of the declaration	YES, at least every 24 months	(PRME, 2018B; WEYBRECHT, 2017A, 2017B)
SDSN *Established 2012*	N/A	**Network:** - Under patronage of the UN Secretary General - Focus on promoting practical solutions for SD (e.g. implementation of SDGs and Paris Agreement)	NO	'Getting started with the SDGs […]'-guide	Not an assessment tool, but it provides recommendations for HEIs on how to engage in the SDGs	N/A	(SDSN, 2018; TAHL ET AL., 2017)
ULSF *Established 1990*	Talloires Declaration *Created 1990*	**Network:** - European focus **Declaration:** - Environmental sustainability - Outreach: stakeholder involvement, partnerships - interdisciplinarity	YES	SAQ	**SAQ:** - Qualitative survey for stakeholders to rate sustainability performance of the Institution - Topics: (1) Curriculum, (2) Research and Scholarship, (3) Operations, (4) Faculty and Staff Development and Rewards, (5) Outreach and Service, (6) Student Opportunities, and (7) Administration, Mission and Planning.	NO	(ULSF, 1990, 2009, 2015)

3.4. Higher education institutions engagement in sustainable development

3.4.1. Engagement in sustainable development

As the number of networks and declaration grew, so did the number of HEIs that are members of such networks or have signed one or several of the declarations. WAAS ET AL. (2009) state that, globally, more than 1000 universities have signed international declarations, pledging to implement SD into their functions. Despite these memberships and pledges very few HEIs have actually carried out SD assessments and reporting. (CEULEMANS ET AL., 2015) found that, in 2012, only 33 HEIs had reported their sustainability performance to the GRI Disclosure Database. Today, the GRI Disclosure Database lists 136 HEI (GRI, 2018B) and STARS lists ca. 300 HEIs[21] (AASHE, 2018) that have reported their sustainability performance. As a comparison, in the business sector, 93% of the world's 250 largest companies produced sustainability reports in 2013 (KPMG, 2013) and in 2012 the GRI Disclosure database listed total 3513 companies that had reported their sustainability performance. Today the GRI Disclosure Database lists 12150 businesses (GRI, 2018B).

HEIs have primarily focussed on the environmental dimension of SD, specifically in education, and have focussed far less on the economic and social dimensions (ALONSO-ALMEIDA ET AL., 2015). This evidently shows that SD and sustainability assessment and reporting in the HEI sector is lagging far behind (LOZANO ET AL., 2015).

3.4.2. Engagement in the sustainable development goals

The state of the SDG implementation is similar to the engagement in SD. The applications of the SDGs in HEIs is still in its infancy (LOZANO ET AL., 2015). Several of the networks and organisations mentioned in table 1 state that it is important for HEIs to engage in the SDGs. Most of the aforementioned networks, as well as a number of individual HEIs, also endorsed the SDG-Accord, where they declare that they will align all functions of their institution with the SDGs. As the SDGs were only developed in 2015, no organisation provides specific indictors to measure HEIs' efforts to work towards the SDGs. The GRI provides SDG-specific indicators, however these focus on the business sector (GRI, 2015; GRI ET AL., 2015). This shows once more, that the HEIs are lagging behind the business sector in regards to the assessment and reporting on the SDGs.

[21] Number of STARS reports only accounts for those that reported in the last 3 years, as older ones are considered expired

HEIs are starting to develop strategies and frameworks for the implementation of the SDGs (TAHL ET AL., 2017). In 2017, the UN-supported SDSN Australia/ Pacific, in collaboration with the ACTS, released the first and most exhaustive guide on how to integrate the SDGs into HEIs (TAHL ET AL., 2017). The guide provides advice for each of the 5 steps (fig. 4), listing useful tools and referring to other organisations, such as the GRI, for additional guidance. In relation to the SDGs, the guide presents how universities can contribute to the SDGs in each core functional area of a HEI. For education and research separately, the SDSN guide presents the targets that are considered to be relevant, but it does not present associated indicators. For education, original SDG targets are select from goal 4 (TAHL ET AL., 2017, P. 11). For research, targets from SDG 2, 3, 7, 9, 12, 14, and 17 are presented (TAHL ET AL., 2017, P. 16). For operations, each SDG is listed, and examples are given for actions that HEIs can take to work towards the goals (TAHL ET AL., 2017, PP. 24–26). The recommended actions are, however, only linked to the goals and not to specific targets or indicators. For community outreach, only general advice is given, that is not linked to specific SDGs, targets or indicators (TAHL ET AL., 2017, P. 28).

Fig. 4: 5 steps of engaging in the SDGs; Source: (TAHL ET AL., 2017, FIG. 3)

PRME, founded in 2007, is another UN-supported initiative that engages in the implementation of the SDGs in management-related HEIs. It is a voluntary initiative with ca. 650 global signatories (PRME, 2018A). As stated in chapter 3.3, PRME does not provide a guide or a framework for HEIs to engage in the SDGs but they have a blog named 'PRiMEtime' (WEYBRECHT, 2017A, 2017B) which communicates advice on how to mainstream the SDGs into management-related HEIs based on HEI case studies. Lastly, the IAU's HESD[22]-Website has a dashboard database which lists HEIs that are taking actions towards each goal.

[22] IAU HESD: IAU Higher Education and Research for Sustainable Development

The development reports of the few SDSN and PRME signatories or members, that have begun to engage in the SDGs, show general characteristics:

1. An acknowledgement is given by the institutions' leaders in a welcome letter within the report, stating that the HEI commits to work towards the SDGs. For example, the Copenhagen Business School states, "We acknowledge our responsibility in relation to the SDGs[...]" (CBS, 2017, PP. 4–5). 7 of 48 PRME Nordic HEI signatories have done this.
2. Previous and current actions HEIs have taken towards each SDG are mapped out and clustered according to the corresponding SDGs. This was done, among others, by the Copenhagen Business School (CBS, 2017), the Bologna University (ALMA MATER STUDIORUM, 2016), and Rotterdam School of Management (RSM, 2017, PP. 26–59). Some HEIs have only presented the SDGs in which they have prioritised, e.g. Deakin University (DEAKIN UNIVERSITY, 2016) and therefore do not address certain gaols. 3 of 48 PRME Nordic HEI signatories did this.
3. The reporting of their actions towards the SDGs is not organised into the different HEI core functions.

Lastly, although not yet engaging with the SDGs in their development reports, some HEIs have stated their intention to engage their whole HEI with the SDGs in future, e.g. King's College London's (KCL) sustainability team is carrying out a baseline survey to identify how KCL can contribute to achieve the SDGs and is writing a baseline report (KCL, 2018). HEIs are holding conferences and workshops to understand how their institutions, or HEIs in general, can become engaged, e.g. SDG Conference Bergen 2018 (UIB, 2018A), Sustainability Science Conference 2017 (NTNU, 2018E), the HVL internal conference (HVL, 2018B), and the University of Manchester Symposium (EAUC, 2018B). The University of Oslo (UiO) has also established the 'The Oslo SDG initiative' which will be a platform for education, research, community outreach and dissemination for the SDGs to inform policymakers and the wider community of the institutes' actions (UIO, 2018).

3.5. Higher education institutions' engagement in sustainable development: where is Norway

Relating to education for sustainable development, a general misconception can be observed in Norway. Internationally, Norway's education system is often considered to have a high standard. Yet the actual implementation of sustainability related issues into educational curricula is not very well established in Norway. Several reasons for this are mentioned in the literature. Firstly, it is argued that Norway's close ties to the oil industry is a barrier (STRAUME, 2016). Secondly, education in Norway traditionally had a strong focus on outdoor education. This is often falsely considered to be the same as education for sustainable development (ESD). Consequently, the public perception often views ESD as well established in the education system (ANDRESEN, HØGMO, & SANDÅS, 2015; STRAUME, 2016). Lastly, it is argued, that Norway has a far greater focus on advancing SD in other countries than in Norway itself (STRAUME, 2016).

Specifically relating to higher (tertiary) education in Norway, there are ten universities, nine specialised university colleges, 14 university colleges/universities of applied sciences, and 18 university colleges with accredited study programmes. Norwegian HEIs are beginning to engage in the SDGs. Norwegian HEIs have held a number of conferences to determine how Norwegian HEIs can contribute to the SDG, such as the "SDG Conference Bergen", held by the University of Bergen in February 2018, the recent internal conference of HVL regarding HVL's commitment to the SDGs in April 2018, and the Sustainability Science Conference in 2017 which was held by the Norwegian University for Science and Technology (NTNU).

Out of the Norwegian HEIs, NTNU appears to be the most engaged as they have fully embedded their institutions' strategy and report in line with the SDGs and their contributions are very visible on their website (NTNU, 2018B). They have created an SDG dashboard *"From vision to action: Explore NTNU in light of the UN's sustainability goals"* where they state their actions in research and education for each SDG. For this, they believe *"Research and education to be central"* (NTNU, 2018B). Their research includes several national and international projects. Sustainability is also one of their four 'Strategic Research Areas' from 2014 to 2023 as stated in the institutions' main missions (NTNU, 2018A). NTNU claims that their *"research on sustainable development of society includes environmental, economic and social aspects in the broadest sense."*; they have four main SD research areas (NTNU, 2018D). However, they do not state if they are taking actions to improve their operations. Although, we are aware they have carried out a carbon footprint assessment (LARSEN, PETTERSEN, SOLLI, & HERTWICH, 2013). NTNU also has three courses offered in three departments[23] that pertain to the SDGs.

When researching other Norwegian HEIs, their actions for the SDGs were not as visible as for NTNU. No other HEIs have mentioned the SDGs in their mission statements. However, some Norwegian HEIs are carrying out research and education for the SDGs. For example, when searching the University of Oslo's website, 62 studies, 12 research projects, and 17 articles from employees, were found that mention the SDGs. The University of Oslo has also established 'The Oslo SDG initiative' which will be a platform for education, research, community outreach and dissemination for the SDGs to inform policymakers and

[23] Department of Public Health and Nursing; Department of Architecture and Planning; Department of Industrial Economics and Technology Management

the wider community of the institutes' actions (UIO, 2018). Despite not mentioning the SDGs in their strategy, UiO recently stated *"When we develop a new strategy for the University of Oslo this fall the SDGs will be a main frame of reference".* They place importance on the fact that they *"will seek to strengthen the ties between research and education"* and improve their community outreach: *"We also aim to be even more outward looking through better and more cooperation with businesses and societies". UiO was found to be the only Norwegian HEI that pledges to address their campus operations: "So how we manage it, [UiO] makes a difference. Recycling projects, green investments, and are all important […]. We are working hard to make sure that the money we spend goes to suppliers that act sustainably and fair – but we need to do more"* (GORNITZKA & BJØRNERUD, 2018).

At UiB, only one study course was found that relates to the SDGs. UiB also has a summer research schools that focuses on the SDGs and how they should be used to promote excellence in research and education. They state that *"this year the new SDG get full attention"* at the summer school of 2018 (UIB, 2018A). UiB has many research initiatives linked to topics of SD[24], although they do not mentioned the SDGs specifically. Their main initiatives in relation to the SDGs include the new 'Ocean Sustainability Centre' as they state the center *"aims to make research and science diplomacy a key part of Norway's contribution towards a sustainable ocean, one of the UN's 17 …(SDGs) in Agenda 2030"* (UIB, 2018C). They also have a research group called 'The Global Sustainable Development Group' which focuses *"on the goals that activate the need for knowledge and relation between economics and politics"* (UIB, 2018B). Even though the SDGs are not mentioned in their current strategy, they place importance on education and research for SD, *"through research and education, we shall contribute towards […] a diversified and sustainable society"* (UIB, 2016). They do not mention how they wish to improve the sustainability of their institutions' operations. Recently, UiB has pledged to work towards SDG 14 as the rector changed the institutions' strategy to be in line with Norwegian national policy; to be 'carbon neutral' by 2030 (UIB, 2018A).

A few Norwegian HEIs are also members of international and national networks. The Norwegian Business School (BI) and the Norwegian University of Life Sciences (NMBU) are members of PRME, and NTNU, UiB and Hedmark Universty College (HiH) are members of SDSN. NMBU, NTNU collaborate, among others, with the Norwegian Agency for Development Cooperation (NORAD), aiming to ensure Norwegian development aid funds are spent in the best way, and to report on project successes and failures, and the Southern Africa-Nordic Center (SANORD), addressing issues of global sustainability.

[24] Climate, Culture and society, Ecology, Education, Gender, Governence, Health, Human Rights, Migration, Poverty

The information we present here may not be fully representative of Norwegian HEIs actions as we were not able to find publications that summarise recent efforts of Norwegian HEIs for the SDGs. We gained much of the information from the Norwegian HEIs' websites and from the UiB SDG conference (UIB, 2018A). To the best of our efforts, we have summarised examples. Fully researching this topic, however, is beyond the scope of this thesis. We merely provide examples of Norwegian HEIs' engagement in SD and the SDGs.

4. Summary

In the last few decades an increasing number of HEIs have acknowledged their role in advancing SD. A standardised and internationally recognised framework can be of great help for HEIs to engage in SD (TAHL ET AL., 2017). A wide array of different frameworks have been developed to assess the sustainability performance of HEIs, each one with a slightly different focus and weight on the different aspects of SD and functional areas of HEIs. However, at current, there is no internationally recognised and standardised framework for sustainability assessments and reporting (TAHL ET AL., 2017; VON HAUFF & NGUYEN, 2014) that holistically assesses HEIs progress towards SD in regards to all dimensions of SD (economic, social and environmental) across all HEI core functions (education, research, campus operations and administration, community outreach).

The difficulty in creating such a framework lies in the fact that the framework would have to be standardised and widely applicable, yet at the same time adaptable to the specific circumstances of each HEI. The SDGs, which are a globally accepted and holistic framework, have the potential to serve as such a framework, if adequately translated and implemented. The translated SDGs would provide precise and measurable targets and indicators, and also provide the freedom for every HEI to choose actions that are in line with the specific circumstances of each HEI.

The SDSN guide 'Getting Started with the SDGs in Universities' (TAHL ET AL., 2017) is the most extensive guide so far for HEIs that aim to engage in the SDGs, and if it would adopt a translation of the SDGs for HEIs, it would be the ideal guide in our opinion.

C: Overview of HVL and the Sogndal campus

We chose to use a case study so we could research the application of the SDGs in 'real-life events'. We place the focus of our thesis on the Western Norway University of Applied Sciences (HVL) and more specifically on the HVL-Sogndal campus, as this is where we both study. Furthermore, HVL Sogndal currently has no holistic sustainability assessment method in place or a holistic sustainability report. Therefore, this case study is of greatest interest to us. In the following we will give a short introduction on the structure of HVL with a specific focus on the Sogndal campus of HVL.

5. Western Norway University of Applied Sciences

5.1. Background

HVL was officially established on 1.1.2017, as a result of the merging of several smaller university colleges (Høgskuler). These former university colleges were the Bergen University College (HiB), the Sogn og Fjordane University College (HiSF)[25] and the Stord/Haugesund University College (HSH) (fig. 5). After the merge, HVL had 16 637 students (HVL, 2017A) and 2175 employees (HVL, 2018D). With approximately 9200 students and 1200 employees, the Bergen campus is the largest one. The second largest is the Sogndal campus (not including Førde), with approximately 3200 students (HVL, 2017A) and 400 employees (HVL, 2018D). In 2017 HVL had a total budget of 1 791 billion NOK (HVL, 2017A).

Fig. 5: Campuses of HVL; Source (HVL, 2017A)

[25] HiSF itself contains two campuses, one in Sogndal and one in Førde

HVL offers a variety of courses on different education levels. Currently there are 2 PhD programmes, 45 master programmes, 38 bachelor programmes and 13 one-year or semester programmes. These are offered in the following four faculties (HVL, 2018G, 2018F):

- Faculty of Education, Arts and Sports (FLKI)
- Faculty of Health and Social Sciences (FHS)
- Faculty of Engineering and Science (FIN)
- Faculty on Business Administration and Social Sciences (FØS)

HVL is closely linked to Studentsamskipnaden i Vestlandet (SAMAN[26]) and Studenttinget på Vestlandet (STVL). SAMAN is the student welfare organisation and provides student services at each campus, including student housing, cantinas, health services, child care facilities for students' children, sports centres and more (SAMAN, 2018A). SAMAN's board consists of both students and employees of SAMAN. The student representatives, however, are not all students of HVL. There are each two student representatives from HVL, the Norwegian School of Economics (NHH) and UiB (SAMAN, 2018B). SAMAN also provides services to students of these institutions. STVL is the Western Norwegian Student Council and it is the advocate for all students at HVL. The student council consists of 20 representatives, based on all campuses of HVL (STVL, 2018B)

5.2. Comparison to other higher education institutions

HVLs structure, with its multiple campuses, is spread over a large area. In the Norwegian, Scandinavian and international context, this is common for rural HEIs. For example, NTNU with its main campus in Trondheim, also has campuses in Ålesund and Gjøvik which are ca. 300 km and 400 km from NTNU's main campus, respectively (NTNU, 2018C). In Sweden, the Swedish University of Agricultural Sciences (SLU) has four main campuses in Alnarp, Skara, Umeå, and Uppsala and several smaller ones spread throughout Sweden (SLU, 2017).In Scotland, UK, the Highlands and the Islands University (UHU) has 13 colleges and research centres located in rural regions of Scotland.

[26] Also called sammen, depending on nynorsk or bokmål spelling

6. HVL-Sogndal

6.1. Background

As stated above, the Sogndal campus is now the second biggest campus of HVL, with approximately 3200 students and 400 employees. Combined with the campus in Førde, the two campuses had a total budget of approximately 430 million NOK (HVL, 2017A) in 2017[27]. At the Sogndal campus, a total of 34 study programs are offered, of which 7 are master programmes, 17 are bachelor programmes and 10 are one-year or semester programmes (HVL, 2018F). HVL-Sogndal offers courses mostly related to health and social sciences, teacher education, outdoor and physical education, economics and administration, and environmental sciences (HVL, 2018F).

The Sogndal Campus of HVL is located in Sogndal, which is the administrative center of the Sogndal municipality. Sogndal municipality lies within Sogn og Fjordane county, Vestlandet (West-region), Norway. Vestlandet is known for its characteristic landscape of fjords and mountains. The Sogndal municipality has about 8000 inhabitants (SOGNDAL KOMMUNE, 2018). The Sogndal campus with its 3200 students and 400 employees therefore plays a major role in the municipality, being directly linked to almost half of the population in the Sogndal municipality. The campus has an even greater impact when accounting for all external stakeholders associated with the campus, such as local companies and governmental institutions.

HVL-Sogndal campus is situated on the Fosshaugane Campus, five minutes walking distance to Sogndal town center and consists of six buildings, (fig. 5, building nr. 1 – 6). The newest building of the HVL-campus is Høgskulebygget, which opened in 2012. Building 2, Gymnaset is currently under construction and will be an additional building for HVL-Sogndal. Fosshaugane campus is also home to Sogndal Football, Sogndal high school Sogndal vidaregåande skule (Sogndal high school), Vestlandsfoskning (Western Norway Research Institute), and a number of local businesses. The development of the Fosshaugane campus, including the development of HVL-Sogndal, was highly influenced by the presence of Sogndal Fotball. In 2011, the men's football team was promoted to the Norwegian Premier League and therefore has strong national standing. Due to the presence of Sogndal Fotball, close to 1.8 billion kroner has been invested in the Fosshaugane campus since the year 2000 (ENITCH, 2017).

