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HOW CAN CALCULATING EMISSIONS IN CONSTRUCTION INDUSTRY WITH ONE CLICK LCA APP ENHANCE BIODIVERSITY?

Bachelor's Thesis

Sustainable Development

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Koulutuksen nimi Kestävä Kehitys
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Työn nimi Kuinka päästöjen mittaaminen One Click LCA -sovelluksella voi auttaa luonnon monimuotoisuutta?
Ohjaaja Maria Lehtimäki

Biodiversiteetti on kaikkialla ympärillämme ja se tukee sekä tasapainottaa ekosysteemejä, ja on siten elintärkeä ihmiskunnan selviytymiselle. Rakennusteollisuuden ollessa merkittävässä roolissa ympäristöpäästöjen kasvattamisessa ja biodiversiteettien vähenemisessä maailmanlaajuisesti, sen on myös tarjottava ratkaisuja niiden säilyttämiseksi. One Click LCA tarjoaa mahdollisuuden arvioida ympäristöpäästöjä rakennusalalla teettämällä elinkaarianalyysejä rakennuksille, rakennustuotteille sekä infrastruktuurille. Yritys on julkaissut kaksi biodiversiteettiarvoja huomioivaa laskentatyökalua. Tämän tutkimuksen tarkoituksena on selvittää asiakaskokemuksia näistä työkaluista.

One Click LCA on tämän tutkimuksen tilaaja. Teoria kerättiin ensin tutkimusta varten. Biodiversiteettityökalujen käyttäjäkunnasta kerättiin tietoa One Click LCA ohjelmistosta. Asiantuntijahaastattelu järjestettiin työkalujen kehittäjän kanssa. Käyttäjiin otettiin yhteyttä ja heidät kutsuttiin tapaamiseen. Vastauksia ei saatu, joten järjestettiin seitsemän ilmaista koulutusta ja työkalujen esittelyä asiakkaille, ja kokeilujaksot työkaluille aloitettiin niiden jälkeen. Asiakkaille lähetettiin uudelleen pyyntöjä tapaamisiin palautteen saamiseksi, mutta vastauksia ei saatu.

Tutkimuksen tulokset perustuvat kerättyyn teoreettiseen tietoon, asiantuntijahaastatteluun työkalujen kehittäjän kanssa sekä asiakkaiden mielipiteisiin ja palautteisiin, jotka vastaanotettiin koulutuksien ja demojen aikana. Biodiversiteetin huomioiminen rakennusalalla on vielä uutta, eikä sitä ole vielä pakollista sisällyttää arviointiin, joten se on helppo jättää huomiotta. Taloudellisesti tiukoilla olevalla alalla tämä voi olla helpoin ratkaisu. Tiedon jakaminen biodiversiteetin taloudellisista hyödyistä on tärkeässä asemassa muutoksen toteutumisen kannalta. Tämän tutkimuksen tulos vahvistettiin keräämällä tietoa kehittäjältä ja palautetta asiakkailta. Alan on saatava aikaa kehittyä ja omaksua uusia toimintamalleja, ja tähän tarvitaan selkeitä ohjeita ja säädöksiä prosessin nopeuttamiseksi.

Avainsanat Biodiversiteetti, luontopositiiviset ratkaisut, elinkaariarviointi, ohjelmisto, asiakaskokemus
Sivut 32 sivua ja liitteitä 2 sivua

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Biodiversity is all around us and it supports and balances the ecosystems and therefore is vital for human survival. Construction industries have played a major part in increasing environmental emissions and decreasing biodiversity globally, they need to offer solutions for saving it. The app One Click LCA offers a possibility for assessing environmental emissions in the construction sector by conducting life cycle assessments for buildings, building products, and infrastructure. It has published two calculation tools that consider biodiversity values. This research studies the customer experience of these tools.

One Click LCA is the commissioner of this research. The theory for the research was gathered first. Information was gathered from the biodiversity tools' users in One Click LCA app. An expert interview was arranged with the developer of the tools. Users of the tools were reached out to invite them for a meeting. No answers were received, and seven free trainings and overviews for the tools were arranged with several customers, and trial periods for the tools were set right after. After trial periods, customers were reached out again requesting meetings for feedback, but no answers were received.

The results of this research are based on collected theoretical knowledge, the expert interview with the tool developer, and the opinions and feedback of the customers given in the training and demo sessions. According to the gathered information, biodiversity is considered as an important factor in the construction industry. However, it is still new. The topic that is not mandatory to include in the assessment is easy to ignore and in an industry that is financially challenging, this can be the easiest solution. The economic values of biodiversity should be more visible. Sharing the knowledge of the benefits biodiversity offers is crucial in achieving this change. Research conclusion was confirmed after gathering information from the developer and the feedback from the customers. The industry needs time to evolve and embrace new factors, and for that, clear guidelines and regulations should be set to speed up this process.

Keywords Biodiversity, nature-positive drivers, life cycle assessment, software, customer experience
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1 Introduction

Since the 19th century, there has been one reason above others when talking about climate change, the human activities on Earth. The way humans use Earth's resources has been non-sustainable, and such things as burning fossil fuels, cutting down forests, and agriculture the way it has been operating, have been some of the main drivers for these changes in temperature and weather patterns. (United Nations, n.d.-a)

It is essential to take steps to mitigate emissions from carbon dioxide and other greenhouse gases. The information technology (IT) sector, which includes the software industry, has a lot of potential to make a difference in reducing global emissions. (Green Software Foundation, 2021) The software industry has transformed our everyday lives and work, and its meaning will most likely grow in the future. Because of this, it is most important to design energy-efficient software solutions. (Green Software Foundation, 2021) Offsetting carbon plays a major role in achieving the goals set for net-zero emissions, and this is where modern technologies can help by providing options for managing and reducing emissions. (Avelar, 2021)

Life Cycle Assessment (LCA) works as a tool for decision support by estimating different environmental impacts from the product's or service's whole life cycle. With this assessment, it is possible to highlight the hotspots for the biggest emissions and compare the impact of different actions. (Suomen Ympäristökeskus, 2024a) It helps to make more sustainable choices, gives a possibility to compare different design options and material choices, assesses product's or policy's environmental benefits, and helps to move forward towards more environmentally conscious designing. (Carbon Leadership Forum, n.d.)

Assessing the biodiversity values is becoming more relevant in the construction industry and actions are being taken to increase biodiversity and restore ecosystems. The construction sector has a vital role in this since it has taken a big part in historically decreasing biodiversity. (Construction Industry Council, 2024) Options and guidance for measuring and assessing nature-related impacts have been generated to encourage businesses to integrate nature into their decision-making processes (Taskforce on Nature-related Financial Disclosures, n.d.).

This thesis is a review on the impacts that software company One Click LCA can have on biodiversity and how it is possible to help the biodiversity in the construction industry. First,

there is an introduction to the basic terminology, explaining the meanings of biodiversity, life cycle assessment, One Click LCA as a company, and what are the services it offers. For this research, one expert interview was conducted and actions to understand the customer experience with the tool were taken. The goal is to have a more detailed knowledge of the pain points for measuring biodiversity effects in LCA calculations and have ideas for possible improvement and development of the tools provided by One Click LCA.

The research questions covered in this thesis are the following:

- What kind of environmental impacts are there in the construction industry?
- What potential biodiversity benefits does life cycle assessment offer?
- How should the calculation of biodiversity be developed?

2 Biodiversity

The term biodiversity considers all living things in one area. That includes plants, animals, and fungi, as well as every small microorganism. These species are all working together in their ecosystems, supporting life, and giving it balance. When humans pressure this planet and consume more of its resources, this balance is at risk. (Hancock, n.d.)

Biodiversity includes all life on Earth in all different forms. It is part of the area's ecosystem. Forests and coral reefs are examples of these. Biodiversity has been evolving for 4.5 billion years to the form that it is today. The influence of human activity has increased highly, and it has put nature in crisis. Humans depend on biodiversity supplies for example for food, medicine, and water, among many other things. Many irreplaceable ecosystems and their species are threatened to be extinct within decades, such as the Amazon rainforest and mangrove swamps. (United Nations, n.d.-b)

Climate change plays its part in affecting biodiversity. It has an impact on the terrestrial, marine, and freshwater ecosystems globally. This is a risk for the health of different ecosystems, but also a risk for human health, since it affects the ecosystem services. Food loss, new viruses, and livelihoods are just a few examples of things affected by climate change. (United Nations, n.d.-c)

There are four types of ecosystem services: provisioning services, regulating services, cultural services, and supporting services. Provisioning services include all the resources

obtained from nature, such as food, water, timber, plants and oil. Regulating services include ecosystem processes that are beneficial for humans, such as decomposition, flood control, and carbon storage. Cultural services offer people non-material benefits, things like knowledge about nature that runs through our cultures, for example, ideas and creativity nature gives us for art or architecture. Supporting services are the services we couldn't live without, since without these, the other three wouldn't exist. These are things such as the water cycle, photosynthesis, or nutrient cycling. (National Wildlife Federation, n.d.) Ecosystems are functioning as natural carbon sinks, which means that they absorb greenhouse gases from the atmosphere. From human activities, half of the emissions are being absorbed by these natural carbon sinks. By protecting biodiversity and different ecosystems and utilizing their potential to absorb greenhouse gas emissions, these emissions can be reduced by about one-third of the needed, only within the next decade. (United Nations, n.d.-d)

2.1 Biodiversity in Cities

Biodiversity loss is a huge environmental challenge, especially in cities. These ecosystems usually have less natural environment and lower levels of biodiversity since the land is used so intensively and there isn't too much space for green areas. Urbanization plays a big role in habitat loss. When cities are built, physical and chemical barriers are built and they are making the moving of species harder, and therefore their ways to find shelter, food, or even partners are limited. As much as cities are responsible for biodiversity losses, they can also offer new opportunities to enhance the state of biodiversity. Green spaces in urban areas, like parks, gardens, and green roofs enable a habitat for many native species, for example, different pollinators and birds. (IUCN, 2023a)

The EU Biodiversity Strategy for 2030 is targeting helping biodiversity recover urban biodiversity. The goal is to create infrastructures that improve the connection between urban and peri-urban areas. The EU Nature Restoration Law co-operates with the Commission and the target is restoring 20% of the land and sea areas in Europe by 2030 and by 2050, all ecosystems that need restoration. Bringing natural-based solutions (NbS) to cities can affect positively for prevention of climate change. (IUCN, 2023b) Nature-based solutions refer to research and innovation initiatives financed by the European Commission. Their goal is to find ways to tackle climate change and biodiversity issues, enhancing the health of people and creating jobs at the same time. These solutions should be supported by nature and provide several benefits, such as economic and environmental benefits. More diverse,

natural features and processes should be brought into different landscapes, seascapes, and cities. The main point of these solutions is to benefit biodiversity. (European Commission, n.d.-a)