[27] Information on the budget of the Sogndal campus alone was not available

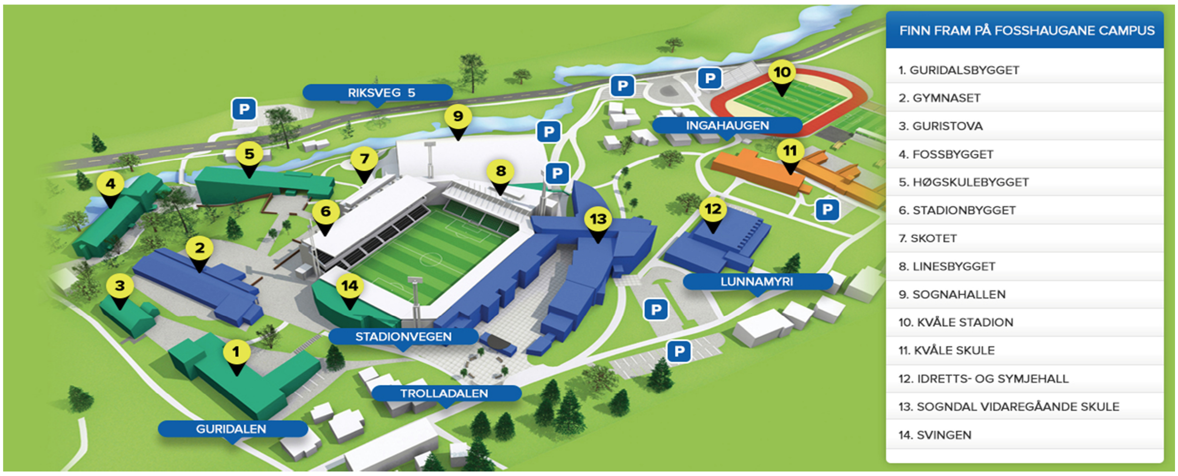

Fig. 6: Fosshaugane Campus; Source (FOSSHAUGANE CAMPUS, 2018)

Fosshaugane campus has been an educational hub dating back to the 1960s. Before the merge, HVL-Sogndal belonged to HiSF which was founded in 1994 as a result of the merge between various HEIs in Sogn og Fjordane including, ‘Sogndal Lærerskole’ and ‘Sogn og Fjordane distriktshøgskule’. HISF consisted of students and staff distributed in Sogndal, Førde and Sandane. From 1995, HISF administration was located at the Fosshaugane campus. Initially, sport primary education was the main study offered at HISF. This was due to the presence of Sogndal Fotball and the opportunities presented by the surrounding western Norwegian fjord and mountain landscape. Since then, the study programmes offered at HVL-Sogndal have grown in number and diversity (ENITCH, 2017).

6.2. Ties to local community

As stated above, the Sogndal Campus plays a major role in the local community. Before the merge, the former HiSF defined the collaboration with local authorities and businesses as a focus area in their strategic plan for 2014 to 2018 (HVL, 2017A). It is inferred in the ‘Årsrapport 2016 – 2017’ (HVL, 2017A) that this focus area will continue for HVL-Sogndal after the merge. As an example, HVL-Sogndal is involved in the organisation of the yearly climate conference, together with the local authorities such as the Fylkesmannen i Sogn og Fjordane, and local research centers such as Vestlandsfoskning (FYLKESMANNEN I SOGN OG FJORDANE, 2018). Furthermore, HVL-Sogndal has links to local businesses, e.g. Rocketfarm, Innovation Norway, SGN, Furberg, and public radio and television broadcasting companies (e.g. NRK). These links are strong as the mentioned companies have a presence at the Fosshaugane Campus.

6.3. International Links

In addition to the links to local authorities and businesses, HVL-Sogndal, and in this case the whole HVL, is involved in a number of international collaborations. These include collaborations in the Nordic countries, such as the 'Nordplus' programme for student and teacher mobility. On the European scale, HVL is involved in the ERASMUS+ programme and collaborates with other institutions in respect to Horizon 2020 research programmes. On a global scale, HVL is, for instance, in research collaborations with institutions in India, and China. A more complete list of collaborations can be found on the HVL webpage (HVL, 2018C).

HVL furthermore collaborates with a number of institutions to ensure student mobility. According to the administration staff at HVL-Sogndal, HVL has around 300 partner universities that offer student exchange programmes. In Europe these include, but are not limited to universities in Germany, Netherlands, Spain, Poland and the Czech Republic. HVL-Sogndal has additional partnerships with universities in Australia (James Cook University & University Sunshine Coast), the US and Canada. Details on opportunities for exchange programmes can be found in the description of each course on the HVL-website (HVL, 2018F). According to the administration staff, students from HVL-Sogndal most commonly apply for exchange programmes with Australia. Exchange students that come to Sogndal are mostly from Germany and the Netherlands. HVL-Sogndal also had an exchange programme with the Livingstone School of Nursing in Livingstone, Zambia, which provided Zambian students the opportunity to study in Norway, yet this programme was cancelled a few years ago. However, a new exchange programme with the University of KwaZulu-Natal in Durban, South Africa is in development. Lastly, HVL-Sogndal also employs a number of foreign staff, for example from Germany, France or Britain.

6.4. HVL-Sogndal's engagement in SD

As stated in chapter 3.5, Norwegian HEIs are lagging behind their Scandinavian neighbours, such as Sweden. HVL does not currently have a stand-alone concrete sustainability assessment system to monitor its sustainability performance, a plan that aims to improve their sustainability, or a report to communicate their effort for SD. HVL is however certified Miljøfyrtårn, which is a Norwegian environmental certificate. It mainly assesses an institution's or company's environmental performance, relating to energy consumption, greenhouse gas emissions, waste management and amount of purchased goods that are certified as well, for example through Miljøfyrtårn or the European Eco-Management and Audit Scheme (EMAS) (HVL & MILJØFYRTÅRN, 2018).

The most notable and most recent milestones for HVL engagement in SD have occurred in 2018. In February, 2018, HVL formed a sustainability team consisting of twelve employees[28]. They organised an internal sustainability conference, held 18th and 19th April, 2018, called 'Sustainable development of HVL – where do we stand, where do we go?' (HVL, 2018B). The conference covered what HVL students learn, what is being done in HVL research, how HVL works towards new innovations, in regards to SD, and lastly how HVL lives up to the SDGs within operations and administration. The conference formed the basis for further ideas and collaboration across the institution, both across campus and across faculties. Together with Valeria Jana Schwanitz, a member of the HVL sustainability team and conference organiser, we summarised areas of action that were identified at the conference:

- **Strategy:** The need to transform and establish a sustainable development framework with measurable goals.
- **Monitoring:** The need to monitor and assess HVL's performance with respect to the SDGs.
- **Data policy:** The need to work out an overarching data policy, handling the access to data and publishing standards (e.g. open access to data and publishing).
- **Communication:** The need to improve communication channels in order to enable staff and students to actively participate in sustainable development.
- **Education:** The need to educate staff and students on sustainable development through implementing sustainable development education in all courses and at all levels.
- **Research:** The need to strengthen and foster research on sustainable development, focusing on the transformative capacity the university holds within their regions.
- **Operation:** The need to set measurable goals that will help to steer operational activities.
- **Outreach:** The need to commit to and report on sustainable development to partners in the public and private sector, in Norway and abroad.

At current, there has been no assessment of the inclusion of education for sustainable development in HVL courses. To research HVLs engagement with SD and the SDGs we searched on HVLs' main website using the terms 'berekraftig utvikling' and 'sustainable development' (HVL, 2018E). Specifically for HVL-Sogndal, we are aware that some courses are focused on specific aspects of SD, e.g. the new masters in 'Climate Change Management', that started in 2016 and the bachelors, 'Renewable Energy', in the institute of environmental and natural science. Elements of SD are also taught in other courses, such as

[28] Anne Marie Møller Vigeland, Knut Vindenes, Berit Natalie Krogh Bareksten, Valeria Jana Schwanitz, Inger Auestad, Alf Harald Aronsen, Knut Steinar Engelsen Carsten, Gunnar Helgesen, Marit Vassbotten Olsen, Marcin Fojcik, Lisa Steffensen, and Bodil Moss

landscape planning with landscape architecture, and geology, but the extent is limited. We are aware of one course taught at HVL-Bergen, 'Sustainable Development by Involvement', which is a preschool teacher training 30 credit course available for 'Early Childhood Education and Teacher Education' students. By searching the HVL website for the terms 'berekraftig utvikling' and 'sustainable development', we found that sustainable development is taught in other courses offered at other HVL campuses including courses within the Institute for Civil Engineering (courses unspecified) offered at HVL-Bergen and HVL-Førde, the 'Natural Sciences 2, 1.-7. Steps' course offered at HVL-Bergen, and the 'Chemical Engineering' course offered at HVL-Bergen (HVL, 2018J). We are aware of six HVL-Sogndal staff members that carry out research for sustainable development: Carlo Aall (researcher at Vestlandsforsking), Valeria Jana Schwanitz (associate professor in the Institute of Environmental and Natural Science), Andrea Synnøve Blomsø Eikset (lecturer on kindergarten teaching), Erling Holden (professor in the Institute of Environmental and Natural Science) and Lars Leer (associate professor at the Department of Social Sciences).

HVL has included SD in their main mission statements and made this visible on the Norwegian version of the HVL website. Their mission is translated as *"We support growth for a sustainable development of the social, work and business sectors and for the individual"* (HVL, 2018I). However, SD is not mentioned on the English translation of the website (HVL, 2018a). SD is also included in the strategy plan for HVL, which states that SD is proposed as one of the three transversal synergy areas in the strategy plan, along with ICT and responsible innovation and regional change to *"develop educators and professionals with the aim of contributing to sustainable development"* (HVL, 2017B, P. 5, 2018H).

No information was found if SAMAN engages with SD or the SDGs when searching their website (SAMAN, 2018A). The only action we found is that they have the miljøfyrtan certificate. Studenttinget, the student council for HVL, supports SD in their action plan as they state *"The Student Parliament shall […] Work for the University College to contribute to a sustainable development of society […] [and] to create climate change cabinets, and the miljøfyrtårn certification [of] all campuses"* (STVL, 2018A, P. 2). They also state in their policy paper *"HVL must have sustainable, environmentally conscious and future-oriented operations"* (STVL, 2017, P. 7). Their reports are written in Norwegian so the statements are English-translations from the reports.

6.5. Summary

The information on HVL we present above is perhaps limited as the HVL website and the HVL documents are written in Norwegian. HVL is in the process of creating a translated English version of the website and their documents, but at current they are not complete. We provide information where we found SD being mentioned on their website. However, we would like to give recognition that HVL is taking several actions for SD, but they are not acknowledged by HVL to be under the SD umbrella. Overall, this case study is interesting for our theses to focus on as HVL does not have a holistic SD assessment methodology or report at current. HVL-Sogndal is specifically interesting to focus on as HVL-Sogndal has a dense environment for students and employees and almost half of Sogndals population is directly involved in HVL-Sogndal (ENITCH, 2017). In this way, if HVL fully engages in SD and the SDGs throughout their entire system, they have great transformative power to influence the Sogndal region.

D: Development of SDG-framework for higher education institutions

7. Purpose

We gained inspiration for our translation from the SDSN guide (TAHL ET AL., 2017) and other HEIs which are in the process of implementing the SDGs (chapter 3.4.2). The SDSN guide stresses the importance of having clear objectives, methodologies and data sources to "Map what you are already doing" (TAHL ET AL., 2017, FIG. 3). A standardised and internationally recognised framework can therefore be of great help for the mapping process. However, the guide also states that such a comprehensive framework does not yet exist for HEIs. The guide mostly only provides targets and actions that can be taken to engage in the SDGs. It does not provide any indicators to measure the progress. Furthermore, not all SDGs are covered. For example, in the HEI functional area 'Education' the SDSN guide only lists targets for SDG 4.Yet, it is important to incorporate all goals into education. Lastly, the provided targets are not translated to apply specifically to HEIs.

For this reason, we translated the SDGs' targets and indicators to apply specifically to HEIs for each core functional area. In the following sections, we present our methodology that we followed to translate the UN SDGs' targets and indicators to apply specifically for HEIs, followed by our resulting translation, and lastly, our discussion of our methodology and final translation.

8. Methods

8.1. Setting the boundaries of a higher education institution

Before we began the translation of the SDGs to apply to HEIs, we defined the HEI system boundaries. Firstly, we defined who we believed to be internal and external stakeholders (fig. 7). The core HEI stakeholders (employees of the HEI or enrolled students at the HEI) were defined as internal stakeholders. Third parties were defined as external stakeholders if they have relevant ties to the HEI. Whether they have relevant ties depends on whether the third party either has an effect on (control over) the internal stakeholders or is affected by the internal stakeholders. The natural environment is, in this definition, also seen as a third party, that can be an external stakeholder, if it effects or is affected by the internal stakeholders. An example for such external stakeholders could be the student welfare organisations such as SAMAN. While SAMAN is governed and funded independently of HVL, its main purpose is to provide services for the students, thereby having an effect on the internal stakeholders. Third parties are not considered stakeholders of HEIs if they do not have relevant ties to the HEI.

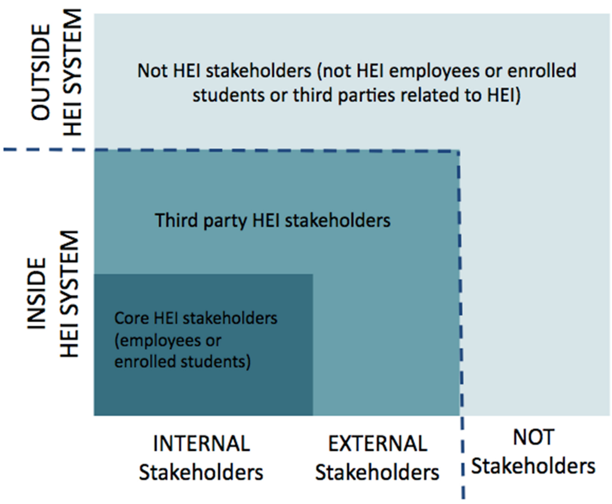

Fig. 7: Definition of HEI-Stakeholders

From this the HEI system boundaries were defined. The HEI system encompasses all internal and external stakeholders, including any kind of physical, economic and social infrastructure associated with these stakeholders. Therefore every entity that is effected by or has an effect on (controls) the internal stakeholders is defined as being within the HEI system. Explicitly, the following is defined to be within the HEI system: the control and effect of an action are internal; the control of an action is internal and the effect of an action is external; the control of an action is external and the effect of an action is internal. Entities that do not control the internal stakeholders or are affected by the internal stakeholders are considered outside of the HEI system (fig. 8).

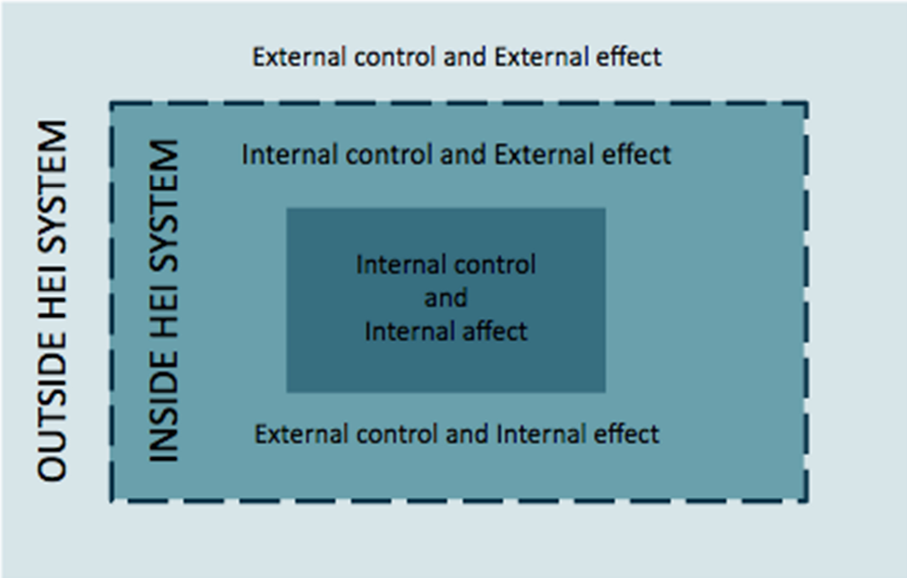

Fig. 8: Definition of the HEI System boundaries

8.2. Defining the functional areas

For the translation of the SDGs to the HEIs the most common categorisation of the functional areas of HEI was used: education; research; operations and administration; community outreach[29]. We provide a definition of the four core functions of the HEIs below. Additionally to the definitions, we provide a list of examples for each core function (table 2).

Research is defined according to the OXFORD DICTIONARY (2018) as, *"The systematic investigation into and study of materials and sources in order to establish facts and reach new conclusions"*. In the context of HEIs, this relates to any research activities of students and staff that are internally or externally funded, or have the aim to be published internally or externally.

Education is defined according to the OXFORD DICTIONARY (2018) as, *"The process of receiving or giving systematic instruction, especially at a school or university."* For the HEIs, this includes all activities directly linked to the HEIs' curriculum.

Operations and administration is defined according to the OXFORD DICTIONARY (2018) as, *"the action of functioning"*, or *"an organized activity involving a number of people"* and *"the process […] of running an organization"*. For HEIs this relates to the action of functioning of the HEI and the process of running the HEI.

[29] Examples of literature using this categorization: (AASHE, 2017B; LOZANO ET AL., 2015; TAHL ET AL., 2017; YARIME & TANAKA, 2012)

Outreach is defined according to the OXFORD DICTIONARY (2018) as, *"An organization's involvement or influence in the community [...]"*. For HEIs this relates to any actions taken by the HEI to involve and influence the internal and external stakeholders and actions taken that go beyond the functions outlined above.

Table 2: Examples for each core functional area;
adapted from (LOZANO ET AL., 2015)

Education	Research	Operations & Administration	Outreach
- courses - programmes' transdisciplinarity - 'Educate-the-Educators' programmes - curricular reviews	- research centres - holistic thinking - inter-linkages between research and teaching - publications - patents - new knowledge and technologies - transdisciplinarity	- energy consumption - waste management - water management - food - purchasing - transport - accessibility for disabled people - equality and diversity - greenhouse gas emissions	- collaboration with other higher education institutions and non-academic stakeholders

8.3. Selection and translation of relevant targets and indicators

Initially, the most relevant original SDG targets were identified for each core functional area of HEIs. If necessary, the relevant targets were then translated to specifically apply to each core functional area. In some cases, several of the original SDG targets were combined to a single translated target. This step also included adopting and, if necessary, translating the original indicator(s) associated with each target. If none of the original indicator(s) were applicable to the translated target, new indicator(s) were developed.

As shown in appendix 1, for each translated target and indicator, associated original target(s) and indicator(s) were listed. It is furthermore specified, whether the translated indicator is qualitative or quantitative. Some of the translated indicators are used for several targets. This is also done in the original SDGs. If this is the case, a reference to the target with the same indicator is provided. It is specified if the link occurs within the same core function or across different core functions.

In the last step the translated indicators were classified according to whether the performance measured by the given indicator: (i) is controlled by internal or external stakeholders; and (ii) affects internal or external stakeholders.

9. Results

Our full translation is presented in appendix 1. The full translation includes six spreadsheets: (i) SDSN recommendations; (ii) Original UN SDGs; (iii) Education; (iv) Research; (v) Operations and Administration; and (vi) Community Outreach. The first spreadsheet shows the SDSN recommendations, copied from TAHL ET AL. (2017), which were used as inspiration for the translation of the SDGs. The recommendations are displayed for each SDG and each of the core functional areas of an HEI. Grey fields indicate that no recommendations were given for this specific combination of SDG and core functional area. The second spreadsheet provides a list of the original SDG targets and indicators (UN ECOSOC, 2016). The last four spreadsheets provide our translated targets and indicators, for each core functional area of an HEI. Each of the four spreadsheets initially names the goal, which is not translated, as the goals are final. It then lists the translated target, the related SDG target, the translated indicator, the related SDG indicator, the indicator type, the link to other targets and indicators (if repeated) in the same core function, the link to other targets and indicators (if repeated) across different core functions, and lastly whether the performance measured by the given indicator: (i) is controlled by internal or external stakeholders; and (ii) affects internal or external stakeholders. In our translation, at least one target for each goal in each core functional area is presented, with at least one indicator per associated target.

For all core functions, we have provided both quantitative and qualitative indicators, most of which are quantitative. For education, the translated indicators mostly refer to the amount of courses or education programmes related to each associated targets and SDG. All indicators for education are classified as 'internal control' and 'internal effect'. For research, the translated indicators mostly refer to the number of research activities related to the associated targets and SDG. All indicators are classified as 'internal control', but are either classified as 'internal effect' or 'external effect'. For outreach, the translated indicators mostly refer to the number of outreach activities related to the associated targets and SDG. All indicators are classified as 'internal control' and 'external effect'. Operations and administration includes the largest number of indicators. Most of the indicators are classified as 'internal control' and 'internal effect', but many are also classified under the different categories.

For education, research, and outreach, our targets and indicators are more precise if the original SDG targets and indicators specifically mentioned higher education, research or outreach activates, respectively.

No indicators are classified as external control and external effect as this combination is considered to be outside of the HEI system boundaries, as explained above (fig 8).

10. Discussion

The purpose of this translation is to provide initial inspiration on how the SDGs can be fully translated to apply to HEIs. Specifically, it shows that each SDG goal can, in fact, be applied to each core function of HEIs. In this way, our translation is innovative compared to other efforts, e.g. the SDSN guide (TAHL ET AL., 2017). The translation, however, is not the ideal final framework and it needs further improvements if it is to be accepted as a standardised universal framework for the application of the SDGs to HEIs.

The applied methods and results will be discussed in three sections. Firstly, the definition of the HEIs' system boundaries and the categorisation of the HEIs' core functions will be discussed. Secondly, the process of the translation itself will be discussed. Thirdly, the classification of the translated indicators into internal or external control and internal or external effect will be discussed.

10.1. The definition of the HEIs' system boundaries and the categorisation of the HEIs' core functions

For the purpose of our translation, our definition of the HEIs' system boundaries is reasonable. It defines the internal and external stakeholders of an HEI, and those who are not stakeholders of an HEI. The applied categorisation of the functional areas of HEIs, i.e. education, research, operations and administration, and community outreach, is well-established and commonly used. However, the boundaries between the categories cannot be clearly defined as they are all closely interlinked, as discussed in chapter 3.1.1 – 3.1.5. As no clear definitions of the categories were found in previous work, we provide our own subjective definitions. A clear definition of the different functions of an HEI was necessary in order to carry out our translation.

10.2. The process of the translation

Even though the applied definitions of the core functional areas are well defined, we found that several targets could be assigned to multiple core functions due to the cross-sectoral nature of the SDGs. For example, the following target was attributed to both the education function (appendix 1, Education 16.1) and outreach function (appendix 1, Operations 16.1.): *"Support and/or work to promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels, with a focus to raise awareness and knowledge on* *global and local issues"*. This target was attributed to both functions as it is equally important to educate students and staff, as well as the wider community on these issues. In almost all cases, the targets listed under the assigned core function overlap with the other core functions. For example, for all the indicators in appendix 1, Education, where the indicator specifies *"Amount of courses offered at the university that deal with topics mentioned in target, categorized by type of course (undergraduate, postgraduate, staff training, etc.)"*, this is primarily attributed to education as it is related to the course curricula offered at the HEI. Yet, the number of courses offered at the HEI depends on the funding available for education, which is governed by the operations and administration function. This was not classified under operations and administration in order to minimise the complexity of the framework.

The translation of the original SDG targets and indicators to apply specifically to a core functional area was subjective as we formulated a translation that we believed to be most applicable for HEIs. The subjectivity of the whole translation processes, allocating the SDGs' targets and indicators to a core function and the translation of the original SDGs' targets and indicators, cannot be removed completely. This means that, if other HEIs carry out the same methodology as presented above, different HEIs are likely to formulate different versions of a SDG translation for HEIs. Therefore, in order to create a standardised universal framework for all HEIs, we advise that several HEIs worldwide carry out the presented process, and combine their efforts in a democratic process. The formulation process of the original SDGs, targets, and indicators is considered one of the *"most transparent and inclusive process in UN history"*, as stated by the former UN Secretary General Ban Ki-moon (THOMSON, 2015). Therefore, their application for HEIs must also be performed in a democratic and participative way.

10.3. The classification of the translated indicators into either internal or external control and internal or external effect

The translated indicators were classified into internal or external control and internal or external effect in order to allow a classification of the relevance of the indicators for HEIs. Firstly, the most relevant indicators are those with internal control and internal effect (fig. 9). The internal HEI stakeholders have the authority to address the indicator and the indicator directly affects the internal HEI stakeholders. These indicators are the easiest to work towards as they only involve the core HEI system. This is key for the formulation of recommendations to improve the sustainability of a HEI. For example, indicator 5.1.3. for operations and administration (appendix 1, Operations and Administration, 5.1.3.), is controlled by internal HEI stakeholders, i.e. those employing staff in decision-making positions, and has an effect on internal HEI stakeholders, i.e. the ratio of male and female staff employed in decision-making positions. This example is mainly 'internal control' and 'internal effect'.

Second to this, the indicators that are classified as either 'external control' and 'internal effect', or 'internal control' and 'external effect', are also relevant for HEIs. In the former case, the internal HEI stakeholders do not have the authority to address the indicator but the indicator directly affects the internal HEI stakeholders. In the latter case, the internal HEI stakeholders have the authority to address the indicator, but their actions affect the external stakeholders. These indicators are less easy to work towards as it involves the wider HEI system. The former case can be illustrated by indicator 1.1.2 in the operation and administration section (appendix 1, Operations and Administration, 1.1.2). The availability of state funded student support systems (loans, scholarships, etc.) is controlled by external HEI stakeholders (i.e. the government), but affects the internal HEI stakeholders. This example is mainly 'external control' and 'internal effect'. The latter case can be illustrated by Indicator 1.1.1 in the operations and administration section (appendix 1, Operations and Administration, 1.1.1), which measures the amount of fair trade goods used in the HEI. The performance of this indicator may be controlled by the internal HEI stakeholders (i.e amount of fair trade goods purchased), yet the performance primarily affects the external HEI stakeholders (i.e. the producers of the goods). The aim of this indicator is therefore to ensure better wages and working conditions for the producers, and it does not primarily affect the internal HEI stakeholders. This example is mainly 'internal control' and 'external effect'.

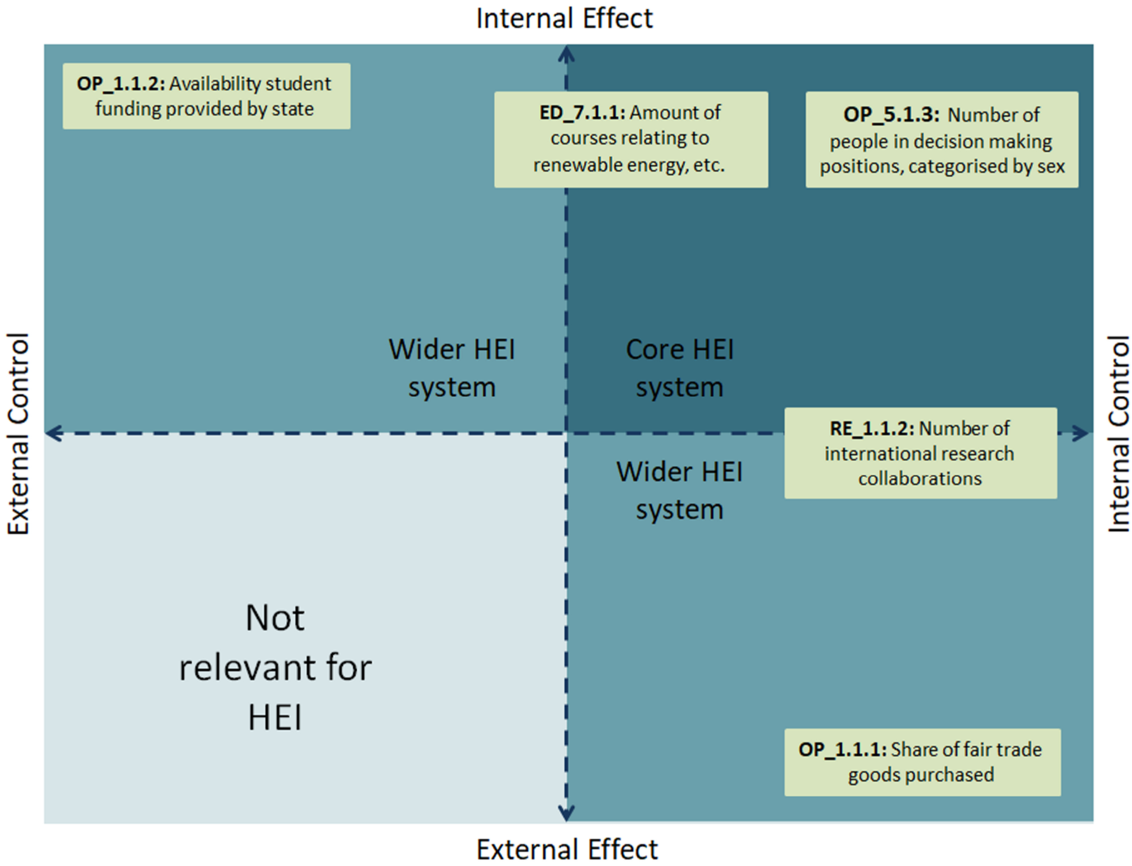

Fig. 9: Examples of Indicator classifications into internal effect, external effect, internal control and external control

The examples presented so far do not overlap into other categories. However, in some cases indicators overlap into other categories. For example, indicator 7.1.1. for education (appendix 1, Education, 7.1.1) is primarily controlled by internal HEI stakeholders as they create the course curricula. Yet, this is also controlled by external stakeholders, as the amount of government funding determines the number of courses the HEI is able to offer. Another example includes indicator 1.1.2. for research (appendix 1, Research, 1.1.2). The number of international research collaboration is controlled by internal HEI stakeholders. The performance in this indictor primarily affects the external HEI stakeholders, e.g. researchers at other HEIs, as the aim of this indicator is to share internal resources with those stakeholders. However, the international research collaboration will also affect the internal HEI stakeholders as the collaboration is not a one-way partnership. In our translation, we have categorised the indicators according to their primary control and effect to minimise the complexity of the translation.

Lastly, it is important to note that the categorisation described above may differ depending on the HEI following the framework. The categorisation is dependent on the individual circumstances of each HEI, such as the organisational structure. This classification was based on the structure of HVL. For example, all indicators relating to student welfare (e.g. student housing services, food services, health services, etc) were classified as externally controlled. As explained in chapter 5.1, these services are provided by an external stakeholder, SAMAN. However, if these services are provided by the internal HEI stakeholders directly, the HEI would categorise these indicators to be internally controlled.

E: Carbon footprint assessment of HVL-Sogndal

11. Linking sustainable development and carbon footprint assessments

As stated in the previous chapters, engaging in sustainable development, and more specifically in the SDGs, requires a holistic approach. A holistic approach that accounts for all aspects of sustainability (e.g. all 17 SDGs) decreases the chance that a certain action towards one aspect of sustainable development has unforeseen impacts on other aspects. Such impacts can be either negative or positive. A simple example for the first is the allocation of funding. In the university context, most higher education institutions have a certain budget. Focusing strongly on, for instance, the reduction of greenhouse gas emissions in the university operations (SDG 13) might lead to lower quality education due to less funding available for education (SDG 4). It is therefore of great importance to weigh the costs and benefits of each action. On the other hand, certain actions might also lead to unexpected synergies. Taking the above example once again, certain action to reduce greenhouse gas emissions might provide new learning opportunities for students, thereby having a positive effect on several SDGs, such as SDG 13 and SDG 4 in this case.

A holistic approach, however, does not imply that actions need to be taken towards each single SDG at the same time. Furthermore, it does not imply that a higher education institution should not set priorities. Quite the contrary, the specific circumstances of each higher education institution very much require the prioritisation of certain SDGs. Such priorities can either be set by identifying those SDGs in which the institution is performing the worst, or those SDGs that provide the easiest and quickest solutions ('low hanging fruits'). Accordingly, the following chapter will show the reasoning for my choice to focus on SDG 13 and assess the carbon footprint of the Sogndal Campus of HVL.

According to the guide 'Getting started with the SDGs in universities' (TAHL ET AL., 2017), one of the first steps for universities that are about to start engaging in the SDGs is to map what has already been done, and afterwards, identify priorities, opportunities and gaps. These steps require a detailed assessment of the HEI's current state in regards to sustainability, involving extensive collection of data and information and subsequent analysis thereof. While a complete assessment of HVL-Sogndal's sustainability performance in all 17 SDGs would be desirable, such an extensive review was not possible in the timeframe given for this thesis. Mapping HVL-Sogndal's current state in regards to SDG 13, by assessing the carbon footprint of the campus was therefore chosen as a priority, mainly due to the fact, that SDG 13 is often considered one of the most important of the 17 SDGs. Remarking on the SDGs, the UN-Secretary General António Guterres stated that *"We need to recognize that climate change became the main accelerator of all other factors"* (GUTERRES, 2017). This statement is backed by numerous experts in the field of sustainability, who believe SDG 13 'Climate Action' to be the most important SDG (GLOBESCAN & SUSTAINABILITY, 2017). Further evidence for the importance of climate change in the sustainable development debate is provided by the Stockholm Environment Institute. The Institute linked the different Nationally Determined Contributions (NDC) to the different SDGs. The NDC are known as the specific climate actions of each country to achieve the goals set in the Paris Agreement (UNFCCC, 2018). The result of the study conducted by the Stockholm Environment Institute clearly shows that each NDC is connected to a variety of SDGs (fig. 10).

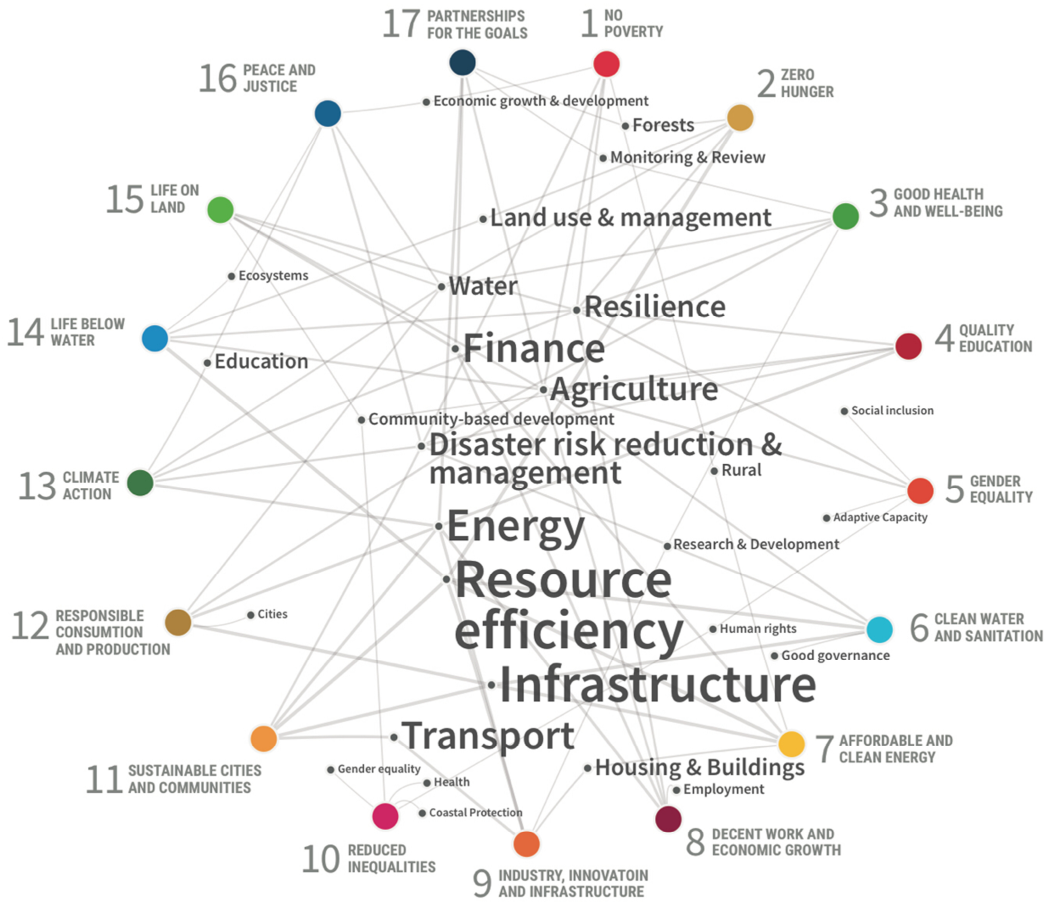

Fig. 10: Relation between SDGs (outer circle) and NDCs (terms inside the circle); Source: (Watt, 2017)

One of the priorities for HVL-Sogndal should therefore be an in-depth analysis of the campus' carbon footprint and the subsequent development of a climate action plan. This thesis aims to provide an initial carbon footprint assessment to identify the most pressing areas of action (e.g. the largest emission sources). Combined with the translated SDG framework for higher education institutions, presented in section D, the results of the carbon footprint assessment for HVL-Sogndal can be used to develop a climate action plan that considers both positive and negative side-effects on the other SDGs.

12. Background and terminology

12.1. Greenhouse Gases (GHG)

Greenhouse gases are gases in the atmosphere that absorb and emit wavelengths that are emitted by the earth's surface, thereby causing the greenhouse effect, leading to global warming. The most common greenhouse gases are water vapour (H_20), carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). All of these appear naturally in the atmosphere, yet their concentration is highly affected by anthropogenic activity. Furthermore, a number of anthropogenic greenhouse gases exist, that do not occur naturally in the atmosphere, such as halocarbons and chlorine and bromine compounds (IPCC, 2014).

12.2. Global Warming Potential (GWP)

Global warming potential is a measurement of the impact of different greenhouse gases on the global temperature. It is defined as the amount of energy absorbed by one tonne of a specific gas over a specific time, in reference to carbon dioxide. Carbon dioxide therefore always has a GWP of 1, independent of the timeframe. The GWP is highly dependent on the atmospheric lifetime of each gas (EPA, 2017).

12.3. Carbon Dioxide Equivalents (CO_2-eq)

Carbon Dioxide Equivalents is the unit to measure the GWP of greenhouse gases in comparison to the GWP of carbon dioxide. The IPCC provides CO_2-eq for a 20, 100 and 500 year timeframe. The most commonly used timeframe is the 100 year one[30].