Urban biodiversity helps reduce stormwater, remove pollution, and most importantly, works as a carbon storage. Estimation of yearly benefits from urban green areas on each hectare can be everything between 2,500 € and 16,500 €. Also, temperatures can be reduced by 1-5 °C with tree shades and evapotranspiration. In addition, many other benefits have been recognized from having green areas in urban environments, such as improved mental health, improved air quality, and ecological resilience to environmental changes. (IUCN, 2023c)

2.2 Construction Industry's Effect on Biodiversity

The Construction industry and built environment influence multiple sectors of the economy. Only in the EU, it is responsible for more than 35% of the waste generated in total. About 50% of the extracted materials are for construction. Material manufacturing and the construction and renovation of buildings contribute 5% to 12% of the total national greenhouse gas emissions. (European Commission, n.d.-c)

With climate change, biodiversity loss is happening globally, and the construction industry affects this a lot. As the population grows, more natural resources, more housing, and more infrastructure are needed. Such materials as concrete, are putting a huge pressure on biodiversity when they are produced, but at the same time, are vital elements in the built environment and enable sustainable infrastructure and buildings. (World Economic Forum, 2022)

Construction finance management needs to be well-planned since building projects can be difficult to predict. Planning the management for finance ensures the profitability of the project and makes sure that the company will have satisfied customers and will succeed with their time management. Good finance management requires detailed budgeting, which will give a clear view of how the money is spent on the project. It also requires cash flow management, cost control, and financial reporting and accountability. It is a relevant factor when choosing the property or land for the construction or deciding materials for the construction. (Union Business Finance, 2024) Since biodiversity includes all living things, these choices can have a significant impact on biodiversity. Investing in biodiversity is recommended and it will generate business opportunities in different areas, such as improving energy efficiency or creating new solutions for the circular economy. Decreasing

biodiversity can affect negatively for example access to raw materials or energy sources. (McCann, 2022)

Embodied ecological impacts need to be considered when choosing materials for the building project since they can have major impacts even if they do not occur on-site. These impacts can be such as deforestation, habitat loss on land and marine, water pollution, and soil erosion. (UK Green Building Council, n.d.-a) Embodied impacts are measured by using a whole-life framework, like when calculating carbon emissions, as shown in Attachment 1. In Chapter 3.1, Figure 4 covers the life cycle stages in more detail. Ecological impacts differ from greenhouse gas emissions in many ways. Ecological impacts are usually more related to the local environments, also being connected to other ecosystems around them, which makes it hard to target these at universal levels. (UK Green Building Council, n.d.-b)

2.3 Construction Industry's Nature-Positive Drivers

Construction plays a major part in causing emissions and decreasing biodiversity, so it is the industry's job is also to address the problems behind these losses. Many positive actions have been taken to help cut down the emissions and their effects on the natural environment. (Construction Industry Council, 2024) Sustainability reporting is required for large and listed companies by the EU law. This means the possible risks and impacts of a company's actions need to be reported to be able to evaluate its sustainability performance. (European Commission, n.d.-d)

The Construction Leadership Council's Green Construction Board launched in February 2024 the Biodiversity Roadmap, which clarifies the actions that the construction industry will execute to help the natural environment and reduce emissions. The main goal set for the Biodiversity Roadmap is aiming in the construction industry to be nature-positive and align with UN Convention on Biological Diversity's Framework's goals (Construction Industry Council, 2024). The Convention on Biological Diversity (CBD) has been verified in 196 nations and it works to promote actions made for a sustainable future. All levels related to biodiversity and its progress are covered in this framework, such as politics, science, and business. (United Nations, n.d.-e) The roadmap helps organizations ways to improve biodiversity in the built environment. The themes cover the following: The key drivers, funding, and delivery through national legislative requirements that make sure that the goals for stopping biodiversity loss will be reached. Measuring, managing, and monitoring the habitats with digital technology is the next step on the themes. (Construction Industry Council, 2024) For this, Biodiversity Net Gain, a requirement in England that became

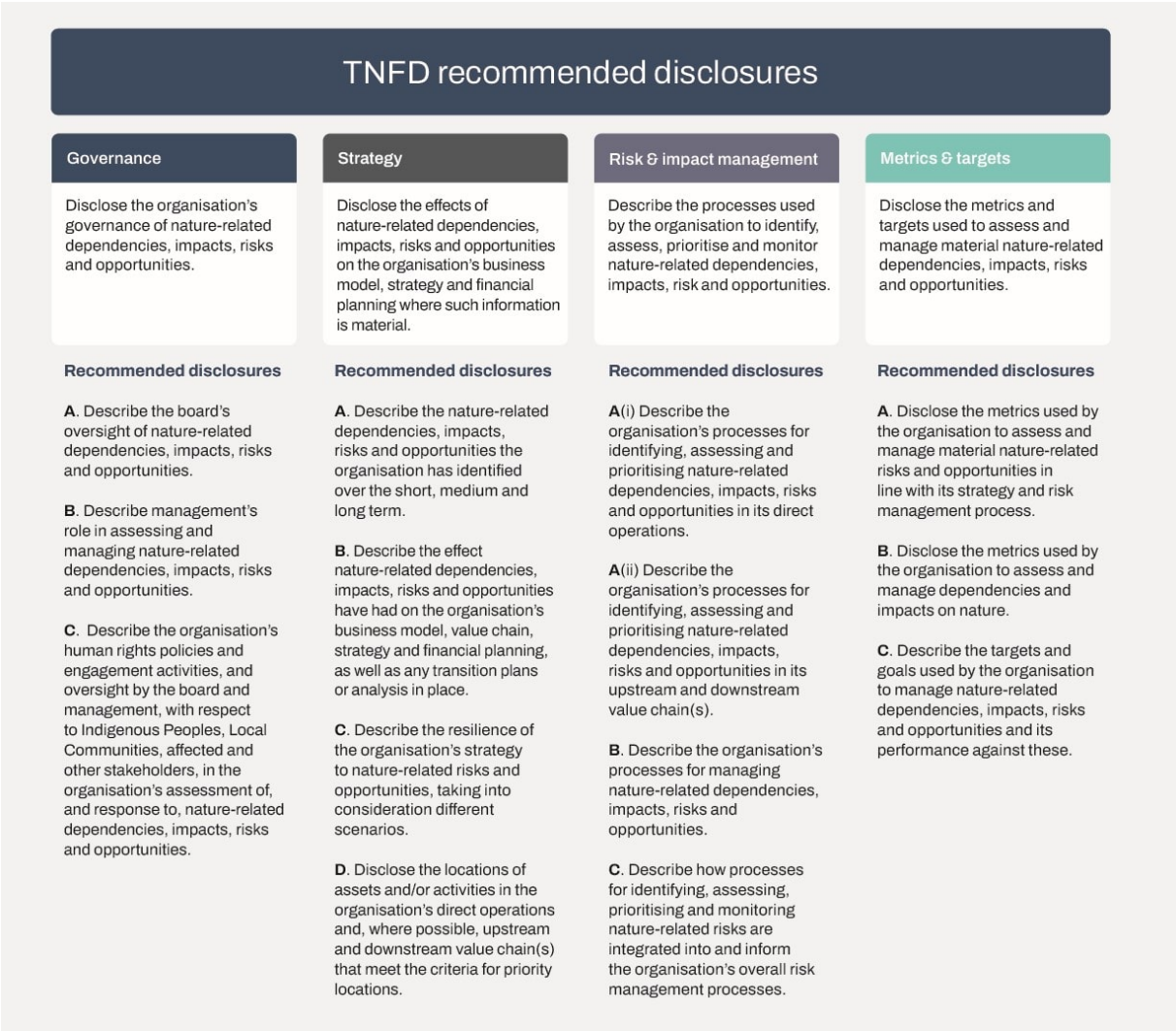
mandatory in February 2024, will make sure that the direction of construction sites' impact on biodiversity will be compared positively to what was on the site before (GOV.UK, 2024). Lastly, adding mandatory training and educate more biodiversity specialists in the industry so the industry gains more knowledge about the Environmental targets and metrics. With the help of this roadmap, organizations and industries can drive forward the changes required. (Construction Industry Council, 2024)

Biodiversity net gain regulation's goal is to add and improve biodiversity in England. It requires construction projects to have a positive impact on biodiversity, which means they need to achieve at least a 10% increase in biodiversity value compared to the pre-construction value on site. This increase is possible to be achieved either by increasing biodiversity on-site, off-site, or with statutory biodiversity credits. (GOV.UK, 2024) A Company needs to have the planning permission granted for the project, and the Biodiversity Gain Plan approved before starting the construction project. The plan makes sure that the objective has accurate post-construction values compared to the pre-construction drawings and plans. It also requires all the offsite biodiversity gains to be registered and granted. It gives a possibility to purchase biodiversity credits for the construction if those are needed. The regulation encourages taking biodiversity into account already in early-stage decision-making, for example when deciding on the site of the construction. (GOV.UK, 2024)

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is addressing biodiversity assessment on a global level. They give an option to create assessments on global, regional, subregional, and even on a thematic scale. The evaluation provides an estimate of the present condition and trends in biodiversity and ecosystem services, while also highlighting their effects on human well-being and the efficacy of response measures. (IPBES, 2019)

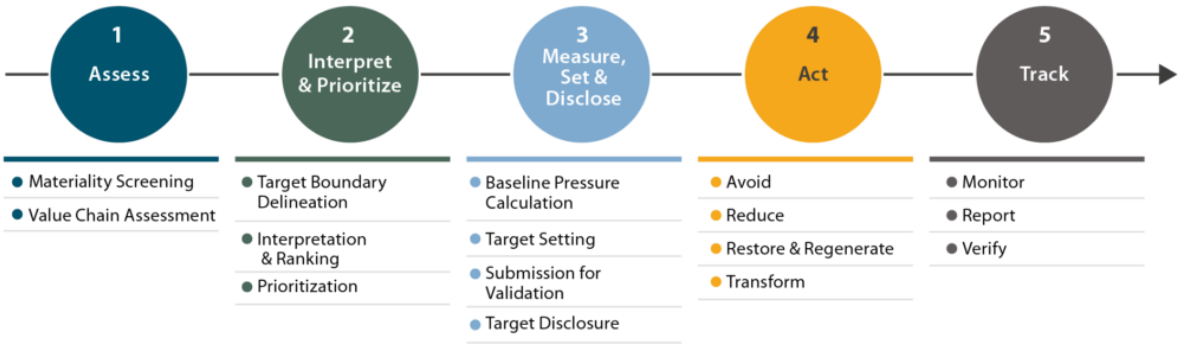
The Taskforce on Nature-related Financial Disclosures (TNFD) created guidance to help businesses assess, report, and take action for nature-related issues. It helps businesses to take nature into account in decision-making and guide them towards nature-positive outcomes. (TNFD, n.d.-a) TNFD has created four pillars that have different approaches that align with the targets set by the Kunming-Montreal Global Biodiversity Framework. The framework drives actions for harmonious living with nature by 2050 and it supports the Sustainable Development Goals. These four pillars of TNFD are governance, strategy, risk and impact management, and metrics and targets, which are explained in more detail in Figure 1.