Industrial Designation or Common Name (years)	Chemical Formula	Lifetime (years)	Radiative Efficiency ($W\ m^{-2}\ ppb^{-1}$)	Global Warming Potential for Given Time Horizon			
				SAR‡ (100-yr)	20-yr	100-yr	500-yr
Carbon dioxide	CO_2	See below[a]	[b]$1.4x10^{-5}$	1	1	1	1
Methane[c]	CH_4	12[c]	$3.7x10^{-4}$	21	72	25	7.6
Nitrous oxide	N_2O	114	$3.03x10^{-3}$	310	289	298	153

Fig. 11: CO_2-eq for the most common GHGs; Source: (FORSTER ET AL., 2007, TABLE 2.14)

30 E.g. GHG-Protocol: refers to 100 year CO_2-eqs in standards on greenhouse gas accounting (GHG-PROTOCOL, 2016)

12.4. Carbon Footprint

The carbon footprint is a measurement of the GHG-emissions associated with a specific entity. Such an entity can be a single person, a product, a household, a company or institution, a municipality, a nation or any other definable system. Today, numerous different approaches to calculating a carbon footprint can be found, ranging from simple online calculators for private households that are designed to be simple to use and easy to understand, to highly complex models for whole countries. In its most basic form, calculating a carbon footprint can be done with only two variables. The first being a measure of quantity, such as number of flights, amount of specific products bought or amount of kilometres driven by car. The second is an associated emission factor. Such emission factors can be found in a number of databases, such as the IPCC emission factor database (IPCC, 2018). Multiplying these two factors results in the emissions associated with the specific action.

The difficulty of calculating a carbon footprint, therefore, depends on several aspects. Some of these are the complexity of the system (e.g. single person vs. a whole institution), the type of activity, and the level of detail of the calculation (chapter 12.6 & 12.7).

12.5. GHG-Protocol

The GHG-Protocol is the main provider for international standards on carbon footprinting for the public and private sector. It was established in 2001 as a partnership between the World Resource Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). Today, 92% of the fortune 500 companies that report on their greenhouse gas emissions use the GHG-protocol standards. Initially being intended mainly for the private sector, the GHG-protocol is increasingly working with cities and countries to establish emission reporting schemes based on the GHG-protocol standards (GHG-PROTOCOL, 2018). Both the STARS sustainability tracking system from the AASHE and the sustainability standards of the GRI refer to the GHG-protocol standards for the section on emission reporting in their sustainability frameworks.

12.6. Scopes

In carbon footprint calculations, the term scope is used to define a specific set of emission sources. The GHG-Protocol identifies three scopes. Scope 1 includes all direct emissions caused by sources that are owned or controlled by the assessed entity. Scope 2 includes all emissions related to the generation of electricity, heat or steam caused by the assessed entity due to the purchase of electricity, heat or steam from third parties[31]. Scope 3 includes all indirect emissions that are caused by third parties as a consequence of the activity of the assessed entity (RANGANATHAN, MOORCROFT, KOCH, & BHATIA, 2001). A list with examples of sources for each scope can be seen in table 3. While scope 3 is the most complicated to calculate it also accounts for most of the emissions. In many cases scope 3 accounts for more than 70%[32].

Table 3: Emission sources associated with each scope;
adapted from (RANGANATHAN ET AL., 2001)

Scope 1 emission sources:	Scope 2	Scope 3
Production of electricity, heat or steam Physical or chemical processing Transportation of materials, products, waste and employees with owned vehicles Fugitive emissions due to leakage, etc.	Purchase/import of electricity, heat or steam	Employee business travel Transportation of materials, products, waste and employees with third party vehicles Outsourced activities, contract manufacturing, and franchises Emissions from waste generated by the reporting company when the point of GHG emissions occurs at sources or sites that are owned or controlled by another company, e.g. methane emissions from landfilled waste Emissions from the use and end-of-life phases of products and services produced by the reporting company Emissions from the use and end-of-life phases of products and services

12.7. Boundaries

In the context of carbon footprint calculations, boundaries describe the limits of the system that is to be assessed, by defining what areas are included in the calculations. Using the example of the Sogndal campus of HVL, different boundaries could be set. A carbon footprint could, for instance, include the

[31] In case of national inventories purchased electricity, heat or steam refers to imported electricity, heat or steam
[32] See: (GHG-PROTOCOL & QUANTIS, 2018; OZAWA-MEIDA, BROCKWAY, LETTEN, DAVIES, & FLEMING, 2011)

student welfare organisation SAMAN. While this organisation is a separate entity, it is so closely linked to campus operations, that an inclusion could be considered. Scopes (chapter 12.6) are another example of specific boundaries. Defining clear boundaries is crucial for carbon footprint calculations, as it ensures transparency, comparability and verifiability of the calculations.

12.8. Life Cycle Analysis (LCA)

A life cycle assessment or Life cycle analysis is normally performed for a single product or a product category. It assesses the energy, material and waste flows from the cradle to the grave of said product. A complete LCA assesses all stages of the life of a product, from the extraction of the raw materials to the management of the waste after the product is out of use. Life cycle assessments are often used to accurately determine the greenhouse gas emissions of all phases of a products life cycle (BusinessDictionary, 2018a). LCAs have the benefit of providing detailed information on the specific product. On the other hand, conducting a life cycle assessment is complicated and time consuming. Therefore LCAs are not available for all products or product categories (Larsen et al., 2013).

12.9. Input-output (IO) models and databases

Input output databases provide information on trade flows between several individuals, most commonly between countries. The data is aggregated into different economic sectors and provided as sum of all trade flows into and out of each respective economic sector. Specific types of those databases are environmental extended input-output (EE-IO) databases. These additionally relate certain environmental impacts to the trade flows of each economic sector. EE-IO databases are available for most countries, the amount of different economic sectors covered by those databases, however, can vary from country to country. EE-IO databases can be either single-regional or multi-regional. Single-regional models assume that imported products are produced in a similar way than domestically produced goods, hence not taking into account the different technological state of a specific economic sector in different countries. Multi-regional EE-IO models, on the other hand, do account for the different technological state of the exporting countries (Wiedmann, 2009).

Environment extended input-output databases, compared to life cycle analyses, include a wider range of activities, as most economical activities can be associated with a general economic sector. On the other hand, EE-IO databases are less accurate and provide less detailed information, for example on a product level and often don't account for small scale regional differences due to being constructed on a national level (LARSEN ET AL., 2013).

12.10. Hybrid Life Cycle Analysis or Hybrid Input-Output models

This type of model uses both input-output modelling and Life Cycle Analysis approaches to make use of the benefits of both, providing a complete, overarching assessment as well as more detailed information in specific sectors, if LCA data is available (LARSEN ET AL., 2013).

12.11. Upstream/ Downstream

Upstream and downstream is a term often used in Life Cycle Assessments and sustainability related activities, but it is also used in economics. Upstream refers to the industry sector related to the extraction and processing of raw materials into intermediary materials. Downstream refers to Industries that process those intermediary materials into the final goods that are sold to the consumers (BUSINESSDICTONARY, 2018B). In regards to sustainability reporting, the boundaries can be set to either include upstream and downstream processes or disregard them. Including those processes implies that the environmental impact of those production and processing stages in a product life cycle are accounted for.

12.12. Previous assessments of the carbon footprint of HVL: Miljøfyrtårn

Previous to this carbon footprint assessment, the Sogndal campus already reported greenhouse gas emissions to the Miljøfyrtårn. According to the available data, the earliest assessment was performed in 2012. Table 4 shows the different emission sources that were included in the reports for the years 2012 to 2016. One can easily recognise that the reporting has been rather inconsistent, including a varying amount of sources every year. Furthermore, the reports never include commuting, purchasing and most of the business trips, other that plane travel.

Table 4: Emission sources included in Miljøfyrtårn assessment of HVL-Sogndal					
	2012	2013	2014	2015	2016
Scope 1	-	-	Fuel for campus fleet	-	
Scope 2	Electricity	Electricity	Electricity District Heating	Electricity	Electricity District Heating
Scope 3	Waste Plane travel	Waste Plane travel	Waste	Waste Plane travel	Waste

13. Methods

13.1. Boundaries and scopes

The following carbon footprint analysis was performed by using the Sogndal campus of HVL as a case study. When setting the boundaries, two aspects had to be considered. Firstly the completeness of the assessment regarding the different emission sources (scopes) and secondly the completeness regarding the physical boundaries (e.g. Sogndal campus vs. all of HVL). As the timeframe did not allow a complete assessment of all scopes for all of HVL, the priority was given to the scopes rather than the physical boundaries. The assessment therefore only includes the Sogndal campus and, furthermore, does not include any third parties such as SAMAN. The calculations were run for the year 2017. To provide a complete overview over the emissions of the Sogndal campus, all three scopes were calculated. Table 5 shows a detailed list of the emission sources that were included, categorised by the corresponding scope. Building on this baseline, additional calculations with adjustments to the boundaries were run, to provide better insight into the impact of each category. A detailed description of the different assessments will be given in chapter 13.4.

Table 5: Emission sources of HVL-Sogndal, categorised into scope 1, 2 and 3

Scope 1	Scope 2	Scope3
• Fuel consumption of campus fleet	• Electricity and Heating	• Purchased goods and services • Capital goods • Waste • Business Travel • Employee and student commuting

13.2. Resources: Scope 3 Evaluator

The calculations were run with the help of the "Scope 3 Evaluator", which is an online calculation tool provided by the GHG-Protocol and Quantis (GHG-PROTOCOL & QUANTIS, 2018), that aligns with the Scope 3 Standard of the GHG-protocol (WBCSD & WRI, 2011). The tool was designed for organisations that have not done carbon footprint calculations before and provides a rough, yet complete first estimation of an organisation's emissions. It is applicable globally and throughout all industry sectors. The tool links the user's data to a series on input-output and life-cycle databases, to calculate the carbon footprint, which is categorised by the evaluator into scope 1, scope 2 and scope 3 emissions. Scope 3 emissions are further broken down into 15 sub-categories (fig. 12). For the Sogndal campus, only categories 1, 2, 3, and 5, 6 and 7 are relevant. The following chapters provide a detailed description of the methods used by the tool for each of the relevant categories. The information on the methods used by the tool is taken from the documentation provided by the developers of the tool (GHG-PROTOCOL & QUANTIS, 2017).

Fig. 12: Scope 3 sub-categories provided by the Scope 3 Evaluator; Source: (GHG-PROTOCOL & QUANTIS, 2018)

13.2.1. General Information

The Evaluator requires a set of general data inputs to create a baseline for the following calculations. This includes a specification of the economic sector the assessed organisation belongs to, a reference timeframe and a number of employees. The economic sector can be chosen from a selection of 36 sectors. The sectors are defined in accordance to the third revision of the International Standard Industrial Classification (ISIC Rev. 3.1) from the United Nations Statistical Division (UNSD, 2002)[33]. The number of employees is selected from a set of ranges[34] and is used to calculate the emissions from employee commuting.

13.2.2. Scope 1 and 2 emissions

Scope 1 and 2 emissions are divided into fuel use (scope 1) and electricity consumption (scope 2). Fuel use provides a selection of different fuel types to choose from and the according data can be entered in kg, kWh, Btu, MJ, or metric tonnes. The Evaluator uses emission and conversion factor datasets from the United States Environmental Protection Agency (USEPA, 2008), ecoinvent (ECOINVENT, 2010), the Massachusetts Institute of Technology (SUPPLE, 2007), and the GHG-protocol (WRI, 2008) to calculate scope 1 emissions. Electricity consumption is entered as MJ, Btu, kWh or MWh and is specified by the country, the organisation is located in. Scope 2 emissions are calculated with emission and conversion factors provided by ecoinvent (ECOINVENT, 2010) and the GHG-protocol (WRI, 2014). Scope 1 and 2 emissions only account for CO_2.

13.2.3. Scope 3 emissions

13.2.3.1. Category 1 and 2: Purchased Goods and Services and Capital Goods

Data on purchased goods and services and capital goods is entered in reference US-Dollars, and is classified in the same 36 economic sectors as listed in chapter 13.2.1. The data is linked to a world multi-regional database on environmental impacts by the sectors classified in the ISIC Rev. 3.1 (TIMMER, DIETZENBACHER, LOS, STEHRER, & DE VRIES, N.D.; WIOD, 2009). Emissions from purchases are thereby provided as average for each sector. These categories account for CO_2, CH_4 and N_2O.

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[33] See appendix 2 for list of economic sectors

[34] Employee number categories: < 50; 51-250; 251-1000; 1001-2500; 2501-5000; 5001-10000; > 10000

13.2.3.2. Category 3: Fuel and Energy related Activities.

This category shows indirect emissions associated with Scope 1 and 2 emissions, such as upstream emissions from the fuel and electricity providers. This category does not require a specific data input and is automatically calculated depending on the scope 1 and 2 data. Emission and conversion factors for this category are provided by the ecoinvent database and the United States Environmental Protection Agency database (ECOINVENT, 2010; USEPA, 2008). Being derived from scope 1 and 2 emissions, this category only accounts for CO_2.

13.2.3.3. Category 5: Waste

Data on waste production is entered as amount of reference US-Dollars spent on waste management. The calculator uses data provided by the Open Input-Output Database of The Sustainability Consortium (TSC, 2011) to calculate emissions from waste management. Category 5 accounts for CO_2, CH_4 and N_2O.

13.2.3.4. Category 6: Business Travel

Business travel data can be entered into the calculator either as distance travelled (in km or mi) or price of business travel (in US-Dollar). Selectable modes of transportation are car, bus, plane, van, train, bicycle, taxi and sea. Conversion from US-Dollar to distance is calculated with factors provided by the UK Government GHG Conversion Factors for Company Reporting Database (UK-DECC & UK-DEFRA, 2016) and emissions associated with travel distances are calculated with the world multi-regional database on environmental impacts (TIMMER ET AL., N.D.; WIOD, 2009). Business travel emissions only account for CO_2.

13.2.3.5. Category 7: Employee Commuting

Employee commuting is calculated by using the average number of employees for each of the range categories given in the general part of the data input (chapter 13.2.1). The calculator uses a value of 1 700kg CO_2-eq/yr, which is derived from the National Household Transport Survey of the USA (USDOT, 2014) and the ecoinvent database (ECOINVENT, 2010). It could not be identified, which greenhouse gases are accounted for in this calculation.

13.2.4. Price Adjustment

Where data is entered into the evaluator in US-Dollars, the evaluator accounts for currency value fluctuations by adjusting the value entered to the reference year of the data provided by the input-output datasets.

13.3. Data

13.3.1. Data collection

The number of employees was collected from the employee registry of HVL, that can be found on the Webpage (HVL, 2018D). The number of students was taken from the Årsrapport 2016 – 2017 of HVL (HVL, 2017A).

Regarding scope 1 and 2, the data on electricity and district heating was taken from the Miljøfyrtårn reports from 2017 (HVL & MILJØFYRTÅRN, 2017, 2018), which provided the energy consumption in kWh, both in total (HVL & MILJØFYRTÅRN, 2018) and, for some years (2014 & 2016), divided into electricity and district heating (HVL & MILJØFYRTÅRN, 2017). The data for the fuel consumption of the campus fleet was taken from the university financial accounting system. An excel spreadsheet with the financial data on purchases for the year 2017 was provided by the administration of the Sogndal Campus (Appendix 2). This data is shown in amount of NOK spent in each purchasing category and includes purchases from both the campus in Sogndal and Førde.

Regarding scope 3 emissions, the data on waste management, purchased goods and services and capital goods was taken from the dataset on campus purchases mentioned above. The data required to calculate the business trips was provided by the administration as well. The data was exported from the university's accounting system that tracks the refunds for business trips of employees and students. Two separate spreadsheets were provided by the administration, one on business trips by car and one on business trips with other means of transport. The data for business trips by car included type of car (electric vehicle or combustion engine vehicle), start and destination and distance travelled in km, for each trip.

The data for the other means of transport included type of transport (collective transport, rental car, taxi, plane), amount of NOK spent on each trip and comments from the person travelling, for each trip.

13.3.2. Preparation

13.3.2.1. General data and data on energy consumption

As the Scope 3 Evaluator tool was not designed specifically for the (higher) education sector, it does not provide the option to enter the number of students at campus. Therefore, students were counted as employees in this case, resulting in 3600 'employees' for the sogndal campus (3200 students and 400 employees), which relates to the selectable employee range of 2501 – 5000 employees.

13.3.2.2. Scope 1 and 2 data

The data on fuel use of the campus fleet (scope 1) was initially converted from price (NOK) to litres[35] and then from litres to kilogram[36], which is the unit used in the Scope 3 Evaluator.

Regarding the scope 2 emissions, the energy consumption from district heating was counted as electricity consumption. The reasons for doing so are firstly, that the Scope 3 Evaluator does not provide an option to enter district heating consumption under the scope 2 category, and secondly, that the available data for 2017 only provided total energy consumption, which was not divided into electricity and district heating.

13.3.2.3. Purchasing Data

In a first step, the purchasing data was categorised into services, standard goods and capital goods. Any purchases that are not associated with the procurement of material goods were classified as services. Standard goods (or consumer goods) were defined as goods that are consumed within one financial year. Capital goods were defined as goods that are used over several years and are therefore depreciated yearly in the financial accounting system.

Within these 3 categories, the purchasing categories of the university were further divided according to the economic sectors given in the Scope 3 Evaluator, which correspond to the International Standard Industrial Classification of All Economic Activities (ISIC Rev. 3.1) from the United Nations Statistical Division (UNSD, 2002) (apendix 2).

In a next step, the amount of NOK spent in each category was converted into US-Dollars, which is the currency used in the evaluator. As the reference year was 2017, the average conversion factor from NOK to US-Dollars of the year 2017 was used[37].

Lastly, the data, which originally included purchases from both the Sogndal and the Førde campus, was adjusted to only account for the Sogndal campus. This was done by multiplying the amount spent with the ratio of students and staff at the Sogndal campus, compared to both campuses. The following formula was used:

$$\frac{Staff\ \&\ Students\ Sogndal}{Staff\ \&\ Students\ Sogndal + Staff\ and\ Students\ Førde} = \frac{400 + 3200}{400 + 3200 + 84 + 800} = 0{,}8029$$

[35] NOK/Litre (average from 04.2017 – 04.2018): 14,45 NOK/Litre (SSB, 2018)

[36] Density of Gasoline: 750g/Litre (BDBE, 2018)

[37] US-Dollar: NOK = 1:8,263; Source: (NORGES BANK, 2018)

13.3.2.4. Business Trip Data

Due to the fact that the evaluator tool did not have an option to choose between combustion engine vehicles and electric vehicles, and the fact that electric vehicle travels only make up for approximately 1% of the total kilometres HVL employees travelled by car, electric vehicles were counted as standard combustion engine vehicles in this analysis.

The data on business trips by other means of transportation was sorted by the different transport types (collective transport, rental car, taxi, plane). The data on rental cars was disregarded as there was no option to estimate greenhouse gas emissions of this activity. A further classification of the collective transport section into travels by bus, train and boat was conducted. This classification was done by applying a simple text based filter to the comment section of the dataset. The following words were used for the search in each category:

- Bus: bus(s)
- Train: tog, train, trik(k), ban(en), tram
- Boat: båt, boat, ferge, ferje, ferry

Business trips were then aggregated into the three categories according to the words contained in the comment section. A large number of business trips did not contain any comment and could therefore not be assigned to any of the 3 categories. A percentage of the total amount spent on not commented business trips was added to each of the 3 categories, depending on the percentage of the individual category in relation to the total amount spent. Values were then converted from NOK to US-Dollars using the average conversion factor of 2017. The values for each category can be found in table 6.

Table 6: Spending on collective transport

	Commented	Percentage of Sum	Not commented	Commented + not commented
Train	20585,4$	27,35%	46.843,26$ * 27,35% = **12.811,13$**	33396,53$
Sea	29680,25$	39,43%	46843,26$ * 39,43% = **18.471,22$**	48151,47$
Bus	25003,85$	33,22%	46843,26$ * 33,22% = **15.560,91$**	40564,76$
SUM	75269,5$	100%	46843,26$	122112,76$

13.4. Assessments

Using this aforementioned datasets, a number of different assessments were run, each with slight variations in the data input. The different assessments will be explained in detail in the following chapters. If not specified otherwise, the following assessments use the methodology mentioned in the previous chapters. The first five assessments focus specifically on the emissions of HVL-Sogndal, each taking into account a different array of emission sources. Assessment 6 and 7 are used to calculate the baselines for different comparisons.

13.4.1. Assessment 1: HVL-Sogndal total

This scenario is the baseline scenario, which was run in accordance to the aforementioned methods. The following assessments will be variations of this. If not otherwise specified changes in the additional scenarios will not transfer to other additional scenarios.

13.4.2. Assessment 2: HVL-Sogndal staff commuting

It can be expected, that student and staff commuting behaviour varies greatly, with staff members causing higher commuting emissions than students. Yet, there was no data available on staff or student commuting behavior. Consequently, this scenario only accounts for the 400 employees and disregards the 3200 students. The number of employees entered into the evaluator is therefore lowered to the 251 – 1000 employees range.

13.4.3. Assessment 3: HVL-Sogndal adjusted for Norwegian commuting behaviour

To address the issue, that the evaluator uses commuting behaviour of US – citizens to calculate the emissions from commuting, another assessment was run, slightly adjusting for the different behaviour. According to the open source database "Numbeo", in Norway the average GHG-emissions per person, caused by commuting, are 607,07 kg CO2-eq/ year (NUMBEO, 2018). This corresponds to 35,71% of annual commuting emissions per person in the US (1 700kg CO2-eq/ year), which is used as a baseline to calculate commuting emissions in the Scope 3 Evaluator. This assessment uses the data provided by Numbeo (2018) to calculate the emissions of employee commuting. As this value is an overall average, accounting for both students and employees in Norway, the value is multiplied by the number of staff and students at campus.

13.4.4. Assessment 4: HVL-Sogndal disregarding commuting

This scenario excludes all emissions from commuting. The first reason to perform this assessment is that several other higher education Institutions do not include commuting either[38]. To provide a better comparison to other institutions this scenario excludes commuting as well. Additionally, it can be argued, that commuting is not one of the direct emission sources of a HEI, as it depends highly on the individual behaviour of the students and employees and therefore, the HEI itself has little control over these emissions. Lastly, the calculation methods for commuting in this analysis are very crude. Hence, an accurate estimation of the commuting emissions cannot be given.

13.4.5. Assessment 5: HVL-Sogndal District heating

This scenario attempts to differentiate between emissions from purchased electricity and purchased district heating. This involved several extrapolations and assumptions. Data on both district heating and electricity is only available for two years (2014 & 2016). Therefore, these years were used to calculate the share of district heating and electricity as percentage of the total energy consumption. The percentages were averaged, and then used to extrapolate the share of district heating and electricity in 2017 (table 6). This resulted in an estimated district heating consumption of ca. 747 740 kWh for HVL-Sogndal in 2017.

Table 7: Extrapolation of District heating consumption of HVL-Sogndal;
Data Sources: *(HVL & MILJØFYRTÅRN, 2017); **(HVL & MILJØFYRTÅRN, 2018); Red values are calculated

	2013	2014	2015	2016	2017
Electricity [kWh]	3 073 759*	2 260 805*	2 339 762*	2 411 108*	2 706 812,66
District Heating [kWh]	N/A	620 697*	N/A	661 220*	**742 730,34**
SUM [kWh]	3 073 759**	2 881 502**	2 339 762**	3 072 328**	3 449 543**
El/SUM [%]		78,46		78,48	78,47
DH/SUM [%]		21,54		21,52	21,53

In a next step, the amount of energy used on district heating was divided into the different primary energy sources of district heating production in Norway (table 8). The percentages were calculated from

[38] See Carbon footprint of HNE Eberswalde (HNE EBERSWALDE, 2018) and NTNU (LARSEN ET AL., 2013)

the total amount of fuel consumed in the production of district heating in Norway (SSB, 2017A). The amount of kWh for each fuel type was then entered in the scope 1 category of the Scope 3 Evaluator.

While district heating is technically a scope 2 source, the calculator only allowed for an input of electricity consumption in the scope 2 category. Data categorised by fuel type could only be entered in the scope 1 category. As the categories 'Bark, wood chips and wood', 'waste' and 'waste heat' are not selectable in the Scope 3 Evaluator, those fuel types were converted into Natural gas. According to LIEN (2013), producing district heating from burring waste with a 50% organic matter content emits approximately the same amount of greenhouse gases then producing district heating from natural gas.

Table 8: Share of fuel type used for district heating of HVL-Sogndal according to Norwegian average;
Data Source: *(SSB, 2017A)

Fuel Type	Percentage share of Norwegian district heating*	District Heating consumption of HVL-Sogndal, 2017 [kWh]
Total	100	742 730
Gas-/diesel oils, heavy fuel oils	13,6	10 113,68
Bark, wood chips and wood	28,4	210 466,51
Bio fuel	0,8	5 652,05
Waste	50,2	372 595,45
Electricity	13,0	96 535,09
Waste heat	2,5	18 406,69
Gas	3,9	28 960,53

13.4.6. Assessment 6: HVL-Sogndal electricity mix comparison

The Scope 3 Evaluator accounts for regional differences in emissions from electricity consumption. These differences are mainly caused by variations in the electricity mix of each individual country. To gain insight into the impact of the national electricity mix on the carbon footprint of an organisation, a number of assessments were run, to show the carbon footprint of a hypothetical institution similar to the Sogndal campus of HVL, but situated in different countries. The comparison was done for the Nordic countries, including Sweden, Iceland, Finland and Denmark. Other countries were chosen due to having above average percentages of specific energy sources in their respective energy mix. The selected countries are Australia (87% coal and natural gas), Brazil (70% Hydroelectric + 11% Biomass and waste) and France (79% nuclear power) (TSP, 2014).

13.4.7. Assessment 7: HVL-Sogndal comparison to other HEIs

This final scenario is intended to be a brief comparison to other higher education institutions. For this comparison, the Hochschule für Nachhaltige Entwicklung Eberswalde (HNE Eberswanlde) in Germany and the Norwegian University of Science and Technology (NTNU) were chosen.

13.4.7.1. Hochschule für Nachhaltige Entwicklung Eberswalde (HNE Eberswalde)

The reasons for choosing the HNE Eberswalde are threefold. Firstly, the university is approximately the same size as the Sogndal Campus of HVL. In 2015 the HNE had about 2200 students and 250 employees (HNE EBERSWALDE, 2015). Secondly the university provides information on its carbon footprint and the boundaries of the carbon footprint calculation, which is crucial to allow a comparison. Lastly, the HNE only includes scope 1 and 2 emissions and a few selected scope 3 emissions, namely business travels, energy related up- and downstream emissions, emissions from the production of purchased paper and emissions from water supply and waste water treatment. The HNE does not include emissions from commuting and purchases, other than purchased paper (HNE EBERSWALDE, 2018). In the carbon footprint calculations done for HVL, the emissions from commuting and purchasing are the most uncertain. Therefore, excluding those for a comparison with another HEI ensures a more accurate comparison.

To perform this calculation, the dataset was changed to only include scope 1 and 2 data and the scope 3 data for the following categories:

- Category 1: Purchased goods and services (only purchased paper)
- Category 3: Fuel- and energy-related activities
- Category 6: Business travels

13.4.7.2. Norwegian University of Science and Technology (NTNU)

The NTNU was mainly chosen in order to have a comparison to another Norwegian University. NTNU also provides a carbon footprint and information on the emission sources that were included. Due to the NTNU being much bigger than the Sogndal campus, a direct comparison is more complicated. Different ways of comparisons will be discussed in chapter 15.6.2.

The carbon footprint of NTNU accounts for scope 1 and 2 emissions, and all scope 3 emissions except commuting. Therefore the calculated carbon footprint of the Sogndal campus that is used for this comparison includes scope 1 and 2 emissions as well as the following scope 3 emissions:

- Category 1: Purchased goods and services
- Category 2: Capital goods
- Category 3: Fuel- and energy-related activities
- Category 5: Waste
- Category 6: Business travels

14. Results

The following chapter summarises the results of the carbon footprint calculations. Following an initial section with a detailed description of the results from the category on purchased goods and services, the chapter will be divided into the different assessments described in the methods (chapter 13.4). A table with more detailed information on the emissions can be found in the appendix 3. While the scope 3 evaluator provides results in accuracy of the 10 gram range, the results that are shown in appendix 3 are rounded, due to the low quality of the data and the limitations of the calculator itself. Values in the tonne and ten tonne range are rounded to tonnes, values in the hundred tonne range are rounded to tens of tonnes and values in the thousand tonne range are rounded to hundreds of tonnes. In the following text, values are mostly shown in units of kilotonnes, to provide a simplified illustration of the main results. Percentage values are given in whole percent, again, due to the high uncertainty of the results. Due to the different rounding, the total emission values do not represent the exact sum of all its constituents.

14.1. Breakdown of Purchased Goods and Services

As no changes were made to the category on purchased goods and services in the different assessments, the results are identical in each assessment[39]. Therefore a detailed breakdown of the emissions from the different purchasing categories will be given in advance. Fig. 13 shows the amount and percentage associated with each purchasing sub-category. To clarify, the percentages provided in this figure do not relate to the total emissions of the Sogndal campus, but only to the total amount of emissions from the purchasing of goods and services. Furthermore, this breakdown does not include the purchase of capital goods.

The total emissions from purchased goods and services amount to 1,7kt CO_2-eq/yr. The biggest sources are the renting of machinery and equipment and other business activities with 0,62kt CO_2-eq/yr and other community, social and personal services with 0,44kt CO_2-eq/yr. A list of activities associated with each of the categories seen in can be found in the appendix 2.

[39] The only exception is the assessment 7 which is intended to provide a comparison to the carbon footprint of the HNE Eberswalde.

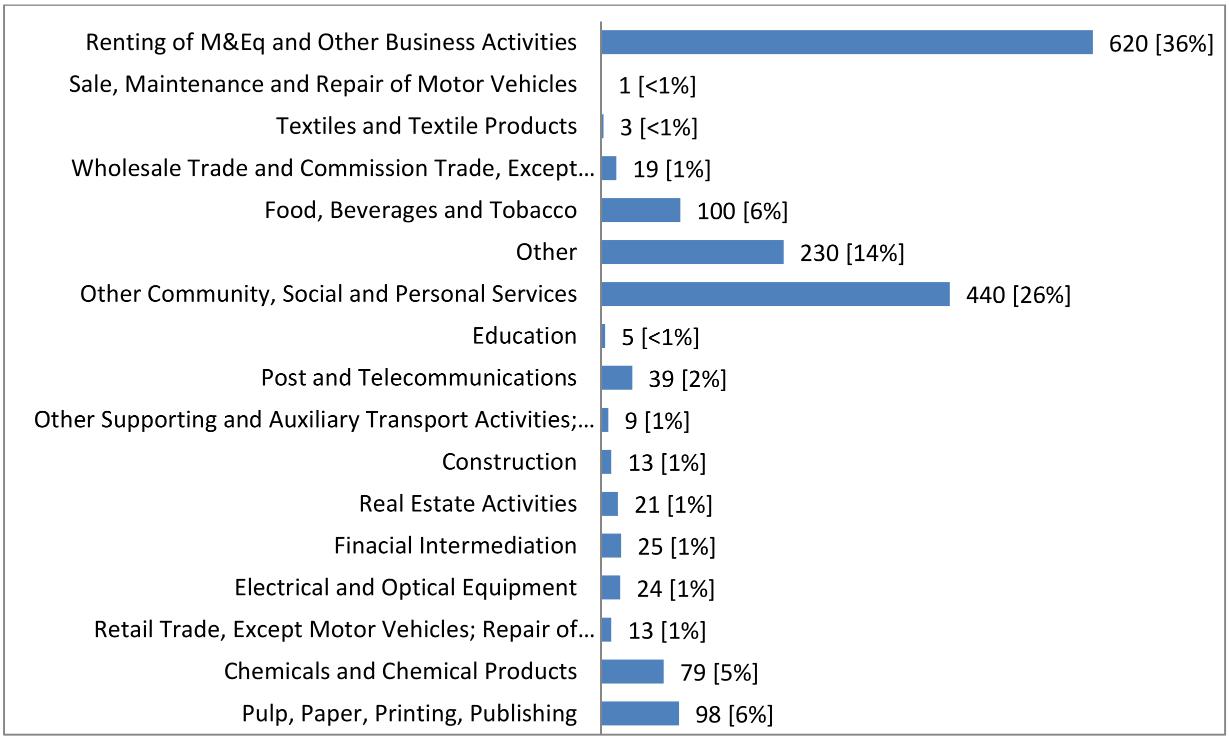

Fig. 13: Emissions in t/yr and associated percentages for each purchasing sub-category

14.2. Impact assessment for sub-categories of purchased goods and services

In order to estimate the impact of each sub-category of purchased goods and services, the average emissions in t CO2-eq per 1000 US-Dollar spent was calculated for each sub-category (fig. 14). For all purchased goods and services combined the emissions per spending are ca. 0,33t CO_2-eq/ 1000$, as illustrated by the red line in (fig. 14). Categories with a higher value have higher emissions per spending than the average; categories with a lower value have lower emissions compared to the average. The highest emissions per spending can be seen in the category ‘Chemicals and Chemical Products’ (1,11t CO_2-eq/ 1000$), followed by the category ‘Textiles and Textile Products’ (1,00t CO_2-eq/ 1000$). The lowest emissions per spending can be found in the categories ‘Financial Intermediation’ (0,13t CO_2-eq/ 1000$), and ‘Real Estate Activities’ (0,10t CO_2-eq/ 1000$).

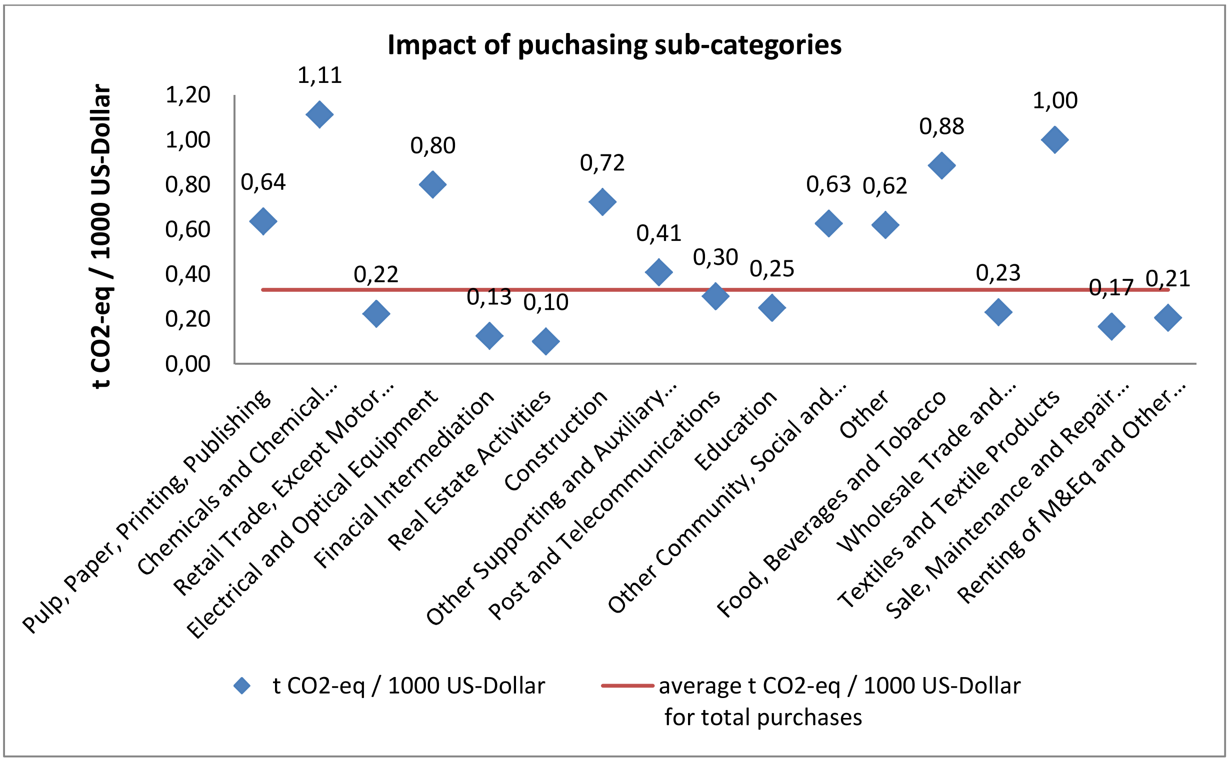

Fig. 14: Impact of purchasing sub-categories in t CO2-eq / 1000 US-Dollar

14.3. Assessment 1: HVL-Sogndal total

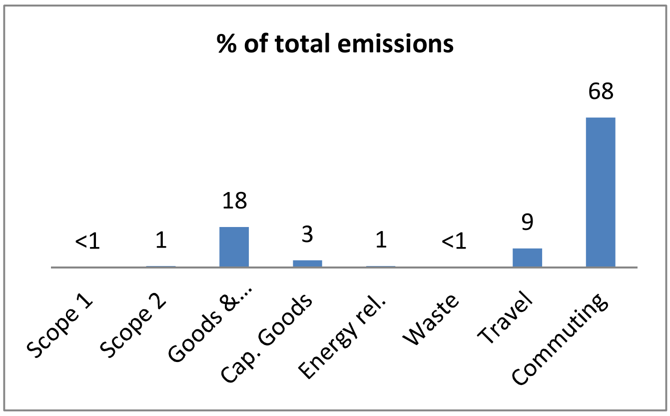

Fig. 15: Assessment 1: Share of total emissions per emission source

The results for the baseline assessment show that the Sogndal Campus of HVL emitted a total of ca. 9,2kt CO_2-eq/yr for 2017. Scope 1 and 2 combined account for roughly 1% (0,05kt CO_2-eq/yr) of the total emissions, whereas scope 3 accounts for about 99% (ca. 9,2kt CO_2-eq/yr) (fig. 15).

With ca. 6,3kt CO_2-eq/yr, the majority of the emissions (ca. 68 %) originate from commuting. In this scenario, commuting includes both employees and students. It is assumed that students have the same commuting behaviour as the employees. Data on commuting behaviour is based on statistics from the USA. The emissions from purchasing (purchased goods and services and capital goods) account for ca. 21% (ca. 2,0kt CO_2-eq/yr) of the total emissions, therefore being the second largest emission source. The third largest category is business travels with ca. 0,80kt CO_2-eq/yr (ca. 9%).

14.4. Assessment 2: HVL-Sogndal staff commuting

The second scenario only accounts for the emissions of staff commuting and disregards student commuting. Data on commuting behaviour is based on statistics from the USA. The total emissions in this scenario amount to ca. 4,0kt CO_2-eq/yr. The absolute emission value of each category is the same as in Scenario 1, except for the emissions from commuting. Commuting emissions are estimated at ca. 1,0kt CO_2-eq/yr in this scenario. Scope 1 and 2 emissions account for 1% - 2% of the total emissions, whereas scope 3 accounts over 98% (fig. 16). The biggest contributor in this scenario is the purchased goods and services category with ca. 43%. All purchases combined (purchased goods and services + capital goods) account for ca. 50%. Commuting is still the second largest contributor with ca. 25% and business travel is the third largest with ca. 20%.