Figure 1. The recommendations pillars designed by TNFD (TNFD, n.d.c).



Science Based Targets Network (SBTN) has created a process for setting goals for a nature-positive future. It is a five-step process covering assessing, prioritizing, target setting, acting, and tracking. These steps include tools and methods for guiding businesses during the process and are presented in Figure 2. By assessing the materials and the value chain, defining and prioritizing their impacts, and setting targets, companies can start making the change. SBTN has technical guidance created for these first three steps. Steps four and five, which are acting and tracking, are defined in the first stages and require further measuring, reporting, and verifying. (SBTN, n.d.-a)

Figure 2. SBTN's five process stages (SBTN, n.d.b).

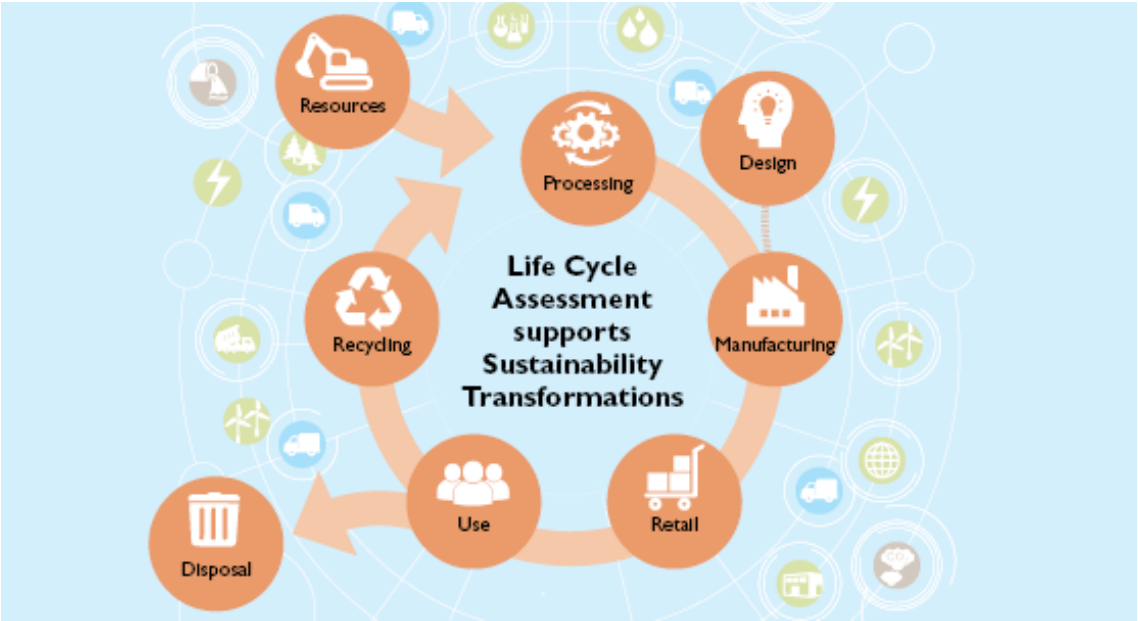


3 Life Cycle Assessment (LCA)

Life Cycle Assessment or LCA, is a method made for defining environmental impacts for a product or a service for its whole life cycle, including all processes in each life cycle stage. The method helps authorities, businesses, researchers, and policymakers measure the environmental impact caused by human activities. With this knowledge, changes can be made towards more sustainable options. (Suomen ympäristökeskus, 2024a)

LCA as a method is an ISO (the International Organization for Standardization) standardized tool for visualizing different options and decisions for a product or service for its whole life cycle. It gives a possibility to define and view which factors are causing the biggest impacts and try out different options for those. The product life cycle is divided into different stages, starting from the resources, going through the processing and design stages, and from there to manufacturing and distribution. From there, the product continues its journey to users and goes through the use stage, where it ends up in recycling or disposal. These stages are presented in Figure 3. In every stage, emissions are made and LCA takes into account these multiple factors, such as transportation emissions, energy, and water consumption. (Suomen ympäristökeskus, 2024b)

Figure 3. Product's life cycle (Suomen ympäristökeskus, 2024c).



3.1 Life Cycle Assessment for Buildings

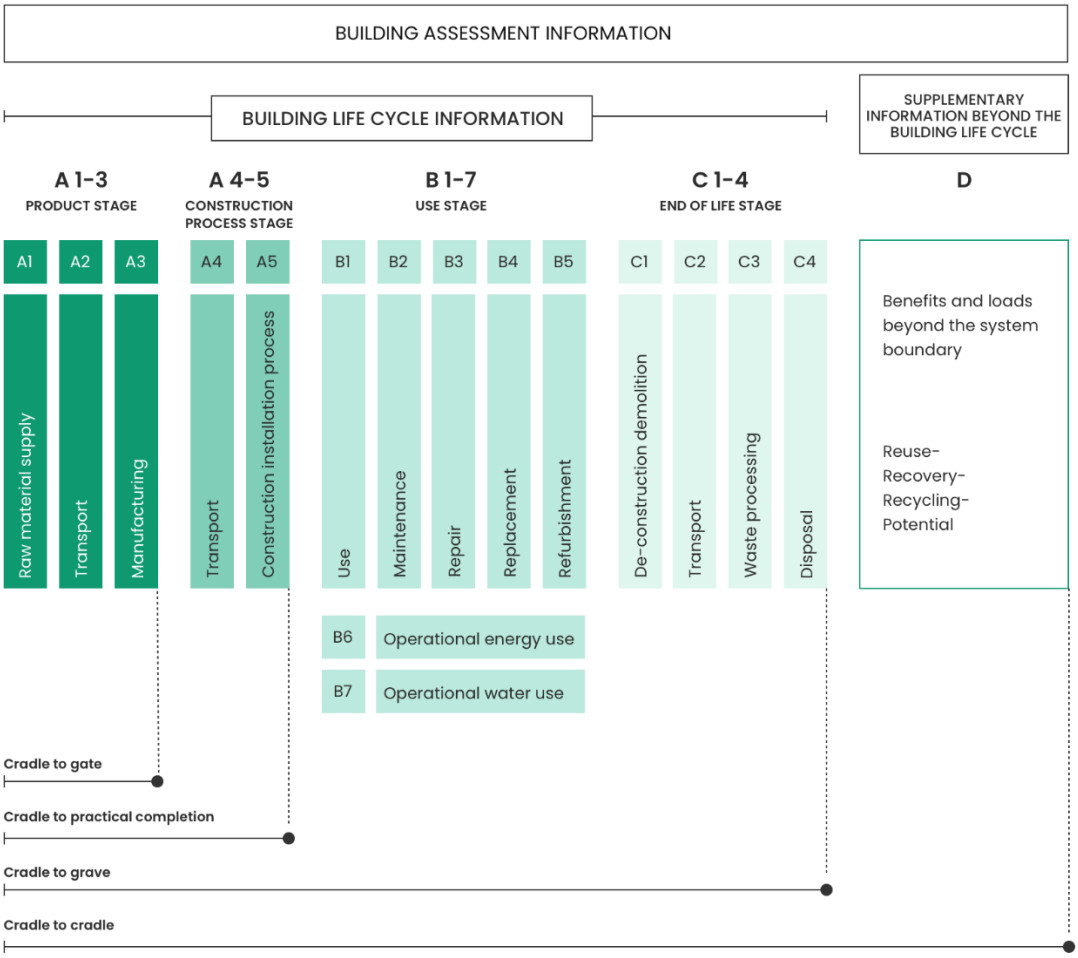
LCA in the construction industry is like any other LCA calculation. With the building LCA, the buildings' lifetime is divided into life cycle stages. These stages are categorized into the following stages: the product stage (A1-A3), which addresses the material extraction and manufacturing processes; the construction process stage (A4-A5), which includes the transportation and construction site operations; the use stage (B1-B7, the operational performance and maintenance of the building; the end-of-life stage (C1-C4), which covers deconstruction, waste processing and disposal of the materials in the building; and lastly, the reuse stage (D), which considers the material recovery and repurposing. (One Click LCA, 2023) The graph below shows each of the stages in the buildings' life cycle (Figure 4). The assessment seeks to evaluate the environmental impacts across the building's entire life cycle, encompassing every aspect from raw material extraction to the final phases of demolition and disposal. (One Click LCA, n.d.-v)

There are many official standards to follow when doing LCA assessments. This thesis focuses on the most relevant standards for Europe, the United Kingdom, and Finland. These standards will be shortly presented as follows:

The European standard, EN 15978, is the one developed for assessing buildings' environmental performance by its life cycle stages (European Standards, 2012) which are presented in Figure 4. This approach is based on data presented in the Environmental

Product Declarations (EPDs) that follow the EN 15804 standard. The EN 15804 standard is made by the European Commission to help align the European Committee for Standardization (CEN) with the Product Environmental Footprint (PEF) requirements. (European Commission, n.d.-b) The National Standardization Bodies of 34 countries in Europe have all been brought together in CEN, which provides a development platform for European Standards and various technical documents related to different products, services, processes, and materials (International Commission on Illumination, n.d.). Alternatively, the PEF provides a standardized framework for measuring environmental performance. It quantifies the environmental impacts of both products and organizations, with the main aim of helping to reduce these impacts and evaluating the entire supply chain from cradle to grave. (European Commission, n.d.-b) This update for the EN 15804 standard became mandatory in July 2022 and required changes in data formats in all EPDs published after that (One Click LCA, 2024d).

Figure 4. Buildings' life cycle stages according to EN standards (One Click LCA, 2023).



The product stage (A1-A3) involves raw material sourcing, transport, and manufacturing. This stage is known as the ‘Cradle to gate’ assessment, which accounts only for the emissions inherent in the materials. By including the emissions from transportation to the construction site and the construction installation activities (A4-A5), the assessment is extended to a ‘Cradle to practical completion’ calculation. The use stage (B1-B7) involves all emissions produced during the building’s operational life, including those from its regular use, energy and water consumption, as well as maintenance, repair, replacement, or refurbishment work. After the use stage, the building progresses to its end-of-life stage (C1-C4), which covers deconstruction, demolition, transport for demolition, waste processing, and disposal. The assessment that extends from the product stage through to the end-of-life stage is termed a ‘Cradle to Grave’ assessment. A ‘Cradle to Cradle’ assessment is the kind of assessment, where the possible benefits of the building (D) are added to the calculation. This means adding different reuse, recovery, and recycling possibilities in the building. (One Click LCA, 2023)

3.2 One Click LCA

One Click LCA is a software company from Finland. It gathers all the features needed for construction companies to be able to achieve their sustainability goals for their projects. (One Click LCA, n.d.-a) Under this platform, users can calculate whole building LCA calculations, LCA calculations for infrastructures, and emissions for materials used in the projects and publish them as Environmental Product Declarations, EPDs.