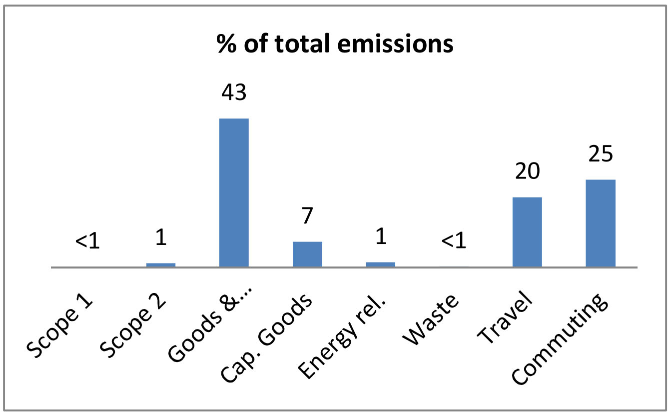

Fig. 16: Assessment 2: Share of total emissions per emission source

14.5. Assessment 3: HVL-Sogndal Norwegian commuting behaviour

The third scenario accounts for Norwegian commuting behaviour (chapter 13.4.3). It takes into account commuting emissions from both staff and students. The total emissions in this scenario represent ca. 5,2kt CO_2-eq/yr. Once more the absolute emission value for each category only changes for commuting. Scope 1 and 2 emissions contribute 1% - 2% of the total emissions and scope 3 contributes more than 98% (fig. 17). The biggest source is commuting with ca. 43% (ca. 2,2kt CO_2-eq/yr), followed by the purchases of goods and services and capital goods with ca. 39% combined. Business travels account for ca. 15%.

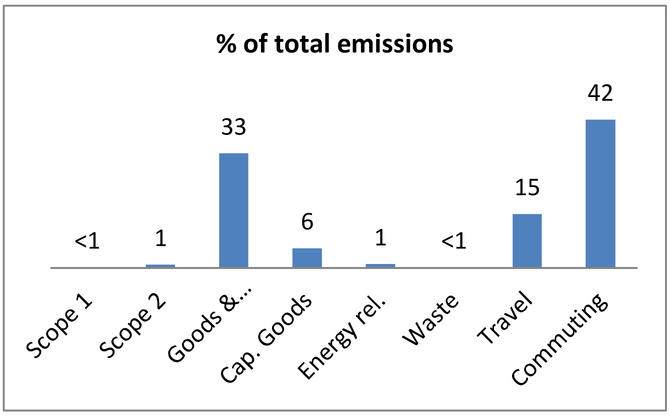

Fig. 17: Assessment 3: Share of total emissions per emission source

14.6. Assessment 4: HVL-Sogndal no commuting

This assessment shows the emissions of HVL Sogndal excluding the emissions from student and staff commuting. The total emissions of the campus are estimated at ca. 3,0kt CO_2-eq/yr. The total emissions for each category (except commuting) are unchanged from the previous assessments. Here, scope 1 and 2 combined accounts for approximately 2% - 3% of the total emissions and scope 3 accounts for more than 97% (fig. 18). The largest contributors are the purchased goods and services with ca. 57%. Combined with the purchased capital goods, all purchases account for ca. 67%. The second highest contributor is the business travel category with ca. 27%.

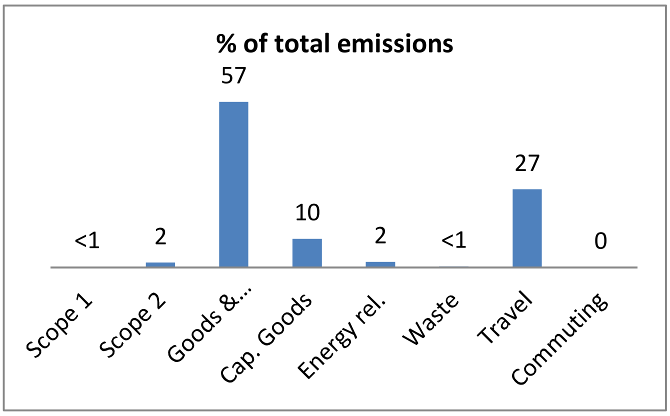

Fig. 18: Assessment 4: Share of total emissions per emission source

14.7. Assessment 5: HVL-Sogndal District heating

This assessment shows how the differentiation of the energy consumption of the Sogndal campus into electricity and district heating affects the emissions of scope 1 and 2. As seen in fig. 19 the differentiation causes the scope 1 emissions to be slightly higher (ca. 14 instead of ca. 5t CO_2-eq/yr) and the scope 2 emissions to be slightly lower (ca. 37 instead of ca. 46t CO_2-eq/yr). The combined emissions of scope 1 and 2 however stay the same (ca. 51t CO_2-eq/yr). The change in the amount of emissions in scope 1 and 2 is mainly caused by the fact that district heating, technically being a scope 2 emission, could only be entered as scope 1 emission in the evaluator. District heating is therefore counted as scope 1 (chapter 12.4.5)

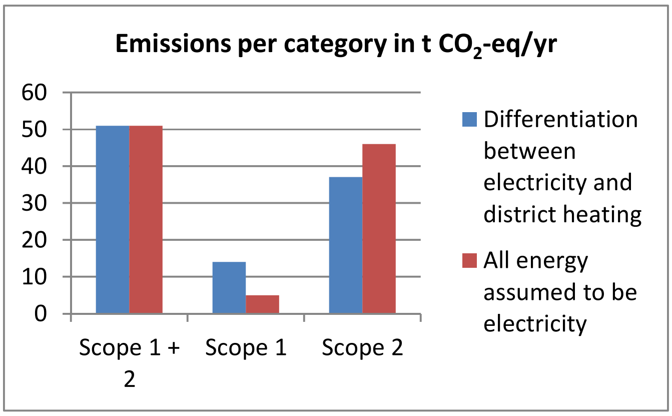

Fig. 19: Assessment 5: Impact of differentiation between district heating and electricity

14.8. Assessment 6: HVL-Sogndal electricity mix comparison

To assess the impact of the national electricity mix on the emissions from energy consumption of HVL-Sogndal, a number of assessments were run. Each assessment places HVL's Sogndal campus in a different country to observe the changes in emissions compared to the actual emissions of the campus (fig. 20).

Most of the absolute emission values stay the same for each country. The only categories that change are the Scope 2 emissions, due to a different electricity mix, and the energy related scope 3 emissions, as these are calculated from the total scope 1 and 2 emissions. The emissions from HVL-Sogndal's energy consumption (scope 2) would be the highest with the Australian electricity mix, with ca. 2,8kt CO_2-eq/yr (ca. 23%). The second highest scope 2 emissions would be caused by the Danish mix, with ca. 1,1kt CO_2-eq/yr (ca. 10%) and the third highest with the Finish mix with ca. 0,66kt CO_2-eq/yr (ca. 7%). Using the Brazilian mix (ca. 0,23kt CO_2-eq/yr) and the French mix (ca. 0,21kt CO_2-eq/yr) scope 2 only contributes ca. 2% of the total emissions. The Swedish mix would cause scope 2 emissions of ca. 0,05 kt CO_2-eq/yr (1%). With the Icelandic mix, the scope 2 contribution is the lowest with only ca. 0,001kt CO_2-eq/yr (<1%).

Combined with the energy related scope 3 emissions, the total emission caused by energy consumption would amount to ca. 3,1kt CO_2-eq/yr (ca. 26%) in Australia, ca. 1,3kt CO_2-eq/yr (ca. 12%) in Denmark, ca. 0,81kt CO_2-eq/yr (ca. 9%) in Finland, ca. 0,31kt CO_2-eq/yr (ca. 3%) in Brazil, ca. 0,27kt CO_2-eq/yr (ca. 3%) in France, ca. 0,1kt CO_2-eq/yr (ca. 2%) in Sweden and ca. 0,06kt CO_2-eq/yr (ca. 1%) in Iceland.

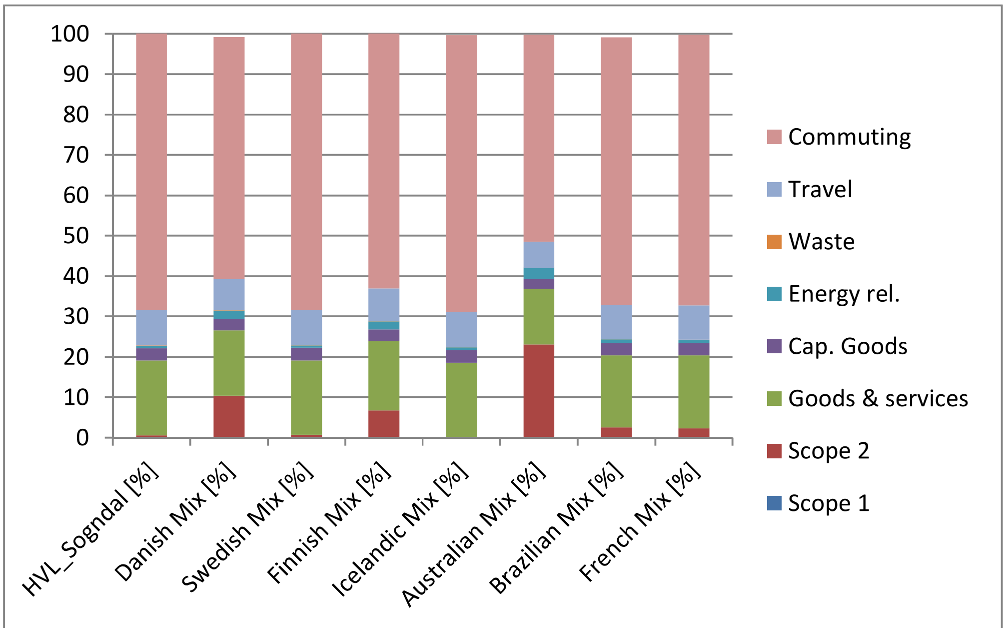

Fig. 20: Assessment 6: Impact of different electricity mixes on composition of emissions of HVL-Sogndal

14.9. Assessment 7: HVL-Sogndal comparison to other HEIs

The following section will only show the results from the carbon footprint calculations that are used for the two comparisons. The actual comparison to the two universities will be discussed in chapter 15.6.

14.9.1. Carbon footprint for comparison to HNE Eberswalde

Fig. 21 shows the percentage of the total emissions for each emission category, when only accounting for the same categories as the HNE Eberswalde. In this case, the total emissions amount to ca. 0,96kt CO_2-eq/yr. Scope 1 and 2 combined accounts for ca. 6% of the total emissions and scope 3 accounts for ca. 95%. By far the biggest contributor is the business travel category with ca. 83% (ca. 0,80kt CO_2-eq/yr). Commuting, waste and capital goods, as well as all purchased goods except paper are not accounted for.

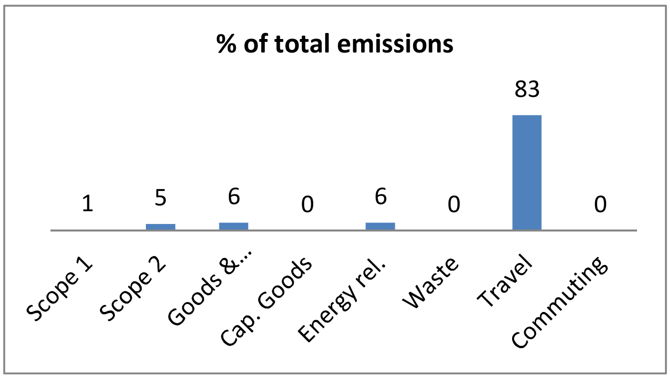

Fig. 21: Assessment 7: Share of total emissions per emission source, according to boundaries of HNE Eberswalde

14.9.2. Carbon footprint for comparison with NTNU

As NTNU only excludes commuting from their carbon footprint, the carbon footprint of the Sogndal campus that is used for this comparison is identical to the one described in chapter 14.4, which excludes the commuting emissions from HVL-Sogndal's carbon footprint.

15. Discussion

In the following section, the results and limitations of those will be discussed for each emission category. Additionally recommendation on how to improve the accuracy of the calculations will be discussed for each emission category. Lastly, the emissions of HVL-Sogndal will be compared to other HEIs and to the results of the Miljøfyrtårn report.

15.1. Energy related emissions (scope 1 and 2 and scope 3: category 3)

15.1.1. Results and limitations

The emissions that are associated with the energy consumption of the Sogndal campus amount to a total of about 0,11kt CO_2-eq/yr in the assessment 1 – 5. Interestingly, the energy related emissions do not account for more than 4% of the total emissions in any of the five assessments. It can be assumed that the low emissions from energy related sources are caused by the Norwegian electricity mix. In Norway, around 96% of the generated electricity originates from hydropower (SSB, 2017B), which does not emit large amount of greenhouse gases. Further evidence for the fact that HVL-Sogndal's low energy related emission are caused by the Norwegian electricity mix is shown in assessment 6. By changing the location of HVL-Sogndal to a different country in the calculator, the energy related emissions adjust to the specific electricity mix of that country. Accordingly, the calculated energy related emissions increased when using an electricity mix with a higher percentage of emission intensive sources (coal, gas, oil). This was the case for the Danish, Finish and Australian mix. Using an electricity mix with a high percentage of low emission sources (hydropower, wind, nuclear, geothermal) resulted in lower energy related emissions, similar to Norway. This was the case for the Swedish, Icelandic, Brazilian and French mix.

The fact that the calculator adjusts for regional differences in the electricity mix indicates a high accuracy of the results in these categories. As the data for these calculations was entered into the Scope 3 Evaluator in kWh, no conversion into different units was required. This eliminates possible uncertainties due to conversion errors. The only exception is the data entered for scope 1 (fuel use of campus fleet). This data was collected in NOK spent on fuel and had to be converted in several steps to kilogrammes. Conversion errors due to fluctuations in fuel price could therefore not be eliminated. However, due to the almost negligible contribution of scope 1 to the total emissions, these errors do not have a large impact.

Assessment 5 was run to estimate the impact of dividing the energy use of HVL-Sogndal into district heating and electricity. It was expected, that dividing the total energy use into these two categories, instead of assuming that all energy was used as electricity, would increase the energy related emissions. This expectation was based on the fact that a large part of the Norwegian district heating energy is generated by waste and biomass combustion (SSB, 2017A). According to LIEN ET AL. (2013) waste and biomass combustion is estimated to cause similar emissions as using natural gas. The emissions from district heating in Norway should therefore be higher than the emissions from electricity production in Norway. Surprisingly, the results did not show the expected increase in emissions. While the ratio of scope 1 and two emission changed slightly, the total emissions from scope 1 and 2 (and scope 3: category 3) did not change. The reason for this cannot be explained. It is, however, possible that the different extrapolations, conversions and estimations that were necessary to divide the energy use into district heating and electricity (chapter 13.4.5) caused a high uncertainty, resulting in the inconclusive results.

15.1.2. Recommended improvements to the methodology

While the results in this category are rather accurate, there are certain improvements to the methodology that should be considered for future investments. Firstly, the Scope 3 Evaluator uses an emission factor of ca. 13g CO_2-eq/kWh for electricity generation in Norway. This is similar to the emission factor of 16g CO_2-eq/kWh for electricity generation in Norway provided by NORGES VASSDRAGS- OG ENERGIDIREKTORAT (NVE, 2018). However, the Nordic countries have a closely linked electricity network, with large imports and exports between the different countries (SKATTNETT, 2018). For this reason, carbon footprint calculations in Norway often use an emission factor for the total Nordic mix. According to (LARSEN ET AL., 2013), this factor is estimated at 189g CO_2-eq/kWh, which is significantly higher than the factor for Norwegian electricity generation. To improve the carbon footprint calculation of HVL-Sogndal's energy consumption, it should be assessed, which emission factor is more applicable. Secondly, the representation of electricity and district heating should be improved. As explained above, the differentiation in assessment 5 did not provide conclusive results. Ideally, the new methodology would use data specifically relating to district heating production in Sogndal.

15.2. Purchases (Scope 3: category 1 & Scope 3: category 2)

15.2.1. Results and limitations

The Scope 3 Evaluator divides all purchases in to two categories. Firstly, the purchased goods and services and secondly, the purchased capital goods. For the first, the tool provides a detailed breakdown of the emissions caused by the purchasing of goods and services from the different economic sectors. For the latter, the calculator only provides the total emission from the purchase of all capital goods combined. It does however allow the user to enter data for the purchase of capital goods that is divided into economic sectors. In assessment 1 – 5, both purchasing categories combined contribute between 21% and 67% of the total emissions. The variation in the contribution, though, is not caused by varying emissions from those categories but rather by the variation in the total emissions from commuting in the different assessment. This consequently leads to varying percentages in all other categories.

Out of the two purchasing categories, the purchased goods and services category contributes far more emissions that the purchased capital goods. Out of the different sub-categories for the purchased goods and services, most emissions are caused by the 'Renting of Machinery and Equipment and Other Business Activities' (36%). Interestingly, the emissions per 1000 US-Dollar are rather low for this category. This indicates that the high amount of emission caused by this category is mainly due to the large proportion of university spending and not due to this category being extremely emission intensive. On the other hand, the highest impact per 1000 US-Dollar can be seen in the category 'Chemicals and other chemical products', indicating that the emissions in this category are conversely caused by a high emission intensity rather than large amounts of spending. This information is useful to identify categories that should be focussed on in a climate action plan to reduce emissions. Categories with high emissions should be focussed on, exactly because of their large contribution, while categories with high emissions per spending provide opportunities for effective and quick action. Such categories can be described as 'low hanging fruits'.

It is necessary to mention, though, that the three biggest contributors, the categories 'Renting of Machinery and Equipment and Other Business Activities' (36%), 'Other Community, Social and Personal Services' (25%) and 'Others' (13%), are also the most uncertain. This is mainly due to the fact that these three categories are the least defined. Compared to other categories, such as 'Chemicals and Chemical Products' or 'Textile and Textile Products', these categories encompass a large variety of business activities. Each of these business activities is associated with different emission factors, which are aggregated to an average emission factor for the whole category.

Except from the uncertainty caused by the aggregation of several business activities into one category, another source of uncertainty is the conversion of the collected data from NOK to US-Dollar. Additionally, the data was provided for both the Sogndal campus and the Førde campus. As explained in chapter 13.3.2.3, the spending values were divided according to the percentage of student and staff being located in Sogndal and Førde, respectively. The data is therefore an estimate of the spending of each campus that does not exactly represent the actual spending.

15.2.2. Recommended improvements to the methodology

The purchased goods and services and the purchased capital goods are arguably the most difficult categories to calculate, as they require extensive information on up- and downstream companies involved in the production and distribution of the goods, or the companies involved in providing specific economic services. Hence, it is almost impossible to account for every detail in these categories, and emission values will always be estimations with a varying degree of accuracy. However, certain actions can be taken to increase the accuracy of the calculations in these categories. Firstly, a more detailed classification of business activities can provide the opportunity to link each category to more specific emission factors, thereby increasing the accuracy. Secondly, using more detailed emission factors helps to account for local variations in the emission intensity of different economic activities. Lastly, while actions that reduce the total consumption will be reflected in the emission calculations, changes in consumption patterns are less likely to be reflected. As an example, switching to the use of more locally sourced products will reduce the emissions, yet, as the Scope 3 calculator does not account for such differences, this will not be reflected in the emission calculations. Hence, the development of a more advanced model that accounts for such differences is required.

Specifically for the purchased capital goods, it could not be identified, whether the Scope 3 Evaluator associates the total emission caused by the production of a certain capital good to the year of purchase, or if the tool uses average lifetimes and divides the total emission by the lifetime, resulting in regularly recurring emissions. More advanced future carbon footprint calculations should focus on one of the two methodologies. If recurring emissions are used, detailed information on the product lifetimes should be collected.

15.3. Waste (Scope 3: category 5)

15.3.1. Results and limitations

With only 8t CO_2-eq/yr, waste management contributes less than 1% of the total emissions in every assessment. The calculator does not account for different types of waste nor different treatment processes for waste. It can therefore be assumed that the uncertainty for this category is comparably high. Additional sources of uncertainty are again the conversion of the collected data from NOK to US-Dollar. Similar to scope 1, though, the emissions from waste management are almost negligible. Hence, the uncertainty of this category does not have a big impact on the total emissions.