One Click LCA strives to add new EPDs, and generic data points the way that the software has all the possible sources needed for producing accurate LCA calculations globally (One Click LCA, n.d.-b). The data integrated into the software goes through the Building Research Establishment (BRE) reviewed ten-point verification process. It is structured to be in a format that is ready for use with different integration possibilities, such as Revit, Excel, and Grasshopper. (One Click LCA, n.d.-c)

Since many advanced economies have their standards and requirements for life-cycle assessments, One Click LCA includes many different databases and compliance modules to help the customer work with the compulsory and voluntary standards globally (One Click LCA, n.d.-d). Some certificates award points or credits when fulfilling the requirements set for conducting life-cycle assessments. One Click LCA has developed tools that help customers achieve those points in confidence. (One Click LCA, n.d.-e)

These calculation tools are made for different parts of the construction process. They are divided into tools made for building LCA, tools for infrastructure LCA, and tools for Product LCA. In addition, customer has the possibility to choose from different level licenses to use, depending on what their needs and requirements are for their projects. The license options are Business, Expert, and Enterprise level licenses and these have different features included (One Click LCA, n.d.-h). These license options are made for each country to ensure that each customer can conduct LCA calculations no matter where they are based.

3.2.1 Building LCA

There are multiple different tools for Building LCA that One Click LCA offers. It supports over 80 certifications, regulations, and standards globally, such as BREEAM, LEED, and DGNB. (One Click LCA, n.d.-i) Through its BREEAM certification system, BRE Group helps to improve building performance from start to finish (BRE Group, n.d.). Leadership in Energy and Environmental Design (LEED) is a rating system used worldwide, and this certification is a recognition of sustainability achievement for the building (USGBC, n.d.). Deutsche Gesellschaft für Nachhaltiges Bauen, DGNB, provides a certification system for evaluating the sustainability of buildings. The DGNB certification system has been globally recognized as the most advanced system of its kind. (DGNB, n.d.) Also, standards such as Level(s), are supported by One Click LCA. Level(s) is a framework developed for reporting and enhancing the sustainability of buildings in Europe and it is designed to support the EU's policy goals (European Commission, n.d.-e). Many national schemes are supported as well.

In Finland, there are national schemes to follow, such as the RTS Environmental classification, which aims to promote sustainable development by using building materials and furniture with low environmental emissions and at the same time, helping to achieve good indoor air quality (Rakennustieto, n.d.). The second one is the Green Building Council Finland, a non-profit association that drives sustainable changes in the built environment together with their members who represent the entire industry. Their goal is to bring the construction industry to a more sustainable stage, that succeeds in keeping the emissions within the planetary boundaries. (Green Building Council Finland, n.d.) Lastly, the Ministry of the Environment in Finland has published guidelines for low-carbon construction. This assessment method is standard-based and will be followed up as part of Finland's strategy for climate and energy (Ministry of the Environment, 2019, p.9). This methodology is based on the European standards and Level(s) framework (Ministry of Environment, 2019, p.11). One Click LCA offers a tool especially made to follow these schemes (One Click LCA, n.d.-j).

The United Kingdom has its regulations and guidelines to follow as well. the RICS whole life carbon assessment is a standard that drives accurate carbon measurements. It helps assess the embodied carbon for the building but also requires the operational and user carbon emissions to be reported. RICS standard was updated in July 2024 to WLCA 2nd edition and is mandatory for all RICS members to follow. (RICS, 2024a) The standard is developed to ensure the reliability of the LCA assessment and pushes companies to long-term thinking. It can be used by professionals, such as consultants and designers, contractors, developers, investors, and lenders. (RICS, 2024b)

The Greater London Authority has set up a guidance for the LCA assessments in London. It complies with Policy SI 2DB of the Intend to Publish London Plan, which drives for minimizing carbon emissions. The policy requires that all construction proposals should have their emissions calculated by nationally recognized WLCA and reducing the emissions from the project's life cycle should be made a priority. The GLA guidance helps notice those requirements and it uses the statement from RICS 1st edition. (Moore and Schembri, 2023, p.7) As of now, the GLA methodology is not aligned with the RICS 2nd edition.

Different integration possibilities are offered, such as plugins for Revit and Grasshopper. These integrations are making sure that the customer's workflow is as easy as possible between different design environments. There are more than 20 of these software tools that work together with One Click LCA. (One Click LCA, n.d.-k) With these integrations, and the One Click LCA Carbon Designer 3D tool, customer can view the possible hotspots in their building and have a better understanding of where the emissions are coming from (One Click LCA, n.d.-l). With the largest database in the world, covering more than 200,000 data points, customer can compare materials with different impacts and identify the best options for their project (One Click LCA, n.d.-m).

3.2.2 Infrastructure LCA

Calculating life cycle assessment for infrastructure works in many ways like building life cycle assessment. Infrastructure tools offered by One Click LCA are designed to follow certain standards and certificates, such as PAS 2080 and BREEAM Infrastructure LCA (One Click LCA, n.d.-n). PAS 2080 is a standard that has been made to meet the requirements of the World Trade Organization for managing carbon emissions in infrastructure projects. The focus of this framework is on reducing emissions at the whole value chain. (Carbon Trust, n.d.) BREEAM Infrastructure is a rating scheme that drives companies to more sustainable infrastructures. It was previously known as the CEEQUAL scheme, which is a world-leading

methodology for high-performing infrastructure projects. (BREEAM, 2024) Material import is possible with BIM integrations or with Excel, the same way as with the building LCA. Also, the database has specific data points for infrastructure materials and many generic assemblies created for infrastructure assessments (One Click LCA, n.d.-o)

3.2.3 Product LCA

For comprehensive life cycle assessments of a building, environmental product declarations (EPDs) for its materials are essential. One Click LCA can generate these EPDs. (One Click LCA, n.d.-f) With the EPD Generator tools, the customer has the possibility to create EPDs that comply with EN 15804+A1, EN 15804+A2 standards, and the following ISO standards:

- ISO 14040:2006 Environmental management – Life cycle assessment – Principles and framework. The standard goes through the LCA framework and represents the principles to follow when conducting the assessment. (International Organization for Standardization, 2006a)

- ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines. The standard provides guidance on LCA scope and targets, including the life cycle inventory analysis, impact assessment, interpretation, review process, limitations, phase connections, and the use of value options and optional elements. (International Organization for Standardization, 2006b)

- ISO 14067:2018 Greenhouse gases – Carbon footprint of products – Requirements and guidelines for quantification. Includes reporting and quantification requirements when assessing a product's carbon footprint. (International Organization for Standardization, 2018)

- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services. The Standard includes requirements and guidance for the construction industry on conducting an environmental product declaration. (International Organization for Standardization, 2017)

- ISO 14025:2006 Environmental labels and declarations – type III environmental declarations – Principles and procedures. This standard focuses on the Type III EPD

development and the procedures behind it. (International Organization for Standardization, 2006c)

In the software, tailored templates are available for the manufacturer and the EPD process can be simplified and the delays with publishing can be minimized. (One Click LCA, n.d.-g)

3.2.4 Calculation Tools in the Software

This chapter covers the basics of the software. To be able to access this view presented in Figure 6 below, one needs an account in the software, which can be created for free. To be able to access the license that has access to the tools, one needs to have a subscription to the software or an educational license. One Click offers licenses for students and universities, where it is possible to test the features in the software. (One Click LCA, 2024c) In this example, the chosen tools are for the UK market and are created to align with the RICS guidance.

There are currently three GLA/ RICS/ Green Mark tools available in the software, two are presented in Figure 6. These two are very similar, the main difference is the available format of data. The GLA/ RICS/ Green Mark (+A2) tool supports the newer standard EN 15804 +A2. The standard reports the impact categories differently and has updated biogenic carbon and storage requirements. It also includes changes in the way the D module (benefits) is calculated and has mandatory reporting for the end-of-life stage. (Circular Ecology, n.d.) Differences in these two data formats are presented in more detail in Figure 5, where the update on reporting with the impact categories is more visible.

Figure 5. The differences between EN 15804 +A1 and EN 15804 +A2 data (One Click LCA, 2023).

Required impact categories according to EN 15804+A1

Impact category	Global Warming Potential (GWP)	Ozone Depletion Potential (ODP)	Acidification Potential (AP)	Eutrophication Potential (EP)	Photochemical Ozone Creation Potential (POCP)
Unit	Kg CO2 Eq.	Kg CFC11 Eq.	Kg SO2 Eq.	Kg PO4 Eq.	Kg Ethene (C2H4) Eq.

Required impact categories according to EN 15804+A2

Impact category	Global Warming Potential - Fossil	Global Warming Potential - Biogenic	Global Warming Potential - LULUC*	Ozone Depletion potential - (ODP)**	Eutrophication Potential - Terrestrial	Eutrophication Potential - Marine	Eutrophication Potential - Freshwater	Photochemical Ozone Creation Potential (POCP)	Acidification Potential
Unit	Kg CO2 Eq.	Kg CO2 Eq.	Kg CO2 Eq.	Kg CFC 11 Eq.	Mol N Eq.	Kg N Eq.	Kg Po4 Eq.	Kg NMVOC nt	Mol H+ Eq.

*Land use and Land Change

** The ODP in EN 15804+A2 is of a different version and is not compatible

In Figure 6, the project's main page is presented in One Click LCA software. Customers will have this view, once they've created a project in the software and added the general information, such as name, type, and address of the project. On that point, customer needs to link their project to their license, which allows them to use the calculation tools that have been purchased.

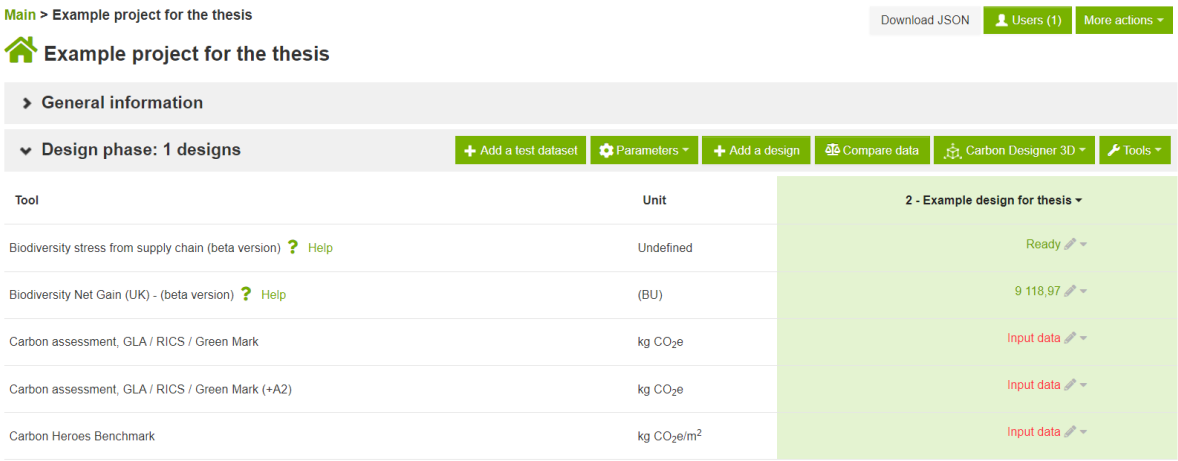
Customers can add other users to the project from the Users tab, which can be entered at the top right of the page. This is a helpful feature if more than one person is working on the same project. The More actions -option has the possibility to modify the basic information of the project, delete, archive, or print the project.

In the Design phase, customer can create designs for their project. There can be many designs on the same project. It is recommended to create many designs on different phases of the assessment to be able to review the data at each project stage. With multiple designs, customers can also compare the differences between these designs created, which is recommended, if one wants to view for example the difference between emissions when using different constructions or materials in the assessment.

As mentioned previously, there are different calculation tools for different regions and countries, and for following different standards and regulations. On the Tools tab, customers

can choose, which tools they want to use on this project. The tools are available with the license linked to the project and are shown to the user as “Available calculation tools”. Once these tools are chosen, they are shown on the project's main page as presented in Figure 6.

Figure 6. Project main page in the One Click LCA software (One Click LCA, 2024e).



Since different tools are based on different standards and regulations, they have different scopes for the assessments. When clicking the green value for each tool on the design, the user can view the options available for a specific tool. As shown in Figure 7 and Figure 8, there are different options for data input in the Biodiversity stress from the supply chain tool compared to the Biodiversity Net Gain (UK) tool. The following chapters present each of these tools in more detail.

Figure 7. Scope for the Biodiversity stress from supply chain tool (One Click LCA, 2024e).

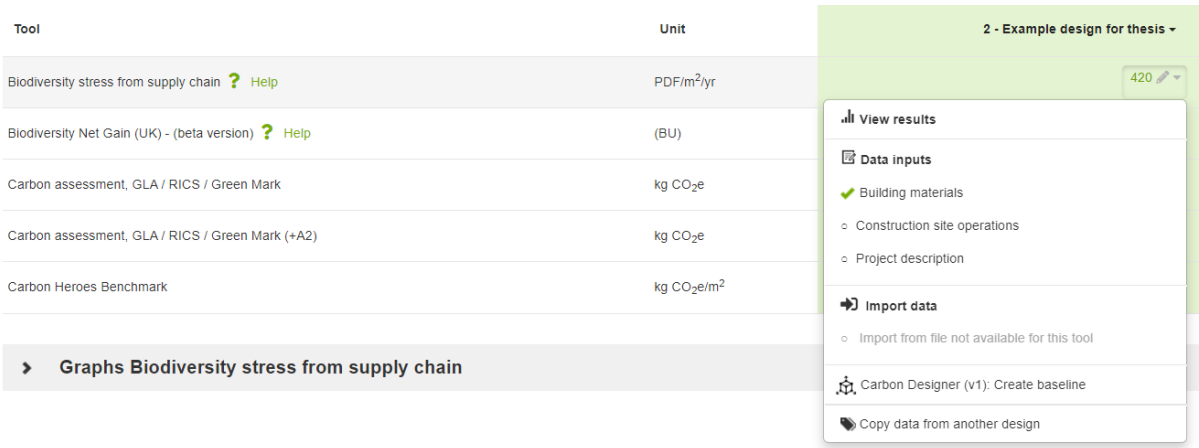
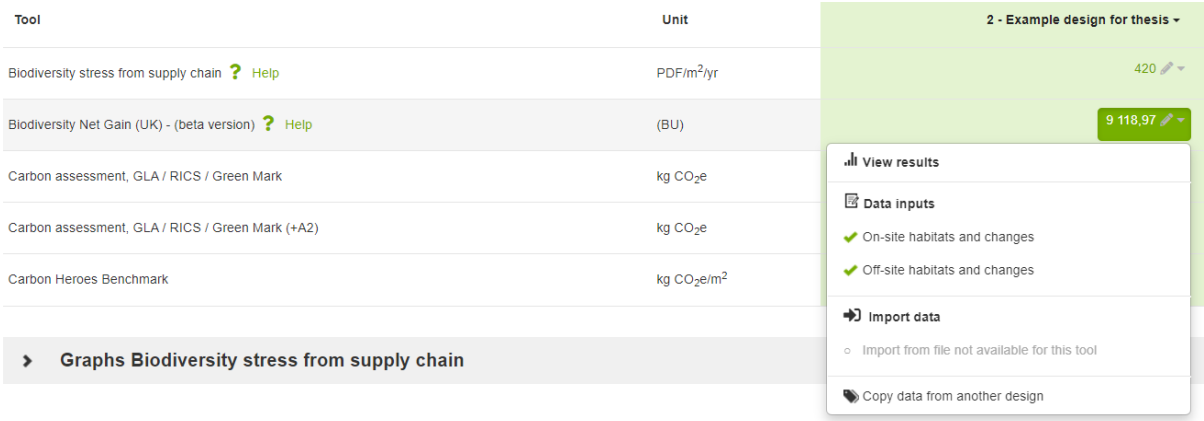


Figure 8. Scope for the Biodiversity Net Gain (UK) tool (One Click LCA, 2024e).



3.2.5 Biodiversity Net Gain Tool

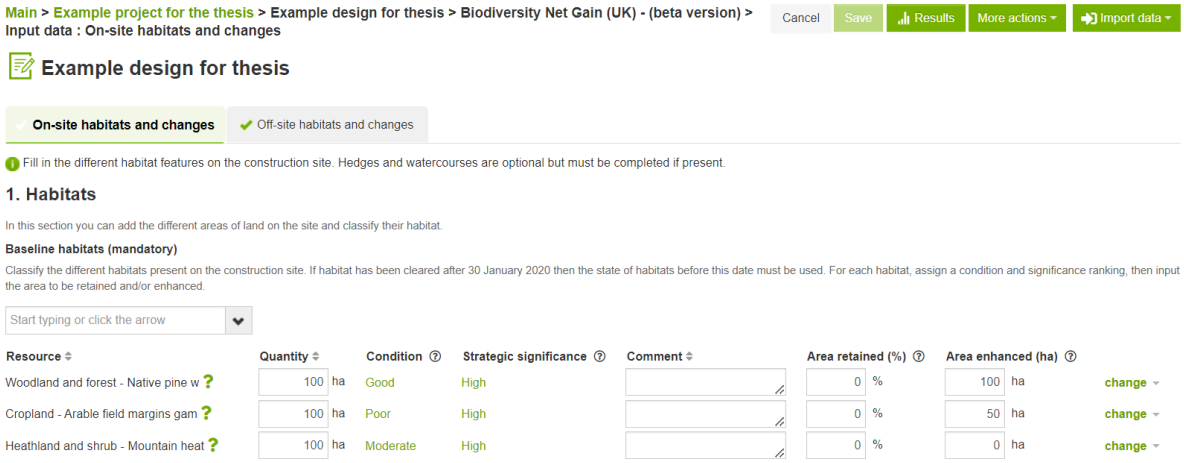
The UK Government's newly introduced Biodiversity Net Gain mandates that developers consider natural habitats as part of the construction process, as mentioned previously in chapter 2.1.3. Increasing the number of habitats and helping the developers to compare the impacts before and after the construction process are the main drivers of this regulation. (One Click LCA, n.d.-p) This requirement became mandatory in England in February 2024 and since then, the developers are legally obligated to provide a 10% net gain for biodiversity in construction projects. (One Click LCA, n.d.-q)

To be able to achieve this 10% net gain on biodiversity, developers have three options to act on in the following order: 1. On-site biodiversity restoration, 2. Mixing of solutions for on and off-site, and 3. As a last resort, purchase credits for statutory biodiversity. Standardized biodiversity units have been used to measure biodiversity. Habitat size, its location, and quality are the factors influencing these units. (One Click LCA, n.d.-r)

In One Click LCA, users can input the on-site and off-site habitats affected by the construction project. The page for this data input is shown in Figure 9. Habitats can be searched for each habitat feature by typing the habitat name in the search box or by clicking the drop-down arrow which will show the categories for the data points. When choosing a data point, it will appear under resources as a separate data row (Figure 9). Users can input the quantity for the habitat and define its condition and strategic significance. Habitat condition should be measured by comparing the ecological optimum state against the actual state of the habitat. Condition assessment needs to be made for each habitat by using Defra's statutory biodiversity condition assessment. Depending on the location of the habitat, strategic significance value can be higher compared to national value. This factor gives users

the possibility to point out potential hotspots for locally important habitats. (One Click LCA, 2024a) The area of the habitat must be inputted as retained and/or enhanced. The same inputs are required for off-site habitats, but the user also needs to define the spatial risk for the habitat.

Figure 9. The habitat query page in an example project using the Biodiversity Net Gain tool (One Click LCA, 2024e).



Users can navigate to the results page by clicking the “Results” button from the top right of the page. The results are presented first by standardized biodiversity units, as shown in Figure 10. All the categories shown in the habitat query pages are presented in this table for the baseline habitats and created habitats, on-site and off-site. The values for enhanced and retained habitats would also show up in this table if this data was inputted to the query pages. Figure 11 shows the net change per biodiversity unit type (habitat, hedge, and watercourse) for on-site and off-site. The total unit change represents the total net change in biodiversity units.

Figure 10. The results page of the example project using the Biodiversity Net Gain tool – by biodiversity unit (BU) (One Click LCA, 2024e).