15.3.2. Recommended improvements to the methodology

Future calculations should account for different waste treatment processes and different waste types. Ideally, research collaboration with the local waste management company Sogn interkommunale miljø- og avfallselskap (SIMAS) should be initiated, to map local waste treatment processes and assess associated emissions.

15.4. Business travel (Scope 3: category 6)

15.4.1. Results and limitations

The emissions from business travels account for 9% to 27% of the total emissions in the assessments 1 – 5. Similar to the purchasing category, the variation of the percentages is a result of the different emissions in the commuting category for each assessment. Several sources of uncertainty have to be noted for this category, both relating to the data itself and the Scope 3 Evaluator tool. The calculator allows the user to enter data for different modes of transportation. It also provides the option to choose either kilometres travelled or amount of US-Dollars spent on travel for the data entry. Entering the data in kilometres reduces the uncertainty, as it requires less conversion steps. Entering data in US-Dollars, on the other hand, causes a higher uncertainty due to price fluctuations. Even though using currency values causes higher uncertainties, the option to enter data in currency values was one of the reasons to choose the Scope 3 Evaluator for the assessment of HVL-Sogndal, as most of the available data, except for travel by car, was provided in currency values. Manually converting business trip spending into distance would have required extensive research that would have gone beyond the scope of this thesis. Uncertainties that arise independently from the use of either currency values or distance values in the data entry are those associates with varying emission from different vehicle types within one category. For instance, the calculator does not account for different car types (e.g. gasoline cars, diesel cars, electric vehicles) within the car travels or different plane types within the plane travels. In addition to these uncertainties that apply to all transport modes, more specific uncertainties for each mode of transport will be given in the following section.

Car travel

Car travel has the lowest uncertainty of all the modes of transport, as the data was provided in kilometres. As mentioned above, uncertainty sources in this case are the different types of cars, such as gasoline cars, diesel cars and electric vehicles, which are not accounted for in the calculator.

Plane travel

In addition to the uncertainties caused by not accounting for varying emission factors of different plane types, uncertainties arose from the fact that the data was provided in currency values. Hence, the associated emissions depend on fluctuations in currency conversion factors (NOK to US-Dollar) and ticket prices. The ticket prices vary greatly, depending on the airline, the time of purchase, the class (economy class, business class, first class etc.), the start and destination of the flight, etc. The provided data did not give any indication towards the aforementioned variables. Furthermore, the emissions per passenger vary on the percentage of booked seats per plane. This, however, is very difficult to account for, as the information is often not available.

Taxi

The data in taxi travels was again provided in currency values. The prices per kilometre for a taxi ride can vary greatly depending on the location, and the available data did not indicate the location of each travel. The emissions relating to taxi transport are therefore highly uncertain.

Other collective transport

A large proportion of the available data on business trips was classified as 'collective transport', encompassing travels by train, bus, boat and ferry. While the Scope 3 Evaluator did allow for data to be entered in each of those classifications, the difficulty lay in the sorting of the collective transport data into the respective sub-groups. The only indication for this could be found in the section with comments from the person travelling (chapter 13.3.2.4). As this section was not standardised in any way and furthermore not complete, the classification is highly uncertain. This consequently results in a high uncertainty for the resulting emissions. In addition, as the data on collective transport was provided in currency values, issues arose that were similar to those in the previously mentioned modes of transportation.

15.4.2. Recommended improvements to the methodology

While the calculation itself is rather simple, only requiring data on the mode of transport, travel distance and associated emissions, the issue lies with the availability of the data. Providing data for the first two parameters lies within the responsibility the campus itself, while the availability of data on associated emission factors depends on third parties. In order to provide better baseline data, that is required for the use of more advanced models on emissions from travels, the Sogndal campus needs to implement a better accounting system that track business trips. As for now, the data was taken from the students' and employees' refund applications for business trips. These refund application only require the user to enter the amount of NOK spent on the business trip. The implementation of a more advanced refund scheme that requires the user to note the distance travelled, or at least the start and destination of the trip, and provides a more detailed list of different modes of transport, would greatly help the data collection process. Additionally, a digital version of the scheme that automatically calculates the distance travelled, depending on the start and destination would reduce the amount of work required to calculate emissions from business trips.

15.5. Commuting (Scope 3: category 7)

15.5.1. Results and limitations

Commuting is likely to be the most uncertain category. This is due to the fact that the calculator uses a simple average of 1 700 kg CO_2-eq per person and year to calculate the commuting emissions. This value is based on statistics on commuting behaviour from US-citizens. The Norwegian commuting behaviour is likely to differ from the US behaviour and even more local variation can occur depending on the infrastructure (e.g. availability of public transport, bicycle infrastructure, etc.). Furthermore, one can assume that the commuting behaviour additionally differs between students and staff. To address these issues, several assessments were run (assessment 1 – 4). Assessment 1 assumes the same US-based behaviour for both staff and students, assessment 2 disregards students, assessment 3 uses a Norwegian average for both staff and students and assessment 4 disregards commuting completely. Consequently the emissions from commuting vary the most, compared to the other categories. Commuting accounts for up to 68% of the total emissions (assessment 1). It is likely that assessment 3 is the most accurate as it accounts for both staff and students and uses a Norwegian average emission value. Assessment 3 results in commuting causing ca. 42% of the total emissions. The Norwegian average value is taken from the Numbeo Website (2018). This value is based on a poll of 98 people and is therefore not representative for all of Norway. Yet, it was the only value on emissions associated with commuting in Norway that could be found.

15.5.2. Recommended improvements to the methodology

Commuting is likely to be the biggest contributor, yet this category is also the most uncertain. It is necessary to run more detailed assessments of this category, which in turn requires more reliable data on the commuting behaviour of the students and employees of HVL-Sogndal. One way of acquiring such data is through a survey on the students' and staffs' mode of commuting (public transport, car, bicycle, walking, etc), distance and frequency. Ideally this survey would cover all affiliates of the campus.

15.6. Comparison with other HEIs

15.6.1. Comparison with HNE Eberswalde

As seen in fig. 22 the HNE Eberswalde emitted approximately 500t CO_2-eq/yr while HVL-Sogndal emitted around 960t CO_2-eq/yr. Yet the emissions from energy related activities (scope 1, scope 2 and scope 3: category 3) are much lower at HVL-Sogndal compared to the HNE Eberswalde. This correlates to the low emissions from energy production in Norway due to the high percentage of hydropower. The higher total emissions of HVL-Sogndal are mostly caused by higher emissions from business trips. With about 2450 students and employees (reference year 2015) the HNE Eberswalde is smaller than the Sogndal campus of HVL with about 3600 students and employees (reference year 2017). To adjust for the difference in affiliates (students and staff), the emissions per affiliate were calculated. This resulted in 0,21t CO_2-eq per affiliate for the HNE Eberswalde and 0,27t CO_2-eq per affiliate for HVL-Sogndal. The

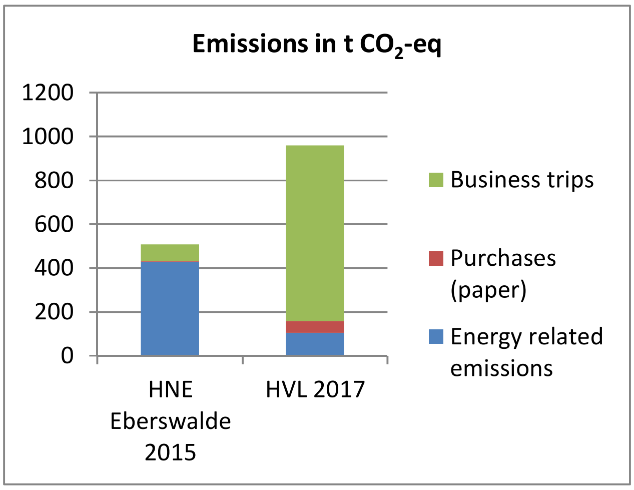

Fig. 22: Assessment 7: Comparison of emissions of HVl-Sogndal and HNE Eberswalde;
Data source for HNE Eberswalde: (HNE Eberswalde, 2015)

emissions per affiliate of HVL-Sogndal are only about 30% higher than those of the HNE Eberswalde, compared to the approximately 90% higher total emissions of HVL-Sogndal.

15.6.2. Comparison with NTNU

As the carbon footprint of the NTNU includes all emission sources except commuting, the results from assessment 4 (no commuting) for HVL-Sogndal will be used for this comparison. The emissions of NTNU are based on the year 2013 (LARSEN ET AL., 2013). The Reference year for HVL-Sogndal is 2017. The following comparison does not account for the difference in reference years. The total emissions of HVL-Sogndal in this assessment are estimated at 3kt CO_2-eq/yr while the emissions for NTNU are estimated at 92kt CO_2-eq/yr. Due to the large difference in total emissions, the fig. 23 shows percentages, to provide a better visualisation of the contribution of the different sources. As seen in fig. 23, HVL-Sogndal has higher percentages in the categories 'purchases' (purchased goods and services and capital goods) and 'business trips', whereas NTNU has higher percentages in the categories 'energy related emission' and 'other'. The reason for the category 'other' contributing a higher percentage for NTNU is that for NTNU this category includes several sources, while for HVL-Sogndal it only includes waste management. The carbon footprint assessment for NTNU did not state which specific emission sources are classified as 'other'. The higher percentages for the category 'energy related emissions' for NTNU are a result of using different emission factors. The calculations for HVL-Sogndal use the emission factor for Norwegian electricity generation (ca. 13g CO_2-eq/kWh) while the calculations for NTNU use the average emission factor for the Nordic mix (189g CO_2-eq/kWh).

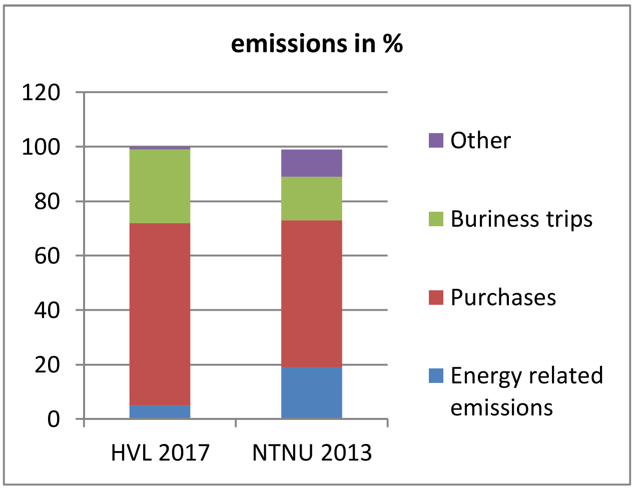

**Fig. 23: Assessment 7: Comparison of emissions of HVL-Sogndal and NTNU;
Data source for NTNU: (LARSEN ET AL., 2013)**

There are two factors that result in the total emission of NTNU being much higher than those of HVL-Sogndal. Firstly, NTNU has more affiliates (students and staff) and a different ratio between students and staff. NTNU has approximately 25500 affiliates, compared to the 3600 affiliates of HVL-Sogndal. Adjusting for the different number of affiliates by calculating the emissions per affiliates results in ca. 3,61t CO_2-eq per year and affiliate for NTNU and ca. 0,81t CO_2-eq per year and affiliate for HVL-Sogndal. The difference in emissions per affiliate is likely caused by the different ratio of staff and students at the two universities. NTNU has a ratio of approximately 1 employee per 4 students, while HVL-Sogndal has a much lower ratio of 1 employee per 8 students. According to (LARSEN ET AL., 2013), employees have a much larger impact on the total footprint than students[40]. Due to the lack of data, the specific contribution of students and staff to the total emissions of HVL-Sogndal could not be calculated.

15.7. Comparison with miljøfytårn

As shown in chapter 12.12, HVL Sogndal has carried out carbon footprint assessments in the past. Yet these assessments only included a few emission sources, mainly energy consumption and waste, and were highly inconsistent, as the assessment included a different amount of sources each year. The latest available results from the Miljøfyrtårn reports are from 2016. These will shortly be compared to the result of this thesis in the following section.

For 2016, the carbon footprint assessment in the Miljøfyrtårn report includes scope 2 emissions and emissions from waste. The scope 2 emissions are estimated at ca. 430t CO_2-eq/yr and the emissions from waste management are estimated at around 13,5t CO_2-eq/yr. The report provides the baseline data (kWh energy consumption and kg waste produced) and the emission factor that was used. There is, however, no documentation of any other applied methods, such as a reference for the emission factors. For waste management, the results of the Miljøfyrtårn report (13,5t CO_2-eq/yr) and this thesis (8t CO_2-eq/yr) are in the same range. A possible source of this variation is the use of different emission factors. For the scope 2 emissions, the results differ more strongly. The Miljøfyrtårn report estimates 430t CO_2-eq/yr, while this thesis estimated 45t CO_2-eq/yr. This is a difference of roughly a factor 10. Again, the reason is most likely the use of different emission factors. The Miljøfyrtårn report uses an emission factor of 128g CO_2-eq/kWh for electricity and 181g CO_2-eq/kWh for district heating, while the Scope 3 Evaluator that was used for this thesis uses an emission factor of 13g CO_2-eq/kWh. The difference between the emission factors is again roughly a factor of 10, coinciding with the difference in the results. The Scope 3 Evaluator furthermore does not differentiate between electricity and district heating. The emission factors used in the Miljøfyrtårn report are closer to the emission factor for the Nordic mix (LARSEN ET AL., 2013), while the emission factor used in this thesis is closer to the emission factor for the Norwegian mix (NVE, 2018). It is therefore likely that the Miljøfyrtårn report used emission factors associated with the Nordic mix, instead of the Norwegian mix

[40] For NTNU: Emissions per student: ca. 4,6t CO_2-eq/yr; Emissions per staff: ca. 16,7t CO_2-eq/yr

16. Conclusion

16.1. Purpose and results

The aim of this assessment is to provide some initial information to identify the most pressing areas to focus on, either through implementing strategies that aim to reduce emissions in the associated area or through further, more detailed, research. This assessment should be used to develop a preliminary climate action plan that sets focus areas and conceptualises overarching strategies for these focus areas. A general tendency can be identified, showing that the categories with the highest share of the total emissions of HVL-Sogndal are commuting, business trips and purchased goods and services. It is therefore recommended to focus further efforts on these areas. In later stages, a monitoring and reporting scheme should be developed. This will require the implementation of a more advanced carbon footprint model, which can also be used to develop more detailed strategies.

It has to be noted, that prioritising these three areas should not result in completely disregarding the other areas. While categories such as waste management might have a comparably low impact on HVL-Sogndal greenhouse gas emissions, they might have other environmental impacts. As an example, an extensive waste management system is important to reduce the release of pollutant substances, especially if the university handles chemicals substances in laboratories.

16.2. Recommended actions to reduce HVL-Sogndal's emissions

This chapter aims to provide inspiration for actions that can be taken to reduce the emissions in the three focus areas, purchases, business trips and commuting. Specific actions, however, will most likely require more detailed assessments of these three focus areas.

Relating to the purchases, the most obvious solution is to reduce the total consumption of goods. However, over the last years, HVL-Sogndal steadily grew bigger (NSD, 2018). If this trend continues in the future, it will be difficult to reduce the total consumption. Possibilities to reduce the total consumption are for instance actions that prolong the lifetime of the purchased good. This can be done, for instance, by increasing the amount of goods that are repaired instead of discarded. However, it might prove more effective to reduce emissions in this category by substituting certain goods with less emission intensive alternatives.

Three purchasing sub-categories should be focused on, as they are more precisely defined, thereby being fairly accurate, and furthermore have noticeable contributions to the total emissions (ca. 5 – 6% each).

These three sub-categories are 'Chemicals and Chemical Products', 'Pulp, Paper, Printing and Publishing' and 'Food, Beverages and Tobacco'. Emissions in the first are solely caused by the purchase of cleaning material. This group also has the highest impact in emissions per spending. Developing strategies to reduce the consumption of cleaning materials or using more environmentally friendly cleaning supplies is likely to noticeably reduce the emissions. The second category encompasses printing paper, books and the publishing of articles and journals. A way to reduce the emissions in this category is to increase the use of recycled paper and focus more on electronic versions of books and published articles or journals. The last group, 'Food, Beverages and Tobacco', includes the catering at meetings, conferences, etc. It is especially important to note that this group does not include the cantina at campus, which is run by SAMAN. It can be expected that the inclusion of the cantina would greatly increase the emissions from this category. It is therefore highly important to focus on this sub-category. Actions to reduce emission could be the use of more locally sourced products or increasing the amount of vegetarian food on offer.

In regards to business travels, an aspect that has to be evaluated is the impact of the recent merge of the different campuses to form HVL. It can be expected that the merge will lead to an increased travel volume between the different campuses. If this proves to be true, HVL should implement strategies to counter this trend, or provide low emission intensive travel opportunities. The total amount of travelling between the campuses could be reduced by focusing more on online lectures, online conferences, etc. Incentivising employees that are required to travel to use more public transport could further reduce the emission from this category. The Bergen campus of HVL has recently developed an app that allows HVL staff to search for other employees travelling the same route, in order to promote carpooling (RUDI, 2018). Expanding on such initiatives is a strategy to reduce emissions from business trips.

Developing strategies for commuting initially requires a more detailed assessment of the commuting behaviour of students and staff. Depending on the results, different strategies can be developed, such as collaboration agreements with local public transport companies, improving bicycle infrastructure, providing charging stations for electric vehicles on campus or providing online lectures to reduce commuting in general. A similar carpooling app as mentioned in the business trip section could also be developed for commuting. Providing more student housing in proximity to the campus is another option.

16.3. Linking carbon footprint and sustainability

During the process of calculating the carbon footprint of HVL-Sogndal, two main challenges could be observed which also apply to the mapping of the university's performance in the other SDGs. These were firstly a general lack of data or lack of accessibility to the data and secondly a lack of awareness on on-going projects related to sustainability. The following section will give some recommendations on how to address these issues.

A way to address both issues at the same time is to develop an open access knowledge platform. Such a platform should provide access to the required data, such as university spending, student and employee numbers, energy consumption, course offers, etc. Furthermore, it should provide information on already undertaken actions and on-going projects in relation to sustainability, including reports on those projects as well as related bachelor, master and PhD theses and articles published by staff and students. Lastly it should provide contact information of the people in charge of such projects. The open access nature of such a platform would make it the ideal tool to raise awareness on sustainability related issues. The data provided by this platform could be collected and processed by a 'flow tracking system', based on the concept of material and energy flow accounting in a socio-economic metabolism (HABERL, FISCHER-KOWALSKI, KRAUSMANN, WEISZ, & WINIWARTER, 2004). This will result in a system that tracks all inputs, stocks and outputs of the socio-economic system that is HVL, including material, energy and financial flows as well as changes in personnel and any other flows. It will enable the identification of the most pressing issues, helping to advance sustainability at HVL in a resource efficient way.

As creating such a platform or database and the subsequent data collection requires a large amount of work, these processes would ideally involve the students. As for now, the administration is in charge of the accounting systems of HVL. Hence, any additional data collection leads to a higher workload for the administration staff. This results in the data collection being inconsistent, as can be seen in the Miljøfyrtårn reports (chapter 12.12) Delegating this work to the students, as part of project work requirements in courses, internships or paid work, would thereby reduce the workload of the administration staff. Additionally it would benefit the students as it provides opportunities for applied learning. This is one of the main ideas on the Living Lab concept (chapter 3.1.5). Students from all faculties and study programmes can be involved in such a project, thereby providing the opportunity for interdisciplinary teaching. This kind of a participatory process, involving students, teachers and administration staff, can be of great benefit for every involved party.