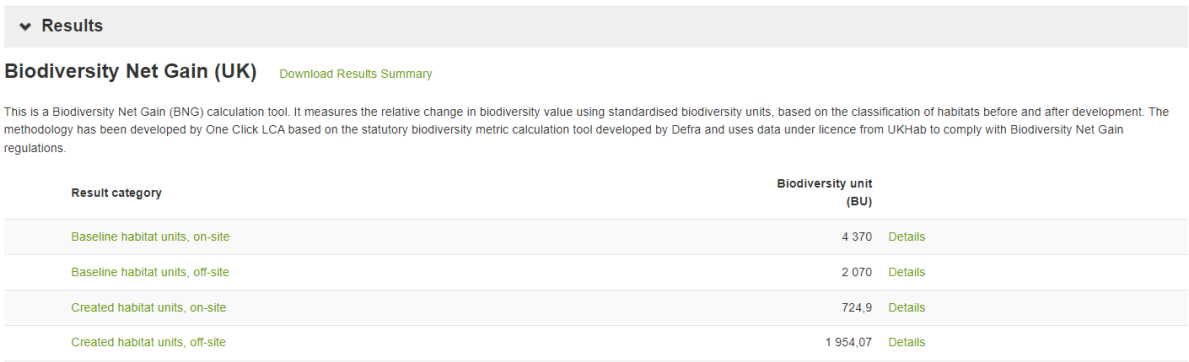


Figure 11. The results page of the example project using the Biodiversity Net Gain tool – On-site and Off-site unit change (One Click LCA, 2024e).

On-site and Off-site unit change

These results are the net change in biodiversity units for each biodiversity unit type, for on- and off-site individually. To calculate a percentage change, divide the biodiversity units from the categories in the table below by the equivalent baseline units in the table above and multiply by 100.

Result category	Biodiversity unit (BU)	
On-site habitat change	−3 645,1	Details
Off-site habitat change	−115,93	Details
On-site hedge change		Hide empty
Off-site hedge change		Hide empty
On-site watercourse change		Hide empty
Off-site watercourse change		Hide empty

Total unit change

These results are the total net change in biodiversity units for each biodiversity unit type, for the whole project. To calculate a total percentage net gain or loss, divide the biodiversity units from the categories in the table below by the equivalent on-site baseline units and multiply by 100.

Result category	Biodiversity unit (BU)	
Habitat net change	−3 761,03	Details
Hedge net change		Hide empty

3.2.6 Biodiversity Stress from Supply Chain Tool

The Biodiversity Stress from Supply Chain tool is a more general tool to use globally, and it differs in many ways from the Biodiversity Net Gain tool. The tool is meant to be an easy-to-use option for companies to utilize in their building's life cycle assessments. Since it doesn't follow any specific standard or requirement, it can be used in different countries, and it can be added to your already existing LCA calculations. (One Click LCA, n.d.-s)

The tool gives companies the ability to view the material's supply chain effects on nature and points out the hotspots and gives a better understanding of the impacts. The tool aligns with the Taskforce on Nature-related Financial Disclosures (TNFD) LEAP approach. (One Click LCA, n.d.-t) As explained in more depth in Chapter 2.2, the TNFD LEAP approach guides the user in identifying and assessing their building's impacts on nature (TNFD, 2023, p.6).

The tool has been developed to look at the short and long-term impacts of materials and operations. It tracks the impacts of climate change, pollution, and resource use. Users can report the life cycle stage emissions for the construction materials (A1-A3), the transportation distances (A4), and the construction site operations (A5). By using the methodology of Potentially Disappeared Fraction of Species (PDF/m2/yr), the user can have the results for the cumulative biodiversity stress coming from the supply chain. The results show the area definition, where all species are disappeared for one year before the biodiversity starts to recover. Since ecosystems are different based on their locations, results are reported as a

single area of destroyed ecosystems instead of the number of extinct species to make the comparison easier between materials and design options, as shown in Figure 12. (One Click LCA, 2024b)

Figure 12. The results page of an example project gives an overview of the measuring factors used in the Biodiversity stress from supply chain tool (One Click LCA, 2024e).

Example design for thesis - Biodiversity stress from supply chain (beta version) Project basic information

Results

Biodiversity stress from supply chain (beta version) Download Results Summary

This is a biodiversity stress assessment tool for supply chains. It measures the extent of potential biodiversity loss. This is calculated using a methodology called Potentially Disappeared Fraction of Species (PDF/m2/yr). The results are showing the cumulative biodiversity stress caused by the supply chain, and the area for which potentially all species disappear for a period of one year. The actual periods of species disappearances from different stressors varies, here all are normalized into one year. The methodology has been developed by One Click LCA based on IMPACT World+ European characterizations, except for climate change for which it uses global characterizations. The tool considers short- and long-term impacts of climate change, pollution and resource use. It does not consider impact of arable land use, for which data quality does not permit accounting.

	Result category	Climate change PDF/m2/yr	Pollution PDF/m2/yr	Resource use PDF/m2/yr	Biodiversity loss PDF/m2/yr	
A1-A3	Construction Materials	271,54	31,13	14,81	317,48	Details
A4	Transportation to site	89,04	0,32	0	89,36	Details
A5	Construction/installation process	11,19	1,18	0,61	12,97	Details
	Total	**371,77**	**32,63**	**15,42**	**419,82**	

4 Finding Out the Customer Experience and Pain Points in the Biodiversity Tools

The construction industry is having a huge impact on biodiversity, as explained in Chapter 2.2. Even with all the positive actions, it is important to see how users are facing these actions and if there could be any areas possible to be improved. Qualitative research such as this depends on the feedback coming from the users, the customers of the product. Interacting with the customer can help the developer to focus on specific requests or suggestions. Quantitative data used together with the qualitative one will add value to the research. It is important to understand which are the used features, but also the less used ones and why. Quantitative data will help identify the users that stand out and are actively using the product. These people are the most relevant to reach out. (Olson, 2020, p. 53-54)

Biodiversity Stress from Supply Chain and Biodiversity Net Gain tools are both new tools in the market and they are presented in more detail in Chapters 3.2.5 and 3.2.6. As knowledge increases, unaddressed issues such as biodiversity are gaining more attention and awareness within companies. Measuring biodiversity factors is a complex process and it requires new knowledge that construction industries are not used to, since it differs from how they have calculated greenhouse gas emissions. Including biodiversity in the companies'

decision-making has already started. Regulations and voluntary frameworks are generated for companies to help them to take biodiversity into account. (One Click LCA, n.d.-u)

This research reaches out to customers' perspectives when using biodiversity tools. It considers possible solutions for improving the customer experience with the tools and is seeking ways to help customers utilize these tools in their workflow when assessing the environmental impacts of construction. Possible issues that are affecting on the results of this research are reflected in the conclusion of the research.

4.1 Background Research and Planning Stage

When conducting a research study, it is important to understand the meaning of the research and why it is needed. Communication is a key factor between all parties involved with the research. They can guide the development and ensure that the research will be conducted properly. Possible risks and benefits need to be considered when conducting the research and those need to be spelled out in the report. The collected information should be handled with care to make sure the quality and validity of the research remains. (Enarson, Kennedy and Miller, 2004). The research for this study has been presented next.

The research focuses on the customer point of view in the One Click LCA software. In 2024, two new calculation tools were published. Those tools calculate the biodiversity values in the construction industry, and they have been presented in more detail in chapters 3.2.5 and 3.2.6. Both the Biodiversity Net Gain and the Biodiversity Supply Chain Stress tools are new tools in the software and there is not a lot of data gathered about the user experiences with these tools. Therefore, having customer feedback and development ideas directly from One Click LCA users is welcome for the developers of the tool.

In this thesis, the newness of the novelty of the tools was acknowledged as the biggest risk factor since not many people have had the time to explore the tools, which meant that it was harder to gain feedback on those. Even for the Biodiversity Net Gain tool, which supports the regulation that became mandatory in the United Kingdom in 2024. Risk factors for the research are presented in Figure 13. Risks are presented with descriptions and possible solutions. These factors were considered when conducting the research and the actions were taken based on the solutions in Figure 13. In the planning stage, the goal was to have three customer interviews. These customers would have been users of the software and the new tools. As the research moved forward, it appeared that there were not many people

using these tools. This led to further actions, and those are explained in more detail in the following chapters.

Figure 13. Research risks.

RESEARCH RISKS

RISK	DESCRIPTION	SOLUTION
TIME	Time of the research, response time is not long for the customer	• Narrow down the list of customers to contact. • Contact the most active customers first and if no responses, contact the less active customers next. • Aim to arrange the interviews soon after contacting customers.
LACK OF USERS	New calculation tools, not many active users yet	• Review user data and find the projects that include data for biodiversity tools. • Review the background of the tools carefully, interview the developer of the tool. • Review previous NPS scores about the tools to gain understanding about the user experience data gathered so far. • Organize demos and trials for customers to gain data of the user experiences.
UNRESPONSIVE CUSTOMERS	When contacting clients, they are not answering the interview requests	• Send first emails as early as possible and if no responses, send reminders next. • Contact customers interested in demos and trials for the tools – offer free trainings to gain knowledge on the tools for customers.
VOLUNTARY INTERVIEW	Voluntary interview for thesis work might not be interesting or motivating enough for the customer	• Offering benefits, such as demos and free trainings for customers. • Focusing on customers most interested in the tools – the ones requesting trials and overview for the tools.
VOLUNTARY TOOL	Biodiversity stress from supply chain tool is voluntary and has no regulation behind it. There is not enough assets budgeted for voluntary assessment, so it is easier to leave out.	• Help customers to gain knowledge on the importance of the assessment by trainings and provided guidance in One Click LCA. • Show customers the way the tool works and highlight the easiness and extra value the tool gives for their assessment.

4.2 Data Collection

The research for this study was implemented as qualitative research. With qualitative research, it is possible to understand an individual's experience and thoughts on the research topic (UK Research and Innovation, 2022) and therefore, it was the most appropriate approach for this study. The results from qualitative research are not calculable and the study sample is often smaller than with quantitative research but can offer a few individuals' points of view (Denny and Weckesser, 2022). In this case study, several software users were chosen for the in-depth interviews, which were meant to give more knowledge on the customer experience for the commissioner of the thesis.

One interview was conducted with a software developer and the biodiversity expert James Thornton, to have the tool developer's opinion about the study and to discuss the suitable topics and questions for the user interviews. He shared ideas behind the tools and the useful resources that have been helping the team with the development work. He participated in all decision-making with the steps of the research to make sure that it progressed in the way

that was the most useful for the commissioner of the thesis. The following chapters go through the steps taken for the data collection.

4.2.1 Expert Interview

People are the biggest challenge when creating software. Product managers need to assess the customer experience of the software. It is in a more important role than coding which requires product managers to have good people skills. Relationships with the customer should be prioritized high, and even more importantly with those being sceptic about their product. Therefore, product managers should attend calls with customers to be able to understand the workflow of the customer and the issues they might be facing. (Olson, 2020, p.57) With these points in mind, it was decided to have an expert interview for this research; to hear the product manager's point of view and discuss topics he has encountered in the demo calls with different customers.

The expert interview took place on the 22nd of April 2024 in Helsinki. The person for this interview, James Thornton, is the biodiversity and product specialist in One Click LCA and has been developing the Biodiversity Net Gain and the Biodiversity Stress from Supply Chain tools in the software. The interview was conducted as a semi-structured interview, which included a list of questions to go through, but with some flexibility depending on the answers, which is important to note when having semi-structured interviews (UK Research and Innovation, 2022) In the interview, we covered the product specialist's point of view on the construction industry's current approach on biodiversity and how he sees or hopes the tools have been developed in the future.

There are many positive actions taken towards acknowledging biodiversity better in the construction industry. Some of those actions were presented in Chapter 2.2.1. Thornton pointed out the money-drivenness in the industry being one of the pain points and one of the reasons taking biodiversity into account is not taken as a high priority yet. It would be an additional thing to do on the long list of tasks for the project. The construction industry in general does not care enough about biodiversity without understanding its financial benefits, which is something still to be learned. Recognizing biodiversity as a factor should have a better outcome financially than ignoring it so that there would be actions taken to increase it. (Thornton, 2024)

The focus in life cycle assessments is currently calculating carbon emissions. The construction industry is regularly developing standards and certifications to conduct more

detailed calculations for these emissions. Some examples of these standards and requirements are presented in Chapter 3.2.1. Since One Click LCA focuses on having tools that support these LCA requirements, Thornton highlighted the need for having all the different impact factors recognized under one platform. This makes approaching new emission factors easier and less intimidating. To be able to look at the whole picture, in this case, the construction industry's effect on nature and ecosystems, more than just one factor needs to be considered. As an example, one material can have very low carbon emissions, but its biodiversity value can be high, which means using it in construction is not sustainable, even if it looks good when assessing only the carbon footprint. Companies need to be aware of all factors, such as air pollution, noise levels, carbon emissions, and biodiversity effects. (Thornton, 2024)

There are many nature-positive impacts when conducting life cycle assessments, even if those are mainly evaluating carbon emissions. Buildings cause 39% of all carbon emissions globally, so life cycle assessment gives companies a chance to take responsibility for the environmental impact their projects create and to build more sustainable building projects in the future. (One Click LCA, n.d.g) It was agreed with Thornton that starting to conduct LCAs is a good starting point to help nature in the construction industry, and to be aware of the impacts that different decisions have. For biodiversity, very powerful improvement will take place, once the data is updated to a more specific location. Currently, the tools on One Click LCA give an estimation based on the country the project is located in and in which location the materials are coming from. (Thornton, 2024)

Thornton revealed the history of the tools and how the idea of having them as part of the LCA software started. One Click LCA aims to fill all customer needs for the LCA assessment in one platform. Improvement areas are viewed regularly, and new ideas are presented if there is room for improvement. The idea of having biodiversity considered as an emission factor in the platform was presented internally and developing the Biodiversity stress from supply chain tool started from there. The goal was to create a tool that is very easy to use and helps customers have biodiversity values for their construction projects fast, by implementing the tool to their existing LCA projects. (Thornton, 2024) As for the Biodiversity net gain tool, as mentioned and explained in more detail in Chapter 3.2.5, follows the regulation in England that became mandatory in July 2024. The tool has been developed following the regulation and aimed to be published and available for clients by the time the biodiversity values became mandatory to report.

The Biodiversity stress from supply chain is a voluntary tool and it is not based on any specific standard, as explained in more detail in Chapter 3.2.6. Thornton recognizes this as one of the reasons for the difficulties in getting people to use it. Based on the previous feedback received from the users, it seems that the tool, or biodiversity as a measuring factor, is not easy to understand. Since the idea of measuring biodiversity values in the construction industry is still new, and as mentioned previously, the industry is very money-driven, a voluntary factor is easy to leave out from the assessment if it is not understood. The tool has faced updates to make it easier and clearer. In the software, the tool explains the steps and terms open when the customer is conducting the assessment to avoid any confusion. There are benefits that the tool offers, such as comparing the material choices and being able to be included in already existing LCA assessments, making it a valuable addition to the assessment. In addition, since it aligns with EU sustainability reporting and follows the TNFD recommendations, the tool has a lot of potential, and it is gaining interest from customers. Customers from the United Kingdom and Japan have expressed interest in the tool, but since there are no policies now, it does not seem motivated enough to purchase the tool. Thornton thinks that all it needs to succeed is a couple of bigger companies starting to use it and other companies will follow that. At that stage, it would be a competitive factor for the companies and therefore more motivating to use. (Thornton, 2024)

The biodiversity net gain tool is based on the regulation in England and will have a solid user base because of it. The main point of this tool is to do something good against the losses within the construction project. Creating habitats for the ones lost in the process gives nature a way to cope with the change. Thornton thinks this is a valuable approach. The tool focuses on the physical habitats in construction sites. Customer needs to report the habitats before the construction process and decide to either retain them or lose them and create new habitats in place. Depending on the habitat, it can have different values based on the rareness and species richness in it. If the habitat has high distinctness, it is recommended to be left alone since it will be harder to compensate for these losses. The tool will count these values before and after the construction and give the net gain for it. This regulation ensures that the outcome for biodiversity will be good in the end. If customers do not have other options, and cannot retain or create habitats, they can buy credits from the government. This is offered as a last solution since it is not wise to spend money on destroying habitats when those can be left alone in the area. According to Thornton, one minus with the regulation is that it is not defining whether the building is a good or a bad one. (Thornton, 2024)

One Click LCA is mainly created for life cycle assessments and measuring environmental impacts and mostly carbon emissions. This makes designing the biodiversity tools hard and

developing is challenging. Thornton stated that having EPDs with more specific locations than just a country would make assessing biodiversity values more accurate since biodiversity can be very different in different parts of the country. Even having the regional data for this would specify it in more detail. This would require the manufacturers to change the way of reporting EPDs and therefore is a wider issue that One Click LCA cannot solve on its own. There is also some uncertainty factors included when assessing biodiversity values since biodiversity is dependent on climate. Some habitats face dry summers and wet winters, which means the conditions are very different based on the weather or the time of year. (Thornton, 2024)

4.2.2 Review of the User Experience

To understand how customers are experiencing the product, the best option is to combine quantitative and qualitative research. Reviewing both data formats will give the opportunity to find the possible development points and feedback for improvement. (Olson, 2022, p.54) In this research, both methods were used to gather data on user experience. The steps of this process are presented next.

The original plan was to have user interviews on how customers have worked with the tools, what issues they have faced, and how they would like those to be improved. Users were chosen for the interviews based on their company licenses in the software and narrowed to certain types of users. These users were the ones having the biodiversity tools available on their licenses. Since users can have more than one calculation tool on their license, as explained in Chapter 3.2.4, it was necessary to review the projects linked to these licenses to be able to see whether the biodiversity tools were used. When reviewing the projects on the licenses, it was noted that not many users use the Biodiversity Stress from Supply Chain or the Biodiversity Net Gain tools that were available on the licenses.

The next action was to make these users aware of the tool options available on these licenses. Notification messages were sent to the users to clarify the availability of these tools. The list included users globally, and for the scope of the research that was planned, first contacting messages were sent to the clients in United Kingdom, Finland, and the rest of the users in Europe. There weren’t responses received for the first messages. After this, the rest of the users of the tools were contacted, receiving no responses from them.

The low response rate led to the following actions. After discussions with the product developer James Thornton, it was decided to offer free overviews and training for the tools.

The goal was to familiarize customers on using the tools and encourage them to try to use them and after this, provide feedback for the research. Seven training offer emails were sent, and two official training sessions were organized because of these messages. These trainings were not official interviews, and no contracts were signed for the interview, which is the reason for the feedback being based on the researcher's point of view and how the author of the thesis experienced these comments. The overview of the tools was kept simple and all the steps for the assessment were explained. Customers seemed interested in the reporting possibilities of the tools and seemed pleased when hearing the results being able to be printed out in the software as a Word document. The possibility of having the Biodiversity stress from supply chain tool implemented in existing LCA assessment was received positively and customers seemed surprised about how easy to use the tool is. Both customers wanted these tools for testing and the trial periods were set for the tools on customers' licenses. Both tools, the Biodiversity stress from supply chain and the Biodiversity net gain were provided for trialing, since these clients were based in the United Kingdom, which means that especially the Biodiversity net gain tool will be useful for them to use since it is required in England, as mentioned in Chapter 3.2.5.

In addition to the free training offered, several sales demo meetings took place during this research, where information on customer's needs for the product was heard and the possibility of presenting the tools was given. The demos were conducted similarly to free overviews, and they were organized and presented by the sales team. In every demo meeting joined during this research, customers seemed interested in the features the tools offer and trial periods were set after the meeting as customers requested.

The final step for gathering data for the research was requesting feedback sessions with the clients who had trial periods set for the tools to receive feedback on those. Emails suggesting the time for the feedback meetings were sent, but no responses were received. Since the deadline for the research was approaching, it was decided to leave the customer feedback interviews out of the research.

5 Results and Conclusion

Biodiversity is facing a global crisis, and the construction industry is responsible for a major part of it. Even if being a contributor to actions that got the world to this state, it can have a significant role in improving it and helping increase biodiversity. This means focusing on

nature-positive solutions that operate within planetary boundaries. (Schweizer, Hessenberger and Lammerant, 2022)

As learned in Chapter 2.2.1, many positive actions have been taken already to help nature recover and guidance and reporting possibilities are starting to be more available for biodiversity. This research pointed out some of these actions. The Biodiversity Roadmap was launched in February 2024 by the Construction Leadership Council's Green Construction Board. This roadmap is created to help the natural environment and is guiding the construction industry to reduce emissions with proper actions. (Construction Industry Council, 2024) One action, where One Click LCA's Biodiversity net gain tool is based, is the biodiversity net gain regulation. It is designed to enhance biodiversity in England and requires at least a 10% increase in biodiversity value. (GOV.UK, 2024) Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) assessment reviews the existing conditions and trends related to biodiversity and ecosystem services, evaluating their effects on human well-being and the efficacy of response measures. (IPBES, 2019) The Taskforce on Nature-related Financial Disclosures (TNFD) has guidance on helping businesses assess, report, and act on nature-related issues. This guidance is created so that companies can consider nature in their decision-making and guides the industry towards nature-positive outcomes. (TNFD, n.d.b) One Click LCA's Biodiversity stress from supply chain tool is listed in TNFD's tool catalog.

Even without biodiversity-specific tools, there are things that companies can consider in their projects that have nature-positive outcomes. Building long-lasting multipurpose buildings, that are easily maintained and rehabilitated is recommended. Materials should have a long service life, and it is preferred that they are reused or recycled. These materials should also be possible to be recycled at their end-of-life stage. (Ministry of the Environment, n.d.) These are all nature-positive steps the user can study, compare, and decide when conducting a life cycle assessment with One Click LCA. In this research, the focus was on the biodiversity tools, but it was clear after data search and the expert interview that LCA can have a positive effect on biodiversity, even if it is done using tools that mainly focus on carbon emissions.