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Appendix

Appendix 1: Translated SDGs to apply specifically to HEIs

See supplementary material 'Appendix 1' for full Excel file with translated SDG targets and Indicators

Appendix 2: HVL-Sogndal Purchases, categorised into ISIC Rev 3.1 Sectors

Table 9: HVL-Sogndal Purchases, categorised into ISIC Rev 3.1 Sectors

Konto	Translation	Beløp 2017	ISIC Rev. 3.1 Sector	Type of Good
6367	Keys and locks	99.449	Basic Metals and Fabricated Metals	Capital Good
SUM		99.449	Basic Metals and Fabricated Metals	Capital Good
SUM $		12.036		
SUM $_Sogn		9.663		
6368	Cleaning material	729.769	Chemicals and Chemical Products	Standard Good
SUM		729.769	Chemicals and Chemical Products	Standard Good
SUM $		88.318		
SUM $_Sogn		70.910		
6392	signs/ signage	10.493	Construction	Capital Good
SUM		10.493	Construction	Capital Good
SUM $		1.270		
SUM $_Sogn		1.020		
6321	Renovation, water, drainage etc	0	Construction	Service
6630	Plumbing services, rented buildings	3.050	Construction	Service
6631	electrician services, rented buildings	12.263	Construction	Service
6632	Other craftsman services, rented buildings	171.107	Construction	Service
SUM		186.420	Construction	Service
SUM $		22.561		
SUM $_Sogn		18.114		
6793	Exams	91.450	Education	Service
6872	Capacity building	51.280	Education	Service
7192	Stipends for studends visiting the university?	58.335	Education	Service
SUM		201.065	Education	Service
SUM $		24.333		
SUM $_Sogn		19.537		
6390	light bulbs	0	Electrical and Optical Equipment	Standard Good
SUM		0	Electrical and Optical Equipment	Standard Good

SUM $			0		
SUM $_Sogn			0		
	6550	ICT / AV equipment	2.149.712	Electrical and Optical Equipment	Capital Good
	6551	AV equipment	0	Electrical and Optical Equipment	Capital Good
	6553	Copy machines, purchasing	0	Electrical and Optical Equipment	Capital Good
	6560	telephone and fax, purchasing	168.447	Electrical and Optical Equipment	Capital Good
	6801	Office and Computer supplies	450.859	Electrical and Optical Equipment	Capital Good
	6803	Computer requisits/ equipment (mouse, keyboards etc)	0	Electrical and Optical Equipment	Capital Good
SUM			2.769.018	Electrical and Optical Equipment	Capital Good
SUM $			335.110		
SUM $_Sogn			269.060		
	6660	Maintenance office machines, printers	309.243	Electrical and Optical Equipment	Service
	6663	Maintenance ICT Equimpment	0	Electrical and Optical Equipment	Service
SUM			309.243	Electrical and Optical Equipment	Service
SUM $			37.425		
SUM $_Sogn			30.049		
	6598	Invesments	1.985.607	Financial Intermediation	Service
	7040	Liability Insurance cars	8.214	Financial Intermediation	Service
	7509	Other Insurance costs	0	Financial Intermediation	Service
	7771	banking fees	59.036	Financial Intermediation	Service
SUM			2.052.857	Financial Intermediation	Service
SUM $			248.440		
SUM $_Sogn			199.472		
	6862	Catering, external personell	0	Food, Baverages and Tabacco	Standard Good
	7352	Catering	1.164.335	Food, Baverages and Tabacco	Standard Good
SUM			1.164.335	Food, Baverages and Tabacco	Standard Good
SUM $			140.909		
SUM $_Sogn			113.136		
	6101	shipping costs	0	Inland Transport	Service
	6199	Other shipping costs	0	Inland Transport	Service
SUM			0	Inland Transport	Service

SUM $		0		
SUM $_Sogn		0		
6541	fixtures	0	Manufactoring (not elsewhere classified); Recycling	Capital Good
SUM		0	Manufactoring (not elsewhere classified); Recycling	Capital Good
SUM $		0		
SUM $_Sogn		0		
6500	Teaching and laboratory machines, purchasing	164.314	Mashinery (not elsewhere classified)	Capital Good
6501	Laboratory machines	0	Mashinery (not elsewhere classified)	Capital Good
6502	Other machines and equipment, purchasing	45.315	Mashinery (not elsewhere classified)	Capital Good
SUM		209.629	Mashinery (not elsewhere classified)	Capital Good
SUM $		25.370		
SUM $_Sogn		20.369		
6661	Maintenance other machines	0	Mashinery (not elsewhere classified)	Service
SUM		0	Mashinery (not elsewhere classified)	Service
SUM $		0		
SUM $_Sogn		0		
7710	Board meeting	0	Other	Service
6393	Plant and plant maintenance	0	Other	Service
6399	Other local costs	0	Other	Service
6899	Other office costs	0	Other	Service
7799	Other costs	1.401.772	Other	Service
7135	Refunds for moving costs	5.201	Other	Service
7151	daily allowances, dutiable	2.016.729	Other	Service
7152	daily allowances, not dutiable	52.450	Other	Service
7301	Sales cost	0	Other	Service
7323	Sponsoring	411.338	Other	Service
7351	Representation	19.372	Other	Service
7797	Refund of other costs	-92.082	Other	Service
SUM		3.814.780	Other	Service
SUM $		461.670		
SUM $_Sogn		370.675		

	6794	Washing and renting of laundry	32.748	Other Community Social and Personal Services	Service
	7412	contribution to student welfare organizations	1.403.126	Other Community Social and Personal Services	Service
	7413	Contribution to student arrangements	226.069	Other Community Social and Personal Services	Service
	7414	contribution to student organizations	578.000	Other Community Social and Personal Services	Service
	6720	uninett service fees	3.051.789	Other Community Social and Personal Services	Service
6847a		Annual library fee etc	663.778	Other Community Social and Personal Services	Service
	7401	Membership fees	1.269.992	Other Community Social and Personal Services	Service
SUM			7.225.502	Other Community Social and Personal Services	Service
SUM $			874.441		
SUM $_Sogn			702.088		
	6846	Movies (and other physical media)	138	Other Community Social and Personal Services	Standard Good
	6855	Movies (bib.)	0	Other Community Social and Personal Services	Standard Good
SUM			138	Other Community Social and Personal Services	Standard Good
SUM $			17		
SUM $_Sogn			13		
	6111	Customs and freight cost	0	Other Supporting and Auxilliary Transport Activities; Activities of Travel Agencies	Service
	6450	Hired cars and other transport	103.255	Other Supporting and Auxilliary Transport Activities; Activities of Travel Agencies	Service
	6460	Hired transport	0	Other Supporting and Auxilliary Transport Activities; Activities of Travel Agencies	Service
	6795	purchase of transport services	123.438	Other Supporting and Auxilliary Transport Activities; Activities of Travel Agencies	Service
SUM			226.693	Other Supporting and Auxilliary Transport Activities; Activities of Travel Agencies	Service
SUM $			27.435		
SUM $_Sogn			22.027		
	6901	Phone and Data communication, internett providers etc	531.672	Post and Telecomminications	Service
	6941	Porto	799.068	Post and Telecomminications	Service
SUM			1.330.740	Post and Telecomminications	Service
SUM $			161.048		
SUM $_Sogn			129.305		
	6821	Printing costs, binding, photography	363.361	Pulp, Paper, Printing and Publishing	Service
	6822	Binding, photography	0	Pulp, Paper, Printing and Publishing	Service

	6829	Other printing costs	2.146	Pulp, Paper, Printing and Publishing	Service
SUM			365.507	Pulp, Paper, Printing and Publishing	Service
SUM $			44.234		
SUM $_Sogn			35.516		
	6802	Paper for printers	48.794	Pulp, Paper, Printing and Publishing	Standard Good
	6843	Books	846.598	Pulp, Paper, Printing and Publishing	Standard Good
	6845	Books for employees	0	Pulp, Paper, Printing and Publishing	Standard Good
	6850	Books (bib.)	0	Pulp, Paper, Printing and Publishing	Standard Good
	6844	E-books	99.445	Pulp, Paper, Printing and Publishing	Standard Good
	6851	E-books (bib.)	0	Pulp, Paper, Printing and Publishing	Standard Good
	6854	Publications, Journal copies, special editions (bib)	0	Pulp, Paper, Printing and Publishing	Standard Good
	6842	Publications, Journal copies, special editions	223.912	Pulp, Paper, Printing and Publishing	Standard Good
SUM			1.218.748	Pulp, Paper, Printing and Publishing	Standard Good
SUM $			147.495		
SUM $_Sogn			118.423		
	6303	Operating costs of rented buildings	0	Real Estate Activities	Service
	6311	Operating costs in connection to rent from statsbygg	0	Real Estate Activities	Service
	6300	Rent other contracts	0	Real Estate Activities	Service
	6304	Random Rent	0	Real Estate Activities	Service
	6310	Rent Statsbygg	0	Real Estate Activities	Service
	7193	Rent for students in practical education	2.150.915	Real Estate Activities	Service
SUM			2.150.915	Real Estate Activities	Service
SUM $			260.307		
SUM $_Sogn			209.000		
	6522	Software, purchasing	87.101	Renting of M&Eq and Other Business Activities	Capital Good
	6422	Software licenses	1.680.408	Renting of M&Eq and Other Business Activities	Capital Good
SUM			1.767.509	Renting of M&Eq and Other Business Activities	Capital Good
SUM $			213.906		
SUM $_Sogn			171.746		
	6721	Purchases for other ongoing operations, ICT	999.618	Renting of M&Eq and Other Business Activities	Service
	6401	Hired academic, scientific and teaching equipment	39.944	Renting of M&Eq and Other Business Activities	Service

6402	Hired machines and tools	0	Renting of M&Eq and Other Business Activities	Service
6421	Hired data systems (servers, pc, printers)	71.317	Renting of M&Eq and Other Business Activities	Service
6499	Other hired costs	67.692	Renting of M&Eq and Other Business Activities	Service
6050	Depreciation allowance of operation equipment, furniture and tools	0	Renting of M&Eq and Other Business Activities	Service
6360	External cleaning services	119.813	Renting of M&Eq and Other Business Activities	Service
6361	Other external cleaning services	271.311	Renting of M&Eq and Other Business Activities	Service
6363	Security, Alarm, Access control	1.447.070	Renting of M&Eq and Other Business Activities	Service
6364	Other security measures	0	Renting of M&Eq and Other Business Activities	Service
6365	Access control	0	Renting of M&Eq and Other Business Activities	Service
6635	Other service costs, rented buildings	130.797	Renting of M&Eq and Other Business Activities	Service
6700	Accounting, auditing and economy services	18.129	Renting of M&Eq and Other Business Activities	Service
6730	Purchase of services for organizational development, recruitment etc	1.838	Renting of M&Eq and Other Business Activities	Service
6740	Hired personell from job agencies	0	Renting of M&Eq and Other Business Activities	Service
6790	Purchase of teaching services	6.026.213	Renting of M&Eq and Other Business Activities	Service
6791	Purchase of research services	4.488.842	Renting of M&Eq and Other Business Activities	Service
6792	Refund for student practise	9.009.882	Renting of M&Eq and Other Business Activities	Service
6797	Purchase of law services	31.383	Renting of M&Eq and Other Business Activities	Service
6798	Puchase of consulting services, translations	396.547	Renting of M&Eq and Other Business Activities	Service
6799	Other services	639.549	Renting of M&Eq and Other Business Activities	Service
6824	Fees for copyrights	167.144	Renting of M&Eq and Other Business Activities	Service
6830	Job announcements	224.945	Renting of M&Eq and Other Business Activities	Service
6831	Purchase announcements	0	Renting of M&Eq and Other Business Activities	Service
6839	Other announcements	7.630	Renting of M&Eq and Other Business Activities	Service
6840	Avis abonnement	98.347	Renting of M&Eq and Other Business Activities	Service
6841	Journal subscriptions	189.678	Renting of M&Eq and Other Business Activities	Service
6848	Databases, Information resources	1.668.641	Renting of M&Eq and Other Business Activities	Service
6852	Avis abonnement (bib.)	0	Renting of M&Eq and Other Business Activities	Service
6853	Journal abonnement (bib.)	0	Renting of M&Eq and Other Business Activities	Service
6857	Databases, Information resources (bib.)	0	Renting of M&Eq and Other Business Activities	Service
6870	Participant fees for courses and seminars, own employees	1.360.258	Renting of M&Eq and Other Business Activities	Service
6871	Organization of courses and seminars, own employees	338.631	Renting of M&Eq and Other Business Activities	Service
6880	Arrangements of courses and seminars, external participants	832.156	Renting of M&Eq and Other Business Activities	Service

	7302	Expenses for fairs	30.141	Renting of M&Eq and Other Business Activities	Service
	7320	Profile Advertising	73.419	Renting of M&Eq and Other Business Activities	Service
	7321	Study Advertising	239.999	Renting of M&Eq and Other Business Activities	Service
	7322	Profile articles	48.873	Renting of M&Eq and Other Business Activities	Service
	7609	licenses	1.699.017	Renting of M&Eq and Other Business Activities	Service
	7798	Fees for complaints in inkasso	144	Renting of M&Eq and Other Business Activities	Service
SUM			30.738.964	Renting of M&Eq and Other Business Activities	Service
SUM $			3.720.073		
SUM $_Sogn			2.986.847		
	6856	electronic media (bib)	0	Renting of M&Eq and Other Business Activities	Standard Good
	6710	Purchases of software development tools, ICT-Solutions	165.648	Renting of M&Eq and Other Business Activities	Standard Good
	6847	Electronic media (bib)	0	Renting of M&Eq and Other Business Activities	Standard Good
SUM			165.648	Renting of M&Eq and Other Business Activities	Standard Good
SUM $			20.047		
SUM $_Sogn			16.096		
	6690	other repairs and maintenance	592.651	Retail Trade, Except for Motor Vehicles and Motorcycles; Repair of Household Goods	Service
	6662	Maintenance fixtures, furniture	0	Retail Trade, Except for Motor Vehicles and Motorcycles; Repair of Household Goods	Service
SUM			592.651	Retail Trade, Except for Motor Vehicles and Motorcycles; Repair of Household Goods	Service
SUM $			71.723		
SUM $_Sogn			57.587		
	7021	Transport vehicles service/maintenance	28.942	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel	Service
	7099	Other costs, vehicles	32.789	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel	Service
SUM			61.731	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel	Service
SUM $			7.471		
SUM $_Sogn			5.998		
	6570	Work clothes and protective equipment	35.400	Textiles and Textile Products	Standard Good
SUM			35.400	Textiles and Textile Products	Standard Good
SUM $			4.284		
SUM $_Sogn			3.440		

	6391	Operating equipment	158.471	Wholesale Trade and Commision Trade, Except of Motor Vehicles and Motorcycles	Capital Good
	6510	Tools, purchasing	61.371	Wholesale Trade and Commision Trade, Except of Motor Vehicles and Motorcycles	Capital Good
	6543	Other equipment	56.130	Wholesale Trade and Commision Trade, Except of Motor Vehicles and Motorcycles	Capital Good
SUM			275.972	Wholesale Trade and Commision Trade, Except of Motor Vehicles and Motorcycles	Capital Good
SUM $			33.399		
SUM $_Sogn			26.816		
	6542	Decoration, purchasing	935	Wholesale Trade and Commision Trade, Except of Motor Vehicles and Motorcycles	Standard Good
	6590	Consumables	375.585	Wholesale Trade and Commision Trade, Except of Motor Vehicles and Motorcycles	Standard Good
	6591	Teaching material	345.598	Wholesale Trade and Commision Trade, Except of Motor Vehicles and Motorcycles	Standard Good
	6592	Other operating material	42.151	Wholesale Trade and Commision Trade, Except of Motor Vehicles and Motorcycles	Standard Good
	7411	Gifts for externals	83.218	Wholesale Trade and Commision Trade, Except of Motor Vehicles and Motorcycles	Standard Good
SUM			847.487	Wholesale Trade and Commision Trade, Except of Motor Vehicles and Motorcycles	Standard Good
SUM $			102.564		
SUM $_Sogn			82.349		

Appendix 3: Results of the carbon footprint assessments of HVL-Sogndal

Table 10: Results of carbon footprint assessments of HVL-Sogndal

	total	Scope 1	Scope 2	Scope 3						
				Goods & services	Cap. Goods	Energy rel.	Waste	Travel	Commuting	Total
HVL-Sogndal 2017 [t CO2-eq/yr]	9.200	5	46	1.700	290	54	8	800	6.300	9.200
HVL-Sogndal 2017 [%]	100	0	1	18	3	1	0	9	68	100
HVL-Sogndal 2017; Staff commuting[t CO2-eq/yr]	4.000	5	46	1.700	290	54	8	800	1.000	3.900
HVL-Sogndal 2017; Staff commuting[%]	100	0	1	43	7	1	0	20	25	98
HVL-Sogndal 2017; Nor. commuting [t CO2-eq/yr]	5.200	5	46	1.700	290	54	8	800	2.200	5.100
HVL-Sogndal 2017; Nor. commuting [%]	100	0	1	33	6	1	0	15	42	98
HVL-Sogndal 2017; no commuting [t CO2-eq/yr]	3.000	5	46	1.700	290	54	8	800	0	2.900
HVL-Sogndal 2017; no commuting [%]	100	0	2	57	10	2	0	27	0	97
HVL-Sogndal 2017; Denmark [t CO2-eq/yr]	10.500	5	1.100	1.700	290	220	8	800	6.300	9.300
HVL-Sogndal 2017; Denmark [%]	100	0	10	16	3	2	0	8	60	89
HVL-Sogndal 2017; Sweden [t CO2-eq/yr]	9.200	5	59	1.700	290	44	8	800	6.300	9.100
HVL-Sogndal 2017; Sweden [%]	100	0	1	18	3	0	0	9	68	99
HVL-Sogndal 2017; Finland [t CO2-eq/yr]	9.900	5	660	1.700	290	150	8	800	6.300	9.200
HVL-Sogndal 2017; Finland [%]	100	0	7	17	3	2	0	8	64	93
HVL-Sogndal 2017; Iceland [t CO2-eq/yr]	9.200	5	1	1.700	290	60	8	800	6.300	9.200
HVL-Sogndal 2017; Iceland [%]	100	0	0	18	3	1	0	9	68	100
HVL-Sogndal 2017; Australia [t CO2-eq/yr]	12.300	5	2.800	1.700	290	330	8	800	6.300	9.400
HVL-Sogndal 2017; Australia [%]	100	0	23	14	2	3	0	7	51	76
HVL-Sogndal 2017; Brazil [t CO2-eq/yr]	9.500	5	230	1.700	290	79	8	800	6.300	9.200
HVL-Sogndal 2017; Brazil [%]	100	0	2	18	3	1	0	8	66	97
HVL-Sogndal 2017; France [t CO2-eq/yr]	9.400	5	210	1.700	290	62	8	800	6.300	9.200
HVL-Sogndal 2017; France [%]	100	0	2	18	3	1	0	9	67	98
HVL-Sogndal 2017; Distr. heat [t CO2-eq/yr]	9.200	14	37	1.700	290	54	8	800	6.300	9.200
HVL-Sogndal 2017; Distr. heat [%]	100	0	0	18	3	1	0	9	68	100
HVL-Sogndal 2017; HNE Eberswalde [t CO2-eq/yr]	960	5	46	55	0	54	0	800	0	900
HVL-Sogndal 2017; HNE Eberswalde[%]	100	1	5	6	0	6	0	83	0	94