As explained earlier in Chapters 3.2.5 and 3.2.6, One Click LCA offers an option to take biodiversity values into account more specifically. Biodiversity net gain and Biodiversity stress from supply chain tools are new calculation tools that were released in 2024. The customer base for these tools is still new and progressing, which had a significant effect on the results of this research. These results are presented next, and they are based on the

theoretic research, the expert interview, and training and demo sessions which were taken with the customers.

The regulation for the biodiversity net gain gives the Biodiversity net gain tool an advantage when reviewing the number of users. Since the regulation became mandatory in July 2024, users have been interested in the tool. As for this research, the timing for evaluating the user experience for this tool was too early. The biodiversity net gain tool is new and has a lot of new information that construction companies are not familiar with, which means it will take time before having a customer base that understands the tool well. Having this data requires a new way of thinking for companies and therefore updates in their workflow. Guidance for the tool aims to be clear and simple and therefore easy to understand. As discussed in the expert interview, it makes enhancing biodiversity more profitable than destroying it. In the money-driven industry, where the financial point of view matters greatly, this regulation has a lot of potential for helping biodiversity.

A challenge and a benefit for the Biodiversity stress from supply chain tool is the lack of regulation, which makes it a very flexible tool to use, but on the other hand, not motivating enough for the customers. This risk was acknowledged before the research and was confirmed as it moved forward. The tool has received a lot of attention and interest from customers. It has been marketed actively and many trial periods are set for it in a weekly basis. As a result of training sessions with the customers, trial periods for the tool were set every time. The easiness of the tool is an advantage for it since it can be included in existing life cycle assessment as an additional tool and the customer receives results right away. As mentioned previously, the construction industry is money-driven, and projects are often budgeted tightly. This makes it harder for the users to have additional tools with additional features, and since they are not yet mandatory to be used, it is easier to leave that part out of the calculation. Once the industry takes biodiversity values as a competitive factor, the change is expected to happen. At that point, the Biodiversity stress from supply chain tool will have a higher value for customers.

This research shows the importance of regulations and standards and how those can drive changes for the better. Mandatory reporting drives companies to change faster than voluntary reporting. The biodiversity crisis can be avoided, but it requires urgent actions. Voluntary programs will help, but they take time and are not as effective. Financial point of view is important to consider since many companies have tight budgets to follow. Increasing biodiversity can have a positive impact on the economy, and it can create new business opportunities, as mentioned in Chapter 2.2., but it requires for people to be open to learning

and adapting to new ways of working. Conducting life cycle assessments in general is new in many countries, and there is a lot to improve, as discussed in the expert interview. There are a lot of new things to learn, standards that are updating, and adding more factors can be intimidating and confuse people. Therefore, it is important that information is clear and easy to find, and companies are open to gaining knowledge.

6 Own Reflection

There are many positive changes happening in the industry, as discovered during this research. It was very easy to find information on nature-positive actions that are taken. A lot of research work has been done related to the benefits when increasing biodiversity. Multiple sources agree that nature can recover if given the chance.

Life cycle assessment itself is still new and the requirements for it are constantly updating. There are many parts of LCA that companies are still struggling with, and it can make adding new things unmotivating. There is not enough knowledge in the field and people are not aware of the benefits increasing biodiversity offers. Knowledge sharing could be ensured with standards and guidelines for the companies, and it should be clear for the user, where this information is found, what is the correct guidance to follow, and somehow make the list of the assessment tools easy to find and understand. When the information exists, but is scattered around here and there, it is confusing for the user and makes it an unpleasant experience for the user.

How could we make sure this information is shared properly? We have country-specific regulations for many areas, reducing carbon emissions being one of them. Making the guideline mandatory to be followed, would ensure that users are taking certain factors into account in their decision-making – because they must. This would be the most effective way to increase the number of biodiversity assessments fast, and since we have a biodiversity crisis and habitats are being lost faster than we can create them, I would say that instant actions are required.

The timing was too early for this research to be conducted. The fact that the tools are new was acknowledged as a risk factor for this research. The user base for these tools was very small, and many licenses that had the trial of the tool on their license when the user data was searched, didn’t have any projects where these tools were activated. This made finding

people for the interviews extremely difficult. It was soon realized that many people were not familiar with the tools even if those were added to their license for testing.

Because of the difficulties with reaching out to the clients, it took more time than was planned to arrange the offered training for the customers. Even if the feedback meetings couldn't be arranged because of the lack of responsiveness from customers, training and demo sessions showed that people are clearly interested in the tools, especially the Biodiversity stress from supply chain tool, but unfortunately, it is not a regulatory or mandatory tool to use, so there was not enough motivation for the customers to purchase the tool. The main issue for this research was time. Within a longer period, customers could have been reached out again trying to set up the dates for the feedback interviews.

For a wider research topic, interviewing external parties, such as research centers, could have been an option and it might have given another point of view. For the research this size, it was important to recognize that the topic should be limited and that there is not going to be enough time to try all the different options. Therefore, the external interviews were left out as an option.

In conclusion, I would say that the research was useful, but the results would have been more productive if this research had taken place further in the future. Many good actions were taken during this research. Multiple customers were trained to use the biodiversity tools and important knowledge was shared. Good discussion and comments about the tools were shared during the training and demos. Many trial periods were started because of this research, and we were able to learn more about the potential users of the tools.

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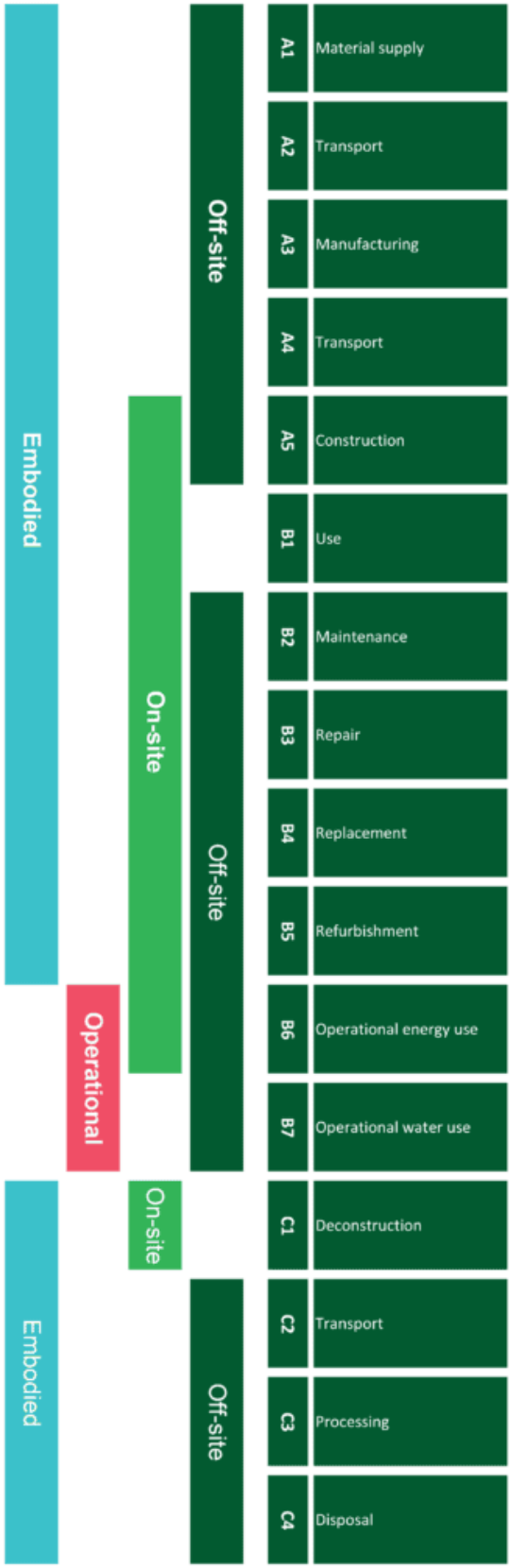
Attachment 1: Embodied carbon in the building's life cycle, on and off-site. (UK Green Building Council, n.d.)



Attachment 2: Material Management Plan

Aineistonhallintasuunnitelma

Yolanda Korpi – Kestävän kehityksen opinnäytetyö, kevät 2024

Aihe: Kuinka päästöjen mittaaminen One Click LCA -sovelluksella voi auttaa luonnon monimuotoisuutta?

1 Tutkimusaineiston tallennus ja säilytys

Tutkimusaineistona opinnäytetyössä käytetään asiantuntija- sekä asiakashaastatteluita. Tutkimusaineistoa käsitellään vain One Click LCA:n omistamalla työkoneella, jolloin varmistetaan tarvittava suojaus yksityisiä tietoja käsiteltäessä. Haastateltavat saavat täytettäväkseen tietosuojalomakkeen. Aineisto säilytetään One Click LCA:n Google Drivessa, jonne kaikki yrityksen materiaalit on tallennettu. Tänne pääsee käsiksi vain OCL työntekijät ja yksittäisiin tiedostoihin vain henkilöt, joille ne on erikseen jaettu. Työssä ei käsitellä arkaluontoista sisältöä, mutta aiemmin mainitut toimenpiteet on sovittu erikseen yrityksemme IT-vastaavan sekä esihenkilöiden kanssa.

Näiden lisäksi tietoa on haettu luotettavilta verkkosivuilta, webinaareista, eri artikkeleista sekä aiheeseen liittyvästä kirjallisuudesta. Tätä aineistoa hyödynnettäessä noudatetaan HAMKin lähdeviittausohjeistusta.

2 Henkilötietojen ja arkaluonteisten tietojen käsittely

Haastateltavien asiakkaiden henkilötietoja ei julkaista valmiissa opinnäytetyössä. Asiantuntijahaastattelussa haastateltavan nimi ja asema ovat julkista tietoa, mutta laajemmin henkilön taustoihin ei mennä. Haastatteluaineistoa ei julkaista opinnäytetyön liitteenä. Tietosuojalomakkeena hyödynnetään HAMKin lomakepohjaa.

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3 Opinnäytetyöaineiston omistajuus

One Click LCA omistaa opinnäytetyön aineiston ja tulokset.

4 Opinnäytetyöaineiston jatkokäyttö työn valmistumisen jälkeen

Aineisto luovutetaan One Click LCA:lle jatkokäyttöön mahdollisia ohjelmiston kehitystoimia varten. Tutkittavien tarkempia tietoja ei luovuteta eteenpäin ja heille toimitetaan tietosuojalomake haastatteluita varten. Nimiä ei mainita, lukuun ottamatta asiantuntijahaastattelussa haastateltavaa henkilöä, joka työskentelee myös tilaajalle.

Mikäli HAMK haluaa hyödyntää opinnäytetyön materiaaleja jatkokäytössä, tulee tästä laatia kirjallinen sopimus.